

# Cereal competition against weeds

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EWRS Working Group  
in collaboration with  
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# Why investigate crop competitive ability?



- Weed control is a key issue when considering lower input and organic systems
- Working towards a '*package*' of traits that are useful in low input systems (genotype x agronomy)
- Competition = stressed weeds = lower herbicide rates?
- Managing weeds in a *non-aggressive* state
- Crop-weed composition is the foundation for other trophic levels

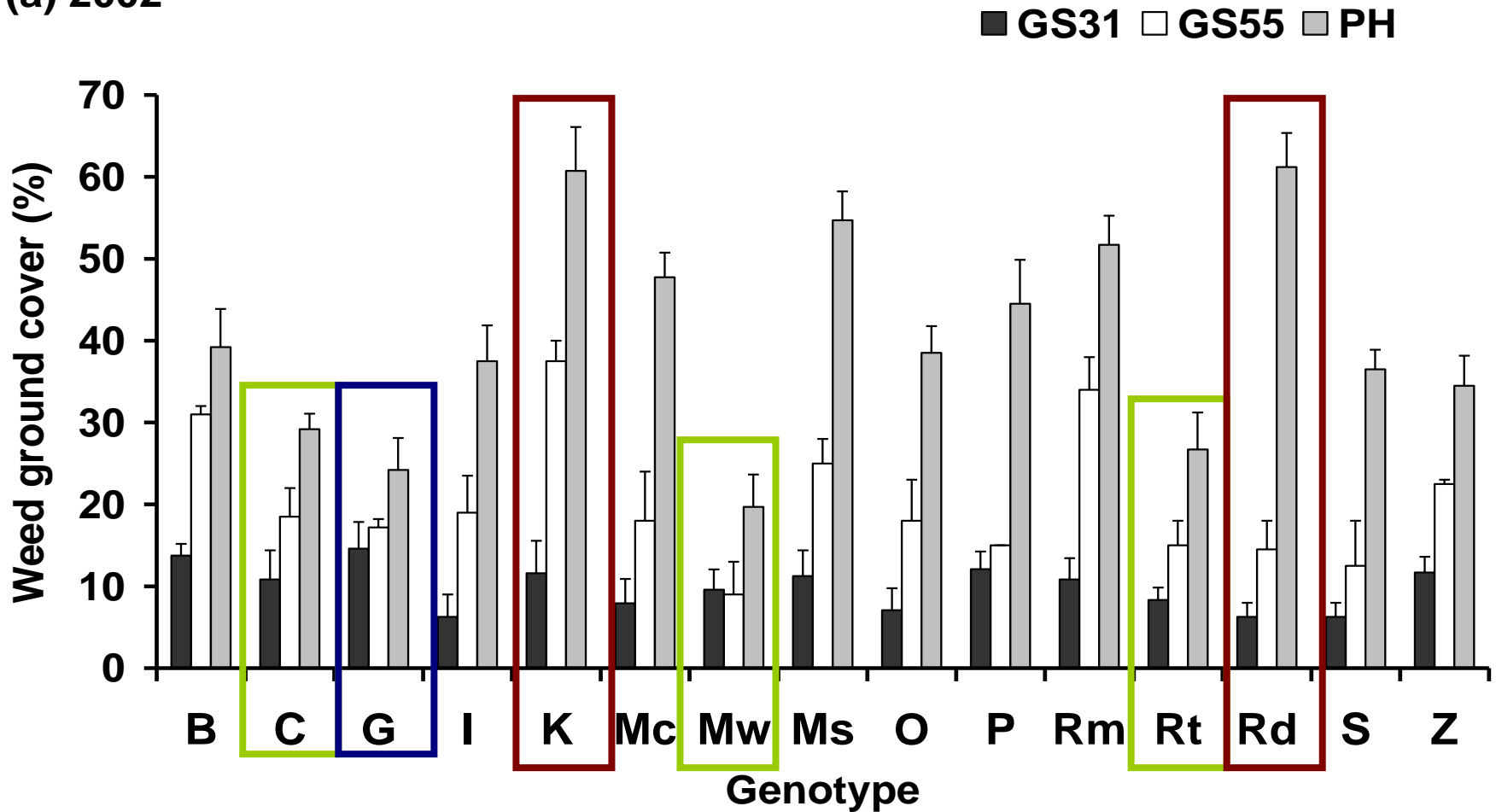
# Starting point ....



- Variation between genotypes in ability to suppress weeds
- Evidence that high shading ability is a function of mean leaf angle e.g. planophile structure is most competitive
- Can we describe plant characteristics and *ideotypes* that correlate with a high degree of weed suppression?

# Variation in weed competitiveness across wheat varieties

(a) 2002



# Plant and crop characteristics for weed suppression (above ground)



- Early vigour and establishment
- Plant height
- Tillering ability
- Leaf canopy size
- Shading ability (i.e. light interception)
- Crop ground cover
- Plant growth habit (leaf angle)
- Yield potential

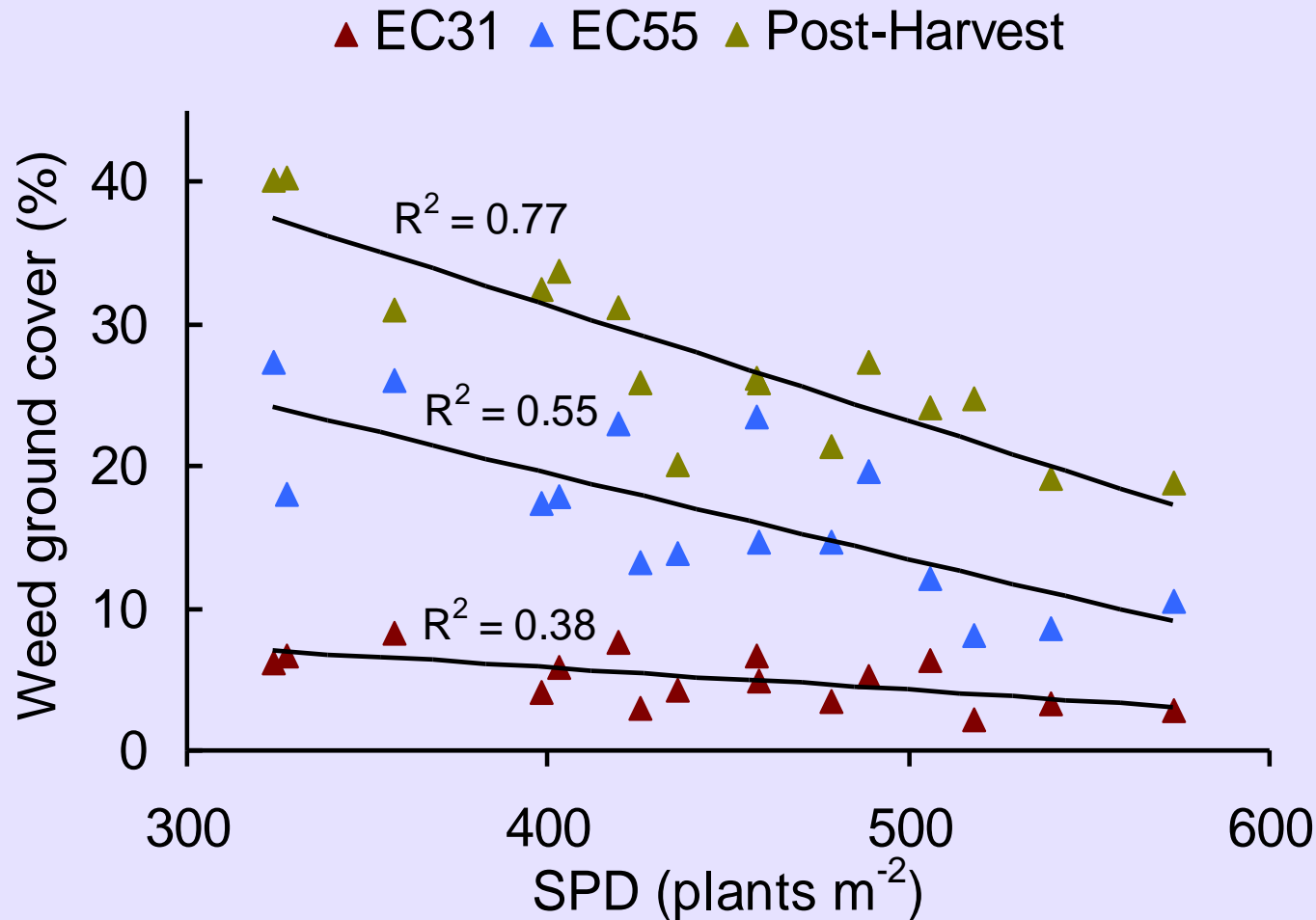
- Often, the effects of plant height on weed suppression were not consistent (especially before anthesis)
- However, across several trials, an increase in maximum plant height was associated with weed suppression

# Does shoot population density contribute to crop competitiveness?



- Shoot population density (plants per m<sup>2</sup>) had significant effects on weed growth
- Generally, high tillering ability is an advantage
- As with plant height, shoot population should be considered in relation to other plant and crop characteristics e.g. leaf canopy size

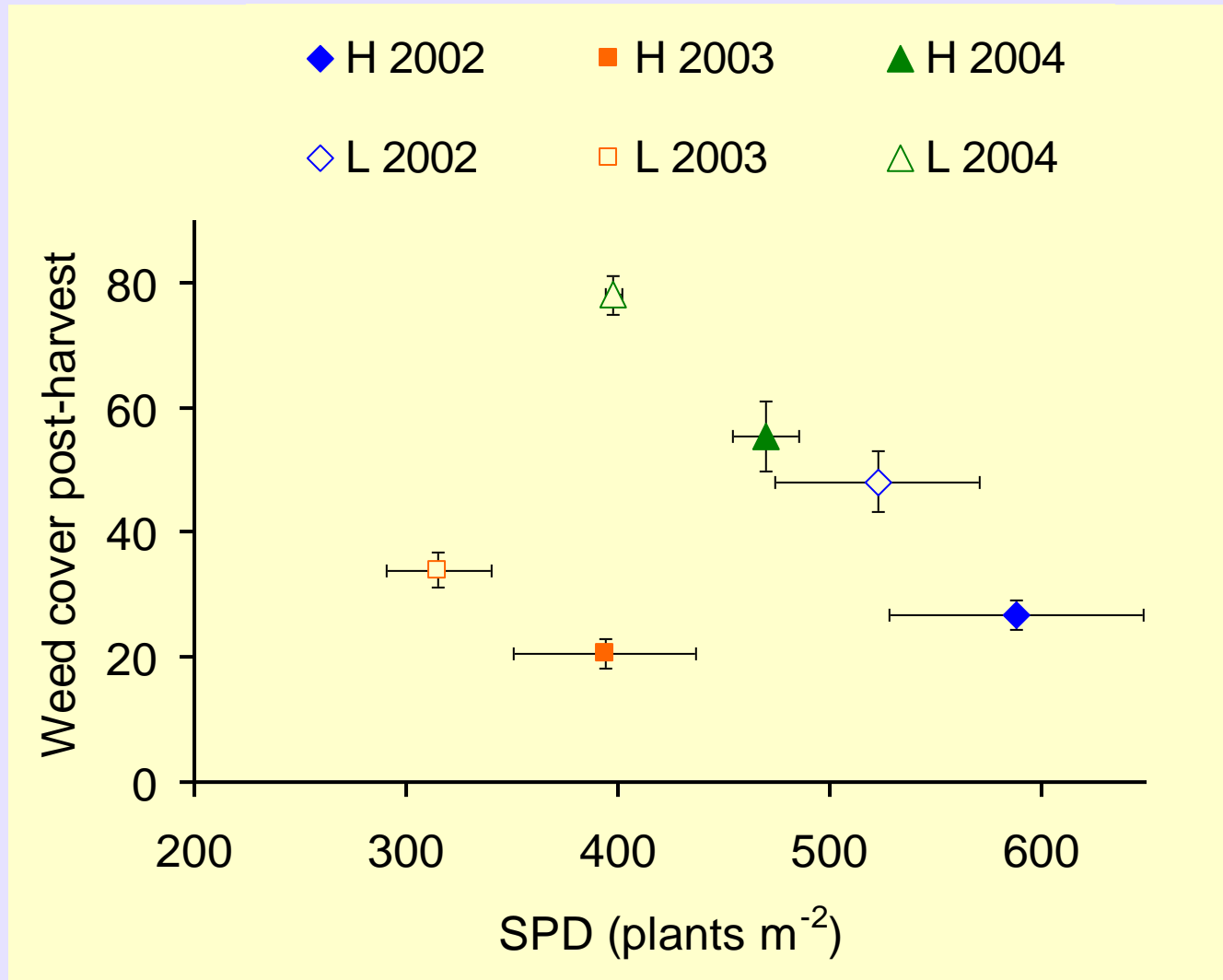
# Effect of shoot population density at GS31 on weed ground cover (at 3 growth stages)



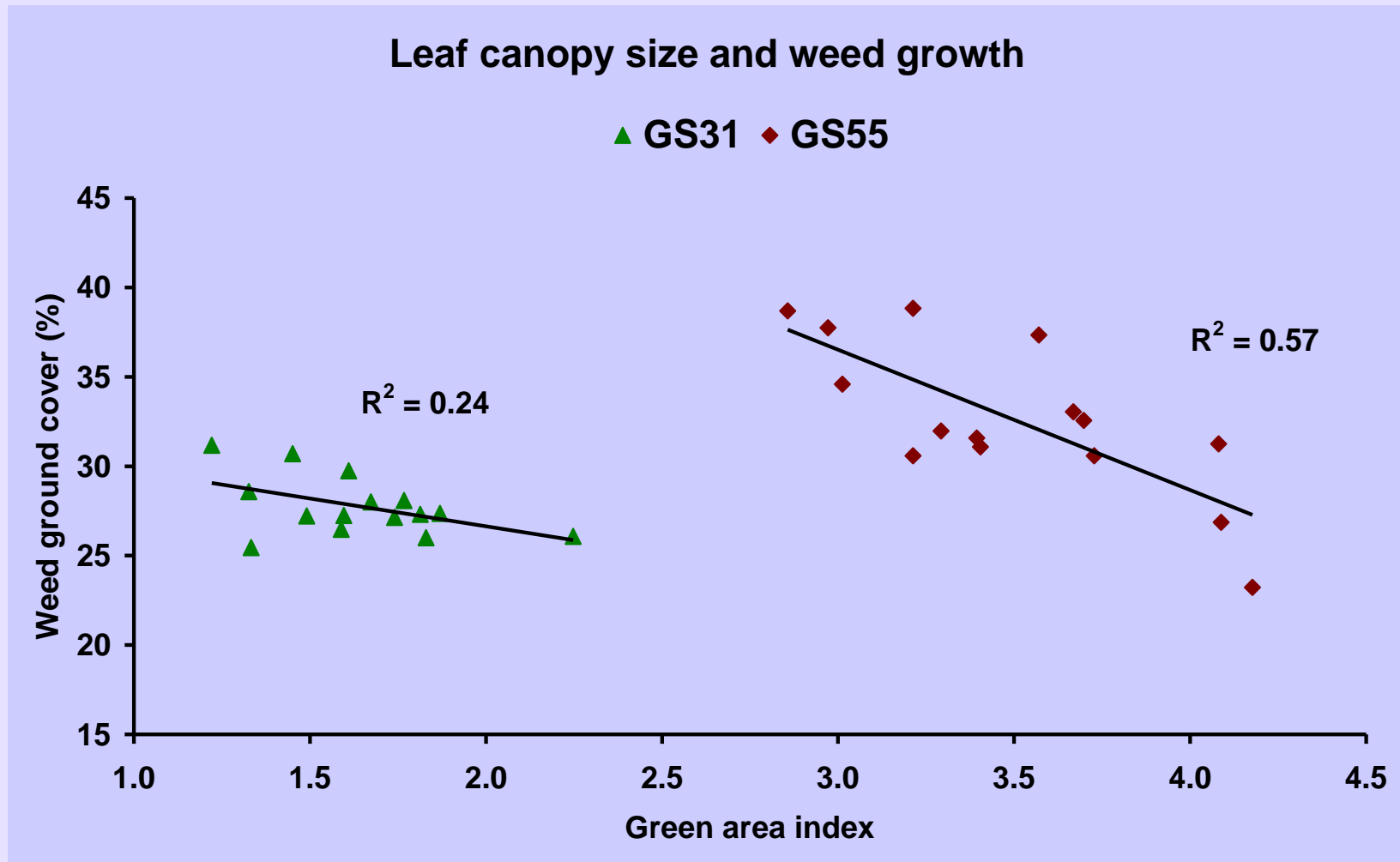
Each point represents a variety mean. Data from 2003.



# Weed growth as influenced by genotype-groups with High and Low shoot population density

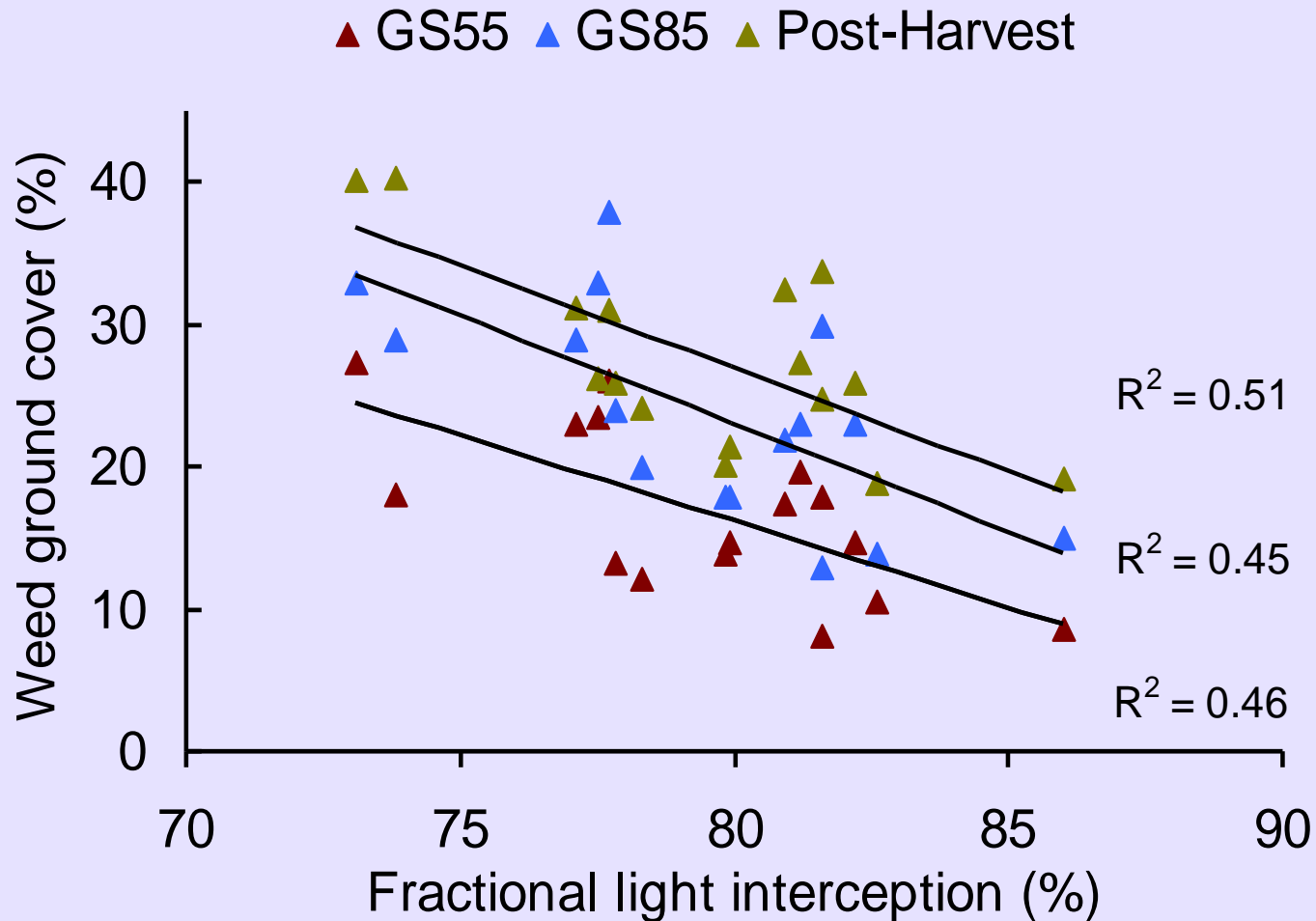


# It is important to maintain a good leaf canopy size and high light interception



Summary of trials 2002-2004. Each data point is a genotype mean

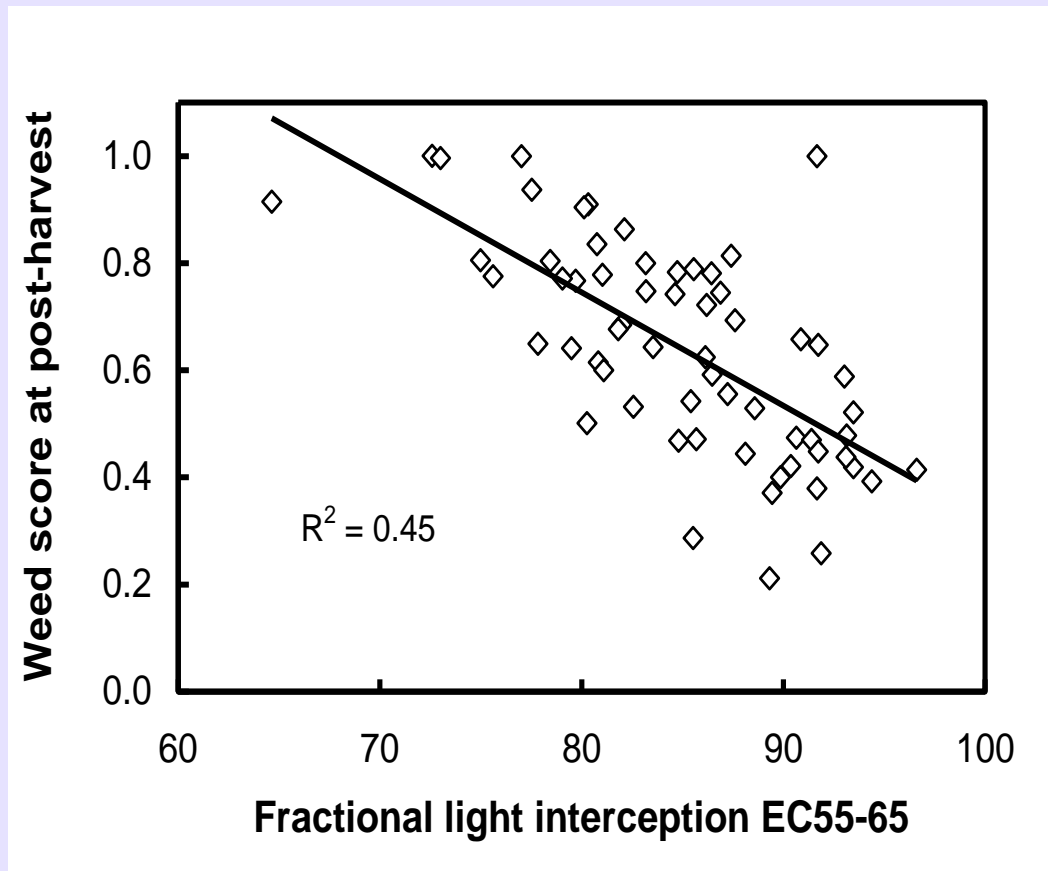
# Effect of fractional light interception at GS55 on weed ground cover



Each point represents a variety mean. Data from 2003.

# Fractional light interception was a good indicator of competitiveness

Relationship between crop fractional light interception (ear emergence) and weed ground cover (post-harvest) across all varieties and seasons.



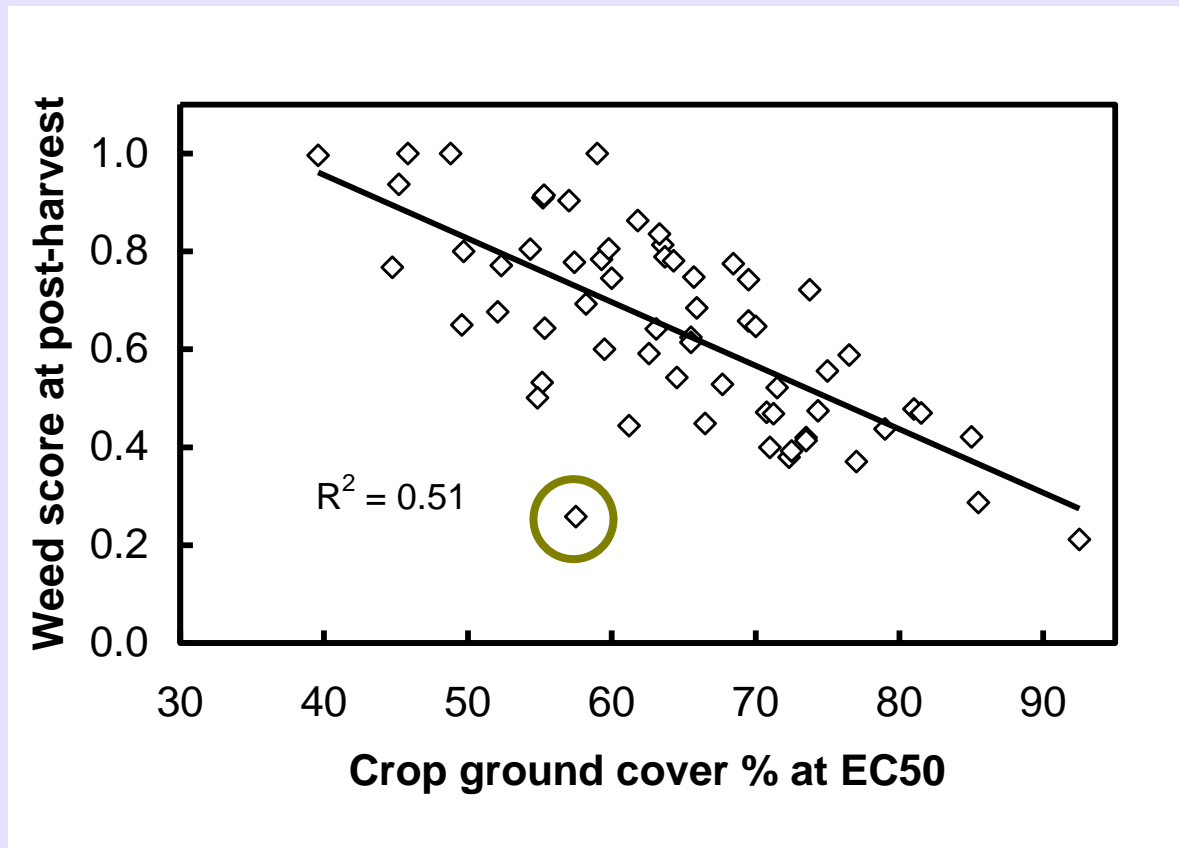
# The role crop ground cover in weed suppression



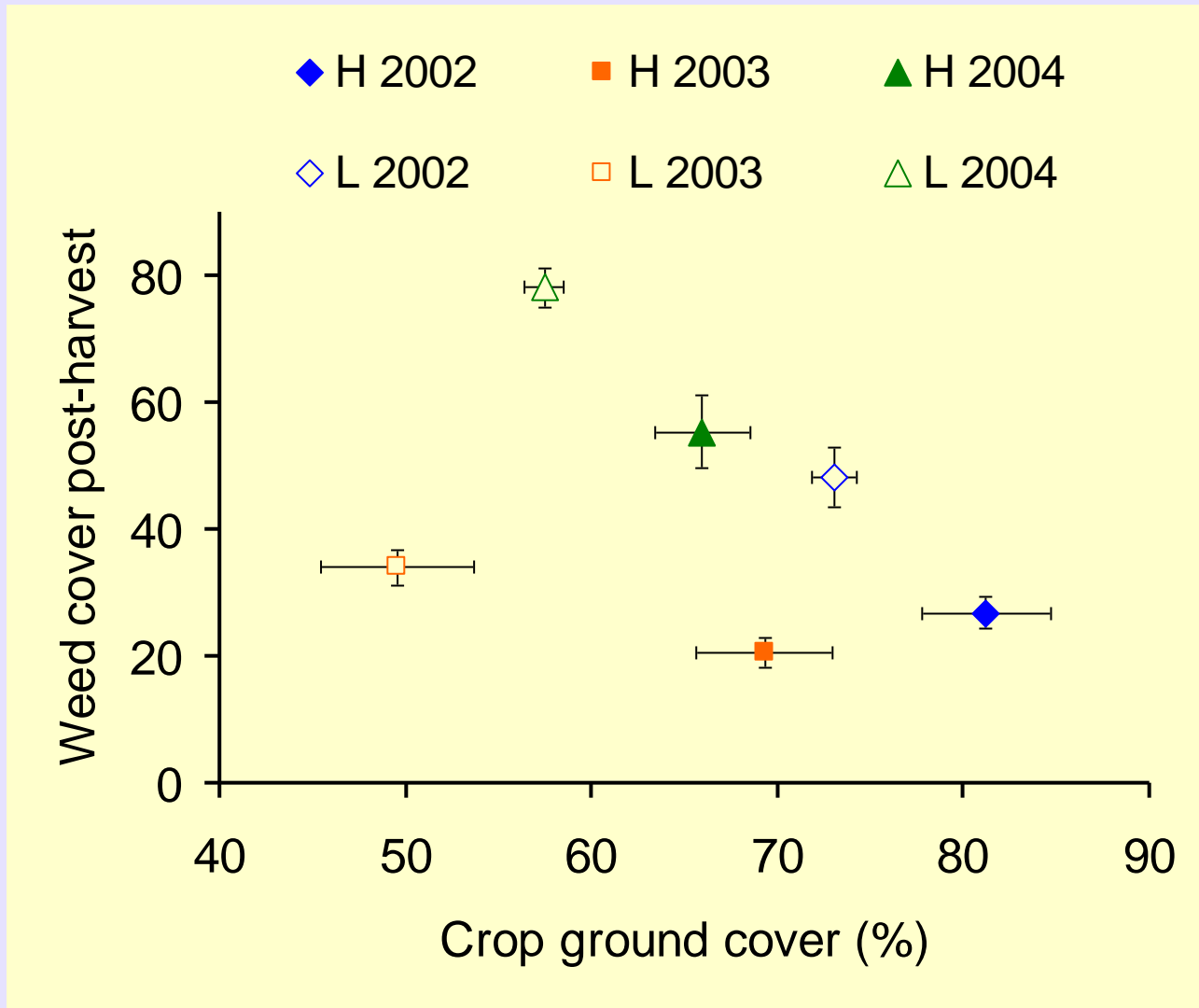
- No single plant characteristic determines competitive ability. Crop ground cover is the most important single measure (and is relatively easy to measure)
  - Links strongly to fractional light interception
  - More complex relationships with GAI, shoot number and plant growth habit
- It is important to maintain a good crop ground cover throughout the season

# Crop ground cover is a robust measure of competitiveness

Relationship between crop ground cover (at start of ear emergence) and weed ground cover (post-harvest) across all varieties and seasons.



# Weed growth as influenced by genotype-groups with **H**igh and **L**ow ground cover at ear emergence



# The role of plant growth habit in weed suppression



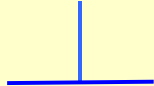

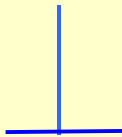

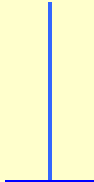


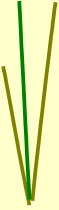


- Practicalities of measuring plant growth habit
- We started by developing protocols (contributing to the WECOF Breeders Manual)
- SAC-WECOF scoring system:
  - A five point scale ranging from 1 = erectophile to 5 = planophile

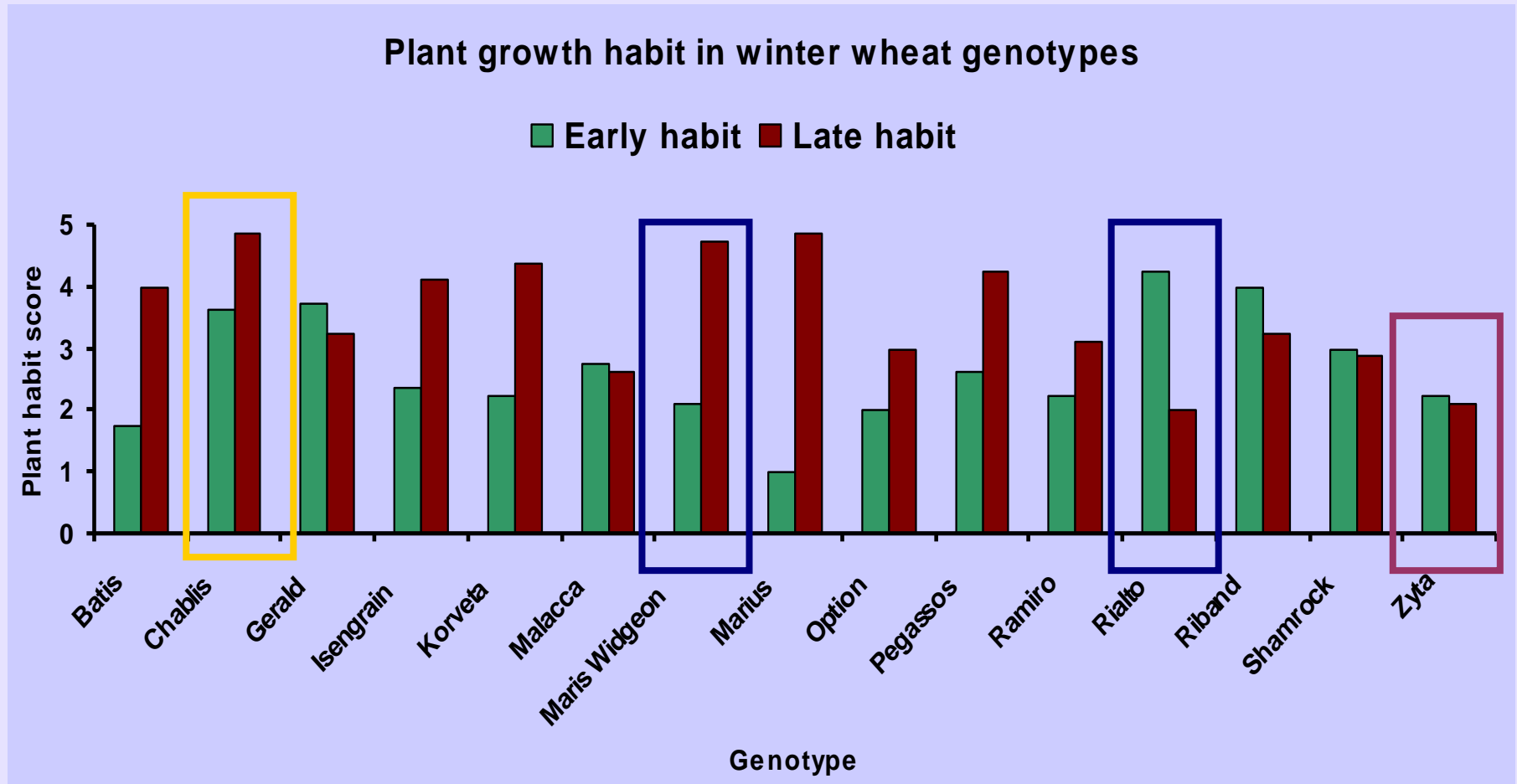


# SAC-WECOF scoring system for plant growth habit

## Plant growth habit

	Description	Height to width ratio	Plant structure
5	Planophile flat > 45° (extended)		
4	Planophile flat 45° (compressed)		
3	P-E intermediate of 2 and 4		
2	Erectophile spread		
1	Erectophile narrow		

# Plant growth habit changes through crop developmental stages

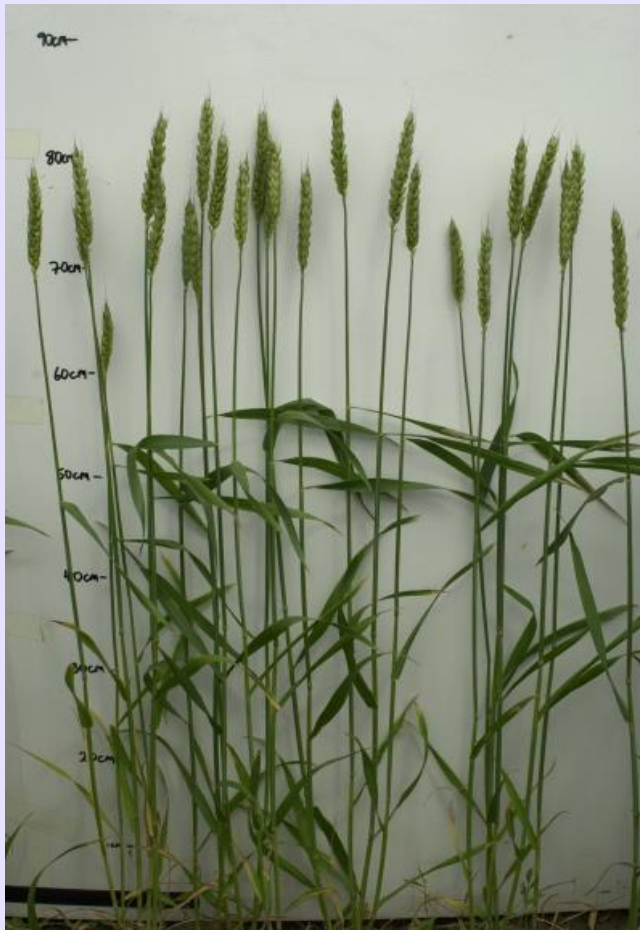


Summary of trials 2002-2004

1 = erectophile to 5 = planophile

# Examples of growth habit types

## Chablis Planophile



## Maris Widgeon Erectophile to planophile



# Examples of growth habit types

**Rialto**  
**Planophile to erectophile**



**Zyta**  
**Erectophile**





# Examples of growth habit types

## **Pegassos** E-P to planophile



## **Gerald** Winter oat: erectophile with long leaves

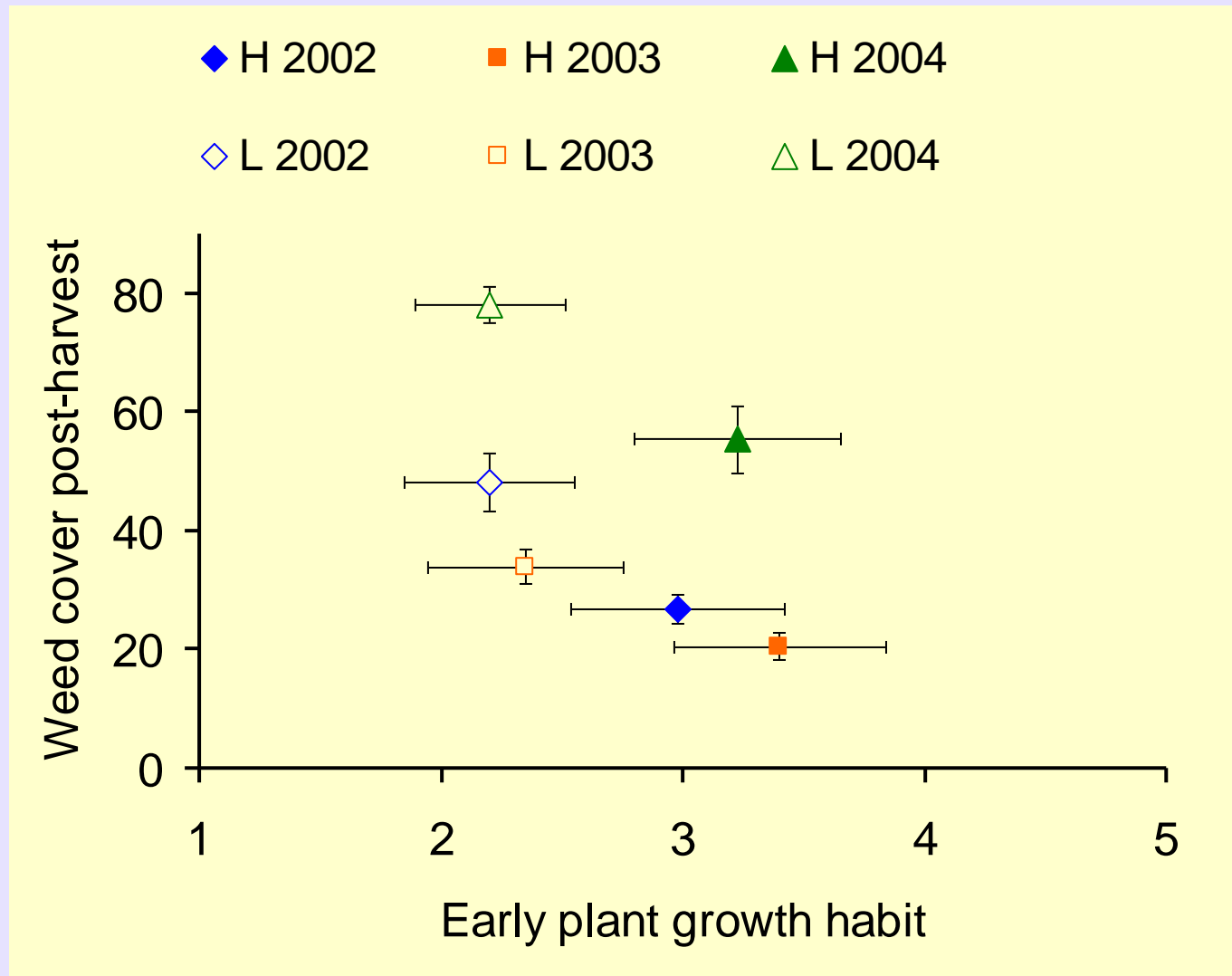


# Role of plant growth habit more complex than initially proposed



- Benefits (or disadvantages) of different plant growth habits can be confounded by other differences in **plant** or **crop** structure
- Need to consider how variation in plant population, shoot population and leaf canopy size may over-ride the influence of plant growth habit on weed suppression.
- Beginning to consider groups of genotypes or traits

# Influence of early plant habit on weed growth in genotypes of High and Low competitive ability



# Thoughts so far about the role of plant growth habit



- Early growth habit appears to be more important than late growth habit in weed suppression
- Late in season (after stem elongation) influence of leaf canopy size or final shoot number may be more important than plant growth habit



# Work still to be done on the role of plant growth habit in weed suppression



- Need to look more closely at light interception within leaf canopy layers and light distribution on the canopy floor e.g. within and between plant rows
- However, when other crop factors are equal (e.g. plant and shoot number), we are able to provide general comments about the role of plant growth habit on weed suppression

# General comments about plant growth habits



If plant population density and leaf canopy size are similar then ....

- **Continuous planophile:** has advantage over the highly erectophile habit
- **Early planophile to late erectophile:** can compensate for low establishment
- **Early erectophile to late planophile:** must have good establishment
- **Continuous erectophile:** risky when weed growth is high or shoot numbers low

# What about grain yield?



- The best weed suppressors tend to be amongst the best yielding genotypes
- Yield benefits are not lost when aiming for good weed suppression
- Must consider *robustness* of each genotype across experimental/variety testing trials

- No single **plant** characteristic determines competitiveness
- **Crop** ground cover is the most useful measure of competitiveness
- Still working towards how plant growth habits can be used in variety testing and selection
- Some features of crop competitiveness against weeds **are/are not** practical to measure in the field

# Partners and SAC Team



## Partners:

1. IOL, Bonn
2. SAC
3. WAU, Warsaw
4. Instituto Madrilenio  
IAA, Madrid
5. University of Ancona
6. FR Strube

## SAC Team:

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