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Wahrnehmung und zukünftige Rolle der Schweizer Bioforschung in Europa

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Rangliste Bioforschung in Europa

(nach Kriterien des UK-RAE)

Bio-Agrar Institute

		R&D	TT
1.	FiBL, CH	(4)	(4)
2.	Kassel, D	(2/3)	(2)
3.	LBI, NL	(2)	(3)
4.	EFRC, UK	(1)	(3)
5.	HDRA, UK	(0)	(3)
6.	Bolzman, A	(0)	(2)
7.	GRAB, F	(0)	(2)

Konventionelle Agrar-Institute*

		R&D	TT
1.	DIAS, DK	(4)	(3)
2.	WUR, NL	(4)	(2)
3.	Agroscope	(3)	(1)
4.	INRA, F	(3)	(1)
5.	UNEW, UK	(3)	(1)
6.	SAC, UK	(2)	(2)
7.	UH, D	(2)	(2)
8.	BOKU, A	(2)	(2)

* die auch Ökoforschung machen

Schweizer Bioforschung – Wahrnehmung

Forschunginstitut für Biologischen Landbau (FiBL)

- **Führende Bioforschungsinstitut in Europa**
  - Wissenschaftliche Veröffentlichungen (z.B. in *Science*)
  - Technologietransfer (FiBL-Handbücher in 4 Sprachen)
  - EU und Industry Unterstützung
  - Kollaborationspartner in der Schweiz, Europa & International
- **Systementwicklung anstatt "Input"-Substitution**
  - Langzeit-Systemversuche,
  - "Farmer participatory" – Forschungsansätze
  - Kombination von etablierten, alternativen und holistischen Analysemethoden
  - Integrierung der Sozial, Natur und Ernährungswissenschaften ermöglicht "whole supply chain" Ansätze

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Schweizer Bioforschung – Wahrnehmung

Forschunginstitut für Biologischen Landbau (FiBL)

Alle Bereiche Lebensmittelproduction werden abgedeckt:

- **Landwirtschaft** (agriculture)
  - Grassland – Wiederkäuer Systeme
  - Scheine und Geflügelhaltung
  - Ackerbaukulturen (Getreide, Hackfrüchte etc.) dominierte Fruchtfolgesysteme
- **Gartenbau** (horticulture)
  - Glasshausproduktionsysteme
  - Feldgemüse/salat dominierte Fruchtfogesysteme
  - Dauerkulturen (Wein, Obst etc.)
- **Lebensmittelverarbeitung** (processing)

Schweizer Bioforschung – Wahrnehmung

Forschunginstitut für Biologischen Landbau (FiBL)

- **Enge Zusammenarbeit mit der biologischen Landwirtschaft und Ihren Organen, Lebensmittel verarbeitenden Industrien und Supermarktketten**
  - Ansatz ist **“Bottom-up”** und nicht **“top-down”**
  - Relative **Unabhängigkeit** von “Trends” in der “konventionellen” Forschung
- **Enge Zusammenarbeit mit international anerkannten**
  - **spezialisierten** (aber mehr auf die konventionelle Landwirt-schaft ausgerichteten) **Forschungsinstituten (inclusive Agroscope)**
  - **Institutionen der Grundlagenforschung** im öffentlichen (e.g. Universitäten) und privaten (e.g. Syngenta, Novartis) Bereich

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Schweizer Bioforschung – Zukünftige Rolle

Forschunginstitut für Biologischen Landbau (FiBL)

- **Koordination von großen EU und Internationalen R&D Projekten im Bereich the Biologischen Landwirtschaft**
- **Prioritäten und Forschungsansätze für die langfristige Entwicklung der Biologischen Landwirtschaft entwickeln,** insbesondere in den folgenden Bereichen:
  - "Sustainability" und "self-sufficiency"
  - Umweltbelastung, Energieverbrauch, CO_2 Emissionen,
  - Pflanzen und Tierzüchtung
  - Einfluß organischer Nahrungsmittel auf die Tier- und menschliche Gesundheit

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Schweizer Bioforschung – Zukünftige Rolle

Agroscope

- **Forschung und Entwicklung <u>spezifischer</u> Verfahren, Innovationen, und analytischer Methoden, die in der biologischen (a)** Lebensmittelerzeugung,**(b)** Lebensmittelverarbeitung und **(c)** Qualitätuntersuchung eingesetzt werden können
- **Technologie-transfer von Innovationen aus der <u>konventionellen</u> Forschung in die biologische Lebensmittel Production und Verarbeitung**
- **Zum Beispiel**
  - **Blight-MOP (Agroscope FAL)** Entwicklung von forecasting, alternativen Pflanzenschutzmitten für *Phytophthora infestans*
  - **QualityLowInputFood (Agroscope ALP)** Käseproductions-methoden die den CLA Gehalt erhöhen.

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Schweizer Bioforschung – Was fehlt?

- Energieverbrauch, CO_2 Emissionen
- Recycling von organischen Abfällen der Stadtbevölkerung in die Landwirtschaft

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Energieverbrauch – CO_2 Emissionen

N-Dünger

- 1 kg N-Dünger = 36,000kJ = 1 Liter fuel = 1 kg CO_2
- Nafferton Farm = 100 ha Getreide (200 kg N/ha)

= 25,000 Liter fuel

= 25,000 kg CO_2 pro Jahr

nur für den Getreideanbau auf einer Englischen Farm

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Recycling von organischen Abfällen der Stadtbevölkerung in die Landwirtschaft

Externe Inputs (N, P, Energie etc.)

↓

Landwirt-Wirtschaft → **Lebensmittel (N,P,C)**

↗ CO_2

↙ **Küchenabfall (N,P,C)**

↘ **Toilettenabfall (N,P,C)**

↓ **Müllkippe** ← **Kläranlage** ↓

↘ ↙

CO_2, CH_4 und N_2, N_2O Atmosphere

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Recycling von organischen Abfällen der Stadtbevölkerung in die Landwirtschaft

Landwirt-
Wirtschaft

→

Lebensmittel
(N,P,C)

CO_2

Küchenabfall
(N,P,C)

Toilettenabfall
(N,P,C)

Aerobische Compostier-
anaerobische Fermentations-
Verfahren

←

organischen
Dünger
(N,P,C)

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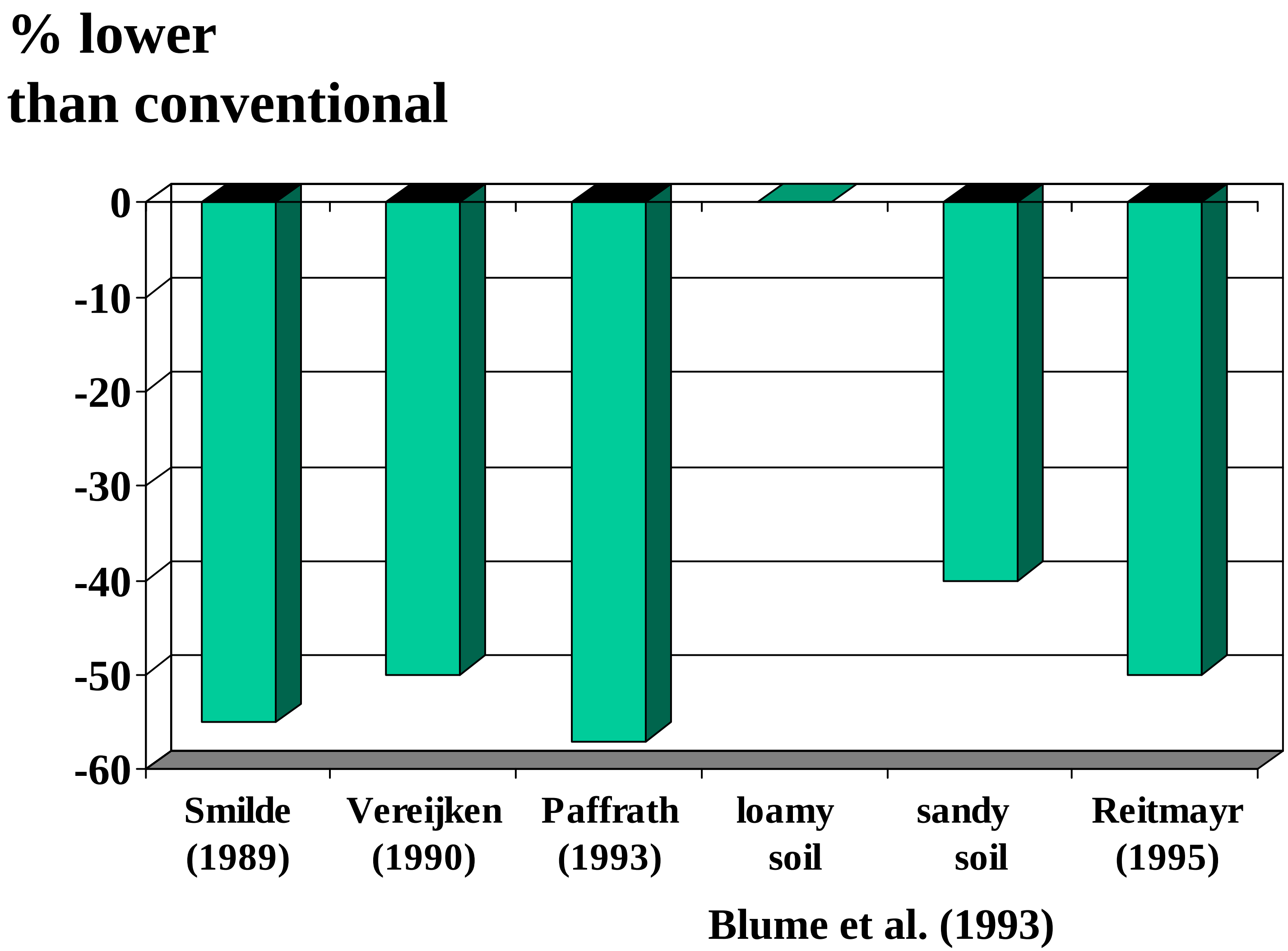
THANK YOU

Nitrate leaching in matched farm comparisons studies



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PESTICIDES

Example: methyl bromide

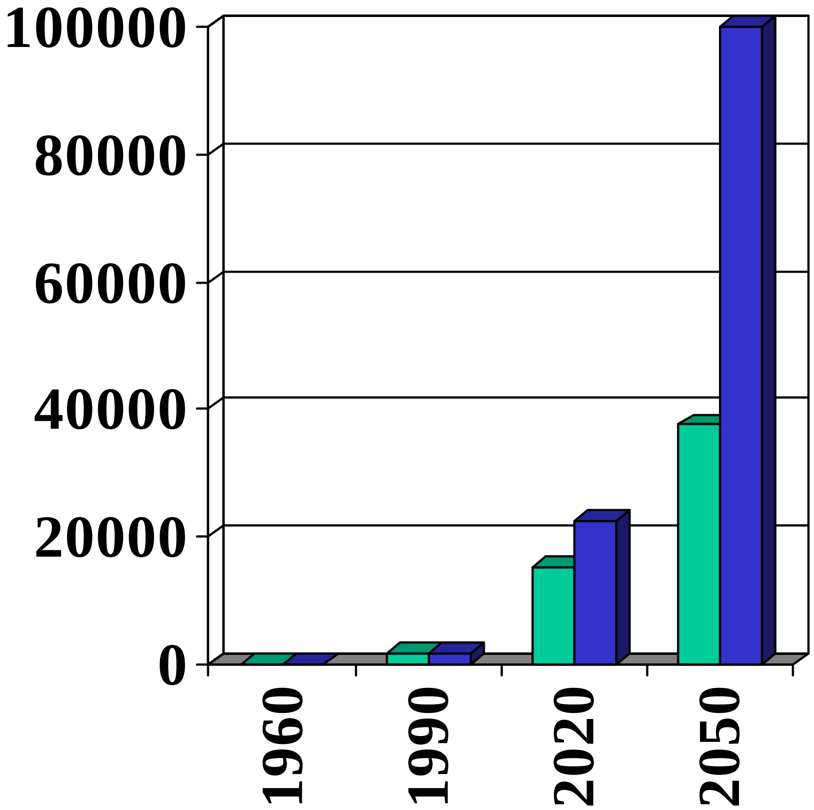
- fumigant for soils and food stores
- used in conventional production for control of soil-borne diseases
- tomato, soft fruit, Brassicas, etc.
- 50 times more powerful than CFCs in destroying ozone
- estimated to have contributed 10 to 20% of the destruction of the earth ozone layer
- even the US accepts the evidence
- still in use !!!!! in the UK

Effect of stratospheric ozone depletion:

Increased UV-B radiation results in higher levels of:

- skin cancer
- suppression of the immune system
- cataracts

Predicted Excess skin cancer cases in NW-Europe



RIVM (2000) Report 48150511
Slaper *et al.* (1996) Nature 384,256-258

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Interdependencies between mineral fertiliser and pesticide use in conventional systems

Nafferton factorial systems comparison

Impact of production systems and their components on:

- food quality/safety
- environmental pollution
- non-flying invertebrates density and biodiversity
- soil activity/biodiversity
- sustainability
- productivity/cost

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Nafferton factorial systems comparison

1. G	2. G	3. WW	4. WW	5. WB	6. P/V	7. WW	8. WB

Conventional Rotation

1. Grass (G)
2. Grass (G)
3. Winter Wheat (WW)
4. Winter Wheat (WW)
5. Winter Barley (WB)
6. Potato or Veg. (P/V)
7. Winter Wheat (WW)
8. Winter Barley (WB)

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1. G	2. G	3. WW	4. WW	5. WB	6. P/V	7. WW	8. WB	Conventional Rotation
1. GC	2. GC	3. GC	4. WW	5. P/V	6. BS	7. P/V	8. SB	Organic Rotation

1. – 3. Grass/Clover (G)
4. Winter Wheat (WW)
5. Potato/Veg (P/V)
6. Beans (BS)
7. Potato/Veg (P/V)
8. Spring Barley (SB)

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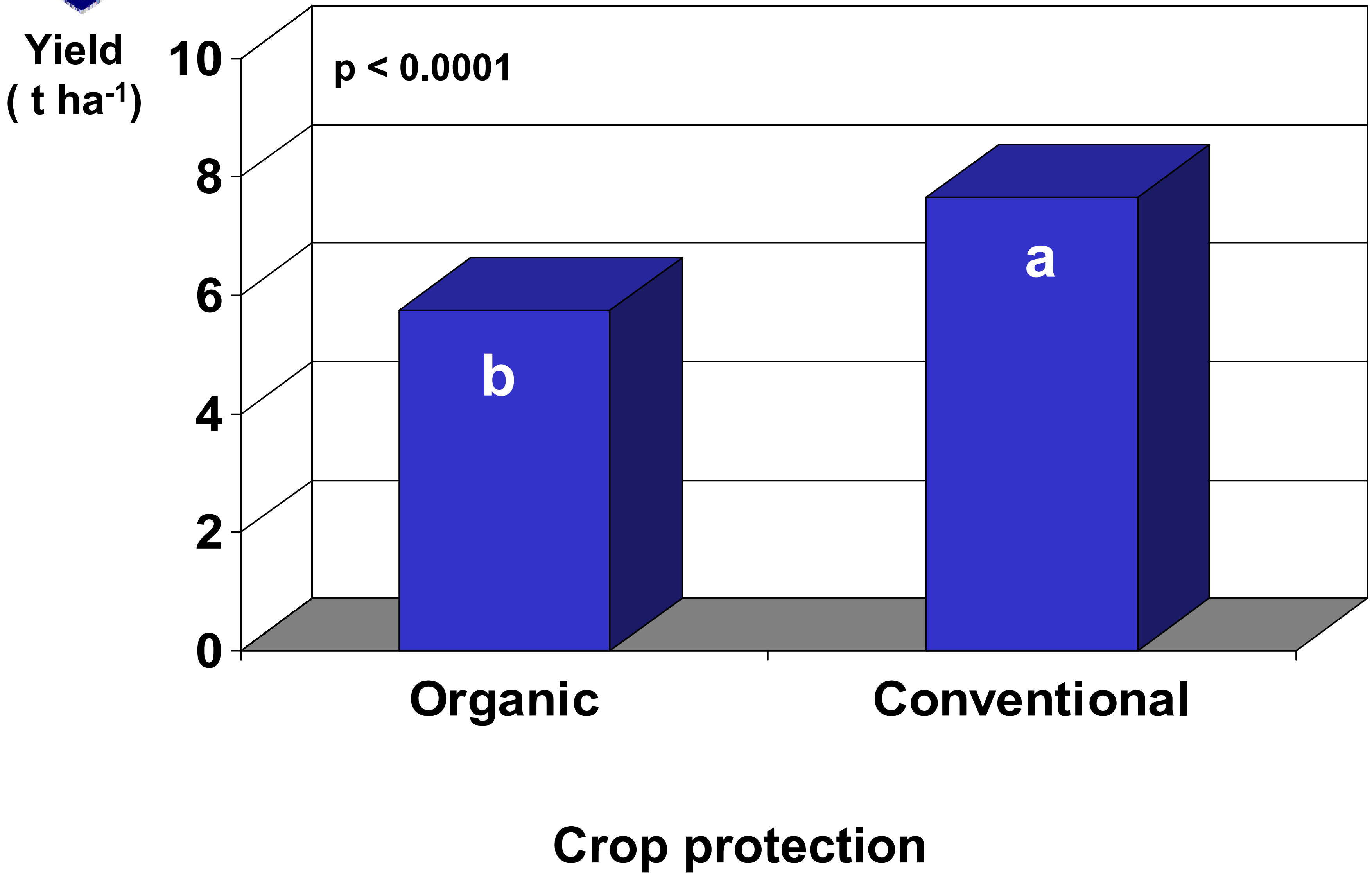
Conventional and organic plots: subplots

Subplot	Mineral N,P&K	synthetic Pesticides	
1.	+	+	Conventional Rotation
2.	+	-	
3.	-	+	
4.	-	-	
1.	+	+	Organic Rotation
2.	+	-	
3.	-	+	
4.	-	-	

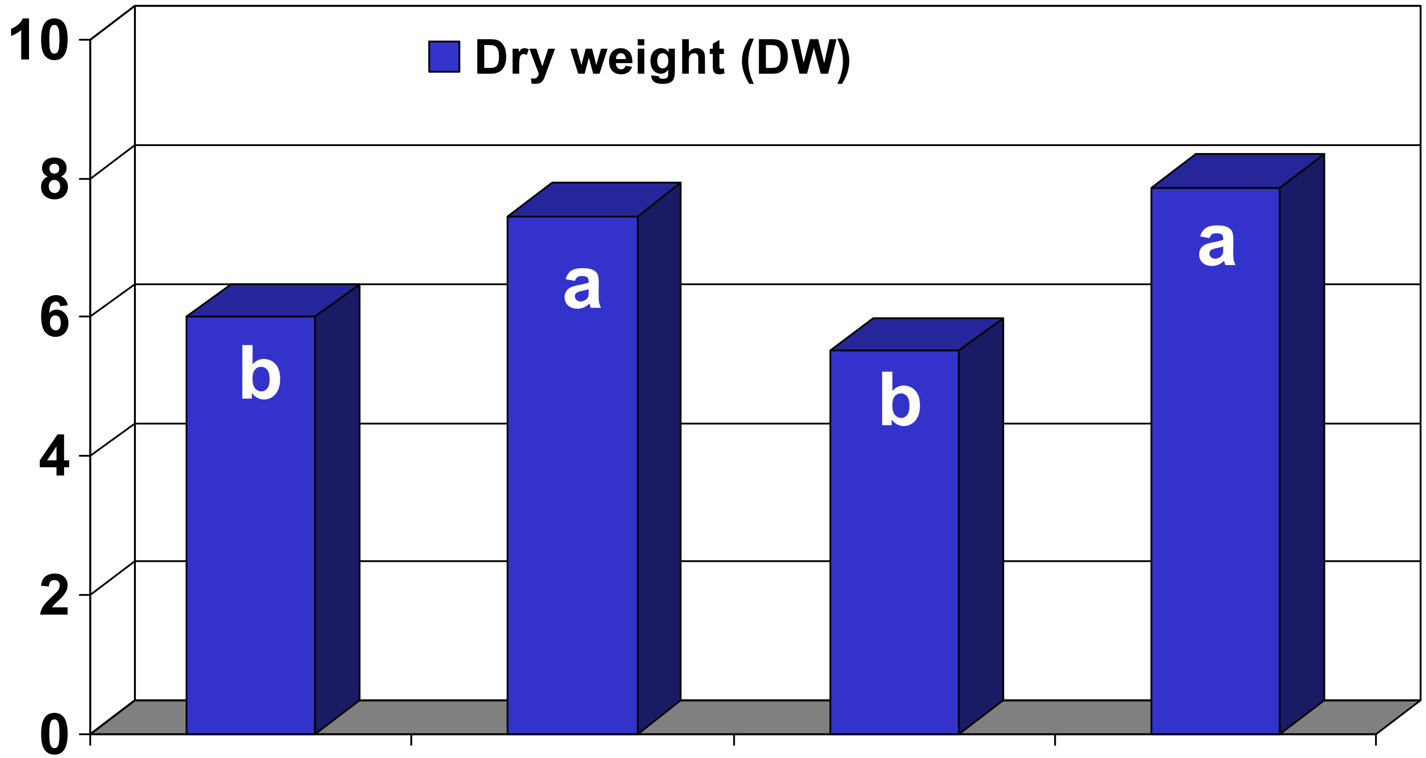
Winter wheat 2004 – yield (dry weight)



Winter Wheat Yield 2004 – Interaction between fertility management and crop protection (p = 0.044 DW)

Adding mineral fertilisers to crops treated with pesticides increase yield, while adding mineral fertilisers to non-pesticide treated crops decreases yield

Yield
(t ha^{-1})



Crop protection	Org (-P)	Conv (+P)	Org (-P)	Conv (+P)
Fertilisation	Organic (-MF)		Conventional (+MF)	

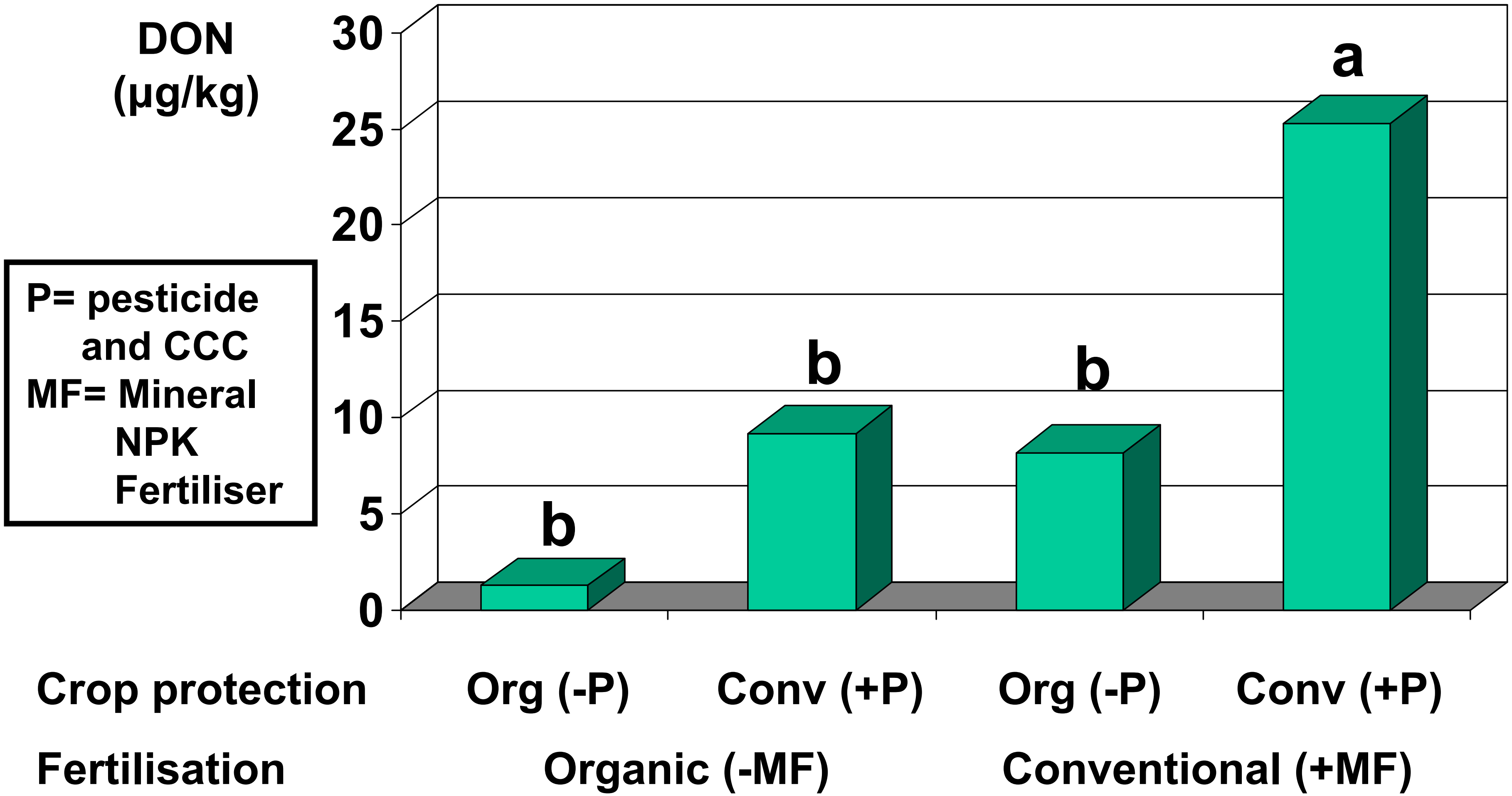
P= pesticide and CCC
MF= Mineral NPK Fertiliser

Effect of different crop management protocols on levels of lodging in winter-wheat (var. Malacca) QLIF – production systems study 2004

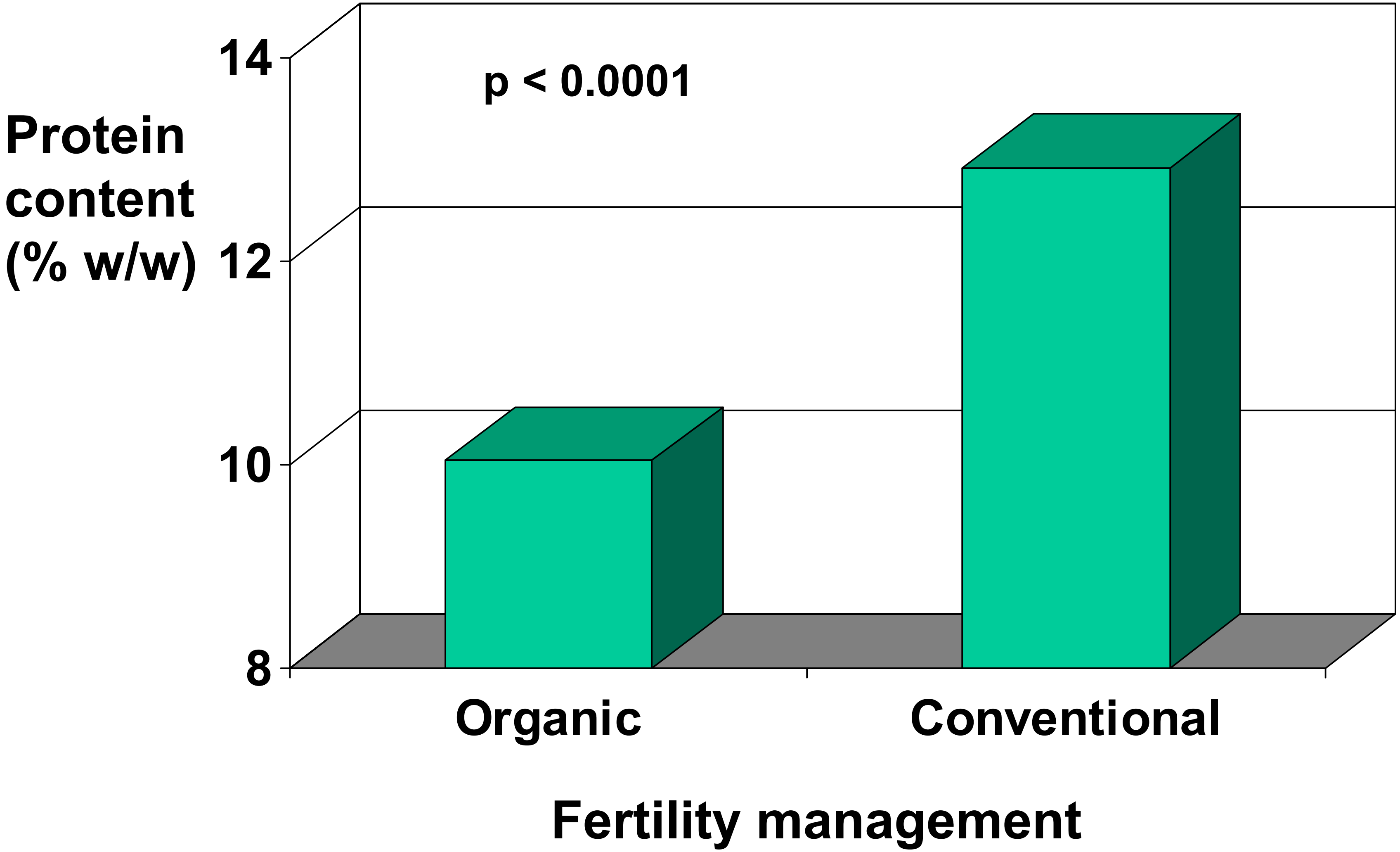
CROP PROTECTION	FERTILITY MANAGEMENT: Clover + Manure	FERTILITY MANAGEMENT: Mineral NPK
NO pesticides or CCC used		
Pesticides or CCC used		

Mycotoxin loads in Winter Wheat (2005)

Adding both mineral fertilisers and pesticides/CCC increased *Fusarium* mycotoxin loads in wheat

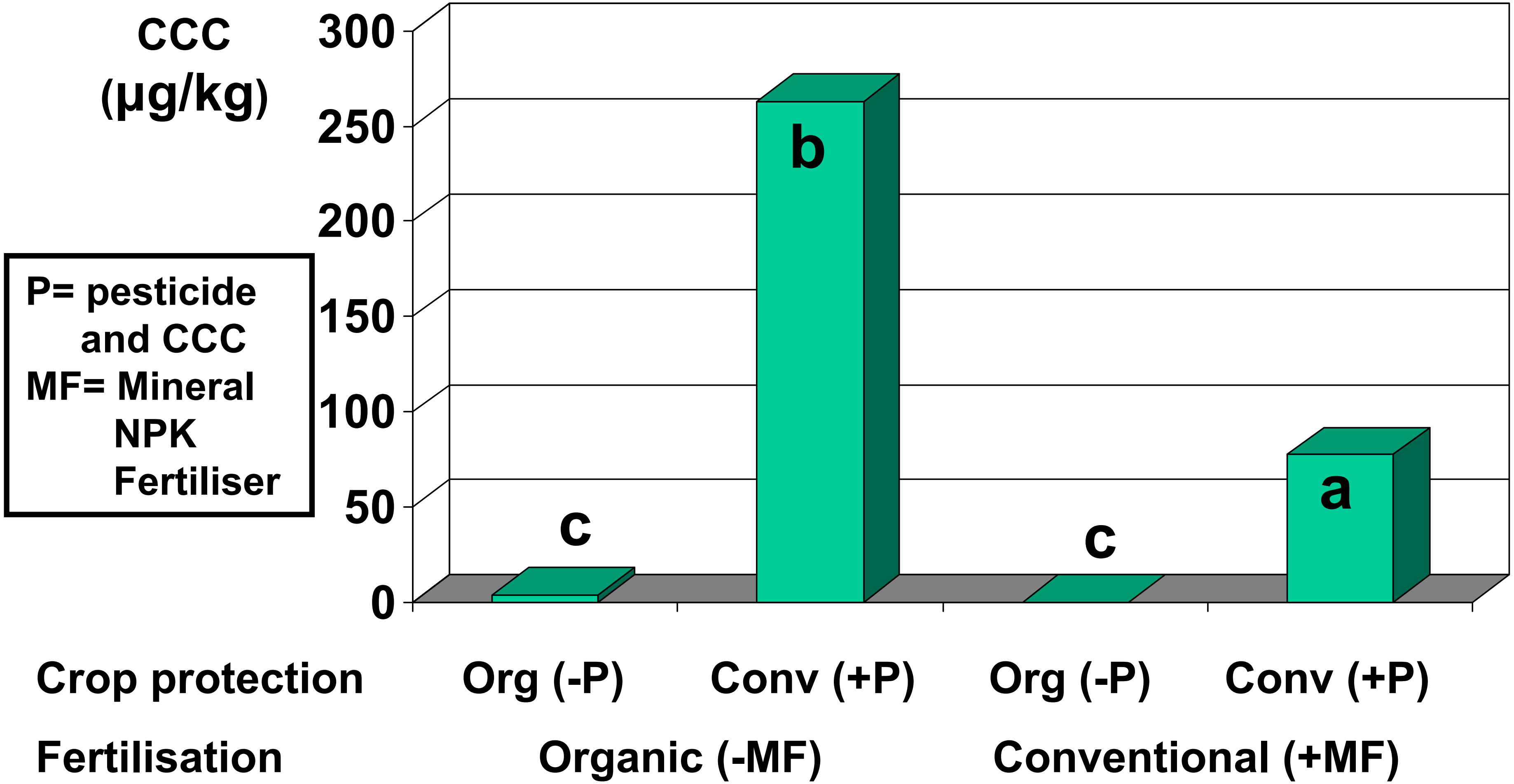


Winter wheat 2004 – Protein content



Winter Wheat chlormequat residues 2004

When pesticides/CCC where applied, organic fertility management practices resulted in 3 x higher CCC residues than conventional fertility management



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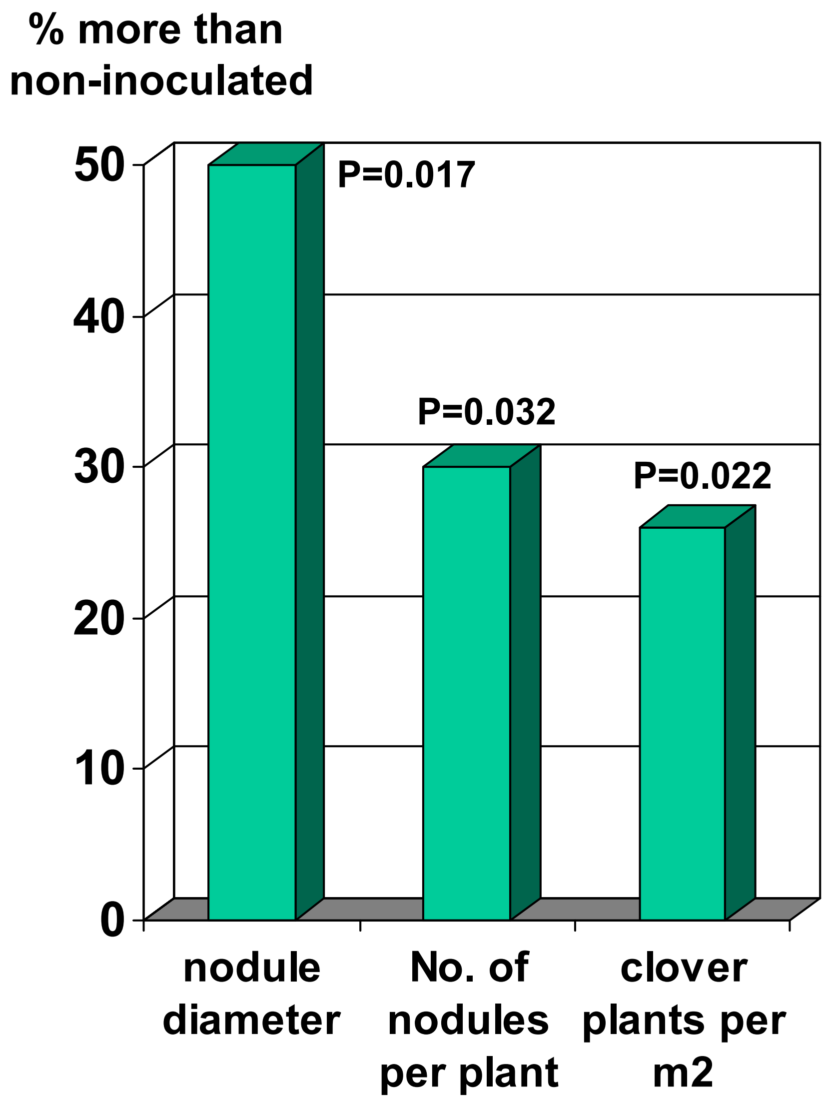
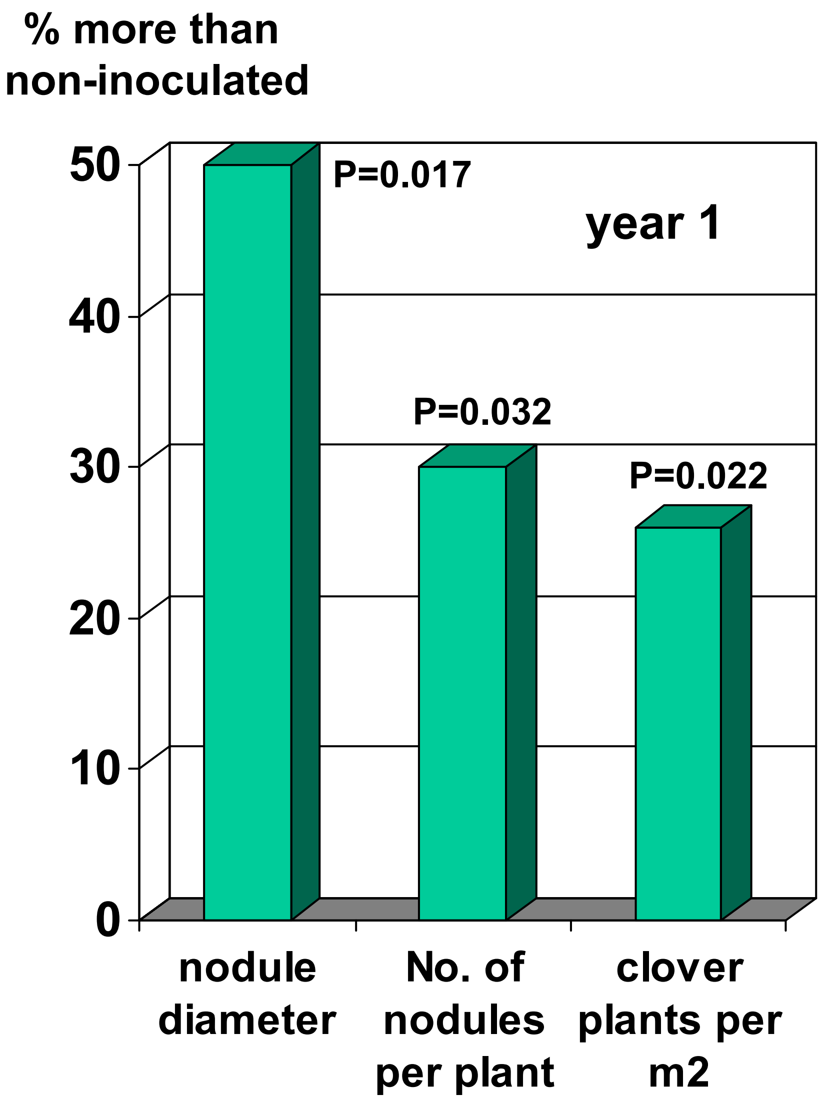
Effect of providing R&D support on the yield and quality of crops in organic production systems

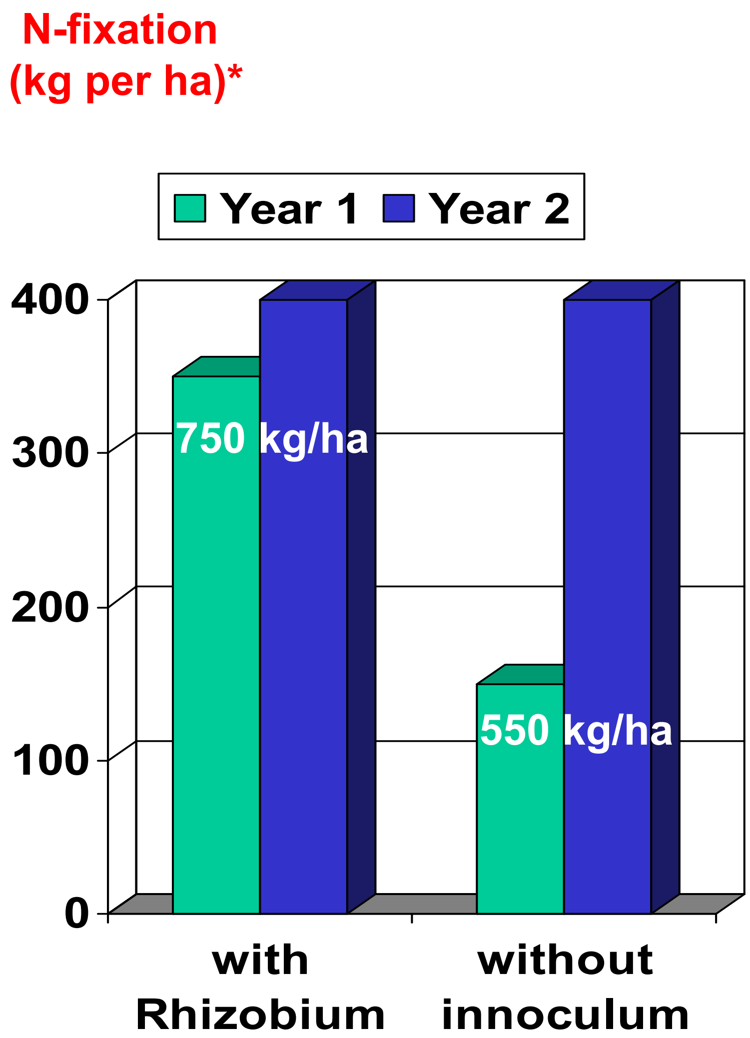
EXAMPLE:
Improved fertility management and variety choice in wheat

Effect of inoculation of seed with *Rhizobium* inocula of nodule diameter, nodules per plant and clover plant density



Effect of inoculation of seed with *Rhizobium* inocula of nodule diameter, nodules per plant, clover plant density and nitrogen fixation capacity*





* An adapted Swedish model (Carlsson, G. Huss-Danell, K. Umea) was used

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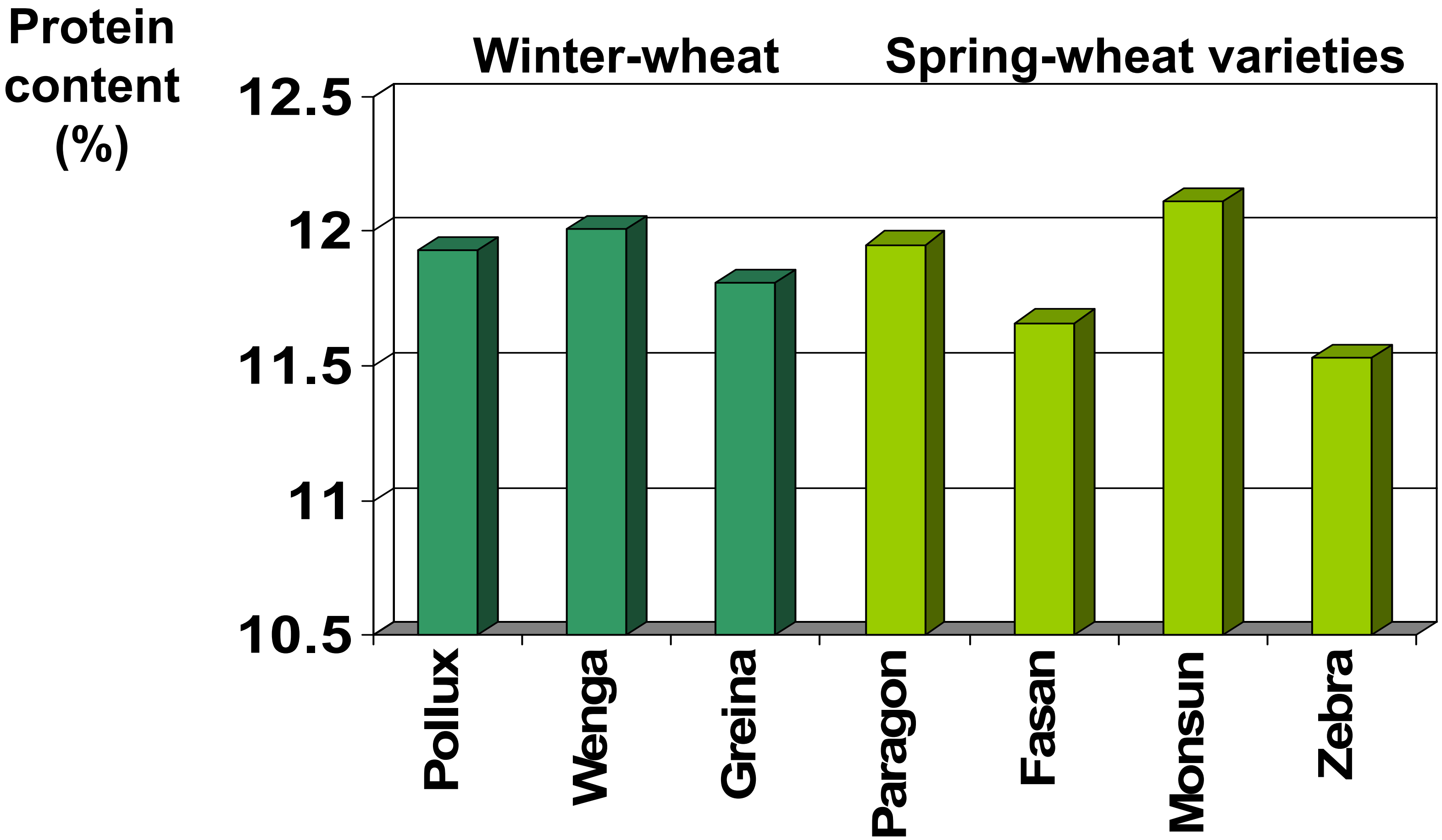
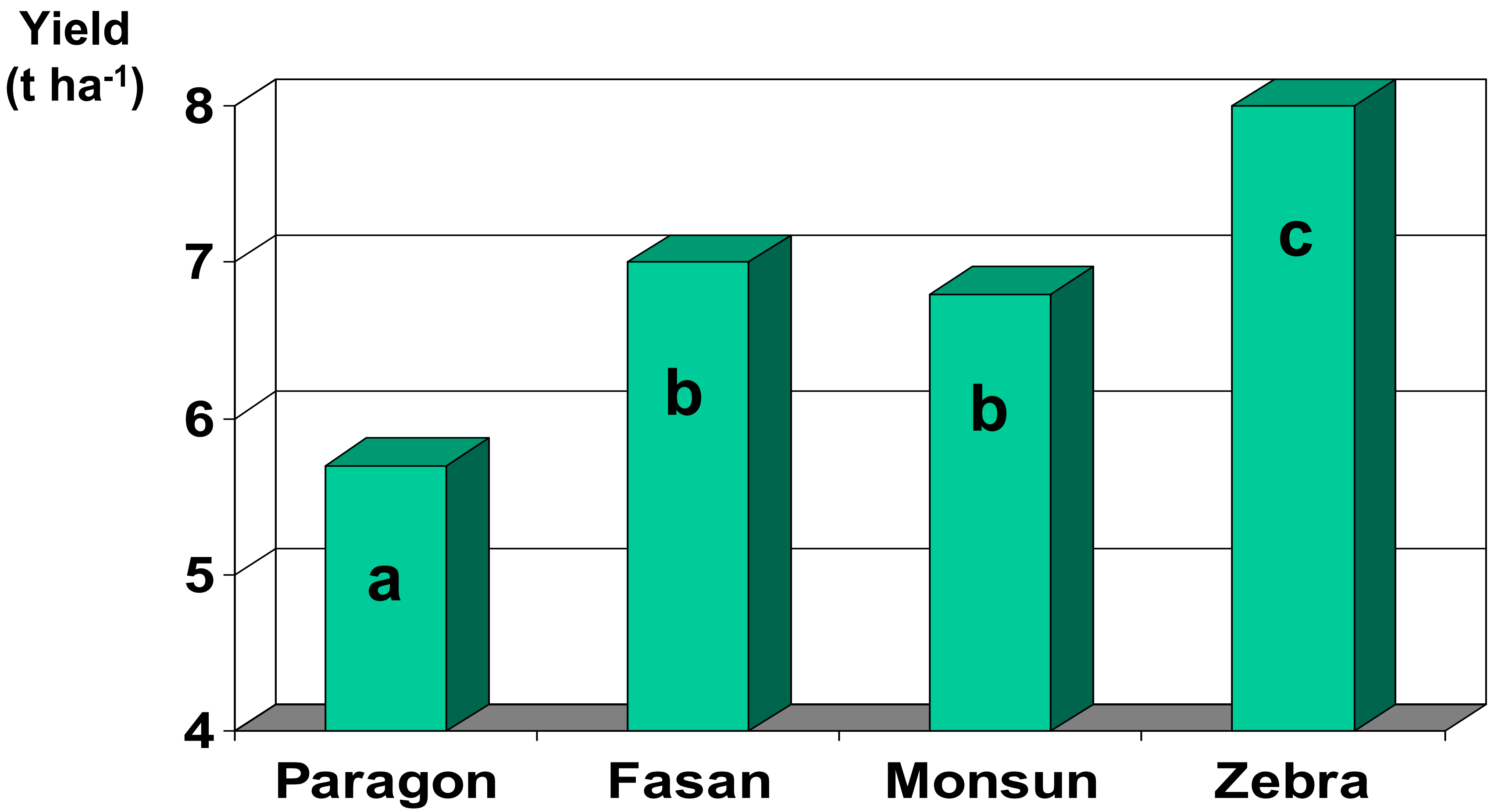
Effect of optimised clover based N-input regimes on baking quality related parameters in different winter and spring wheat varieties

SEM = 0.14 – 0.34



Yield response of different spring wheat varieties to optimised clover based N-inputs and green waste compost amendments



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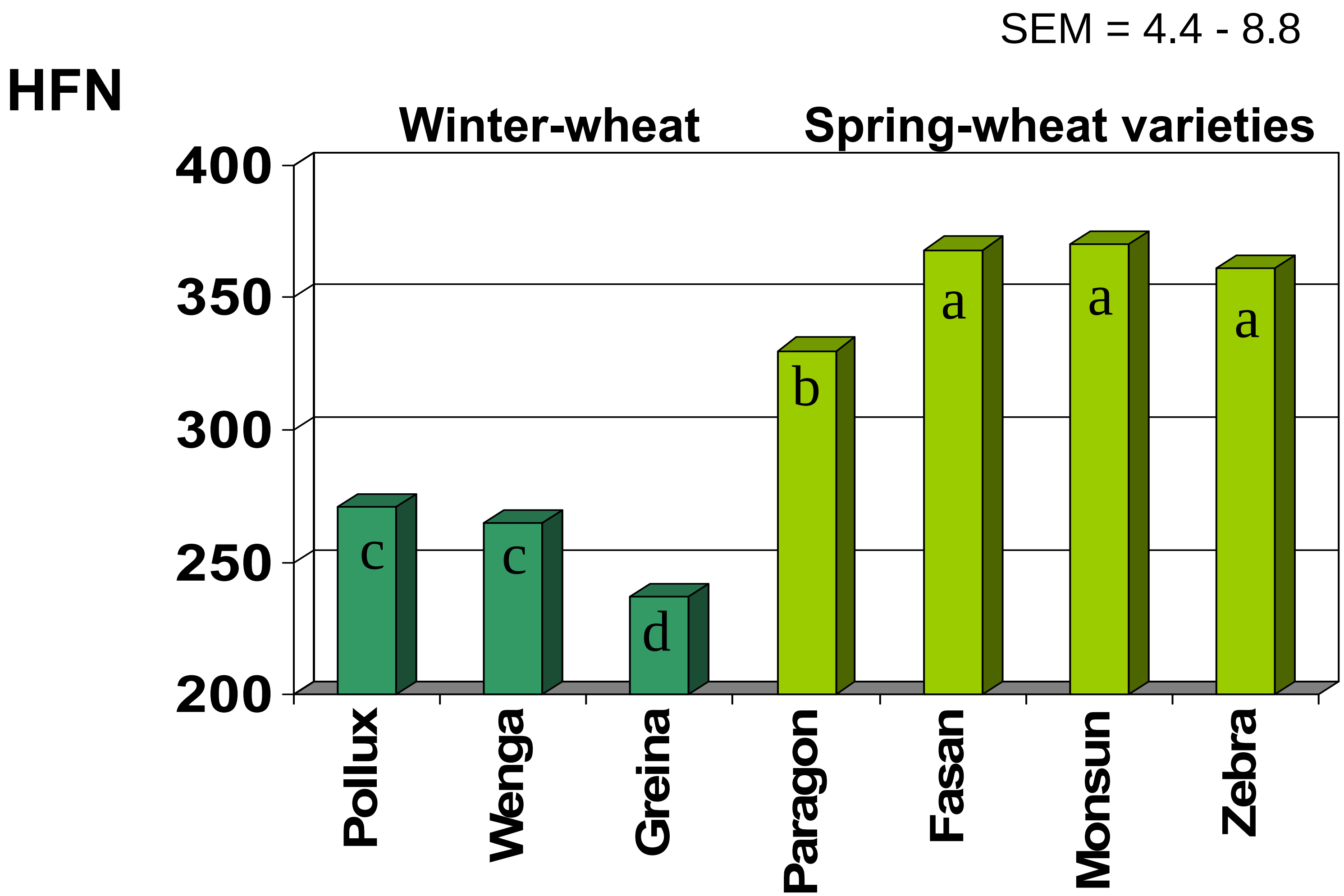
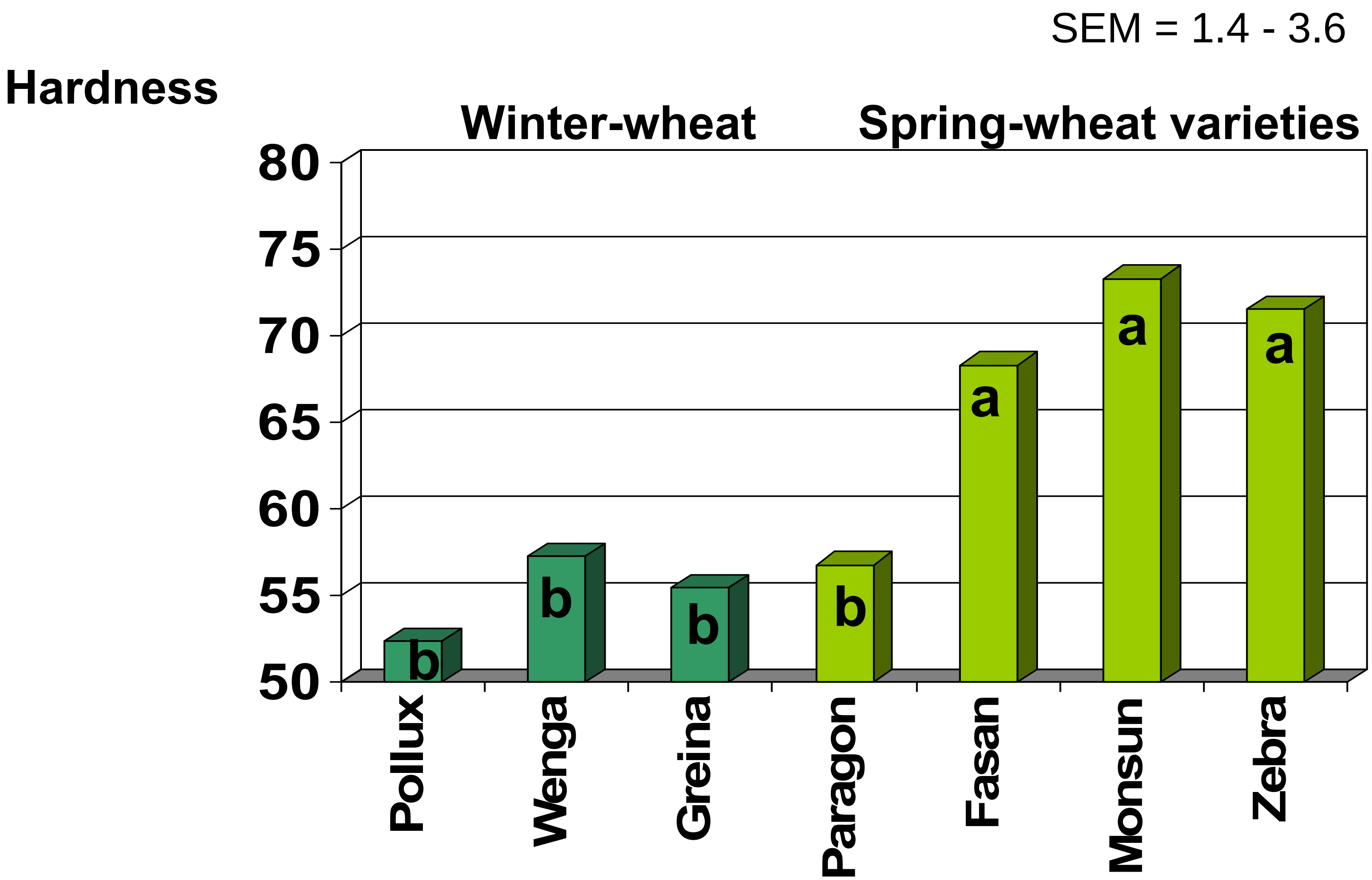
Effect of optimised clover based N-input regimes and green waste compost amendments on baking quality related parameters in different winter and spring wheat varieties



Effect of optimised clover based N-input regimes on and green waste compost amendments baking quality related parameters in different winter and spring wheat varieties



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Additional slides

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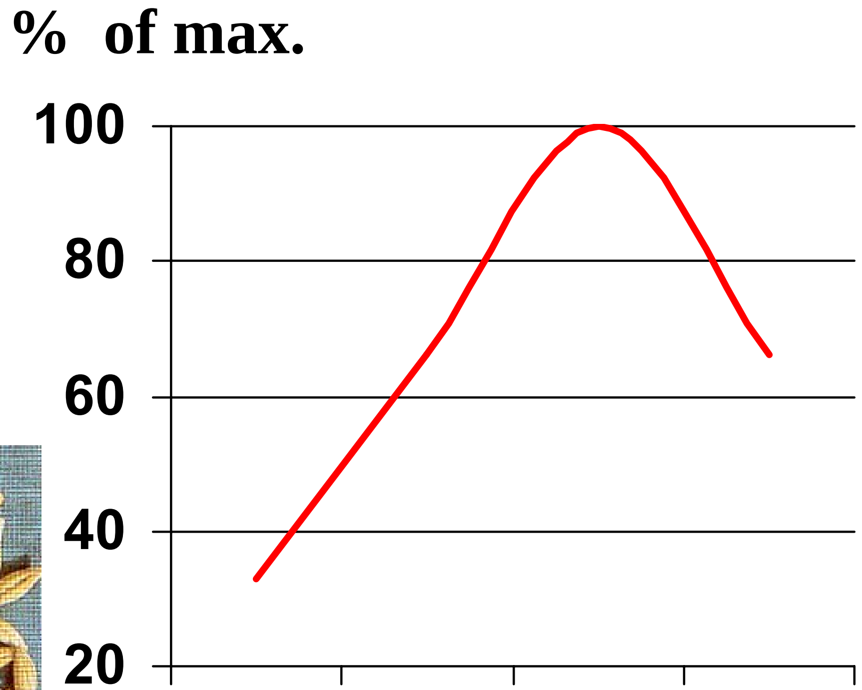
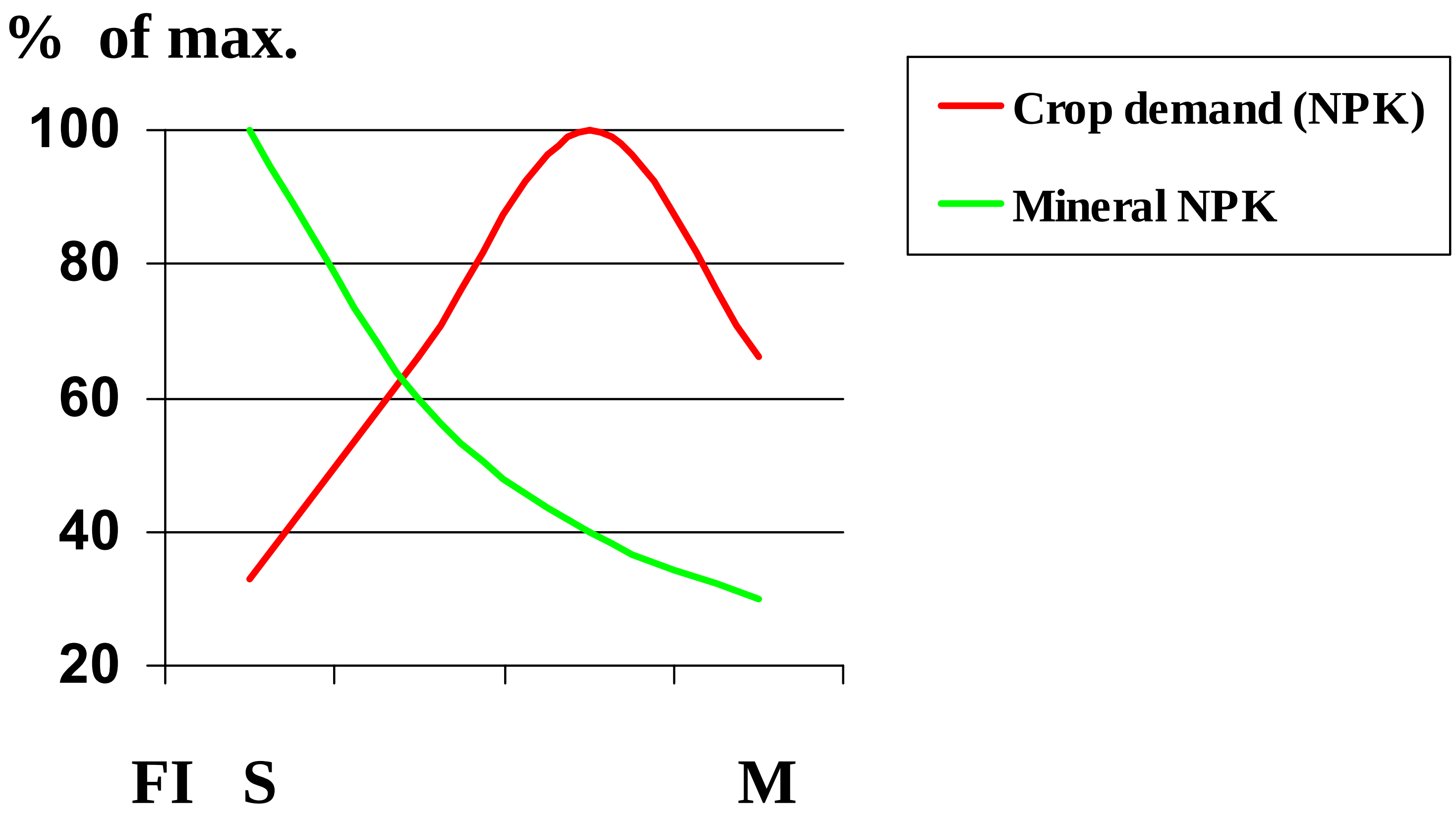
Organic matter based fertility management: Matching mineralisation with crop demand



↑ sowing

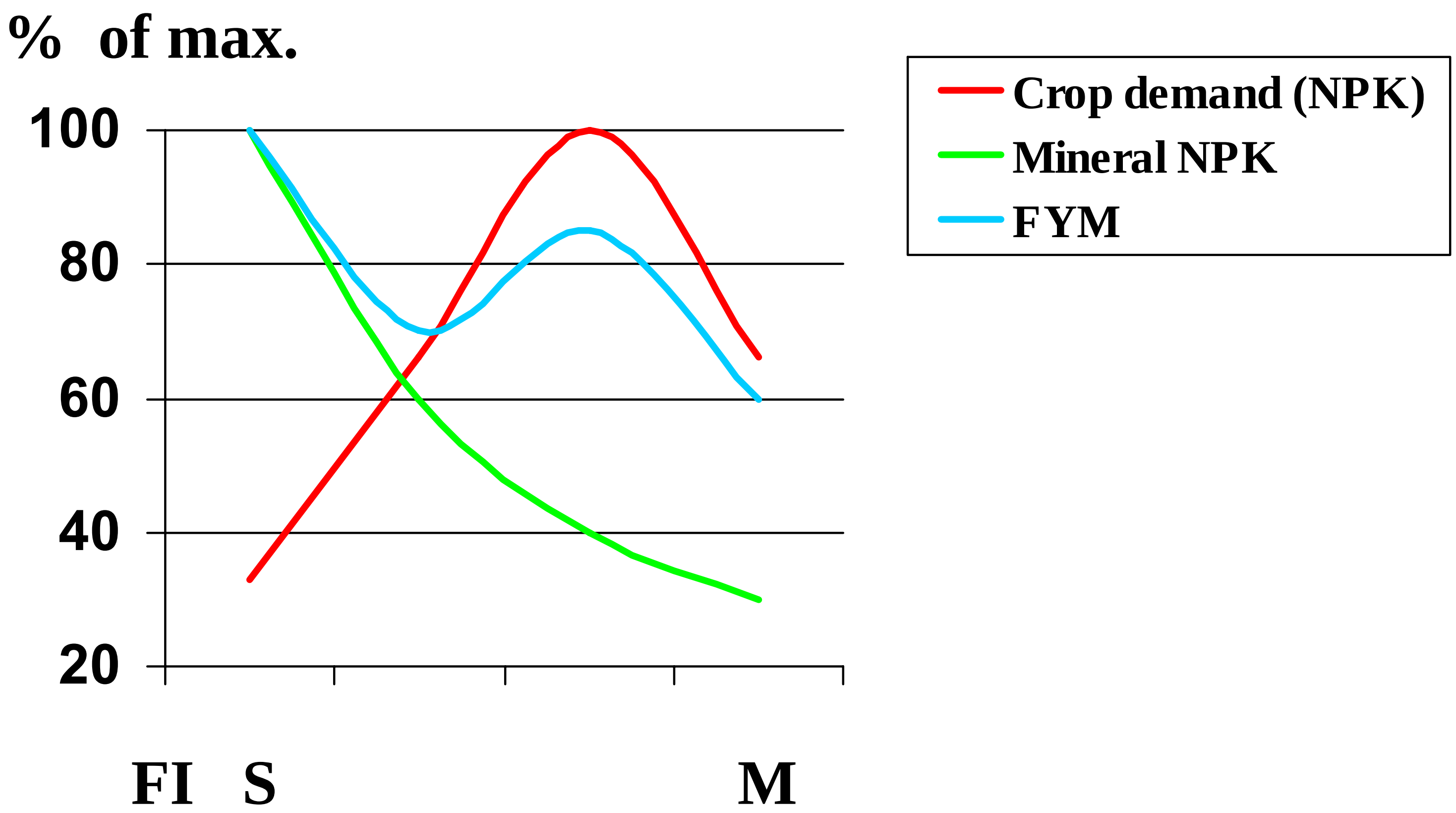
↑ maturity

Organic matter based fertility management:
Matching mineralisation with crop demand



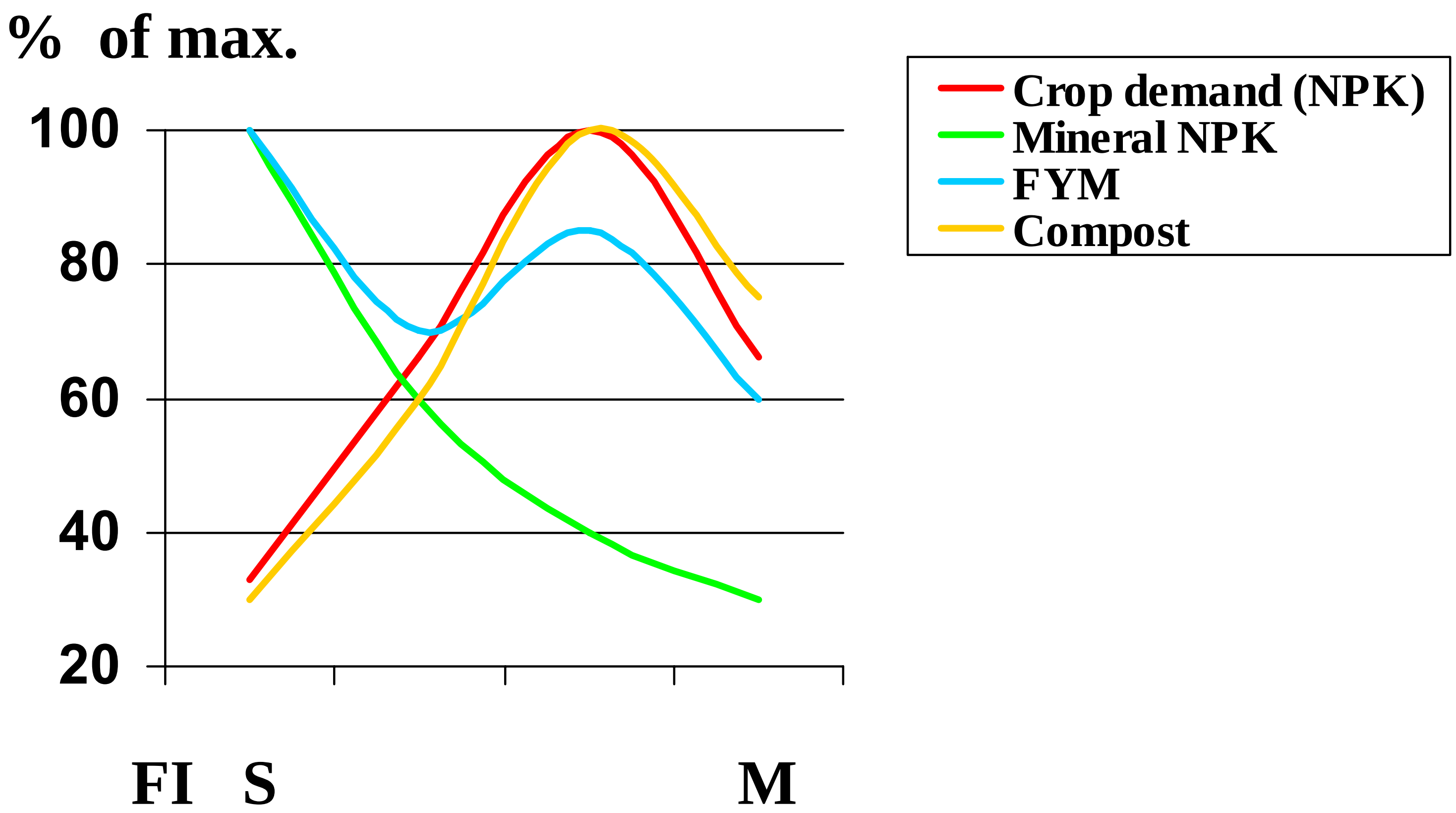
S = sowing M= maturity FI= Fertility input

Organic matter based fertility management: Matching mineralisation with crop demand



S = sowing M= maturity FI= Fertility input

Organic matter based fertility management: Matching mineralisation with crop demand



S = sowing M= maturity FI= Fertility input

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Target: Reduced energy use and CO_2 emissions in agriculture

R&D needs and objectives

- **Improving nitrogen-fixation (legume) based N-inputs**
- **Improving organic matter-based fertility management systems**
- **Developing crop varieties suitable for "low input" food production systems**
  - **Nutrient use efficiency** from organic matter based fertility inputs
  - **Resistance to novel disease, pest and weed challenges** associated with "lower input" systems
  - For example for wheat
    - ◆ **less focus** on powdery mildew, rusts and
    - ◆ **more focus** on Septoria and insect pest resistance

Does this apply also to the developing world?

Yes, even more, because:

- Farmers in the developing world (especially the very poor countries) can not afford mineral fertilisers and especially pesticides inputs

- Mineral fertilisers and pesticide use in developing countries are mainly used to produce for export to the developed world
  - Pesticides that are banned/restricted in Europe (e.g. methyl bromide, organochlorine compounds), because of their global environmental/human health impacts, are used
  - Health impacts in humans due to environmental pesticide exposure are much more widespread

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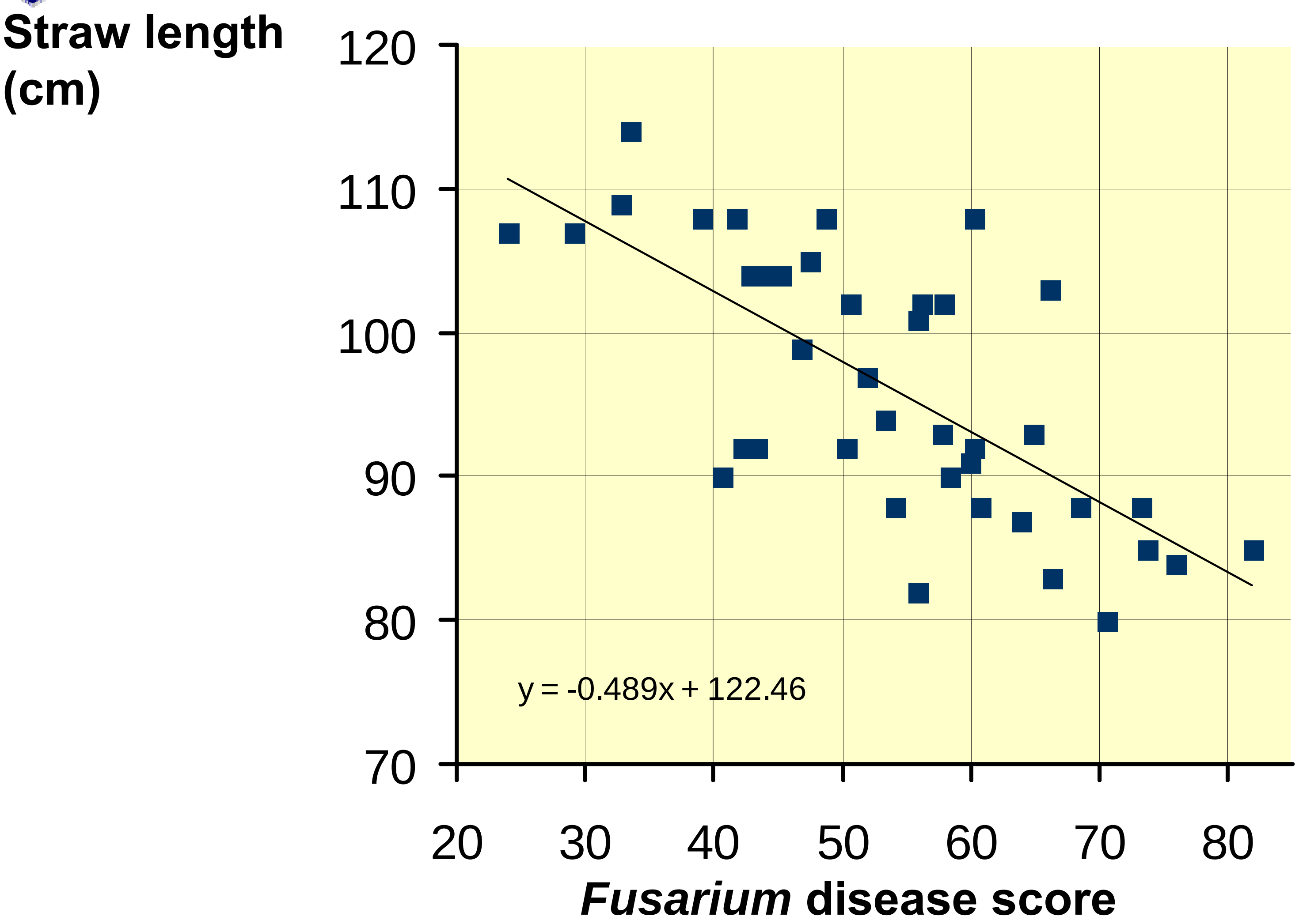
Baking quality of wheat genotypes

Baking Quality	Straw length: Long	Straw length: intermediate	Straw length: short
Very High E	1. Bussard 2. Fasan (S)		
High A	1. Asketis 2. Strube	1. Cubus 2. Trend 3. Chablis (S) 4. Merk (S)	1. Malacca 2. Piccolo (S) 3. Star (S) 4. Velos (S)
Satis-factory B	1. Drifter	1. Greif 2. NEW21-1	1. Macro 2. Habicht 3. Aardvark
Livestock feed C	1. Previa	1. Certo	1. Biscay 2. Genghis 3. Buccaneer

Correlation between susceptibility to *Fusarium* grain infections & stem length in winter-wheat



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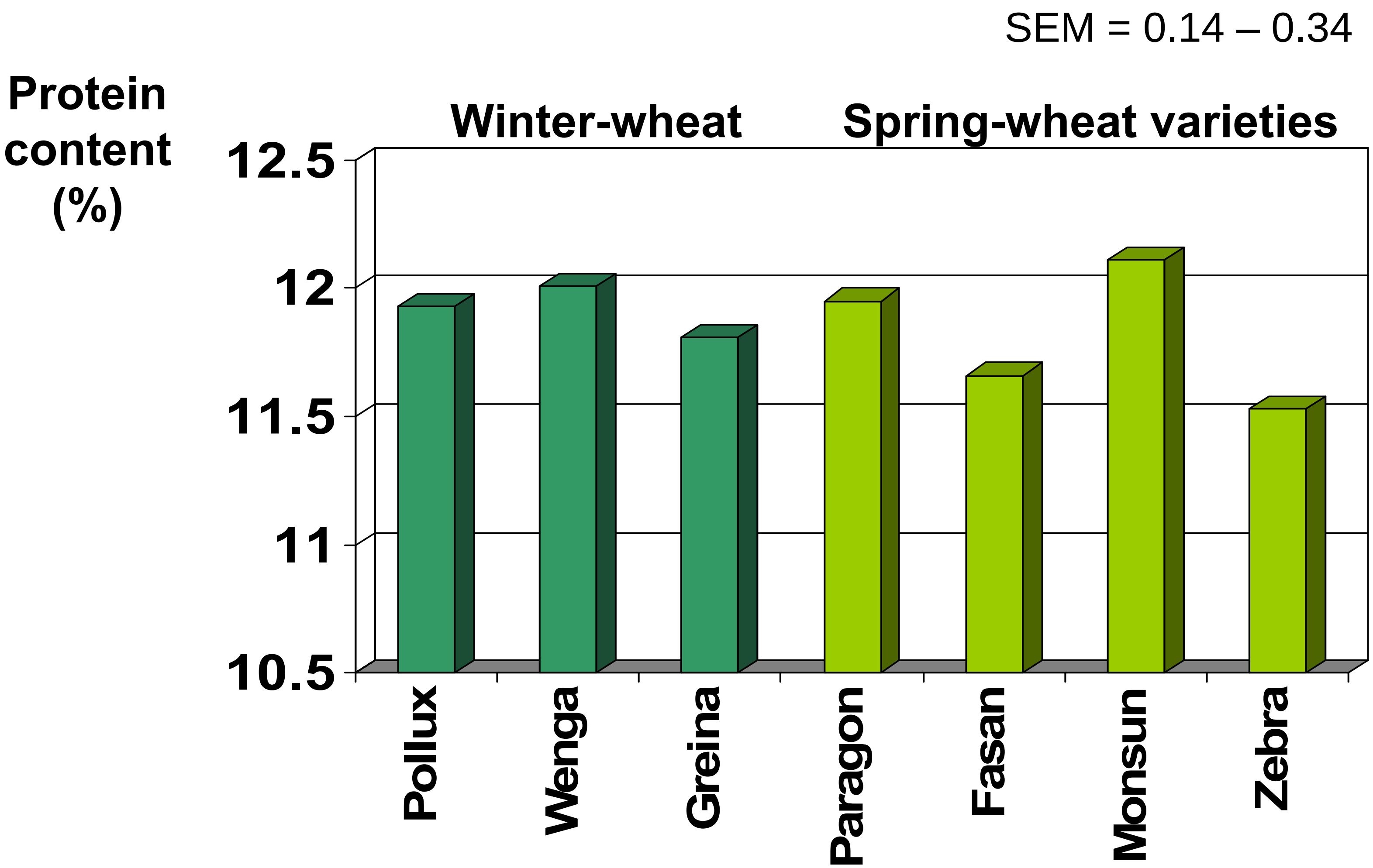
Yield obtained with and without standard fungicide regime by winter-wheat varieties listed in Germany

Varieties	% Market share	Yield (t/ha) - fungicides	+ fungicide	additional yield (%)
15 least responsive varieties	21%	8.4	9.2	9
- Certo	-	9.0	10.0	10
15 most responsive varieties	19%	8.0	9.6	16
- Contur	-	8.0	9.9	19
mean of all listed varieties	100%	8.1	9.3	13

Effect of optimised clover based N-input regimes on baking quality related parameters in different winter and spring wheat varieties



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Effect of optimised clover based N-input regimes on baking quality related parameters in different winter and spring wheat varieties

SEM = 0.12 – 0.71