

# Legumes in organic leys

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# Topics to be covered

- (1) General productivity of legume species**
- (2) Suitability to location**
  - **Response to soil properties**
  - **Response to altitude and regions**
- (3) Quality**
  - **N content**
  - **Breakdown characteristics**
- (4) Yield of following crop**

## Aims

- Characterize legume species
- Improve N use efficiency
- Create a legume based mixture: **improved resilience**

## Tested plant species

### CLOVERS

Alsike Clover (AC)  
 Crimson clover (CC)  
 Red clover (RC)  
 White clover (WC)

### Other LEGUMES

Birdsfoot trefoil (BT)  
Black medic (BM)  
 Large birdsfoot trefoil (LT)  
Lucerne (LU)  
 Meadow pea (MP)  
 Sainfoin (SF)  
 White sweet clover (SC)  
 Winter vetch (WV)

### GRASSES

Italian ryegrass (IR)  
 Meadow fescue (MF)  
 Perennial ryegrass (PR)  
 Timothy (TY)



# Replicated field trials - 6 locations across UK





# Participatory trial at Wakelyns, Suffolk Beginning of August 2010

Clover chicory  
mix

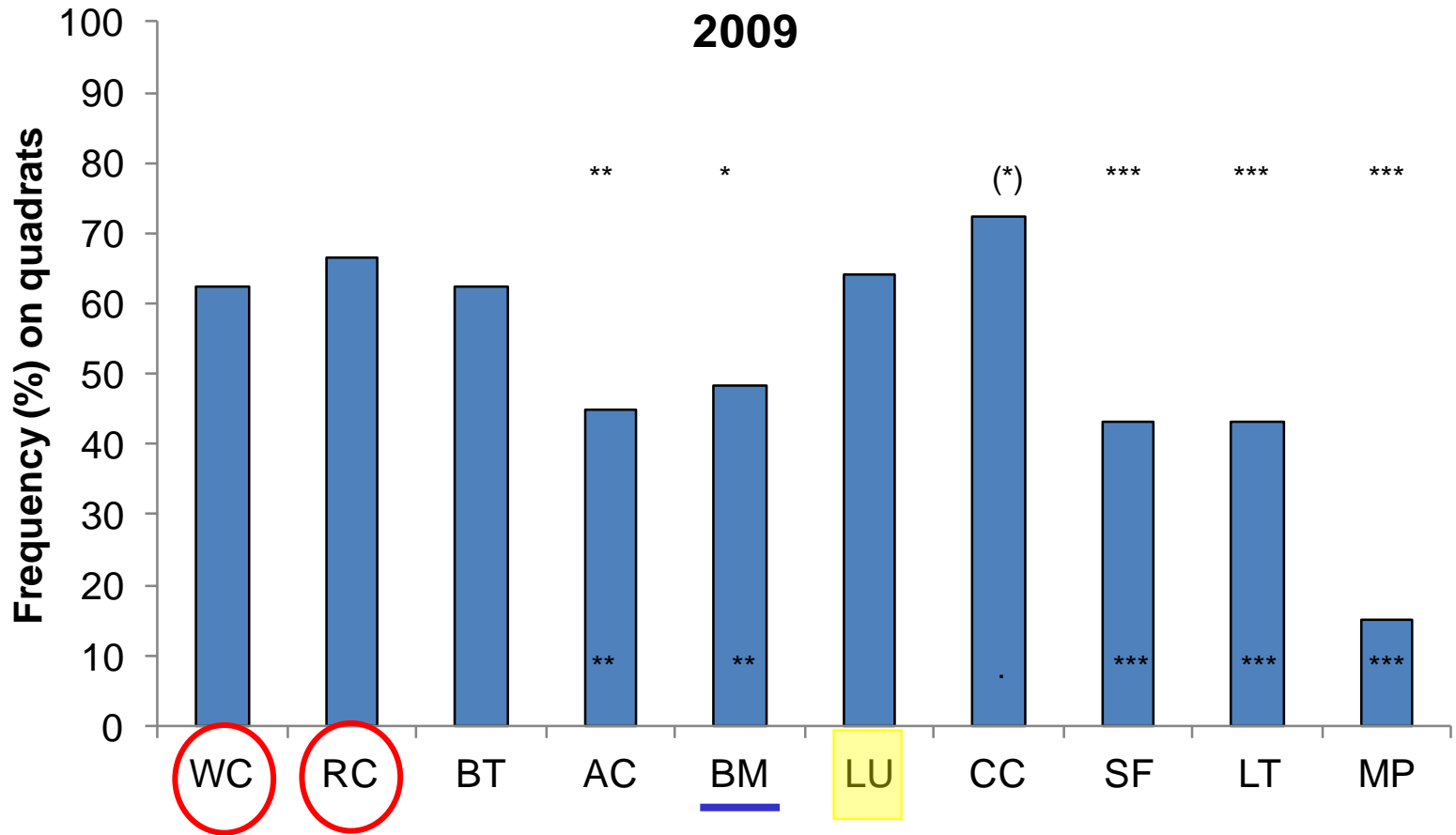
ASM



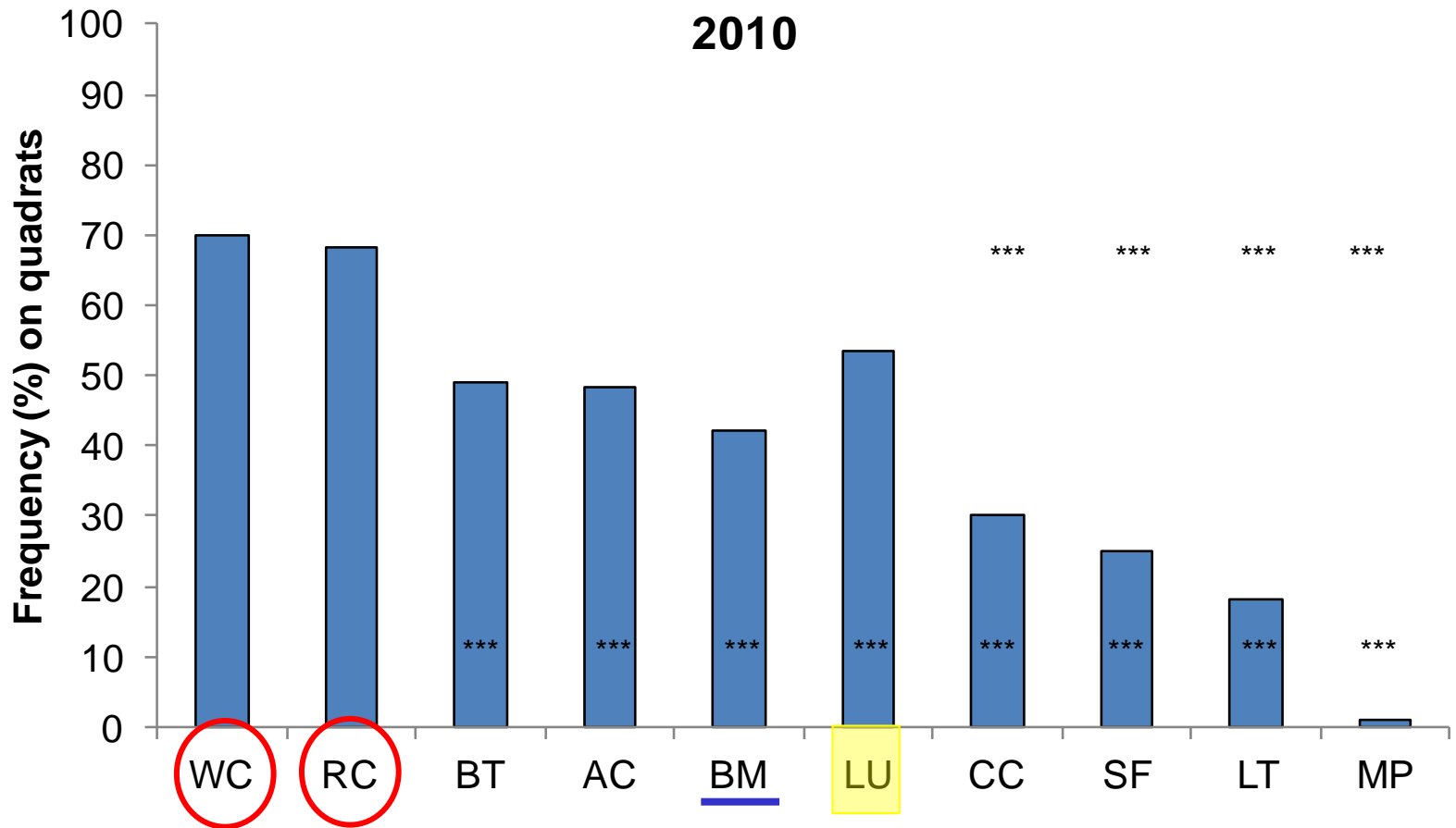
# (1) General productivity



# Presence of indiv. Species in All Species Mix

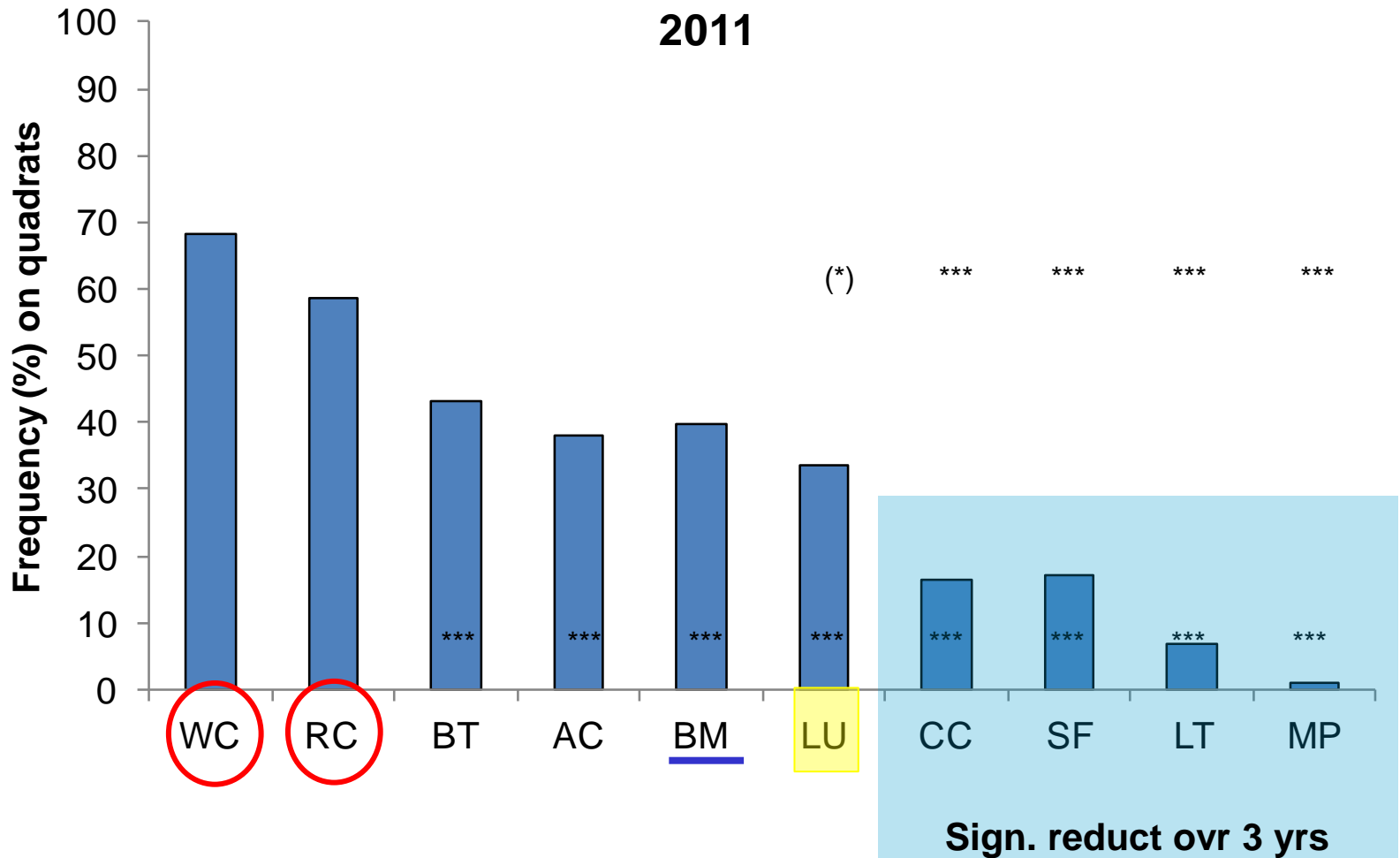


# Presence of indiv. Species in All Species Mix

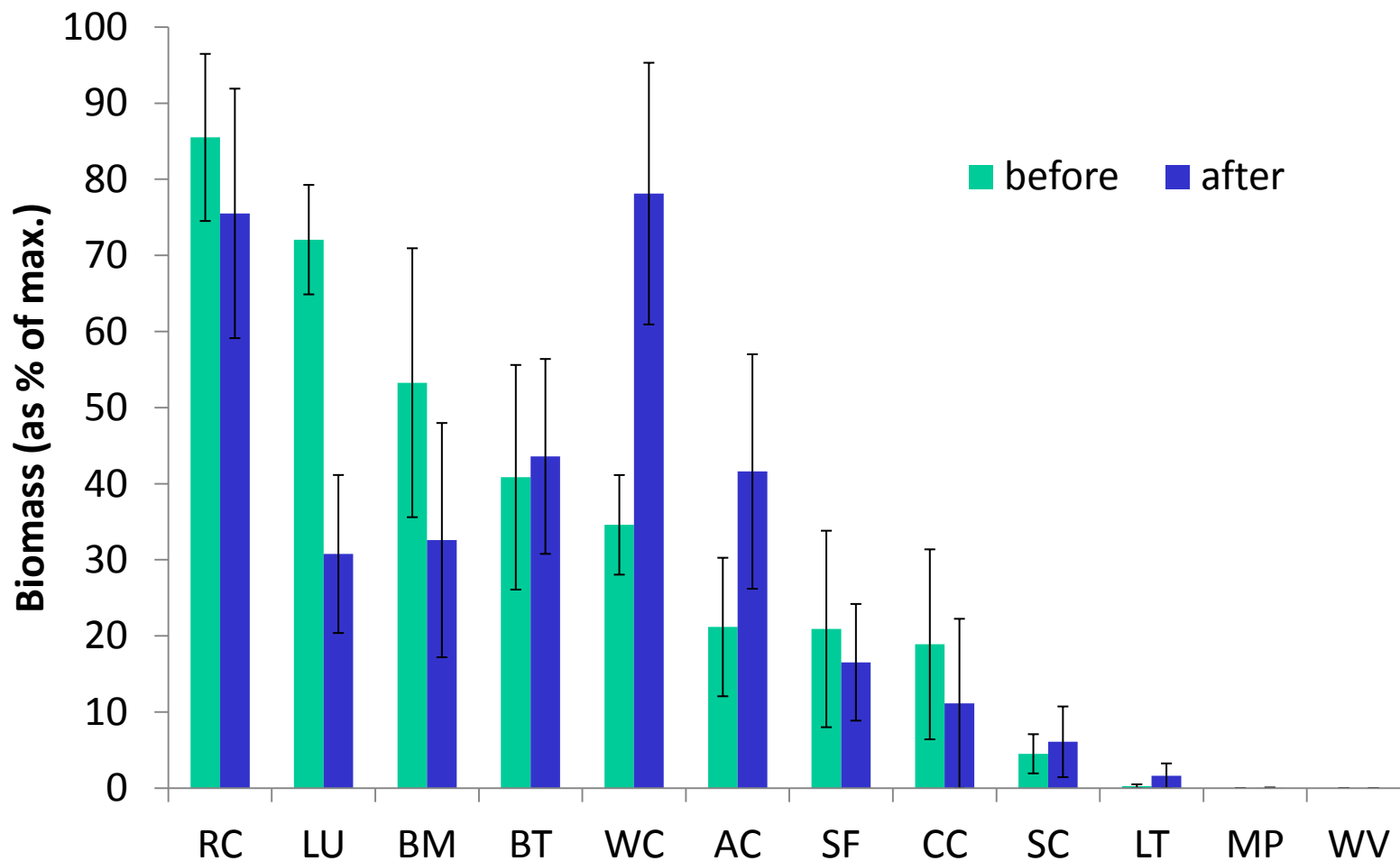




# Presence of indiv. Species in All Species Mix



## Response to simulated grazing (2010)

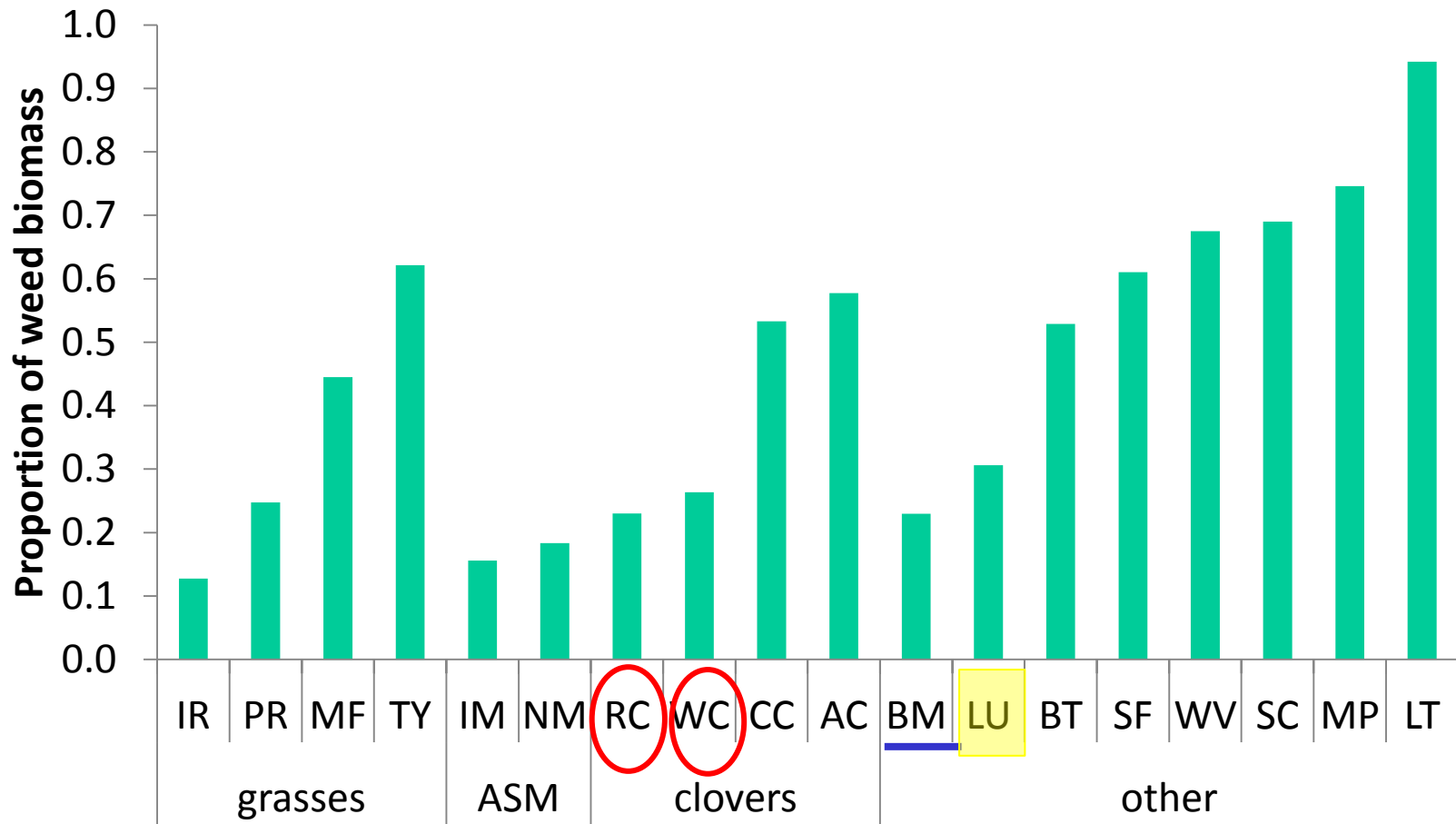


## Re-growth league table

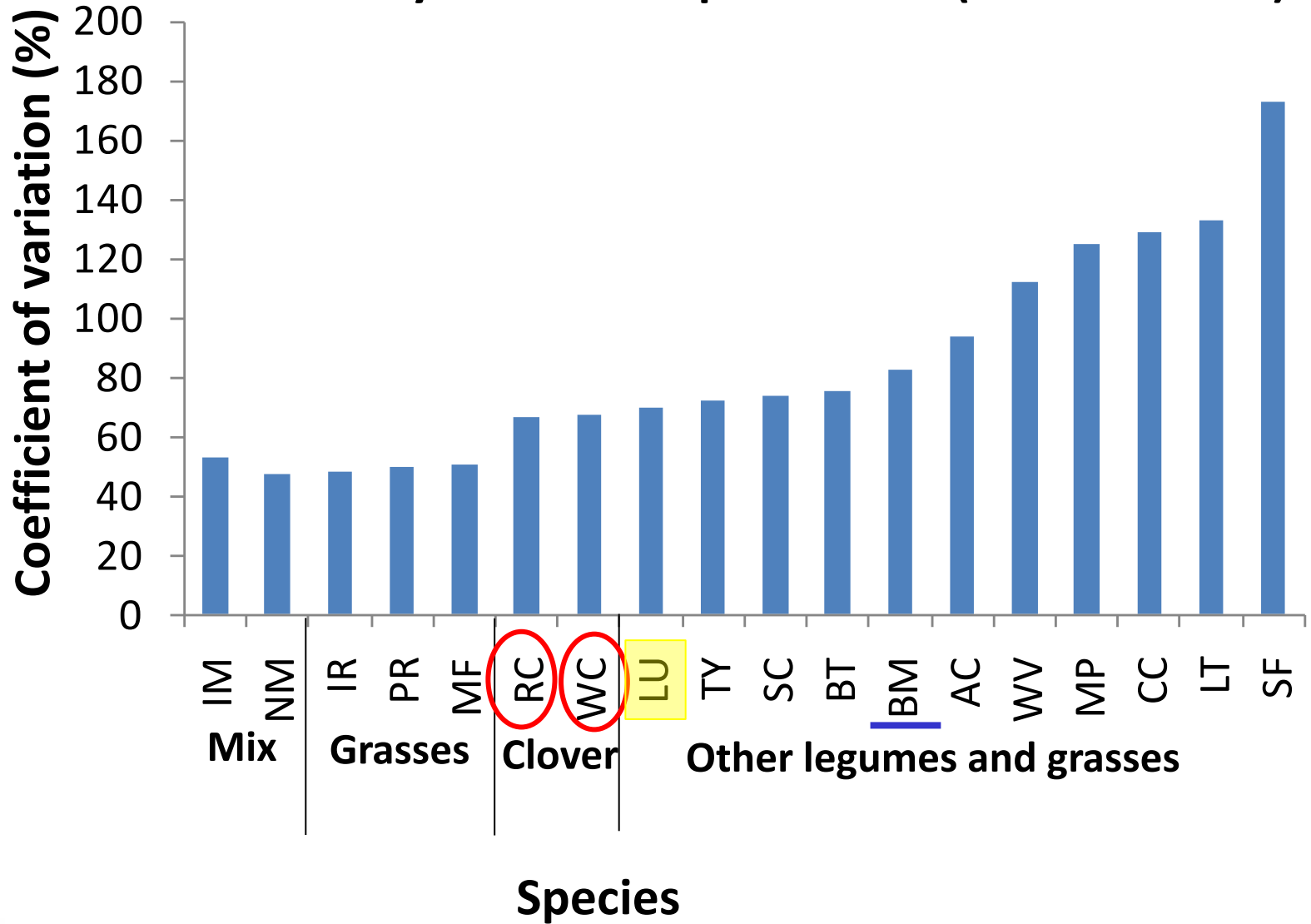
Species	Glouc.	Herts.	Suffolk	Aberdeenshire
Alsike clover	++	++	+	++
Lucerne	++	++	++	+
Red clover	++	+	++	+
White clover	+	++	+	++
B'foot trefoil	++	++	+	-
<u>Black medic</u>	-	+	++	++
Timothy	-	--	++	+
Winter vetch	+	-	-	+
Crimson clover	--	-	-	+
Lg.birdsf.trefoil	--	-	--	++
PRG	-	-	+	--
Sanfoin	+	+	--	--
S. white clover	-	--	-	-
IRG	--	--	-	-
Meadow fescue	--	+	--	--
Meadow pea	-	--	--	--



# Proportion of weed biomass, summer 2009

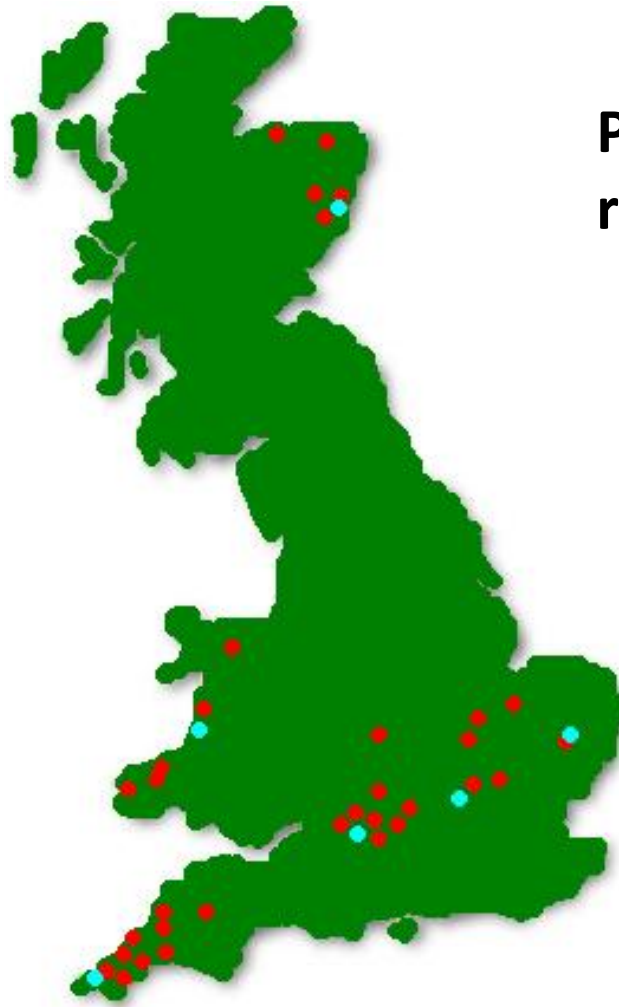


## Variability of biomass production (summer 2009)



## (2) Response to environment

### Climatic region and soil properties



**Participatory &  
replicated hub trials**



## Regional responses: Summary

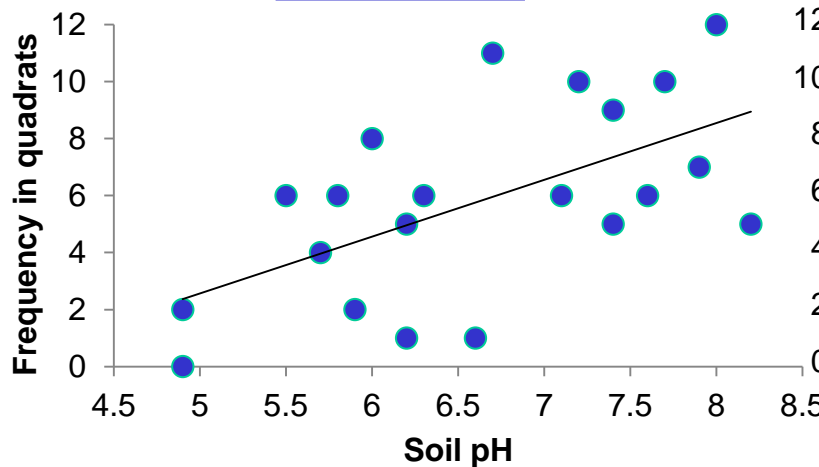
- **Most species:** almost always best in East
- **Lucerne:** less frequent in North and West (grazing?)
- **Sainfoin:** less frequent in North and West (climate?)
- **Alsike:** less frequent in South and West (?)
- **Birdsfoot trefoil:** less frequent in West
- **Altitude:** probably no direct effect, confounded with Region

# Presence of legume species: response to soil parameters

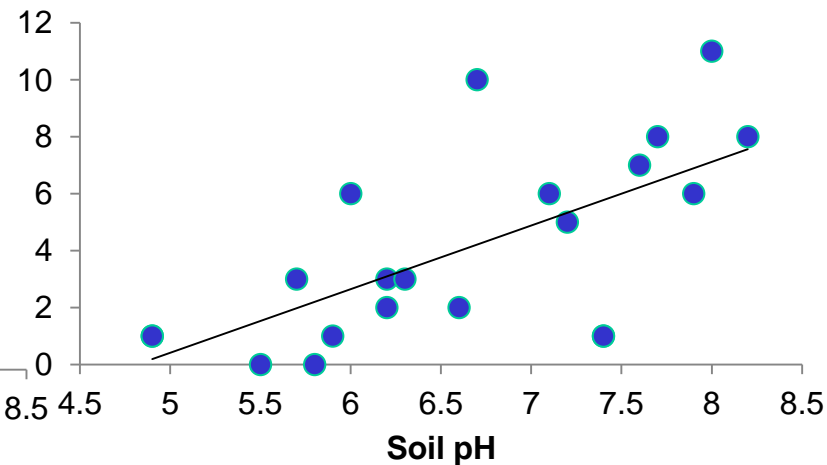
Species	pH	P	Mg	sand	K
Meadow Pea					
Birdsfoot trefoil	+		-		
Large Birdsfoot trefoil					
Black medic	+	+	-		
Lucerne	+				+
Sainfoin	+	-			
Alsike clover	+	+			
Crimson clover			-	(+)	
Red clover	+	+			
White clover	+	+	-	+	

# Importance of soil pH

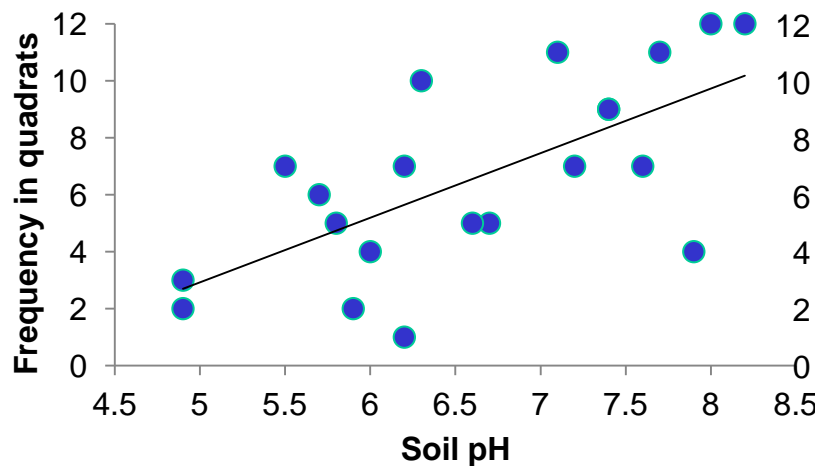
**Black Medic**



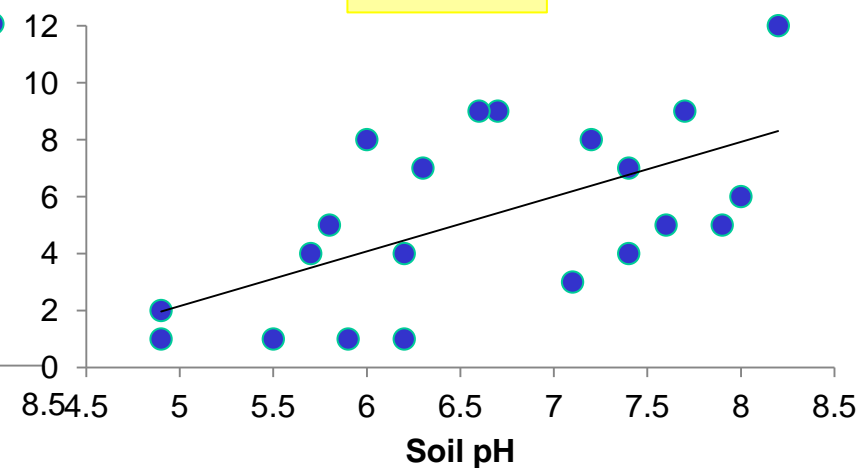
**Sainfoin**



**Birdsfoot trefoil**

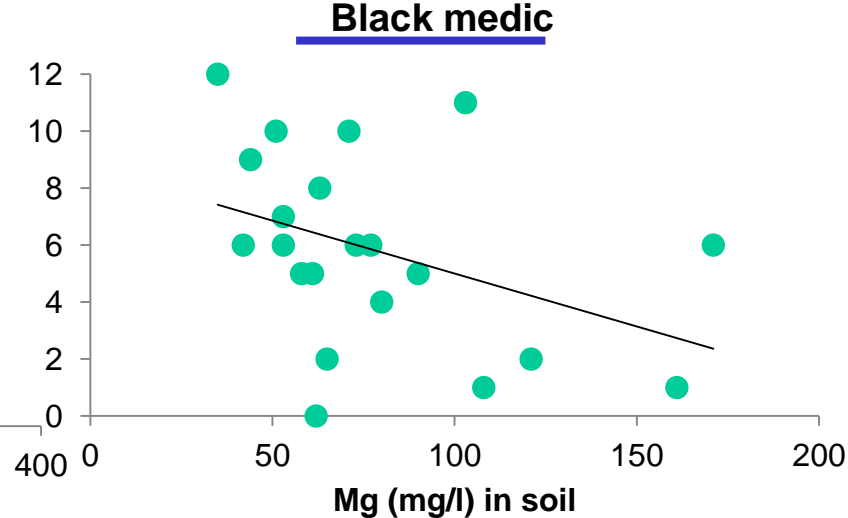
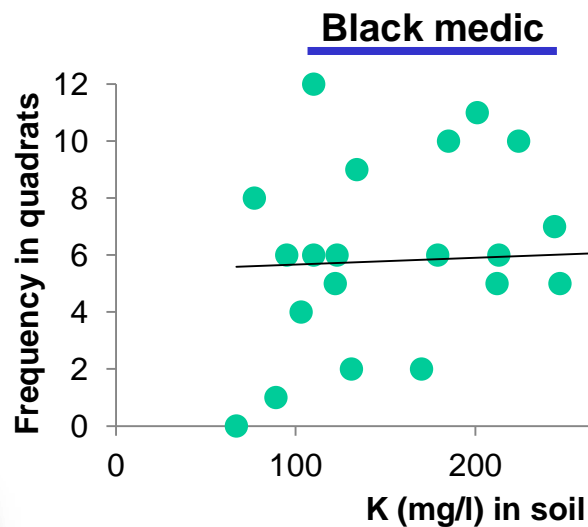
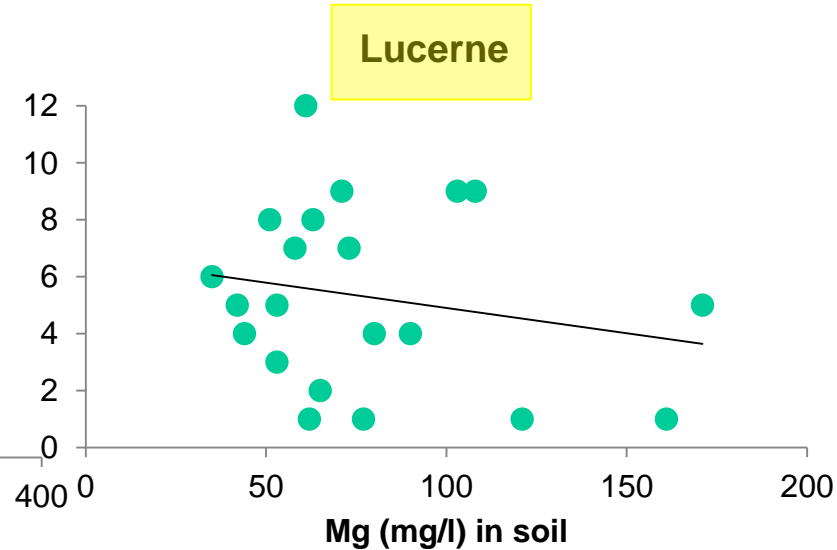
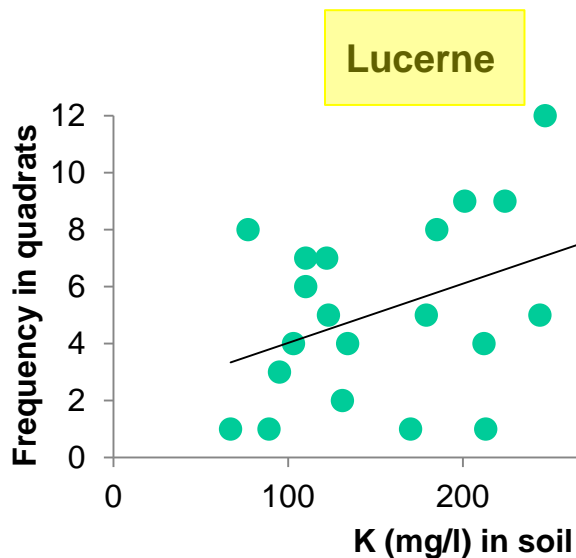


**Lucerne**





## K and Mg

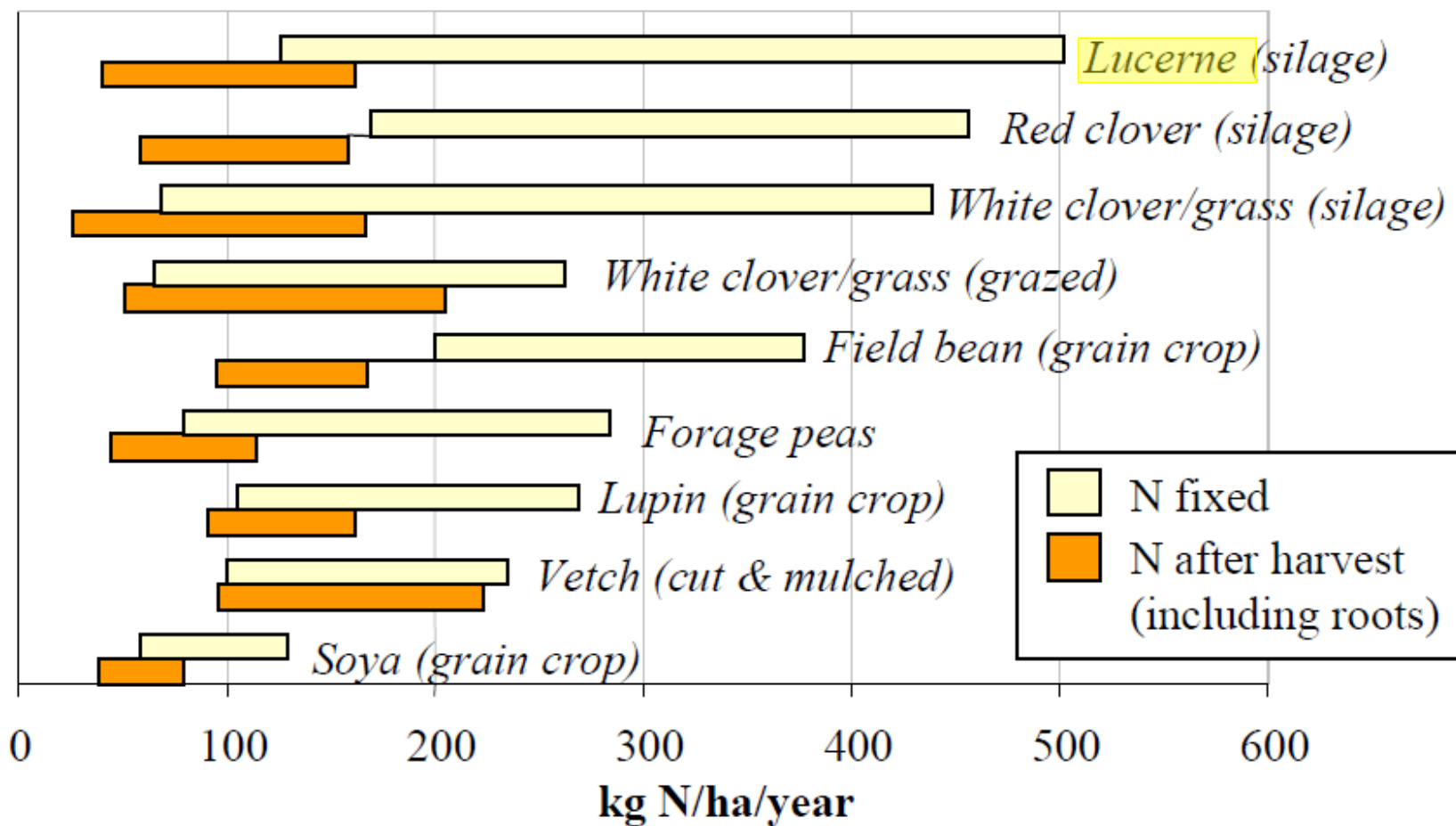


## Ecological indicator values

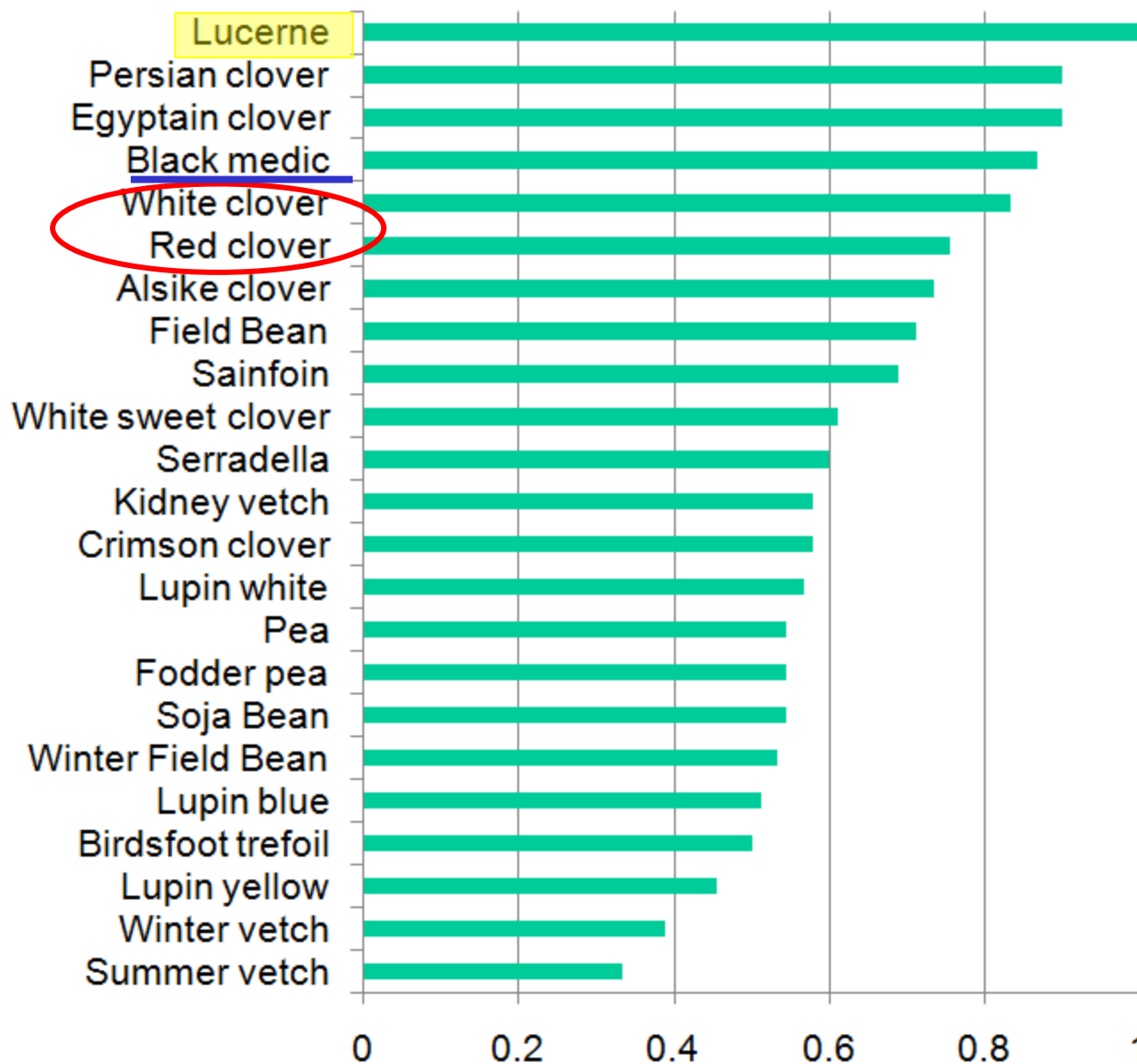
Common name	Moisture	pH
<b>LEGUMES</b>		
White sweet clover	3	7
Sainfoin	3	8
Birdsfoot trefoil	4	7
<u>Black medic</u>	4	8
Lucerne	4	7
White clover	5	6
Alsike clover	6	7
Meadow Pea	6	7
Red clover	x	x
<b>GRASSES</b>		
Italian ryegrass	4	7
Timothy	5	x
Perennial ryegrass	5	7
Meadow fescue	6	x

# (3) N and decomposition

N fixed and N after harvest



## N in plant residues (normalized)

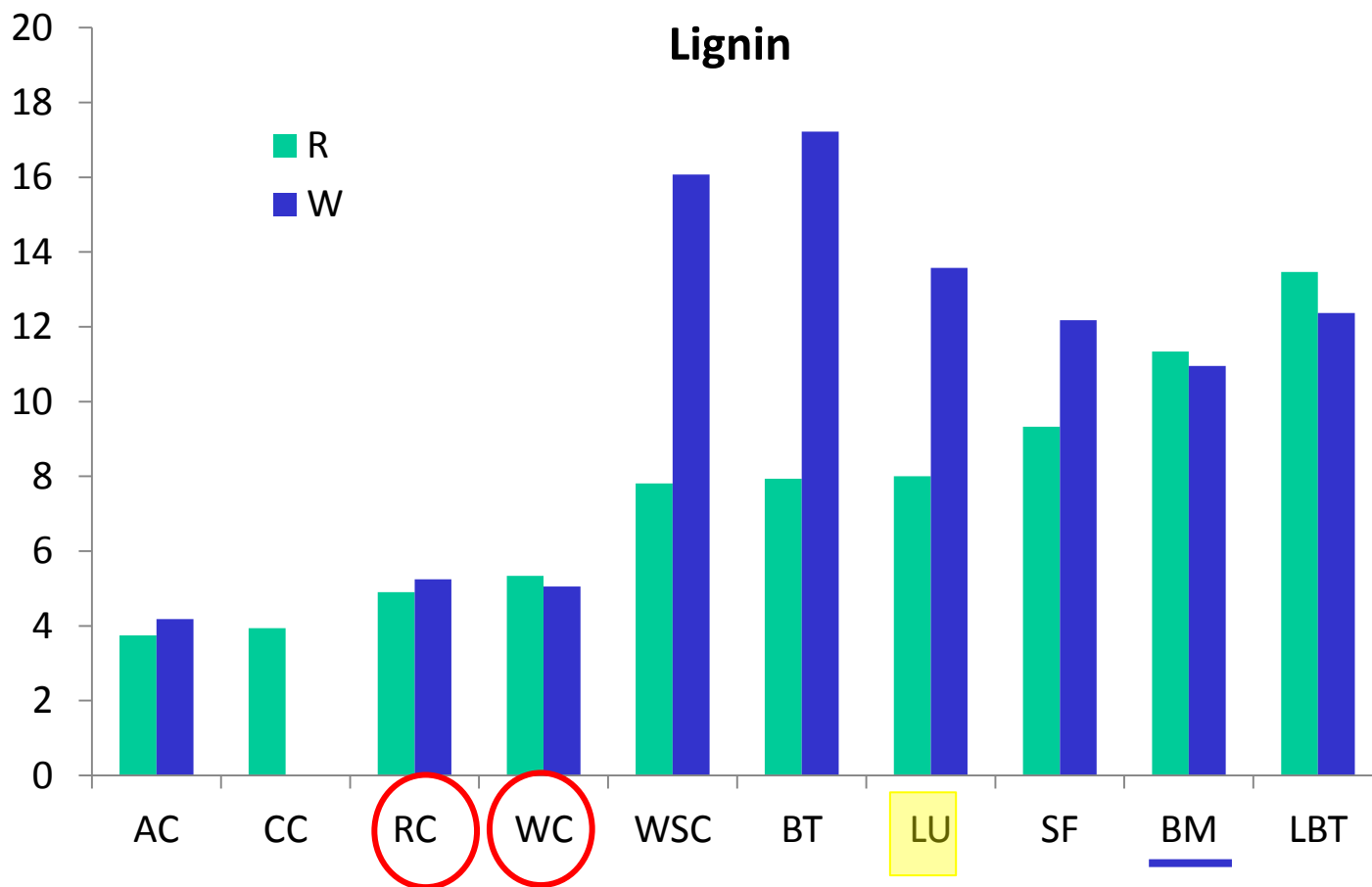


## **Breakdown of plant residues after incorporation into the soil:**

1. The quicker the breakdown, the more N is risked to be lost before next crop can take is up (Flush effect)
2. Breakdown can be 'slowed down' by
  - High lignin content
  - High polyphenol content
  - High C:N ratio

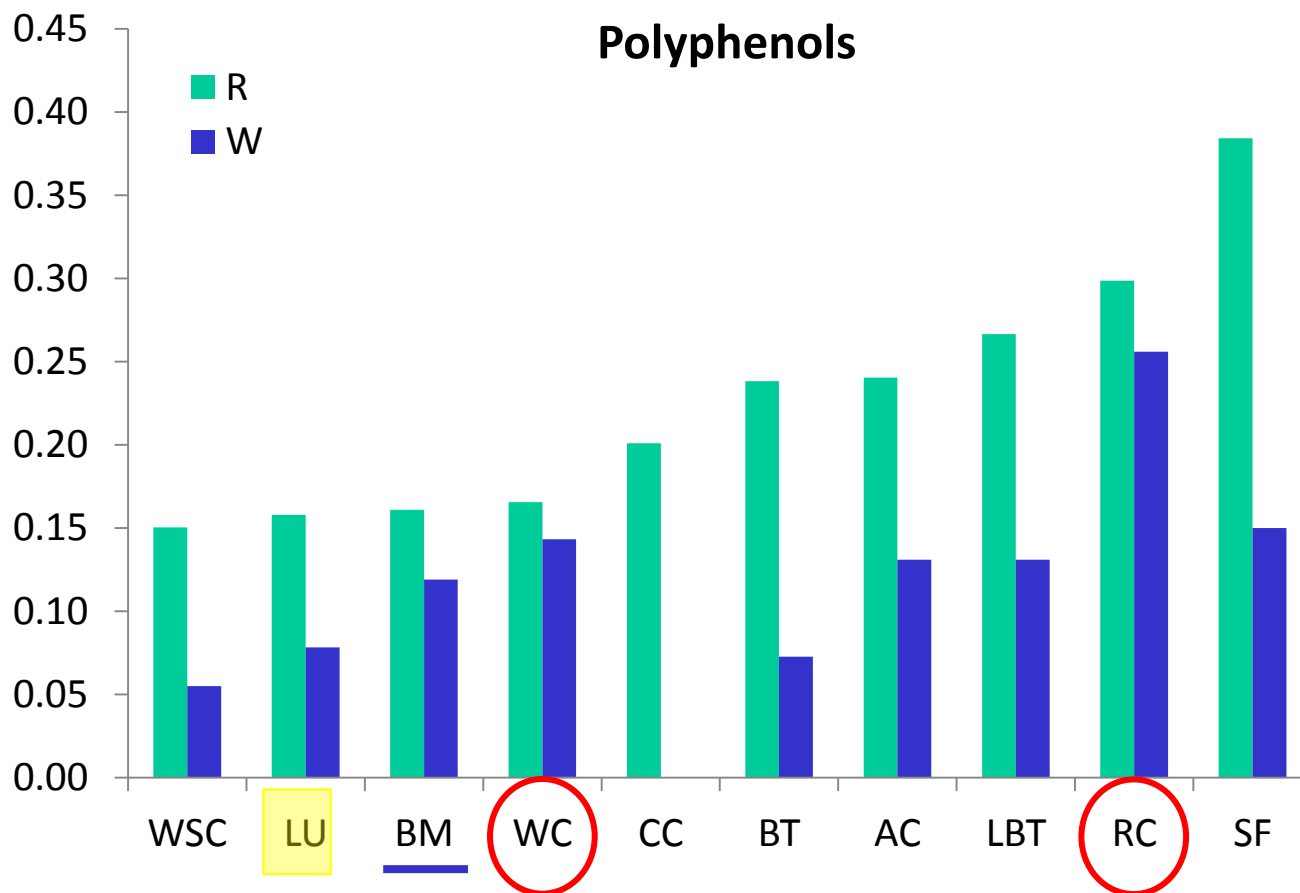


## Residue properties: Phenolics, Lignin, C:N



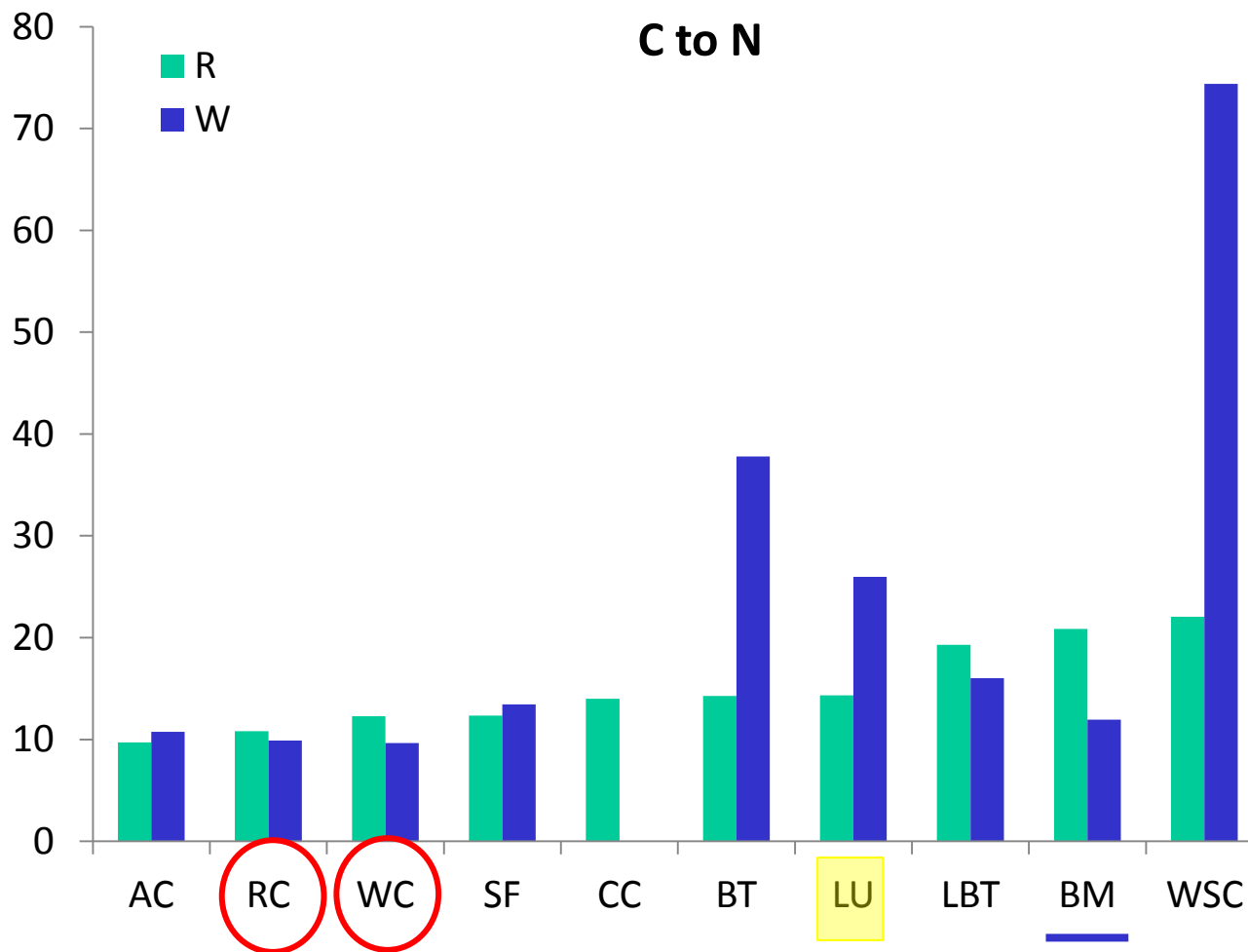
R: Rothamsted, W: Wakelyns

## Residue properties: Phenolics, Lignin, C:N



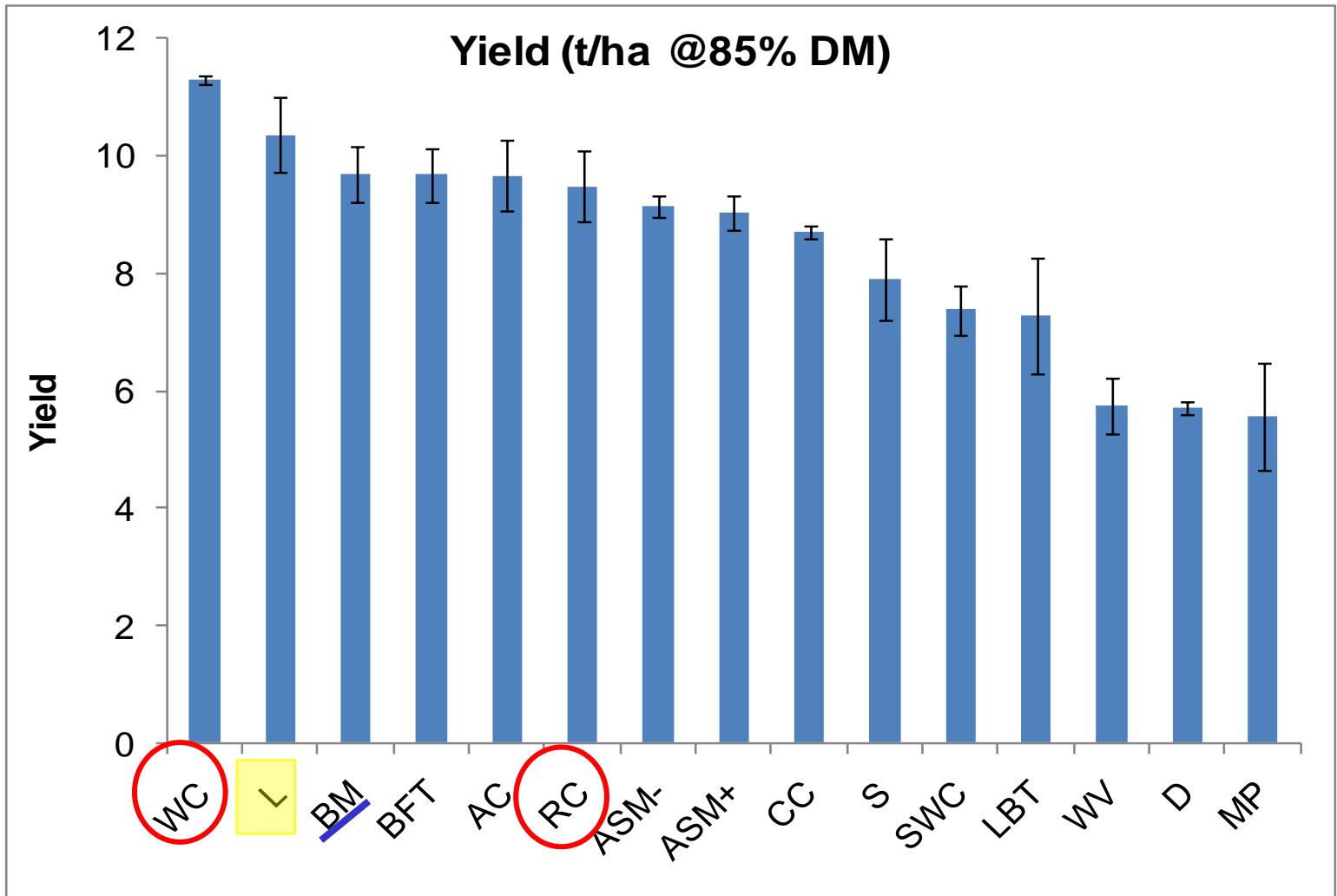
**Pre-incorporation levels are much lower than what is normally found in vegetative phase.**

## Residue properties: Phenolics, Lignin, C:N

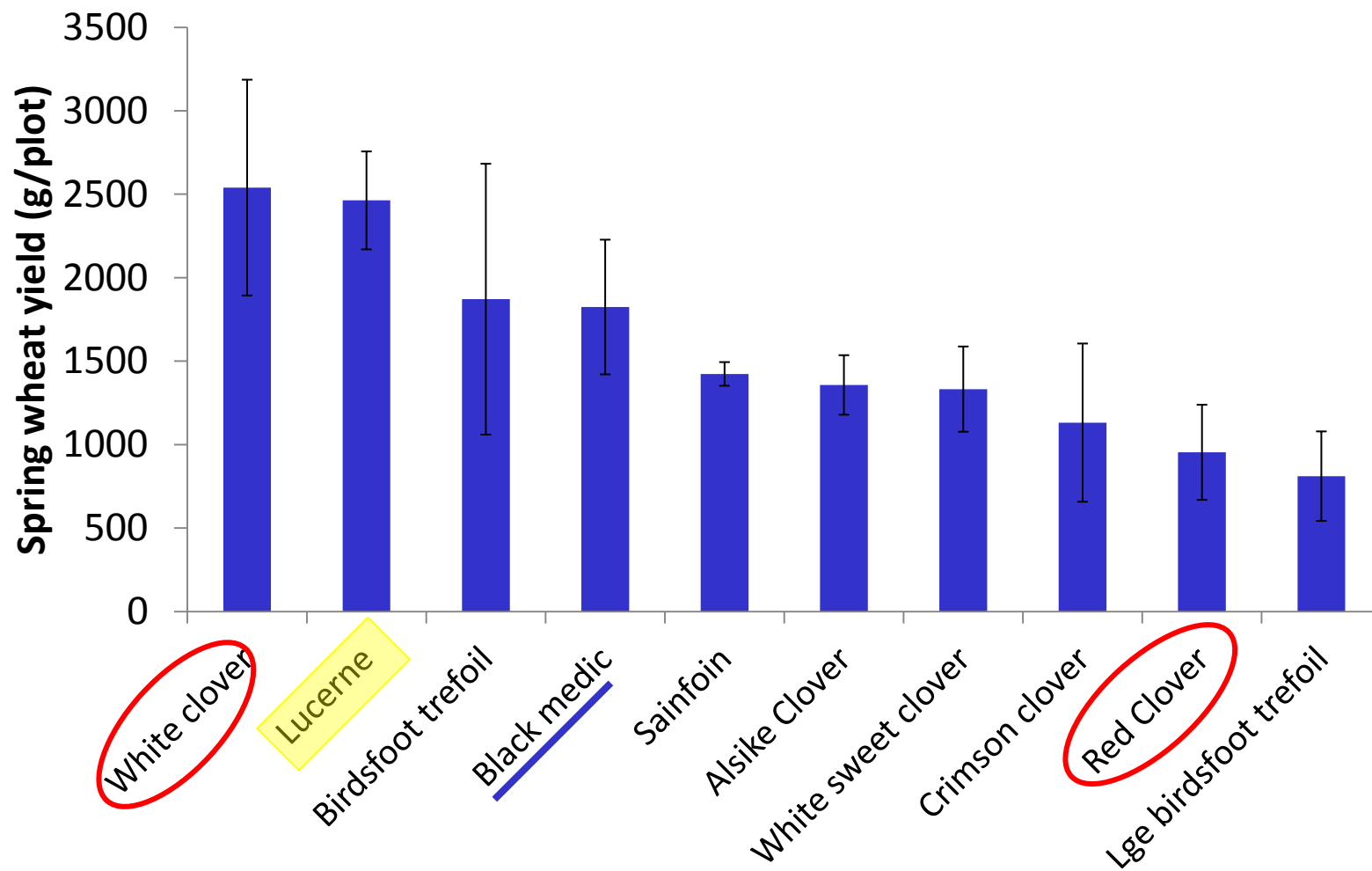


# (4) Yield of following crop

## Winter wheat at Rothamsted

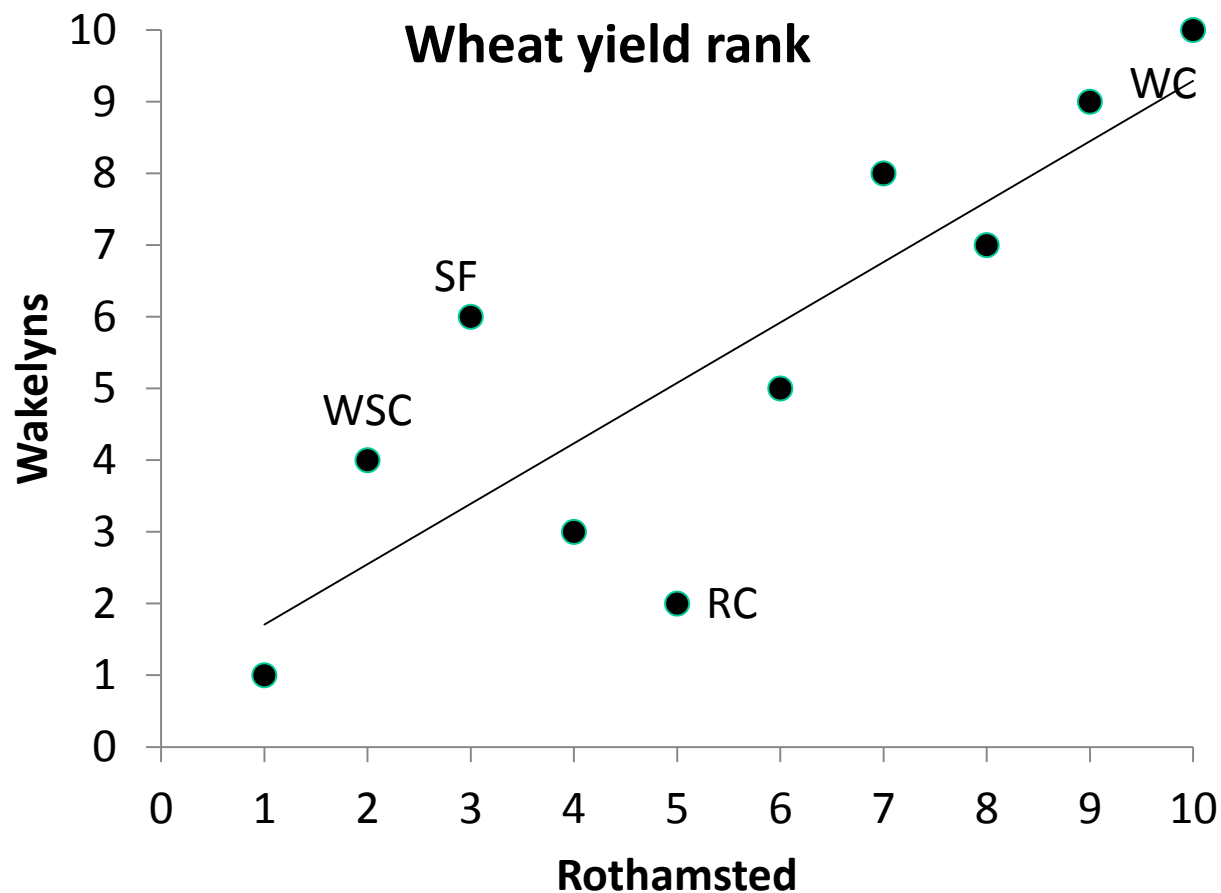


## Spring wheat at Wakelyns

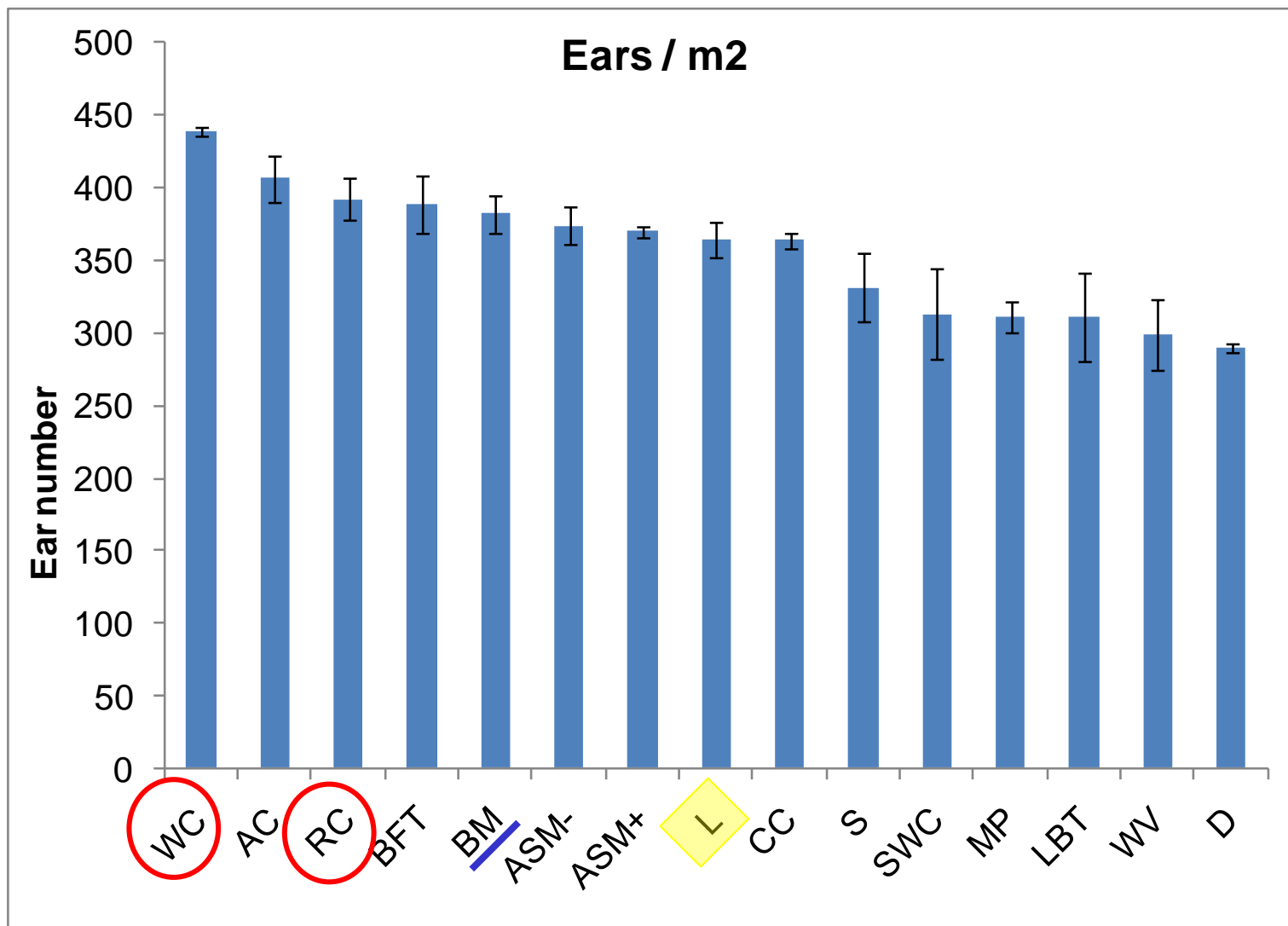




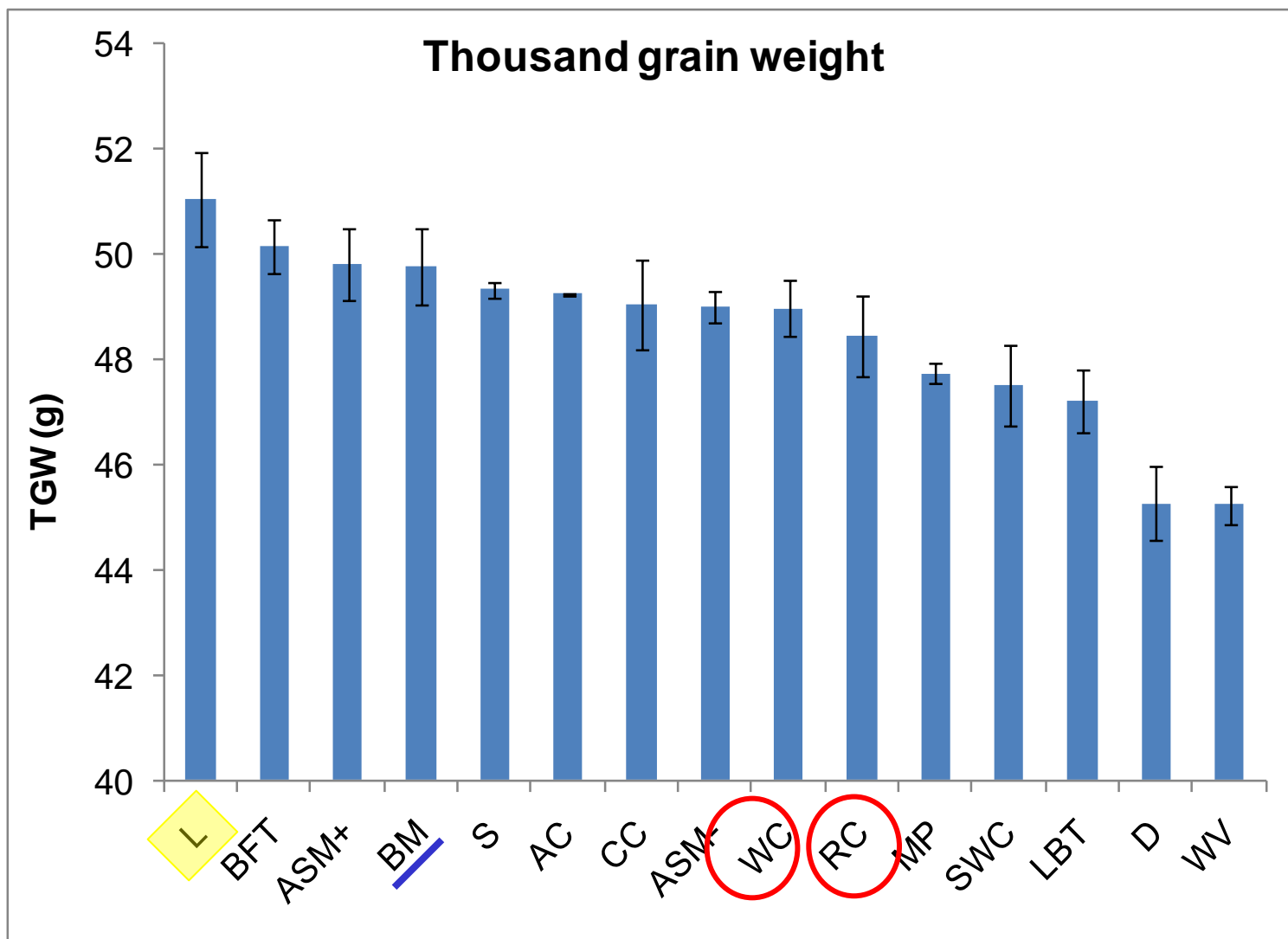
## Wheat yields: consistent results?



## Wheat yield components: Early season



# Wheat yield components: Late season



## Winter wheat at Rothamsted

