¿DOES WHITE ROT RESISTANCE PENALIZE SEED-YIELD IN SUNFLOWER?

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Introduction

In Argentina, around $3.4x10^6$ t of sunflower seeds were harvested in 2022 and more than 50% of it was generated in the Southern and Southeast of Buenos Aires Province.

=> This region is a suitable environment for the sunflower crop but also for White Rot (WR) disease produced by *Sclerotinia sclerotiorum* infections on capitula.

- Farmers must use moderately WR-resistant hybrids to decrease both potential yield losses and annual production oscillations.

Introduction

In favorable environments to diseases, moderately resistant cultivars have higher seed-yield than others without it.

=> For Verticillium wilt, it was showed that seed-yield and seed-oil of resistant isohybrids to *Verticillium dahliae* were nearly 30% high than those of the susceptible counterparts in the most disease severe environments.

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Some papers described that agronomic performance of resistant genotypes growing up in disease-free environments is generally lower than of susceptible ones (i.e. the biological cost of the resistance).

=> But others said that susceptible and resistant genotypes had comparable agronomic performance under disease-free conditions.

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An experiment made previously at Balcarce showed that seed-yield components were not dependent on WR-partial resistance.

=> Some R-lines (bred at Balcarce) showed good ability to make hybnds with favorable levels of both seed-yield and WR-resistance.

Introduction

Objective:

- to generate additional information (using more genetic material, variables and environments) in order to validate or not the results found in that single experiment made previously.

Materials and Methods

– Genetic material and experimental design –

- 56 test-crosses (TC), generated from crossing 40 R-lines to GB and/or GU A-lines,

  => 2 moderately WR-resistant cultivars (PARAÍSO 20 and ACA 884) and a high seed-yield and oil content cultivar (VDH 487) were used.

- RCBD with 2 replications, was made during 2 years.

  => Each plot had at least 15 plants (43,000 pl/ha)

Materials and Methods

- WR disease and measured variables -

- Using the French protocol, 12 pl/plot were inoculated on capitula.

  =>14 dai, they were evaluated twice a week until the detection of the first WR symptoms and then every 7 days. The date and WR-severity (%) were scored.

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  - *RIP:* incubation period (in days) of target capitulum related to the mean of checks inoculated on the same day *(=RIP>1, favorable).*
  - *DLG:* WR-severity progress from the first WR symptom to the date when the maximum WR-severity was detected.
  - *RDLG:* regression coefficient “b” of DLG for the target capitulum related to the mean of checks inoculated on the same day *(=RDLG<1, favorable)*.

Materials and Methods
- Seed yield components -

- All non-inoculated capitula (at least 3/plot), having netting bags, were harvested at maturity.

  - ▶ Seeds were counted and weighed (=at around 11% of humidity).
  - ▶ 1000-seed weight (g).
  - ▶ Seed-oil (%).

Results and Discussion

- WR Partial Resistance -

- Mean of WR disease incidence ≈ 60%

  => Therefore, RIP and RDLG were measured by at least 14 WRotted capitula.

- ANOVA detected effects of hybrids (test-crosses and cultivars) for RIP ($p<0.01$) and RDLG ($p<0.05$), but not of GEI.

  => Relativize DLG to the mean of checks inoculated on the same day (RDLG) plus a second year of trials reduced the uncontrolled source of variation (i.e. error).

Results and Discussion

- WR Partial Resistance -

- Testcrosses GB-R4 and GU-R21 had the maximum RIP value (1.31).

  => RIP values of 7 TC (GB-R16, GB-R45, GB-R6, GU-R35, GB-R1, GB-R2, GB-R5) and PARAÌSO 20 were not different from that one ($p<0.05$).

  - 4 TC (GB-R16, GB-R6, GU-R35, GB-R1) and PARAÌSO 20 had the same performance detected before.

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  ► 4 TC (GB-R16, GB-R6, GU-R35, GB-R1) and PARAÌSO 20 had the same performance detected before.

- Testcross GU-R16 had the minimum RDLG value (0.10).

  => RDLG values of ACA 884, VDH 487 and 43 TC were not different from it ($p<0.05$).

- And the correlation between RIP and RDLG was …

Table: *Correlation coefficient (r) values between WR variables*

	*RIP	RDLG	SNb	Sw	Soil
RIP	1	-0.19			
RDLG		1			
SNb					
Sw					
Soil					

p>0.05

RIP= *Relative incubation period*; RDLG= *Relative daily lesion growth*;

Results and Discussion
- *Seed-Yield components* -

- ANOVA detected significant ($p<0.01$) effects of hybrids (test-cross + cultivars) for all measured variables.

  => *Seed-oil:* VDH 487 showed maximum value (52.6%) and 22 testcrosses were not different from it.

  ► One TC did not have same performance showed before.

  => *Seed-nb:* GU-R13 showed the maximum value (1608) and 2 TC (GU-R14, GU-R33) had similar performance.

  => *1000-seed weight:* GB-R17 showed the maximum value (54.9 g) and ACA 884 and 2 TC (GU-R36, GB-R18) were not different from.

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- The correlation coefficients among these variables …

Table: *Correlation coefficient (r) values between seed-yield components.*

	*RIP	RDL G	SNb	Sw	Soil
RIP					
RDL G					
SNb			1	0.30	-0.01
Sw				1	0.07
Soil					1

p>0.05

SNb= *Seed-number*; Sw= *1000 seed-weight (g)*; Soil= *Seed-oil (%)*

Results and Discussion

- Relationship WR - Seed-Yield components-

- The correlation coefficients of WR-Seed yield components were …

Table: Correlation coefficient (r) values between WR variables and seed-yield components.

	*RIP	RDLG	SNb	Sw	Soil
RIP	1	-0.19	-0.28	-0.13	0
RDLG		1	-0.05	-0.30	-0.20
SNb			1	0.30	-0.01
Sw				1	0.07
Soil					1

p>0.05

RIP= *Relative incubation period*; RDLG= *Relative daily lesion growth*; SNb= *Seed-number*; Sw= *1000 seed-weight (g)*; Soil= *Seed-oil (%)*

Results and Discussion

- Relationship WR - Seed-Yield components-

- The correlation coefficients were all null:

  => It could be suggested that genes controlling WR-resistance seem to be again independent of those ones controlling seed-yield components.

  => A favorable level of mycelium growth resistance after infection, would not being penalizing seed-yield of hybrids cultivated in a WR-free environment.

  => Sunflower breeders could develop moderately WR resistant cultivars without sacrifice seed-yield.

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  => A favorable level of mycelium growth resistance after infection, would not being penalizing seed-yield of hybrids cultivated in a WR-free environment.

  => Sunflower breeders could develop moderately WR resistant cultivars without sacrifice seed-yield.

- There were not R-lines having simultaneously favorable performance to all measured components.

  => Besides the high level of RDLG transmitted by R16 when crossed to GU, it generated a progeny having good performance to RIP and RDLG with GB.

Conclusions

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Conclusions

=> Under our experimental conditions, an absence of underlying biological cost of WR-resistance in WR-free sunflower plants is suggested again.

=> Further experiments using other localities and/or years (i.e. environments) and genetic materials would allow knowing the repeatability of results but also the stability of the absence of that cost in hybrids growing in WR-free environments.

=> None R-lines transmitted simultaneously all favorable attributes.