

Conceptual model used in (i) evaluation of genetic resources, (ii) physiological breeding

$$\text{YLD} = \text{WU} \times \text{WUE} \times \text{HI} \text{ (Passioura, 1979)}$$

Photo-Protection

Leaf morphology

- wax/pubescence
- posture/rolling

Pigments

- chl a:b
- carotenoids

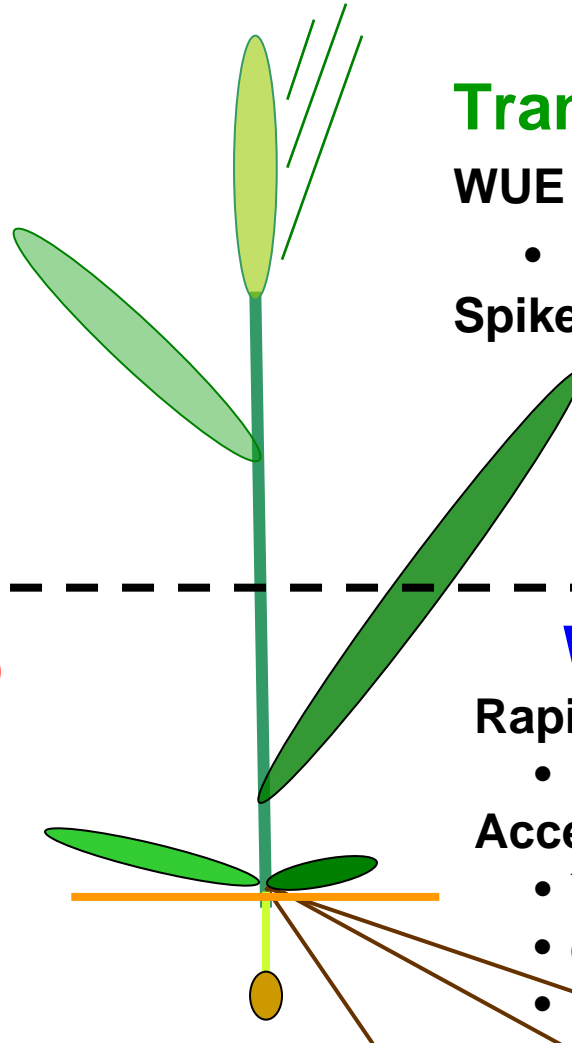
Antioxidants

Transpiration Efficiency

WUE of leaf photosynthesis

- low $^{12}/^{13}\text{C}$ discrimination

Spike/awn photosynthesis



Partitioning (HI)

Partitioning to stem
carbohydrates

Harvest index

- *Rht* alleles

Water Uptake

Rapid ground cover

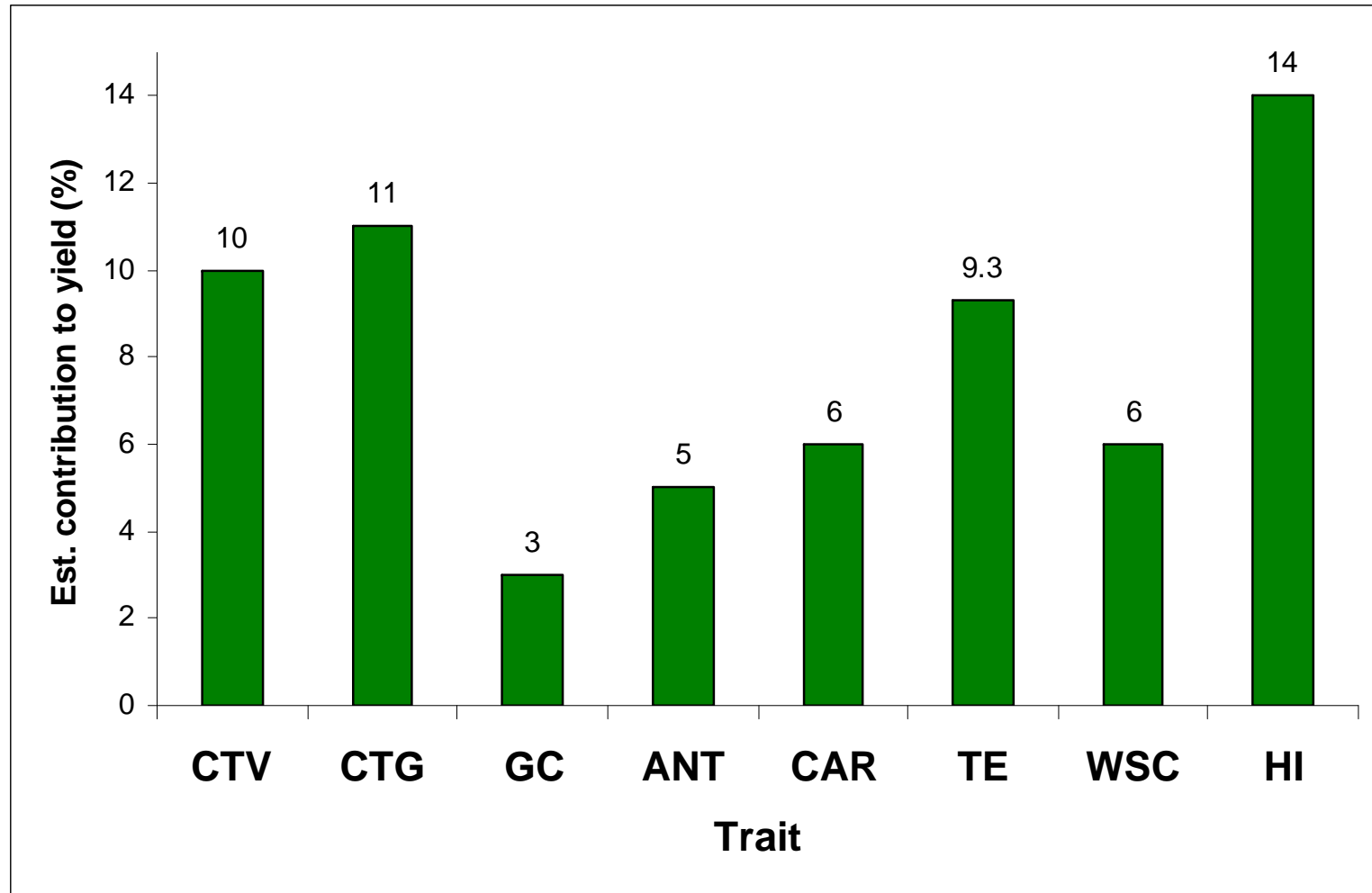
- protects soil moisture

Access to water by roots

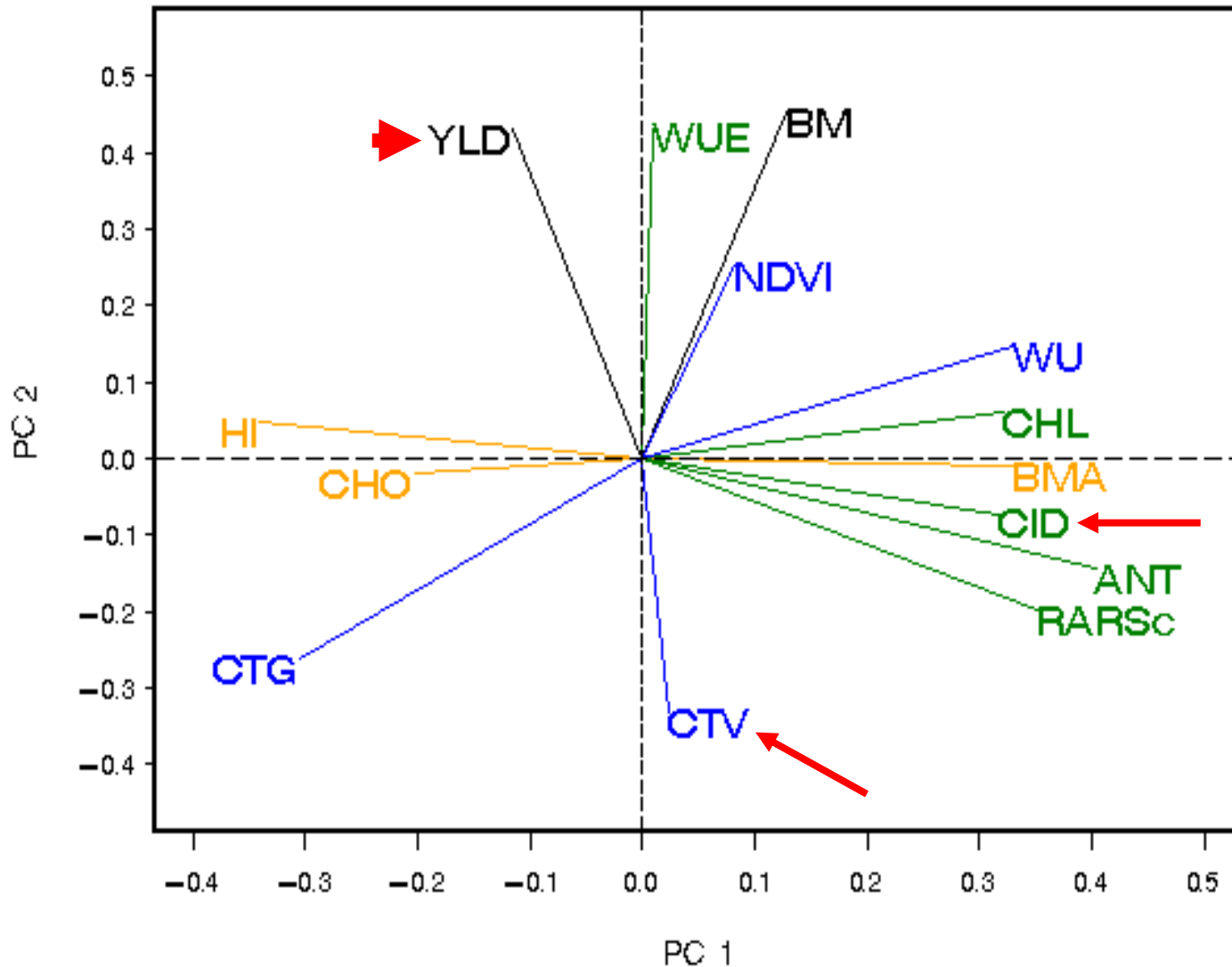
- Ψ leaf
- cool canopy
- (osmotic adjustment)

Potential contribution to yield from traits expressed by elite genetic resources under drought

(CTV/CTG=canopy temp vegetative & grainfill stages, GC=ground cover, ANT=anthesis, CAR=carotenoids, TE= transpiration efficiency, WSC=water soluble carbohydrates, HI=harvest index)



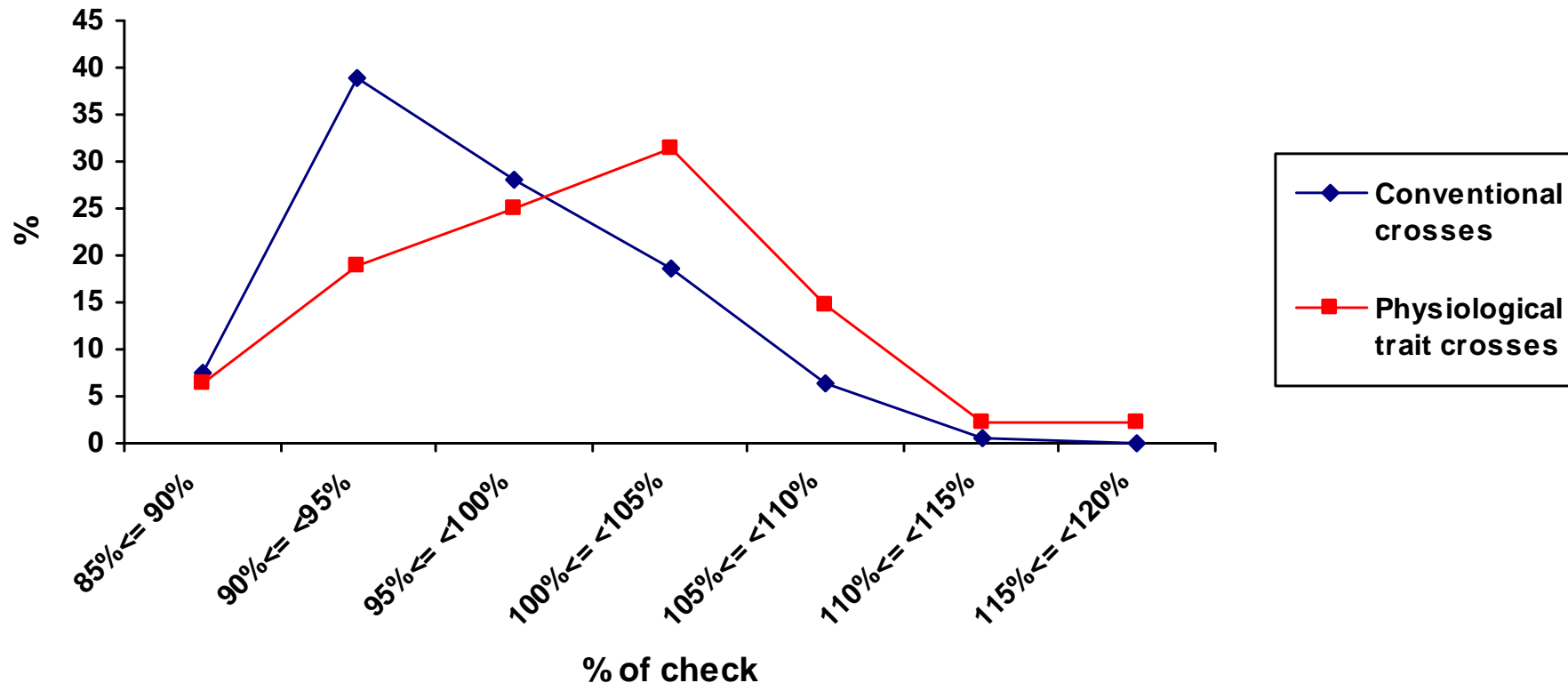
Principal component analysis indicating drought-adaptive traits likely to result in cumulative gene action for yield under water stress



Impact of physiological trait (PT) breeding

(PT lines represent 24% of 23rd SAWSN distributed in 2008)

**Yield distribution of 3 years mean drought trials
(Cd Obregon, Mexico)**



Traits contribution from parents of selected PT progeny

<i>Trait contributes to</i>	WU	WU	WU	WUE	WUE	WUE	HI
	CT °C	Vigor NDVI	Resid. H ₂ O 30–120cm (mm)	CID ‰	Wax visual (1-10)	CHL SPAD	WSC %
<i>3 way</i>							
MEX94.27.1.20	20.1	0.535	4.4	22.3	1.0	42.8	32.4
SOKOLL	20.4	0.575	9.0	21.1	4.4	50.0	30.4
ATTILA/3*BCN	20.4	0.590	5.4	21.4	5.5	46.1	45.6
<i>Progeny</i>	20.1	0.580	5.2	21.6	5.5	49.3	35.4

<i>LSD (5%)</i>	0.35	0.022	1.14	0.35	1.30	3.50	8.1
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Publications 2007 & 2008

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- Pinto S, Chapman SC, McIntyre CL, Shorter R, Reynolds MP, 2008. QTL for canopy temperature response related to yield in both heat and drought environments. In *Proceedings of the 11th International Wheat Genetics Symposium, 24th-29th August, 2008, Brisbane Australia.*
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