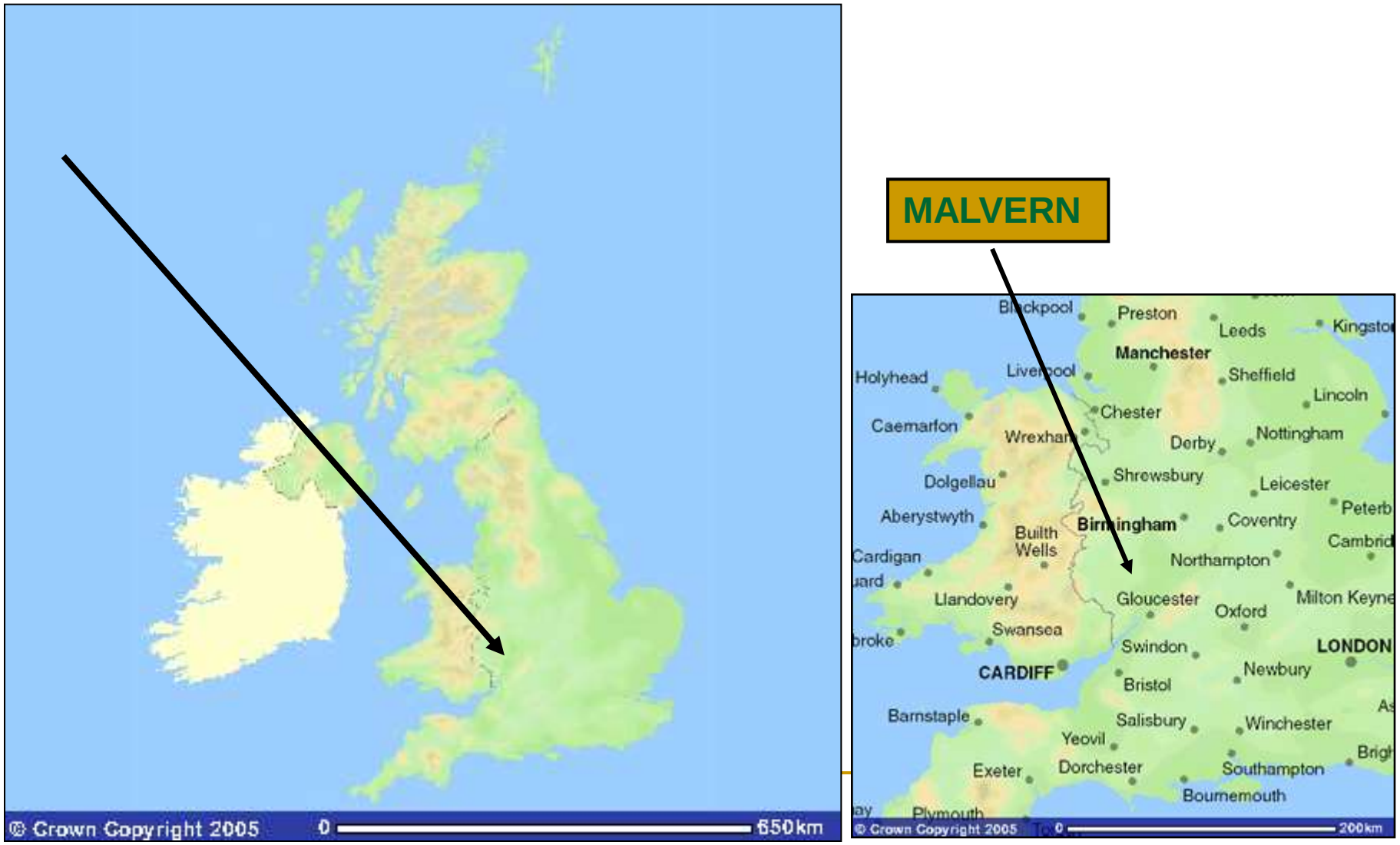
NLSD/BASE 2010

SMI Soil Management Initiative

JIM BULLOCK

Location of Mill Farm, Malvern



Farm information:

Malvern Worcestershire

- **Size – 320 ha**
- **Three units 12 km apart**
- **Average field size 6.8 ha**
- **Soil Type – Heavy Silty/clay**
- **Average Rainfall 700mm (1050 – 2008!)**

Reduced tillage over the last 40 years

Eco-Intensive Agriculture
Jig-Saw – you need all the pieces

Conservation Agriculture
Our results after 12 years

Reduction in use of pesticides and artificial fertilisers

Improved habitats for flora and fauna

Fuel consumption halved

Reduced Machinery costs

Crop yields maintained

Better soil quality

Why reduced Tillage ?

- Differing goals economically and environmentally
- Better understanding of soils and techniques
- New technologies

SD Worldwide

Spring sown crops –
Northern Hemisphere
Canada, US, Finland, Eastern Europe.

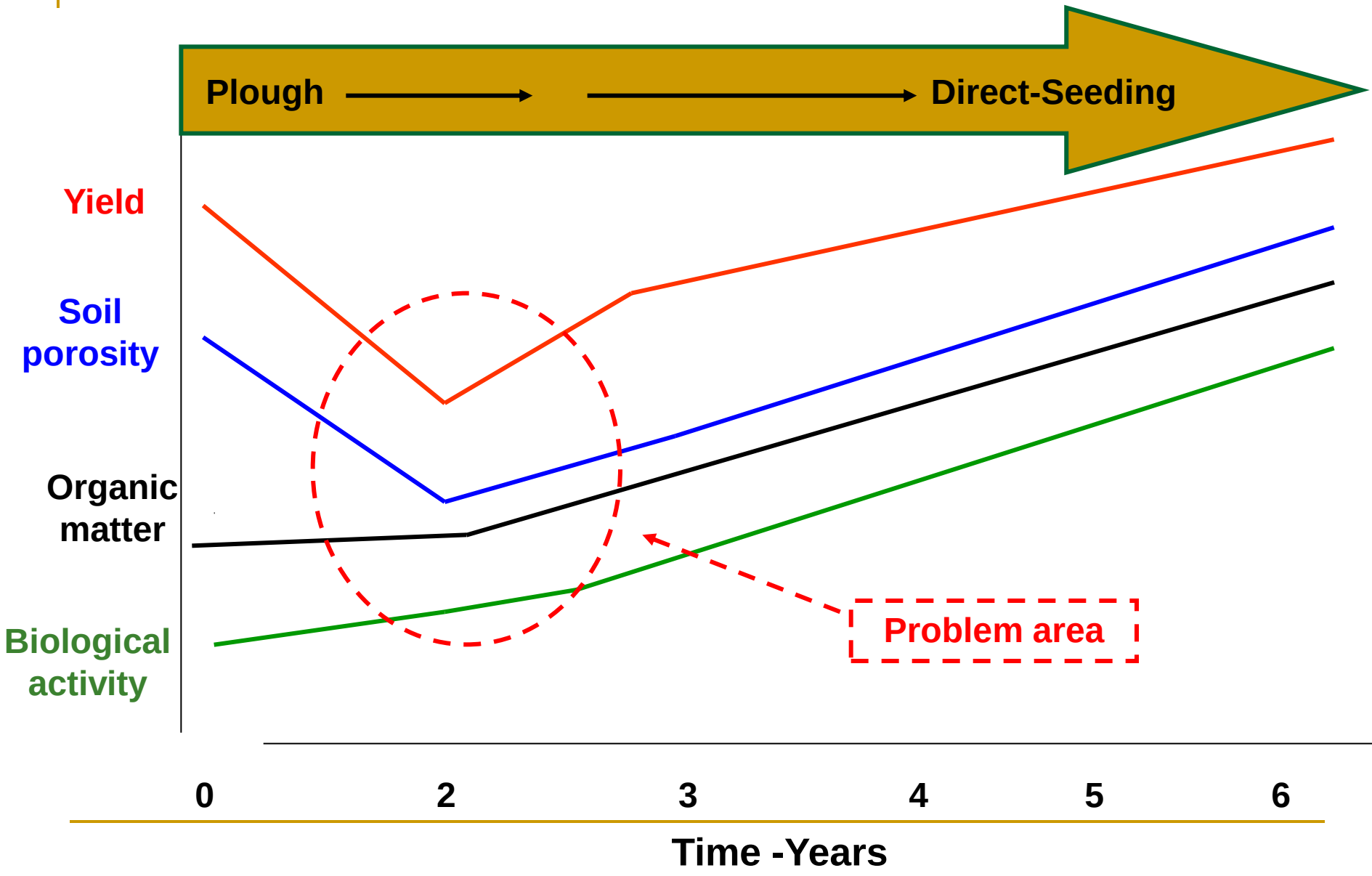
Continuous Growing season -

Southern Hemisphere –
New Zealand, Australia, South America

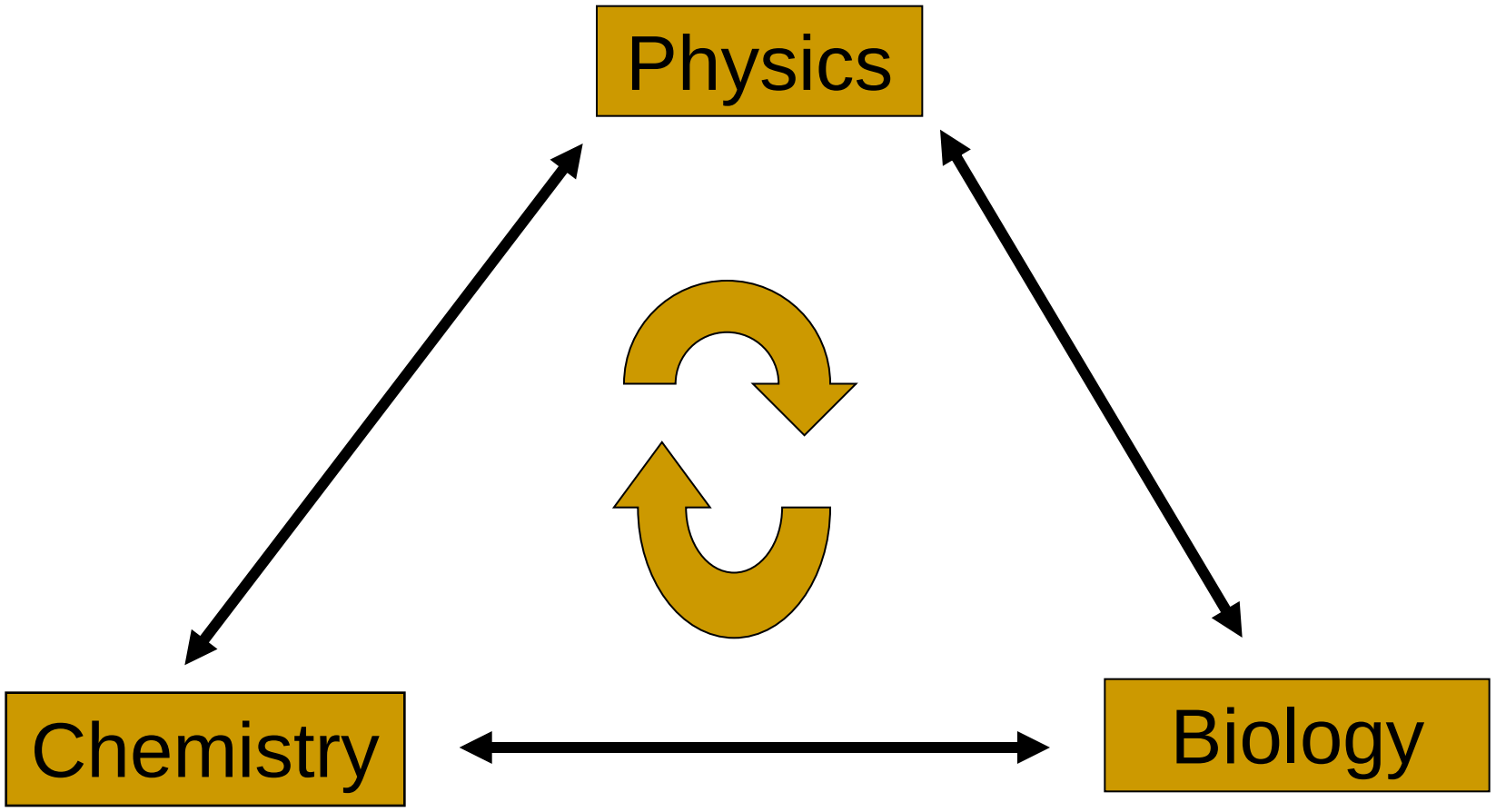
"Crops do not stop growth for Winter"

Direct-Drill or “One –Pass seeding

The effect of changing to non-inversion tillage



Soil Basics



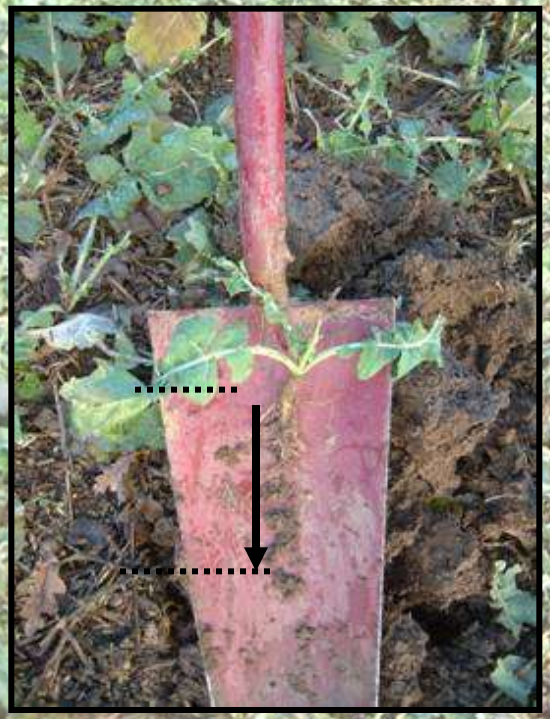
Direct drilled Wheat

Direct drilled Spring Beans

Direct drilled Oats

Soil Structure – compaction depth

Soil structure & its effect on crop rooting



What is happening under the surface?

Boulet draineur

Residue or Trash ?

Residue –

- Improves soil workability
- Maintains soil fertility
- Reduces erosion
- Encourages earthworms

Trash –

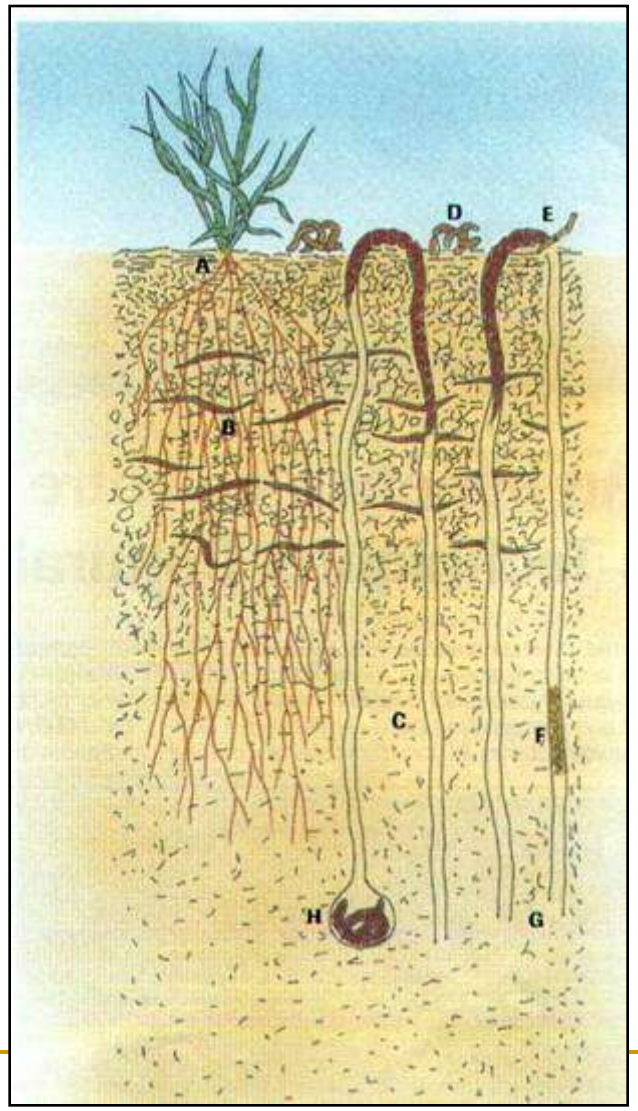
- Creates establishment and weed control problems
- Encourages slugs
- Reduces crop yields

Harrowing to spread straw

Action of Harrow

- Harrow tines disrupt slugs (and slug eggs)
- Micro-tilth promotes germination of weed seeds
- Spreads straw and chaff

Worm activity



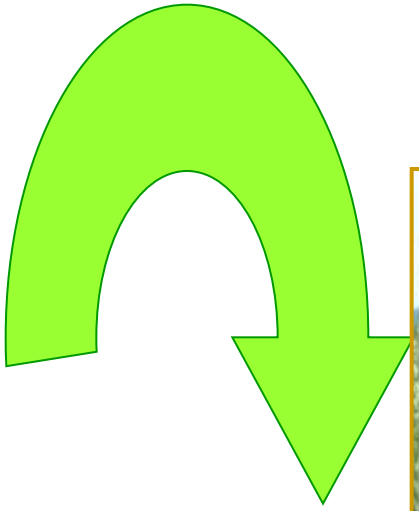

Evidence of worm activity

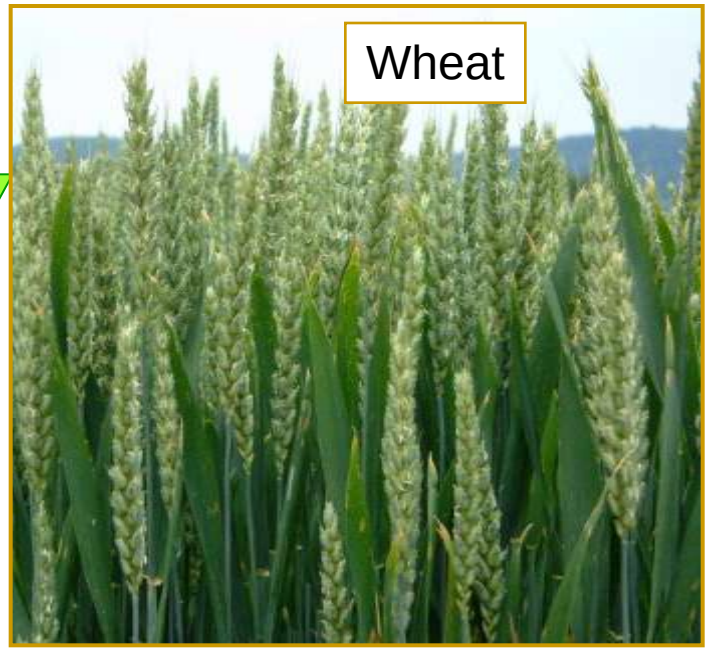
ROTATION TCS/SD

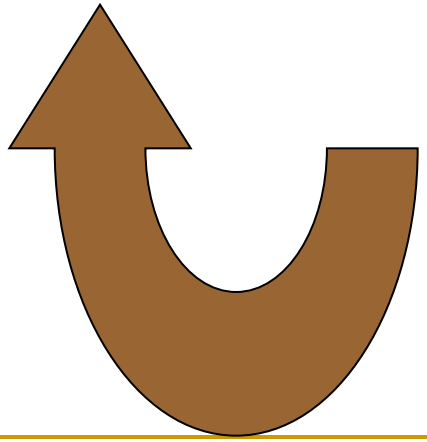
ROTATION

Controllable grass weeds

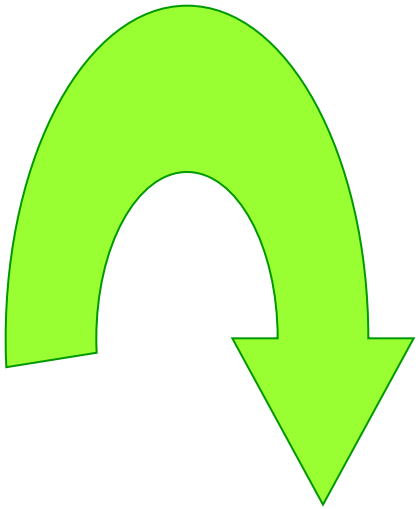
ROTATION Poor soils (low pH & P+K)

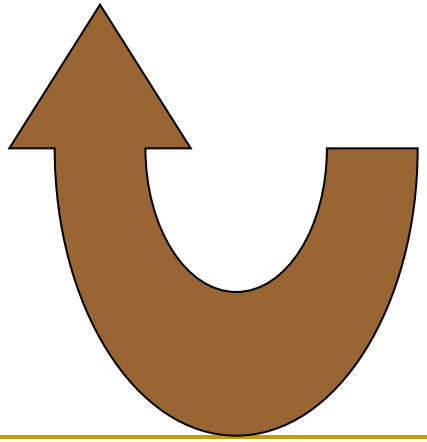




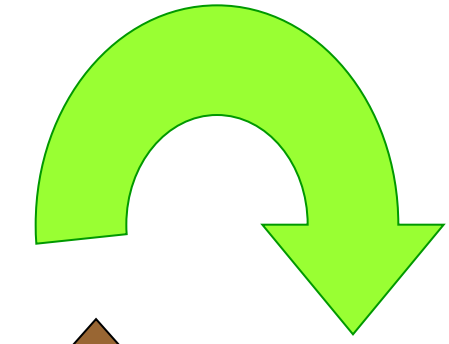


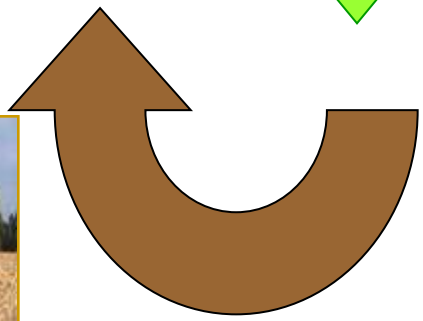
ROTATION Low N input



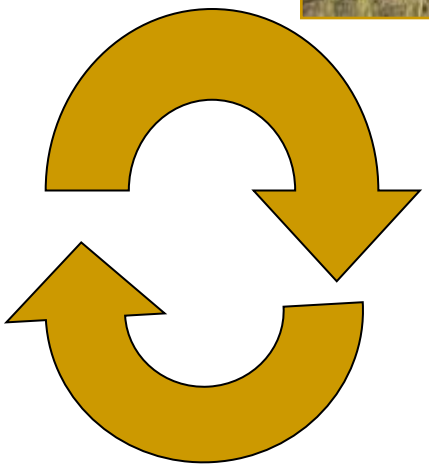


ROTATION : Bio-mass (bio-gas)





Bio-mass rotation



Choice of varieties

- Long strawed cereals tend to have more vigorous root systems
- Hybrid rape varieties are worth considering where drilling is late..

12/9/07 Excalibur/Astrid

Grass weeds

ROTATION - Double-break

Challenge conventional systems

Oilseed rape after wheat

Oilseed rape after spring beans

Value of double break

- Wheat yield increased by 1 ton/ha for -:

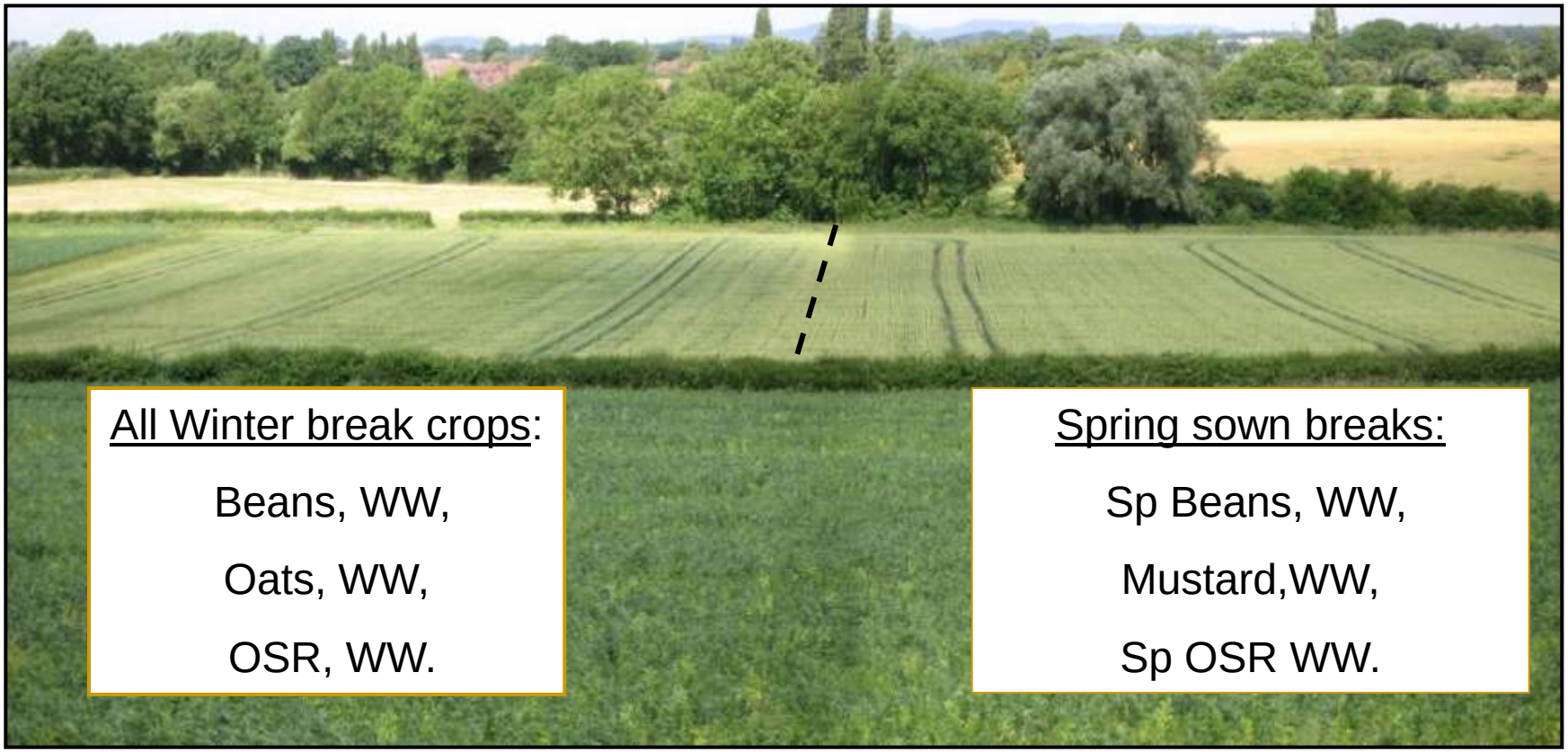
Beans/OSR/Wheat/Wheat

compared to

Beans/Wheat/OSR/Wheat

- Improved grass weed control

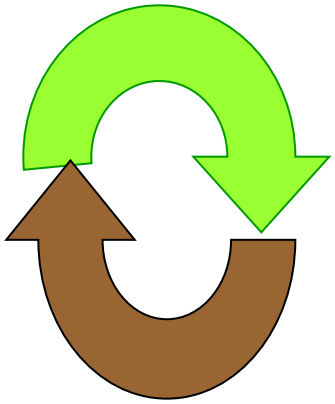
Benefit of Spring break crops.

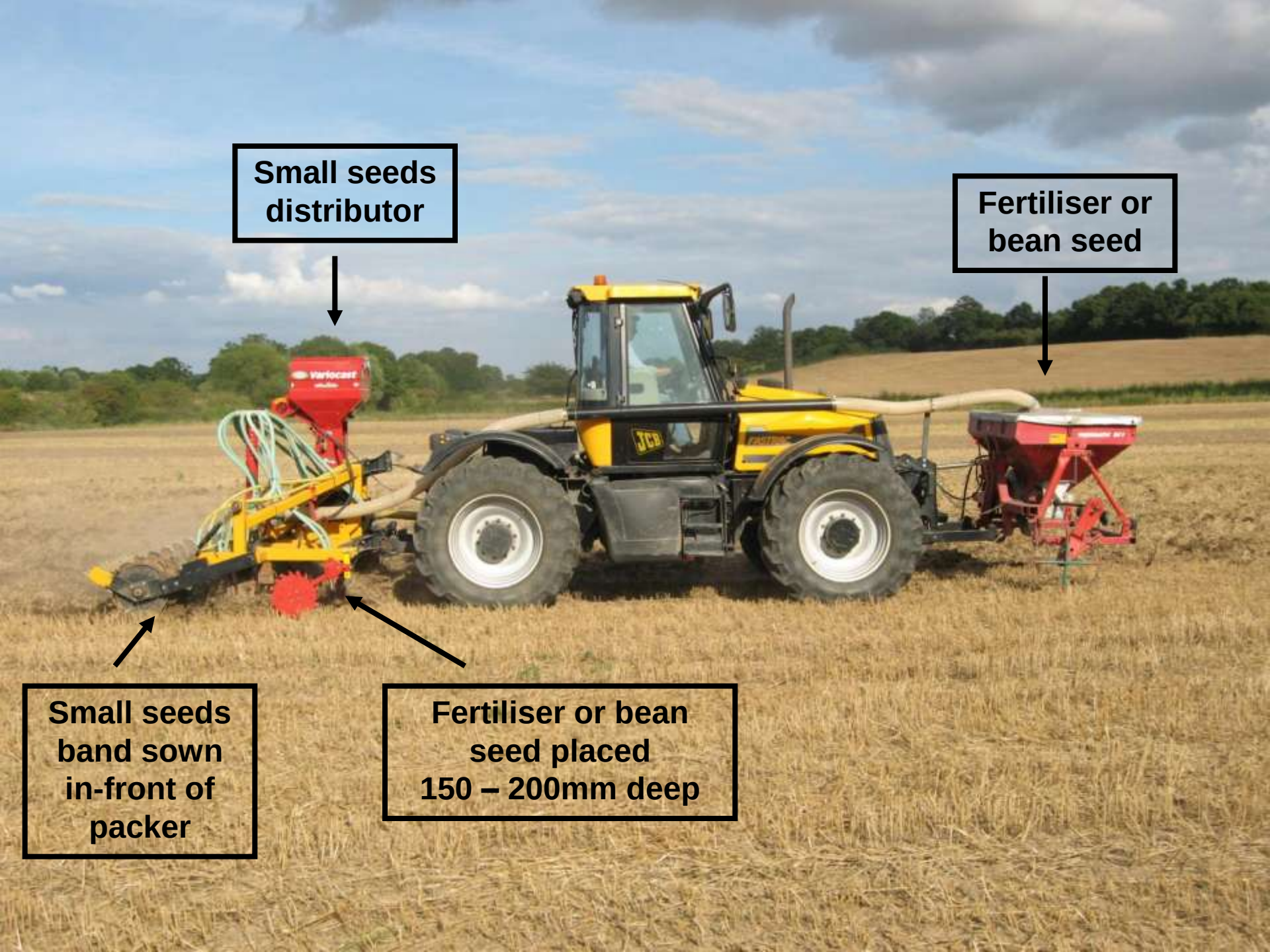


ROTATION – Spring OSR/Wheat

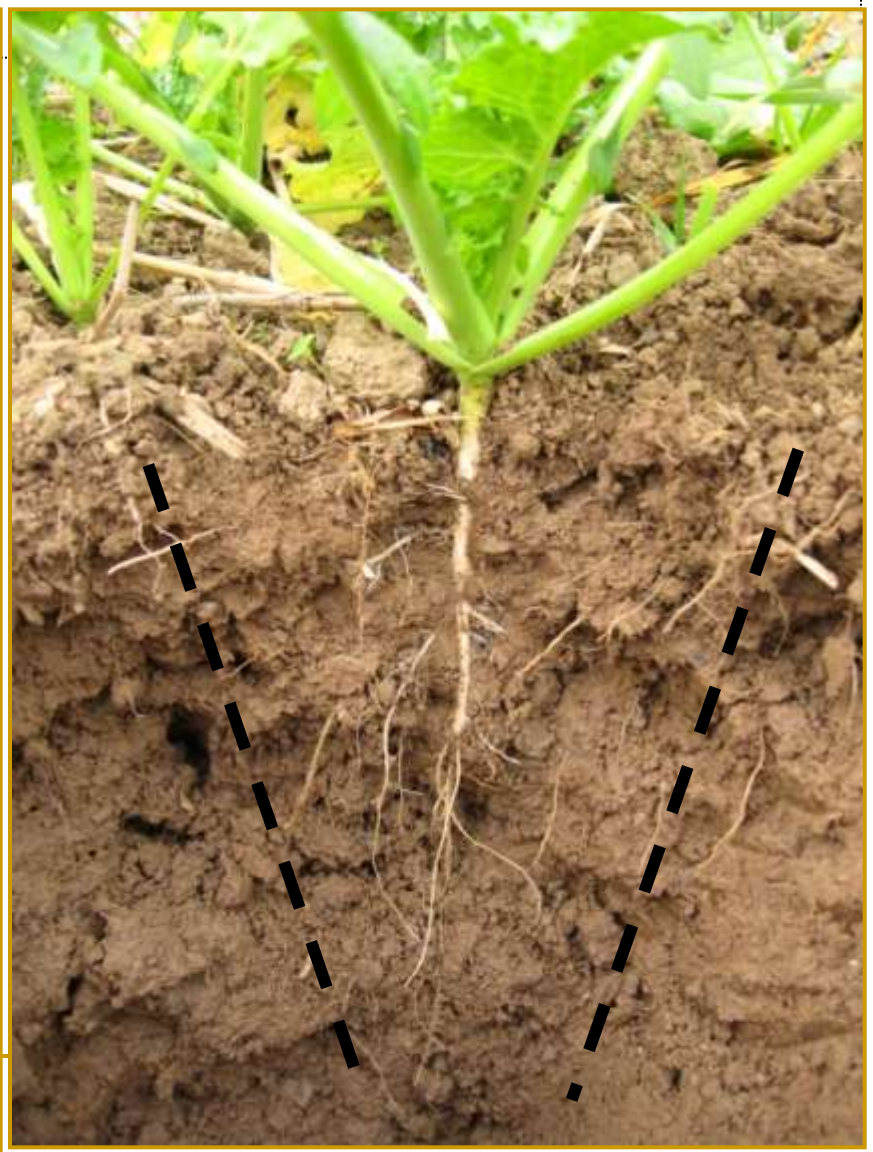
Winter v Spring sown break crops.

Establishment Rotation (direct drill/till-seed)



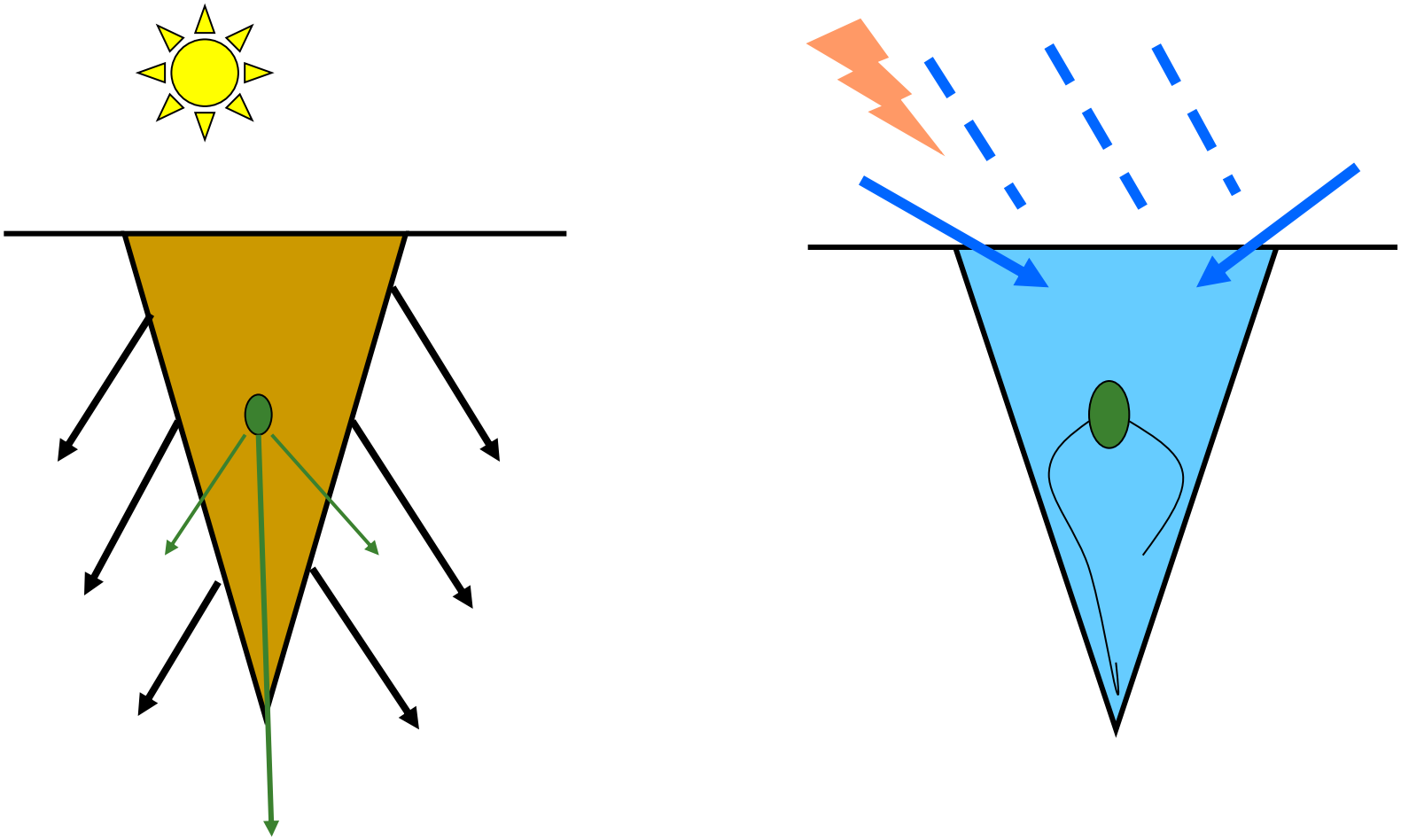

Small seeds distributor
Fertiliser or bean seed
Small seeds band sown in-front of packer
Fertiliser or bean seed placed 150 – 200mm deep

Roots – stabilise soil structure



Till-seeded beans

Problem with strip-till



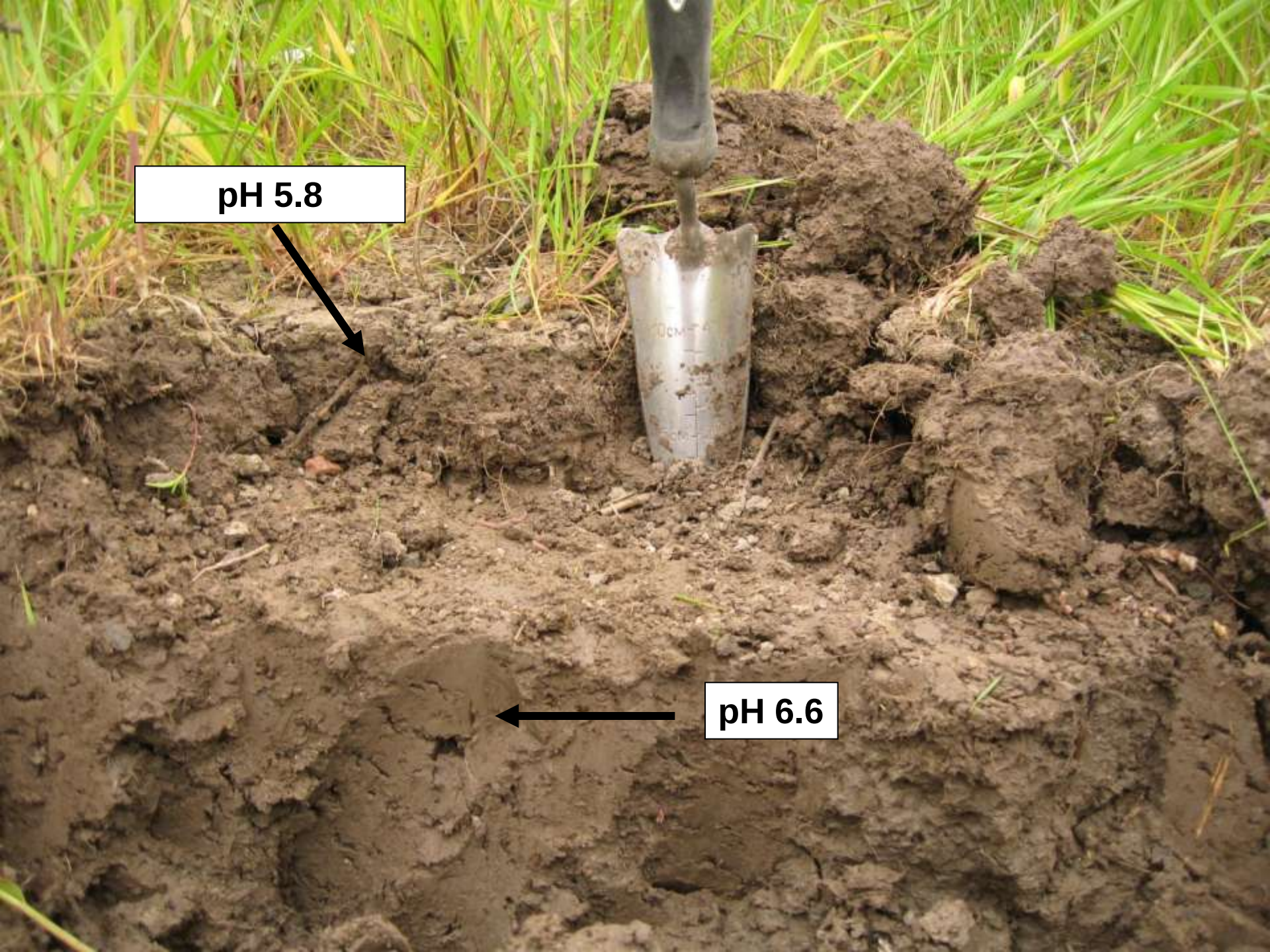
Direct drilling wheat into winter bean residue and volunteers

Three very wet summers

- 135mm rain July 20th **2007** – 170mm total for month
- July/August/September **2008** – 300mm rainfall
- July **2009** – 23 wet days over 125 mm!

Wet straw – severe wheelings

Uneven soil moisture


pH 5.8
pH 6.6

Problem Soil

Well Balanced

Hi Magnesium

The influence of pH on soil biological activity

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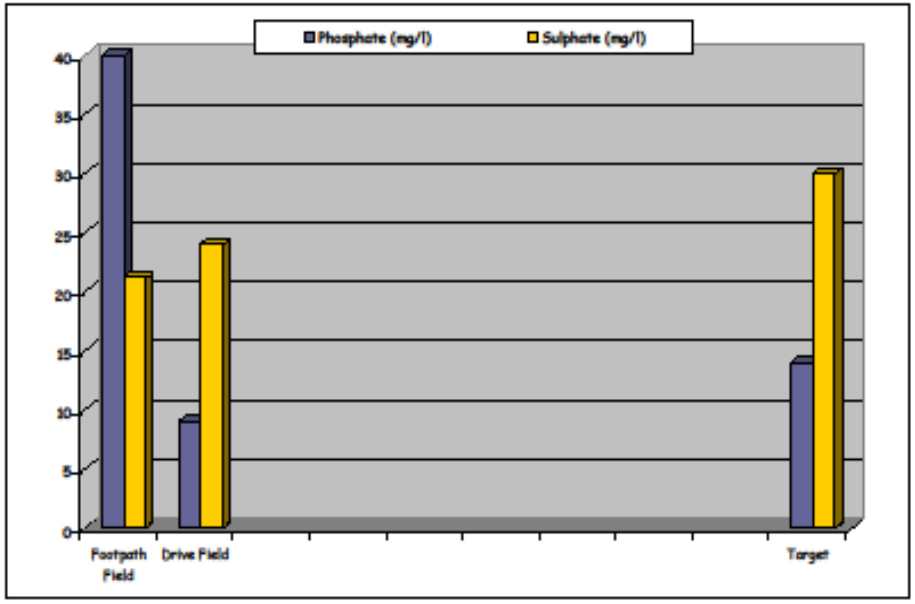
The Mill Farm, Malvern

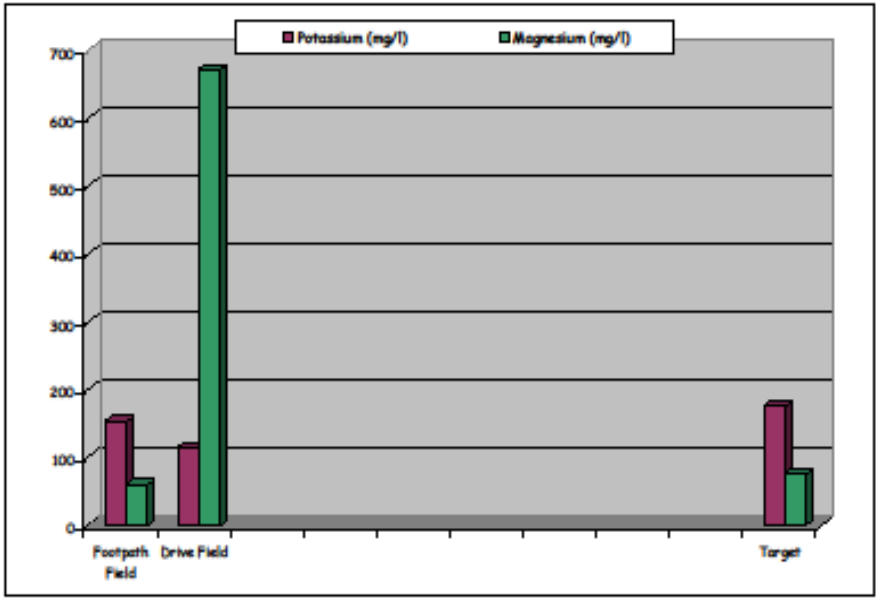
Nov '09

Soil Health Check - Primary Data for Soil & Nutrient Management Plans

Sample reference Field	crop	Soil pH	Phosphate P_2O_5	Potassium K_2O	Magnesium MgO	Nitrogen (SNS)	Sulphate SO_3	Soil O.M.	Soil Particle Distribution Sand	Silt	Clay	Stone content	CEC cmol/kg	Soil Classification class	texture	Erosion Risk based on texture
Footpath Field	arable	7.7	40.0 3+	152.0 2-	59.0 2-	41.2 2	21.2	3.2%	22.0%	44.0%	34.0%		21.2	3 mineral	Clay loam	v low to low
Drive Field	arable	6.4	9.0 0	114.0 1+	672.0 7	41.4 2	24.0	3.3%	12.0%	42.0%	46.0%		31.3	3 mineral	Clay	v low to low
Suggested Range		*6.0 - 6.8*	*14 - 18*	*175 - 225*	*75 - 100*	*30 - 60*	*30 - 45*	*5.0%*								

Major Nutrient Sufficiency Levels (ppm)





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Dedicated Analysis for Integrated Soil, Plant & Animal Nutrient Management

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The Mill Farm, Malvern

Advisor Steve Townsend

Agrimax

Sample Ref Footpath Field

arable

arable

Soil class 3 Mineral

texture Clay loam

Stones <5%

Soil OM 3.2%

Soil pH (water) 7.7

Soil pH (salt) 7.1

Major Nutrients (mg/l)		Deficit	Low	Good	High	Excess	*Kar*	Elemental (mg/l)
Phosphate, P_2O_5	40.0 3+						2.35	17.4 P
Potassium, K_2O	152.0 2-						0.82	126.2 K
Magnesium, MgO	59.0 2-						0.71	35.6 Mg
Calcium, CaO	3808.9 3						1.04	2722.2 Ca
Sodium, Na_2O	15.3 1						0.40	11.4 Na
Sulphate, SO_3	21.2 1						0.53	8.5 S
Nitrogen, $NH_{4-(ENR}$	21.8 2						0.41	103.2 N
Nitrate, NO_3^-								
K:Mg ratio	2.6 :1							
Mg:P ratio	1.5 :1							

Micro-Nutrients (mg/l)		Deficit	Low	Good	High	Excess	*Kar*	
Iron, Fe	69.9						2.15	DPTA
Manganese, Mn	11.2						0.43	DPTA
Boron, B	1.4						0.80	Water
Zinc, Zn	16.0						2.58	EDTA
Copper, Cu	28.0						5.43	EDTA
Molybdenum, Mo	-							
Cobalt, Co	-							
Iodine, I	-							
Selenium, Se	-							
Chloride, Cl^-	-							

Cation Exchange ($cmol_c$/kg)		Deficit	Low	Good	High	Excess	mg/l	$K_{mg/kg}$	BCSR
Total CEC	21.20								
Calcium, Ca^{2+}	18.60						3707.7	1450.0	87.26
Magnesium, Mg^{2+}	0.64						64.8	-281.7	2.55
Potassium, K^+	0.35						136.5	-179.4	1.65
Sodium, Na^+	0.09						23.9	-30.7	0.42
Iron, Fe^{2+}	0.21						67.6	64.2	1.01
Aluminium, Al^{3+}	1.33						127.5	1.7	6.26
Hydrogen, H^+	0.00						0.0	-24.2	0.00
Other cations	0.18							31.0	0.84
Ca:Mg ratio	34.3 :1								
Mg:K ratio	1.5 :1								

Soil Parent Material		Deficit	Low	Good	High	Excess	
Soil pH	7.7						
Conductivity	2117.0 uS						
Bulk Density	1.102 g/cm3						
Infiltration ratio	0.011 cm3/s						
Sand	22.0 %						
Silt	44.0 %						
Clay	34.0 %						0.908 *Kr*
Organic Carbon	1.84 %						0.092 *Kr*
Microbial assay	246.0 ug						FDA extract
C:N ratio	-						
N:S ratio	-						

CATTS Soil Solutions - Provisional Fertiliser Recommendation

Nov '09

W Bullock & Partners

The Mill Farm, Malvern

soil type Clay loam | group 3 Mineral | pH 7.7 | O.M.(%) 3.2

SNS index 2 103 mg/l | Mg index (MgO) 2- 69 mg/l | P index (P_2O_5) 3+ 40 mg/l | K index (K_2O) 2- 162 mg/l

Footpath Field

	W Wheat feed		Fertiliser selection	composition							Application rate	Nutrient applied							Comments
				N	P_2O_5	K_2O	MgO	CaO	SO_3	Na_2O	(per hectare)	N	P_2O_5	K_2O	MgO	CaO	SO_3	Na_2O	
SOIL BUILDING	This soil requires organic matter & routine Calcium inputs to maintain structure. Consider using an organic-based fertiliser to condition soil. Cover cropping with rye or oats would be beneficial.		Nutri-Bio 25 % avail	0.1	1.2	0	0.2	5	0.8	1.3	12000 kg/ha	12	144	4.8	24	600	96	156	
											units/ac	10	115	4	19	480	77	125	
											available in yr 1	3	36	1	6	150	24	39	
												2	29	1	5	120	19	31	
CROP BUILDING	Starter fert - placement N with P. Consider foliar P as an alternative. Microbial or Manganese seed treatment	GS 12/14	Phosphorous																
	N1 - feeding active growth. Use an NKS compound or a Urea-Potassium blend	GS 24-30	NKS	23		25			30		200 kg/ha	46		50			60		
											units/ac	37		40			48		
	N2 - canopy development	GS 31-32	NKS	23		25			30		250 kg/ha	57.5		62.5			75		
											units/ac	46		50			60		
	N3 - grain building	GS 37-39	Urea + S	38					19		200 kg/ha	76					38		
											units/ac	61					30		
											TOTAL NUTRIENT APPLIED (kg/ha)	183	36	114	6	150	197	39	
											RB209 recommendation (kg/ha)	180	20	45					

	Action	Stage	Requirement	Comments
FOLIAR NUTRITION	Nutritional inputs for optimising plant growth, environemtnal tolerance & disease resistance	GS 24	Phosphorous, Magnesium, Manganese, Zinc	
		GS 32	Phosphorous, Magnesium, Zinc, Sulphur	
		GS 39	Magnesium, Sulphur	
	Foliar Nitrogen with Magnesium & Sulphur to maintain grain protein	GS 69	Nitrogen, Sulphur, Magnesium	

Agronomist : Neil Douglas Fuller
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CATTS **Soil Solutions - Provisional Fertiliser Recommendation**

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The Mill Farm, Malvern

soil type Clay loam | group 3 Mineral | SNS index 2 103 mg/l | P index (P_2O_5) 3+ 40 mg/l

pH 7.7 | O.M.(%) 3.2 | Mg index (MgO) 2- 69 mg/l | K index (K_2O) 2- 162 mg/l

Footpath Field

	Oilseed rape		Fertiliser selection	composition							Application rate	Nutrient applied							Comments
				N	P_2O_5	K_2O	MgO	CaO	SO_3	Na_2O	(per hectare)	N	P_2O_5	K_2O	MgO	CaO	SO_3	Na_2O	
SOIL BUILDING	This soil requires organic matter & routine Calcium inputs to maintain structure. Consider using an organic-based fertiliser to condition soil. Cover cropping with rye or oats would be beneficial.		Nutri-Bio 25 % avail	0.1	1.2	0	0.2	5	0.8	1.3	12000 kg/ha	12	144	4.8	24	600	96	156	
											units/ac	10	115	4	19	480	77	125	
											available in yr 1	3	36	1	6	150	24	39	
												2	29	1	5	120	19	31	
CROP BUILDING	Seedbed nutrition - Nitrogen & Phosphorous. DAP or Urea with foliar P as an alternative. Manganese on seed.	drilling	Urea	46							85 kg/ha	39.1							
											units/ac	31							
	N1 - feeding active growth. Use an NKS compound or a Urea-Potassium blend	4-6 leaf	NKS	23		25			30		175 kg/ha	40.25		43.75			52.5		
											units/ac	32		35			42		
	N2 - canopy development	stem ext	NKS	23		25			30		275 kg/ha	63.25		68.75			82.5		
											units/ac	51		55			66		
	N3 - pod building	pre flower	Urea + S	38					19		200 kg/ha	76					38		
											units/ac	61					30		
											TOTAL NUTRIENT APPLIED (kg/ha)	222	36	114	6	150	197	39	
											RB209 recommendation (kg/ha)	220		20					

FOLIAR NUTRITION	Action	Stage	Requirement	Comments
	Nutritional inputs for optimising plant growth, environemtnal tolerance & disease resistance	2 leaf	Phosphorous, Magnesium, Manganese, Zinc	
		stem ext	Phosphorous, Magnesium, Zinc, Boron, Sulphur	
		pre flower	Magnesium, Boron, Sulphur	
	Foliar Nitrogen with Magnesium & Sulphur to maintain oil & seed production	pod	Nitrogen, Sulphur, Magnesium	

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Advisor Steve Townsend

Agrimax

Sample Ref Drive Field

arable

arable

Soil class 3 Mineral

texture Clay

Stones <5%

Soil OM 3.3%

Soil pH (water) 6.4

Soil pH (salt) 5.8

Major Nutrients (mg/l)		Deficit	Low	Good	High	Excess	*Kar*	Elemental (mg/l)
Phosphate, P_2O_5	9.0 0						0.50	3.9 P
Potassium, K_2O	114.0 1+						0.58	94.6 K
Magnesium, MgO	672.0 7						6.85	405.2 Mg
Calcium, CaO	4064.1 3						0.86	2897.5 Ca
Sodium, Na_2O	27.1 2						0.71	20.1 Na
Sulphate, SO_3	24.0 1						0.55	9.6 S
Nitrogen, $NH_{4-(ENR}$	20.6 2						0.33	103.6 N
Nitrate, NO_3^-								
K:Mg ratio	0.2 :1							
Mg:P ratio	74.7 :1							

Micro-Nutrients (mg/l)		Deficit	Low	Good	High	Excess	*Kar*	
Iron, Fe	141.0						4.55	DPTA
Manganese, Mn	26.1						0.87	DPTA
Boron, B	1.6						0.82	Water
Zinc, Zn	2.6						0.36	EDTA
Copper, Cu	10.6						1.75	EDTA
Molybdenum, Mo	-							
Cobalt, Co	-							
Iodine, I	-							
Selenium, Se	-							
Chloride, Cl^-	-							

Cation Exchange ($cmol_c$/kg)		Deficit	Low	Good	High	Excess	mg/l	$K_{mg/kg}$	BCSR
Total CEC	31.30								
Calcium, Ca^{2+}	19.70						3946.4	-2281.2	62.94
Magnesium, Mg^{2+}	4.64						544.8	745.4	14.50
Potassium, K^+	0.25						97.5	-335.0	0.80
Sodium, Na^+	0.11						28.6	-73.7	0.35
Iron, Fe^{2+}	0.50						159.0	220.6	1.61
Aluminium, Al^{3+}	3.25						311.6	324.4	10.37
Hydrogen, H^+	2.82						28.5	35.7	9.00
Other cations	0.13							-8.6	0.42
Ca:Mg ratio	4.3 :1								
Mg:K ratio	18.2 :1								

Soil Parent Material		Deficit	Low	Good	High	Excess	
Soil pH	6.4						
Conductivity	2104.0 uS						
Bulk Density	4.148 g/cm3						
Infiltration ratio	0.002 cm3/s						
Sand	12.0 %						
Silt	42.0 %						
Clay	46.0 %						0.944 *Kr*
Organic Carbon	1.89 %						0.056 *Kr*
Microbial assay	211.0 ug						FDA extract
C:N ratio	-						
N:S ratio	-						

CATTS Soil Solutions - Provisional Fertiliser Recommendation

Nov '09

W Bullock & Partners

The Mill Farm, Malvern

soil type *Clay* group 3 *Mineral*

pH 6.4 O.M.(%) 3.3

SNS index 2 104 mg/l

Mg index (MgO) 7 672 mg/l

P index (P_2O_5) 0 9 mg/l

K index (K_2O) 1+ 114 mg/l

Drive Field

	W Wheat feed		Fertiliser selection	composition							Application rate	Nutrient applied							Comments
				N	P_2O_5	K_2O	MgO	CaO	SO_3	Na_2O	(per hectare)	N	P_2O_5	K_2O	MgO	CaO	SO_3	Na_2O	
SOIL BUILDING	This soil requires organic matter & routine Calcium inputs to maintain structure. Consider using an organic-based fertiliser to condition soil. Cover cropping with rye or oats would be beneficial.		Cal.lime					60			4000 kg/ha					2400			
											units/ac					1920			
			45 % avail								available in yr 1					1080			
																864			
CROP BUILDING	Starter fert - placement N with P. Consider foliar P as an alternative. Microbial or Manganese seed treatment	GS 12/14	MAP	11	52						100 kg/ha	11	52						
											units/ac	9	42						
	N1 - feeding active growth. Use an NKS compound or a Urea-Potassium blend	GS 24-30	NKS	23		25			30		200 kg/ha	46		50			60		
											units/ac	37		40			48		
	N2 - canopy development	GS 31-32	NKS	23		25			30		250 kg/ha	57.5		62.5			75		
											units/ac	46		50			60		
	N3 - grain building	GS 37-39	Urea + S	38					19		175 kg/ha	66.5					33.3		
											units/ac	53					27		
											TOTAL NUTRIENT APPLIED (kg/ha)	181	52	113	0	1080	168	0	
											RB209 recommendation (kg/ha)	180	110	70					

FOLIAR NUTRITION	Action	Stage	Requirement	Comments
	Nutritional inputs for optimising plant growth, environemtnal tolerance & disease resistance	GS 24	Phosphorous, Magnesium, Manganese, Zinc	
		GS 32	Phosphorous, Magnesium, Zinc, Sulphur	
		GS 39	Magnesium, Sulphur	
	Foliar Nitrogen with Magnesium & Sulphur to maintain grain protein	GS 59	Nitrogen, Sulphur, Magnesium	

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BASIS R/IE/1964/H AMTRA ACCS9

FACTS FE/1654 ICM/646

SWM090 BETA

CATTS Soil Solutions - Provisional Fertiliser Recommendation

Nov '09

W Bullock & Partners

The Mill Farm, Malvern

soil type Clay | group 3 Mineral | SNS index 2 104 mg/l | P index (P_2O_5) 0 9 mg/l

pH 6.4 | O.M.(%) 3.3 | Mg index (MgO) 7 672 mg/l | K index (K_2O) 1+ 114 mg/l

Drive Field

	Oilseed rape		Fertiliser selection	composition							Application rate	Nutrient applied							Comments
				N	P_2O_5	K_2O	MgO	CaO	SO_3	Na_2O	(per hectare)	N	P_2O_5	K_2O	MgO	CaO	SO_3	Na_2O	
SOIL BUILDING	This soil requires organic matter & routine Calcium inputs to maintain structure. Consider using an organic-based fertiliser to condition soil. Cover cropping with rye or oats would be beneficial.		Nutri-Bio 25 % avail	0.1	1.2	0	0.2	5	0.8	1.3	12000 kg/ha	12	144	4.8	24	600	96	156	
											units/ac	10	115	4	19	480	77	125	
											available in yr 1	3	36	1	6	150	24	39	
												2	29	1	5	120	19	31	
CROP BUILDING	Seedbed nutrition - Nitrogen & Phosphorous. DAP or Urea with foliar P as an alternative. Manganese on seed.	drilling	MAP	11	52						100 kg/ha	11	52						
											units/ac	9	42						
	N1 - feeding active growth. Use an NKS compound or a Urea-Potassium blend	4-6 leaf	NKS	23		25			30		175 kg/ha	40.25		43.75			52.5		
											units/ac	32		35			42		
	N2 - canopy development	stem ext	NKS	23		25			30		275 kg/ha	63.25		68.75			82.5		
											units/ac	51		55			66		
	N3 - pod building	pre flower	Urea + S	38					19		200 kg/ha	76					38		
											units/ac	61					30		
											TOTAL NUTRIENT APPLIED (kg/ha)	194	88	114	6	150	197	39	
											RB209 recommendation (kg/ha)	220	100	65					

	Action	Stage	Requirement	Comments
FOLIAR NUTRITION	Nutritional inputs for optimising plant growth, environemtnal tolerance & disease resistance	2 leaf	Phosphorous, Magnesium, Manganese, Zinc	
		stem ext	Phosphorous, Magnesium, Zinc, Boron, Sulphur	
		pre flower	Magnesium, Boron, Sulphur	
	Foliar Nitrogen with Magnesium & Sulphur to maintain oil & seed production	pod	Nitrogen, Sulphur, Magnesium	

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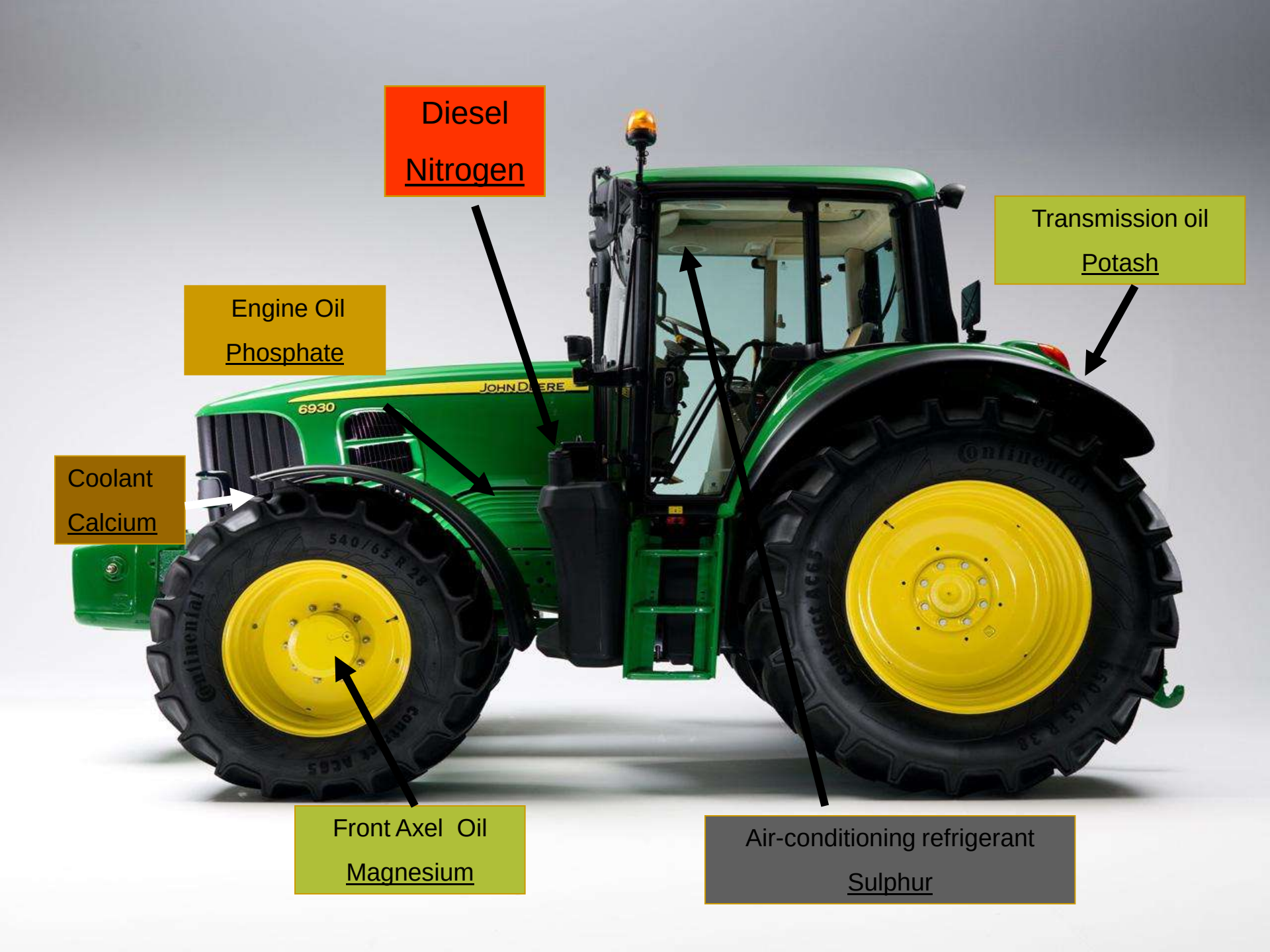
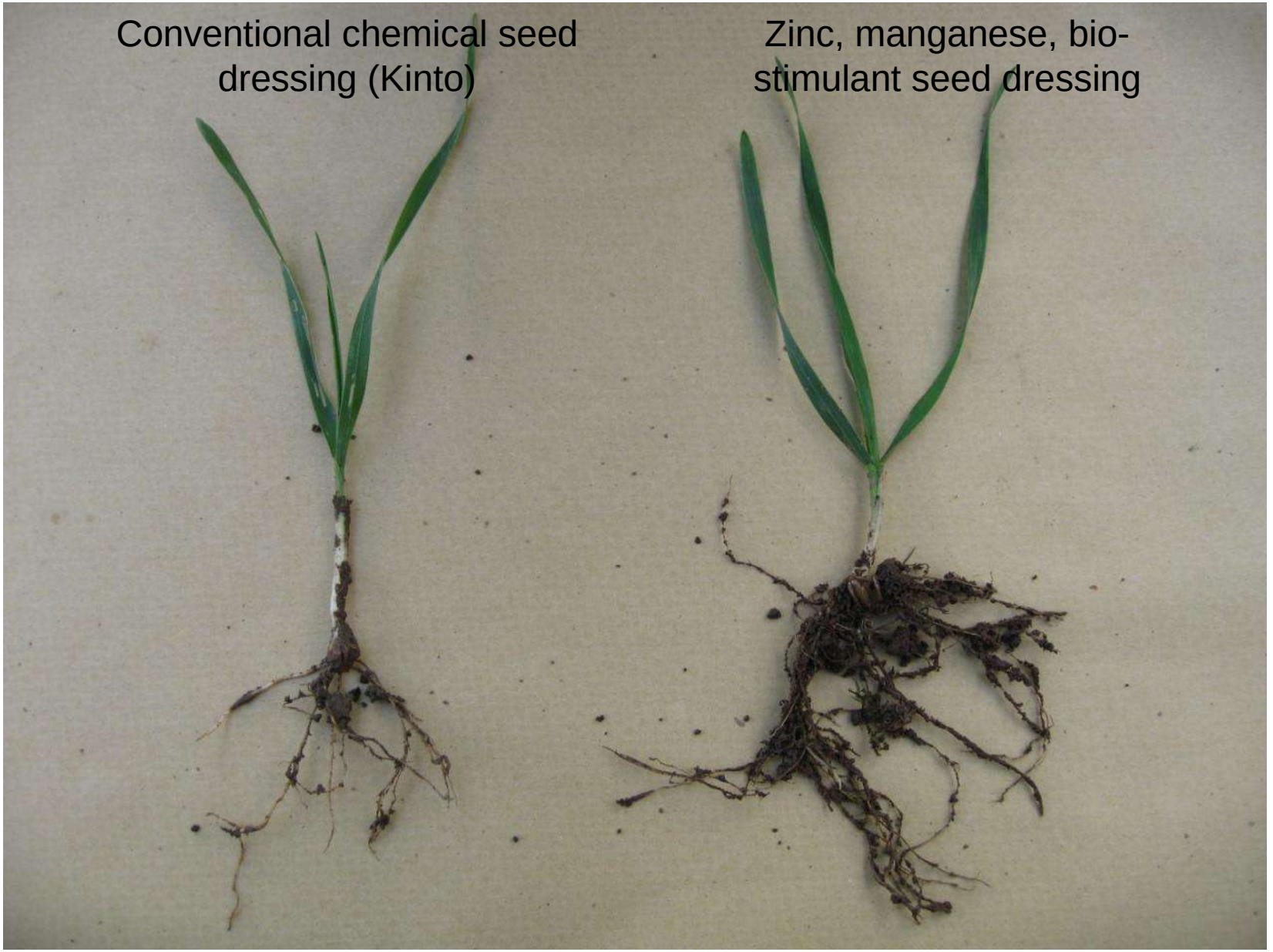

Diesel
Nitrogen
Transmission oil
Potash
Engine Oil
Phosphate
Coolant
Calcium
Front Axel Oil
Magnesium
Air-conditioning refrigerant
Sulphur

Solution:

to attempt to rebalance Calcium/Magnesium ratio

- Compost – Organic Matter
- Gypse (Calcium Sulphate 19%-21%) @ 5tons/ha
- Limex - Calcium, phosphate and sulphur @ 5 tons/ha


Conventional chemical seed dressing (Kinto)
Zinc, manganese, bio-stimulant seed dressing

Maxi-phi products

Winter Wheat

Product & rate		Timing	Cost/ha
Maxi-phi Manganese	1.0 l/ha		£2.15
+			
Maxi-phi Zinc	1.0 l/ha		£2.56
+			
Maxi-phi Hi-Mag	1.0 l/ha		£1.50
+			
Activate MP	1.0 l/ha		£4.42
……			
Maxi-phi Manganese	0.5 l/ha		£1.08
+			
Maxi-phi Hi-Mag	2.0 l/ha		£3.00
+			
Maxi-phi Sulphur	2.0 l/ha		£5.20
+			
Activate MP	0.5 l/ha		£2.21
……			
Maxi-phi Manganese	0.5 l/ha		£1.08
+			
Maxi-phi Hi-Mag	2.0 l/ha		£3.00
+			
Maxi-phi Sulphur	2.0 l/ha		£5.20
+			
Activate MP	0.5 l/ha		£2.21
		Total	**£33.60**

Grain Quality 2010 harvest

Field Code	Variety	Treatment	Moisture	Specific wt	Protein	Hagberg	Estimated yield
OH1	**Solstice**	**Maxi-phi**	**14.60**	**79.5 kg/hl**	**14.01**	**349**	**7.5 ton/ha**
OH2	Solstice	Conventional	15.10	79.7 kg/hl	13.95	300	7.5 ton/ha
C3	**Solstice**	**Max-phi**	**14.60**	**81.8 kg/hl**	**13.86**	**393**	**7.5 ton/ha**
C4	**Solstice**	**Conventional**	**14.80**	**79.1 kg/hl**	**12.80**	**313**	**7.5 ton/ha**
F5	**Solstice**	**Maxi-phi**	**14.90**	**80.2 kg/hl**	**13.01**	**353**	**8.75 ton/ha**
F6	**Solstice**	**Conventional**	**15.20**	**80.9 kg/hl**	**10.47**	**342**	**8.75 ton/ha**

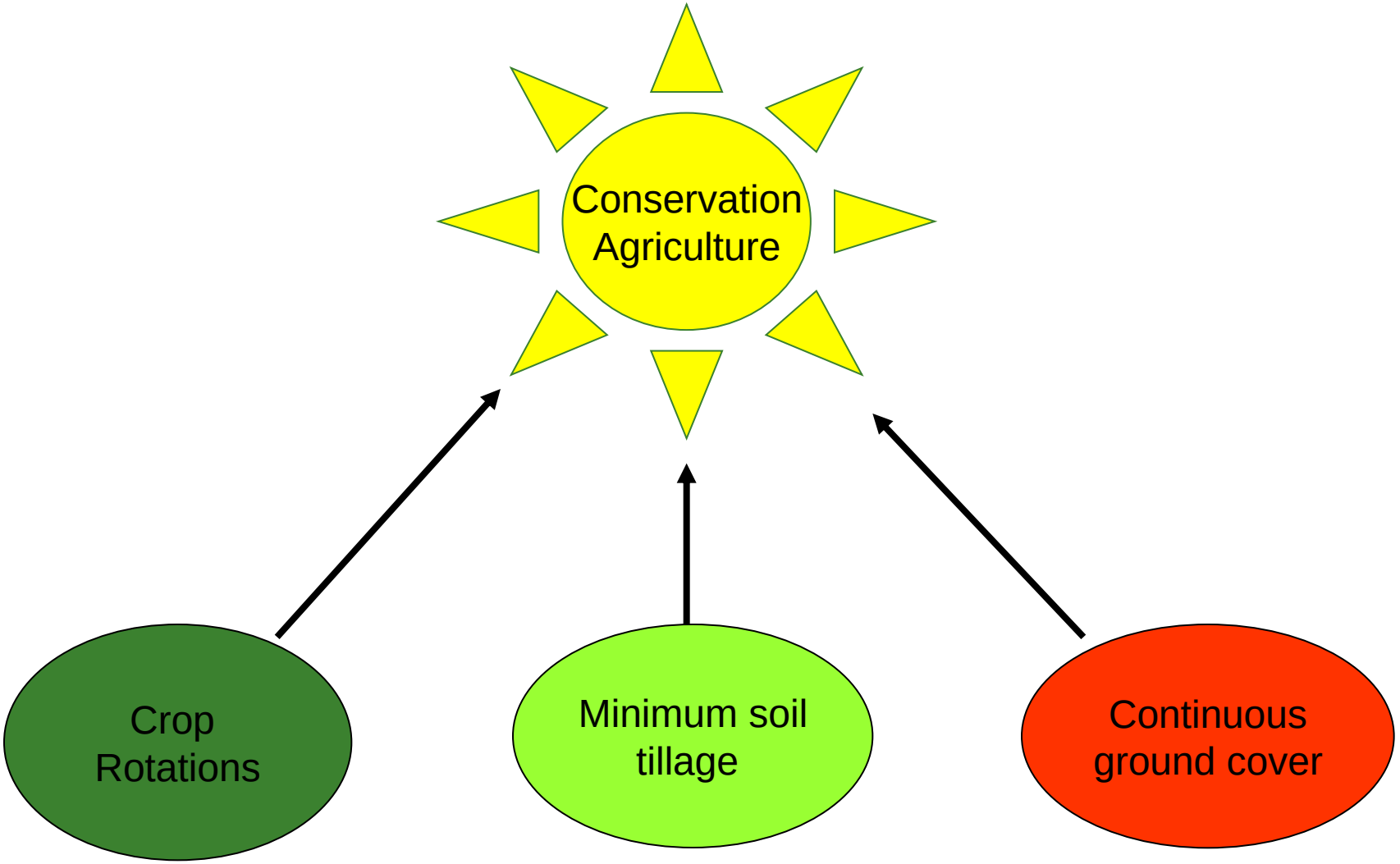
SD v Strip-Till
Soil Temperature

Starter Fertilisers – Fertiliser placement ?

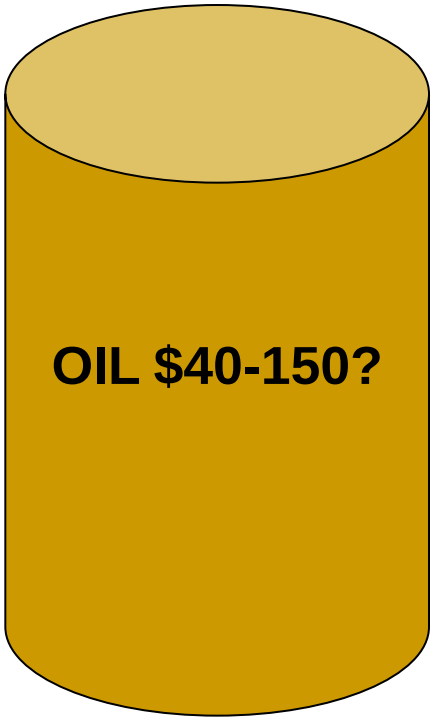
Summary

- Rotation
- Residue management
- Soil type/structure/drainage
- Weed control
- Choice of varieties
- Drill early
- Check soil fertility status
- Monitor and control slugs

Conservation Agriculture



Financial pressures are now even greater

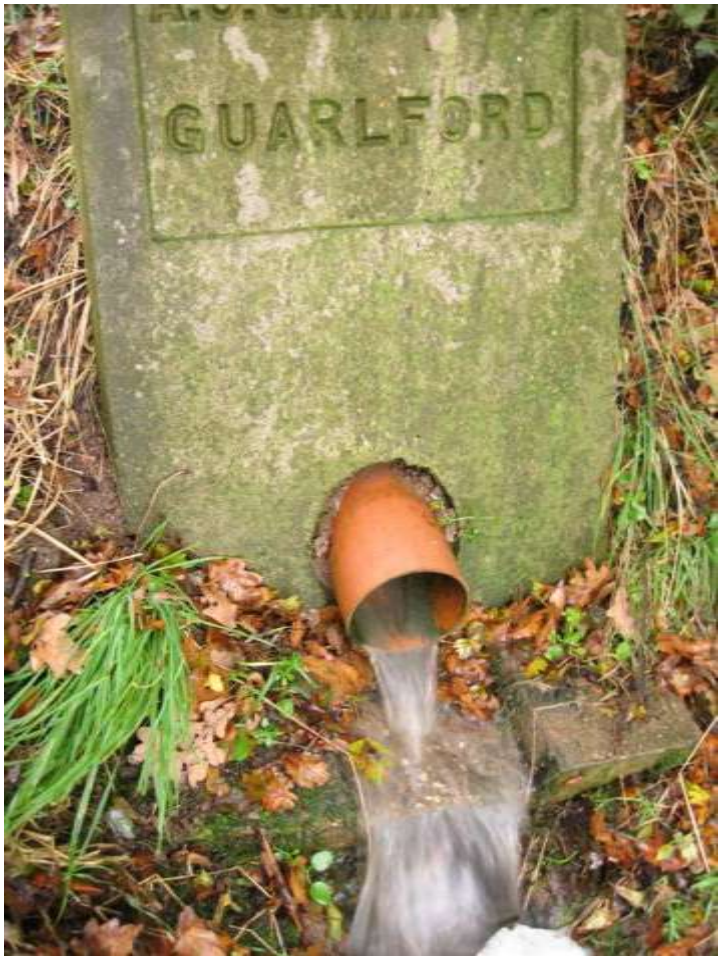


- Fertiliser
- Fuel
- Transport
- Machinery

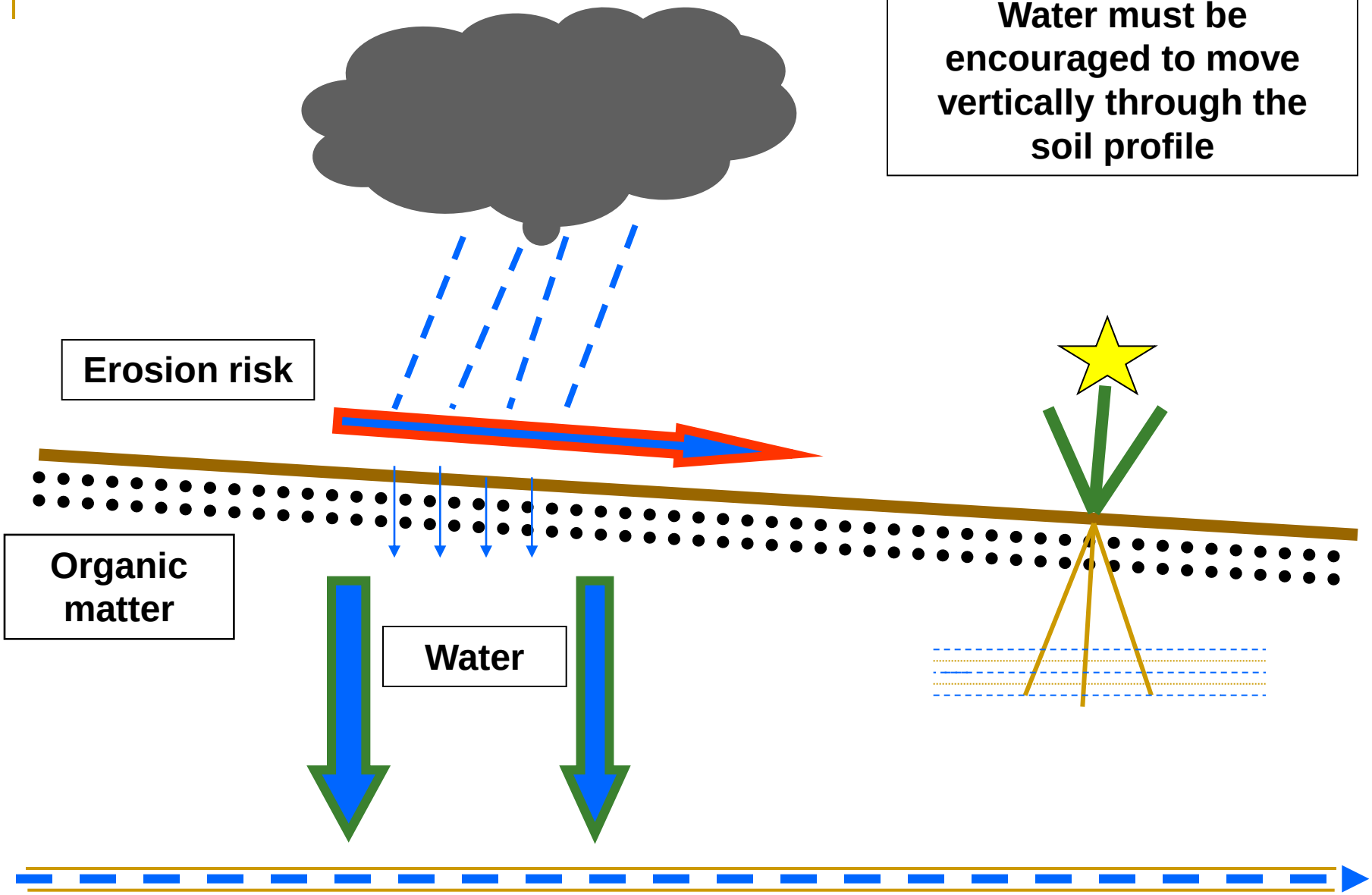
- Rents
- Labour
- Interest rates/loan repayments

Who has actually Banked £200/ton for wheat in the so called good times?

Drainage water – how clean is yours?



Water must be encouraged to move vertically through the soil profile



Mechanical soil re-structuring

Only if necessary. Dig first!

- Possibly only compacted headlands & access points
- Danger of disrupting natural soil structure
- Expensive and time consuming

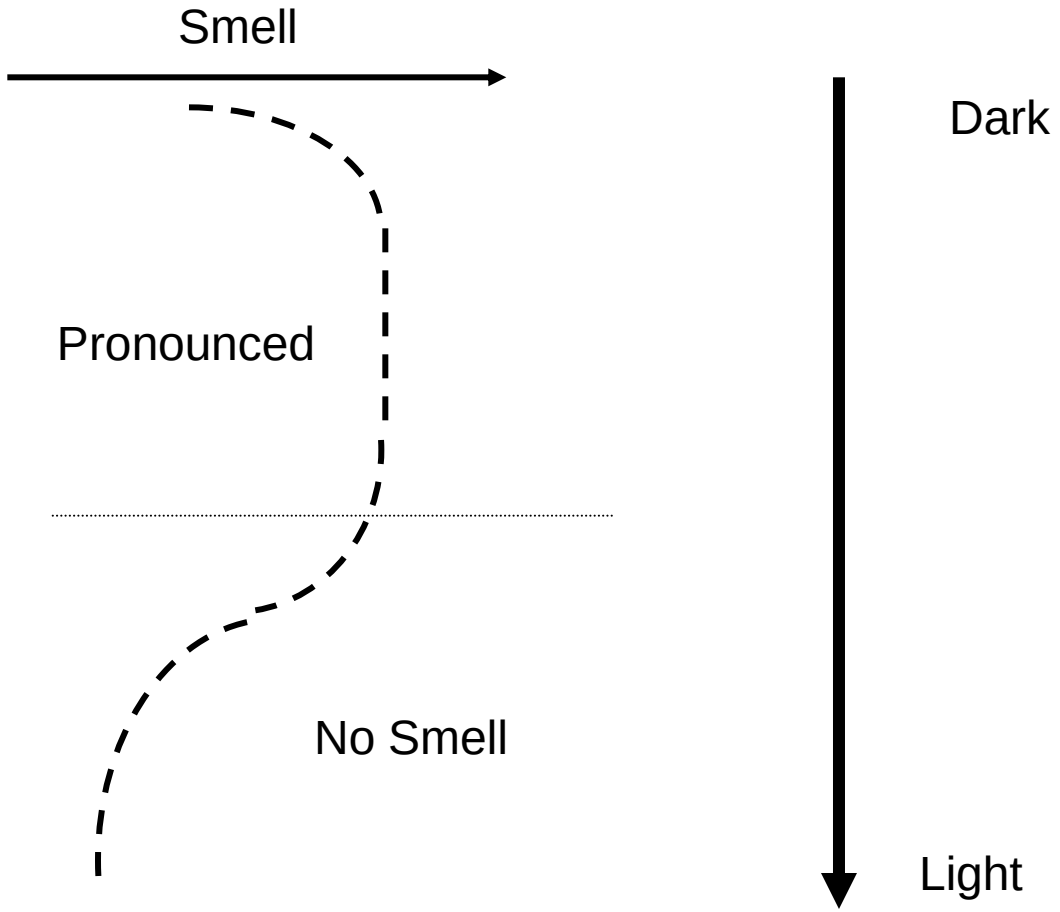
Effective drainage is essential……

Evolution of natural soil structure

Ploughed

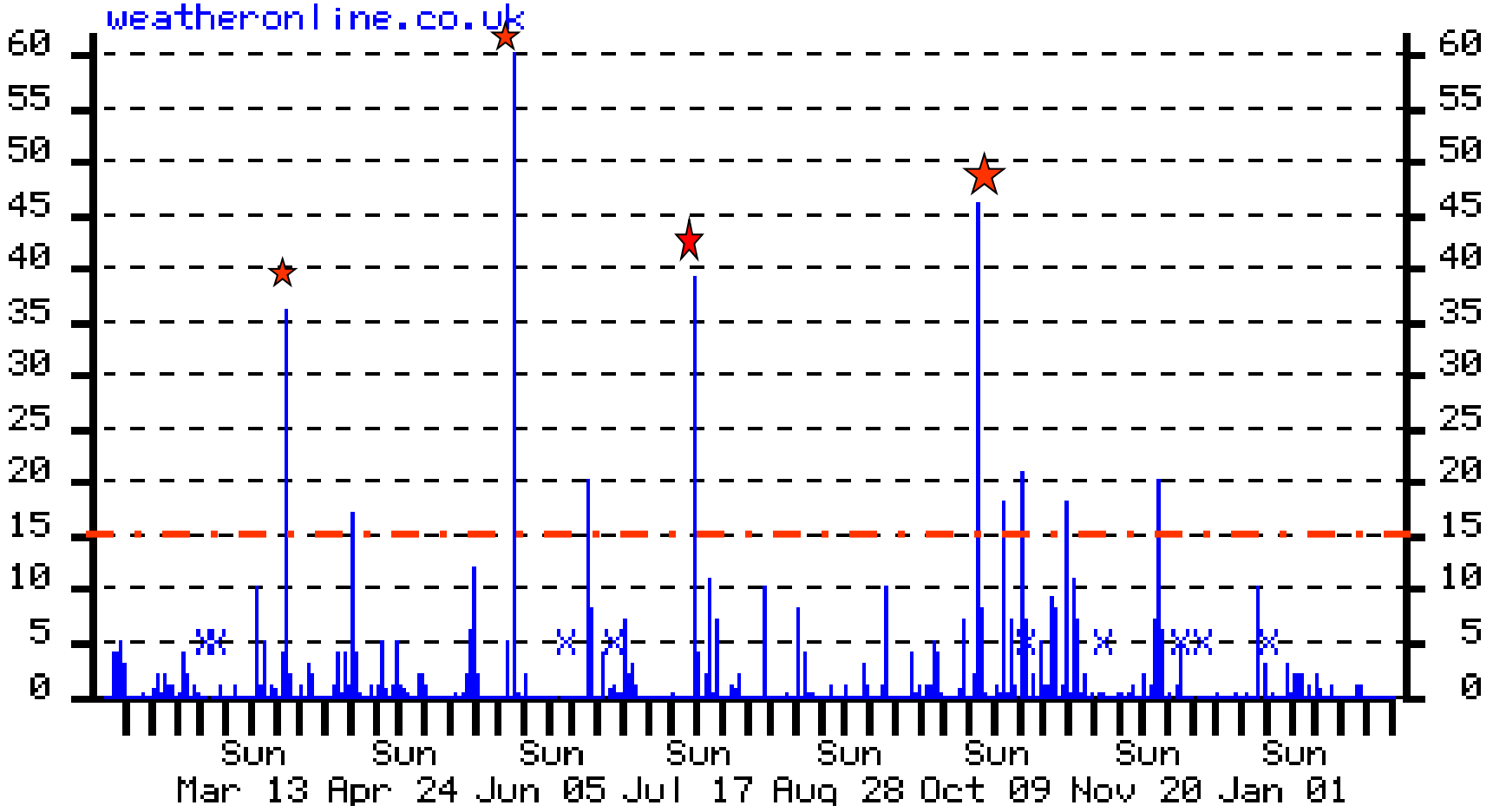
Min-till/direct-drilled for 9 years

Organic Matter - Soil Smell/Colour



The influence of pH on soil biological activity

Rainfall Great Malvern 2005/06



★ **25% of rainfall in 4 days and a further 15% in 6 days = 40% in 10 days**

Soil Erosion

Rilling

Naturally soils are colonised by re-structuring and fertility building plants

Always wait for weeds and volunteers to emerge

- Grass weeds growing in crop

Slug control

- Monitor immediately after harvest
- Apply pellets pre-drilling if slug problem
- Monitor until crop fully emerged
- Always apply pellets to OSR at emergence
- Slug problem reduced after 3-4 years

Min-till – it doesn't work……?

Stale seedbed

Triggers -

- Weed and volunteer germination
- Breakdown of crop residues

Unless time is on your side…….

Min-till promotes germination of weeds & volunteers

Poor crop establishment due to N lock-up

Long stubble

- Less material passing through combine - *reduced fuel consumption*
- Straw remains evenly spread
- Residue takes longer to breakdown reducing Nitrogen tie-up (OSR)
- Provides soil cover

OSR direct drilled with disc drill

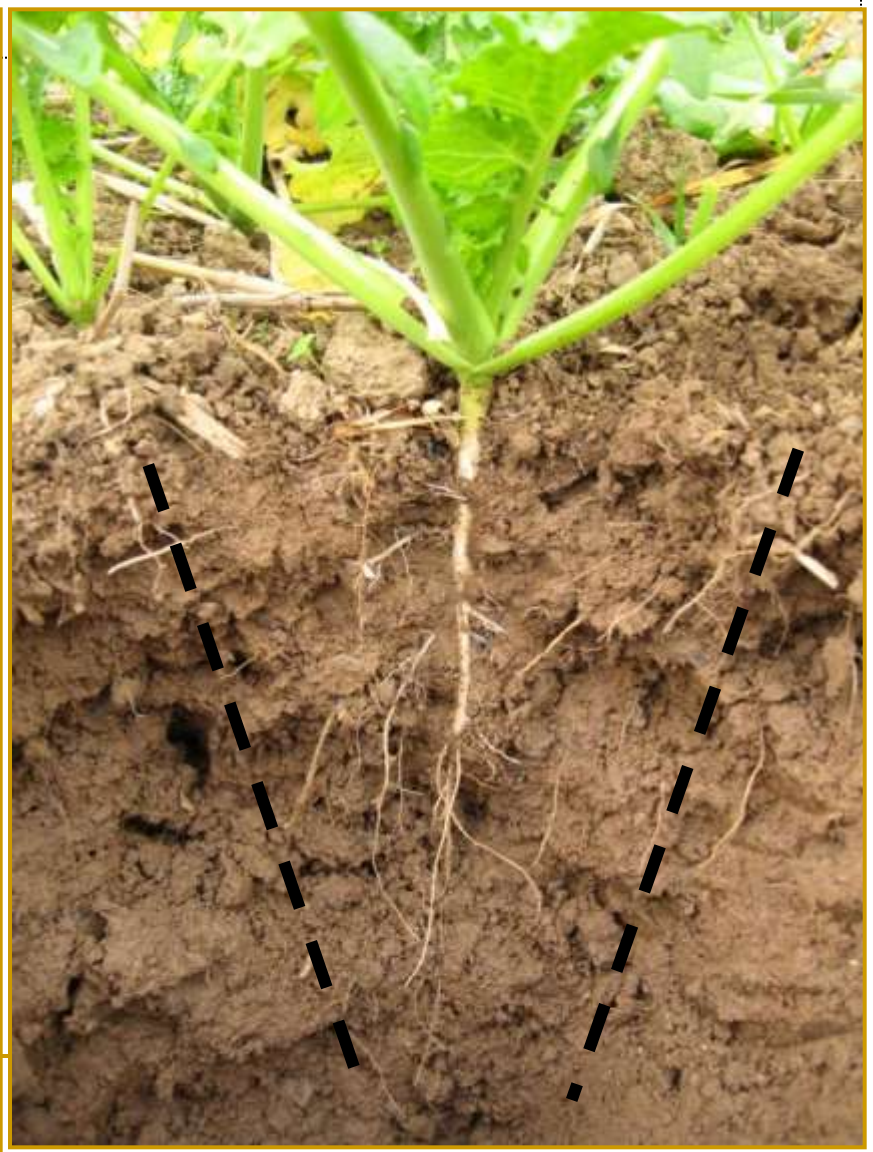
Poor establishment due to

- Hair-pinning
- Slugs
- Smeared and compacted slots
- Water-logging

OSR in Chopped Straw

Winter beans direct into undisturbed wheat stubble and chopped straw

Roots – stabilise soil structure



Wheat direct-drill into bean residue

OSR Residue

Volunteer OSR as a cover-crop

- Inexpensive
- Maintains soil structure
- Re-cycles nutrients
- Adds organic matter
- Maintains soil moisture

- Possible slug problems
- High rates of glyphosate required to destroy cover
- Weed control ?

Direct drilled oats


Wheat min-tilled into oat residue

Crops ready for harvest August 2007/08

Wet straw – severe wheelings

Worse in 08 than 07

Cultivation necessary to remove compaction and level soil surface

January 2009 !

The most cost effective piece of cultivation machinery !