



# Effect of *Plasmodiophora brassicae* inoculum density on yield of canola (*Brassica napus*)

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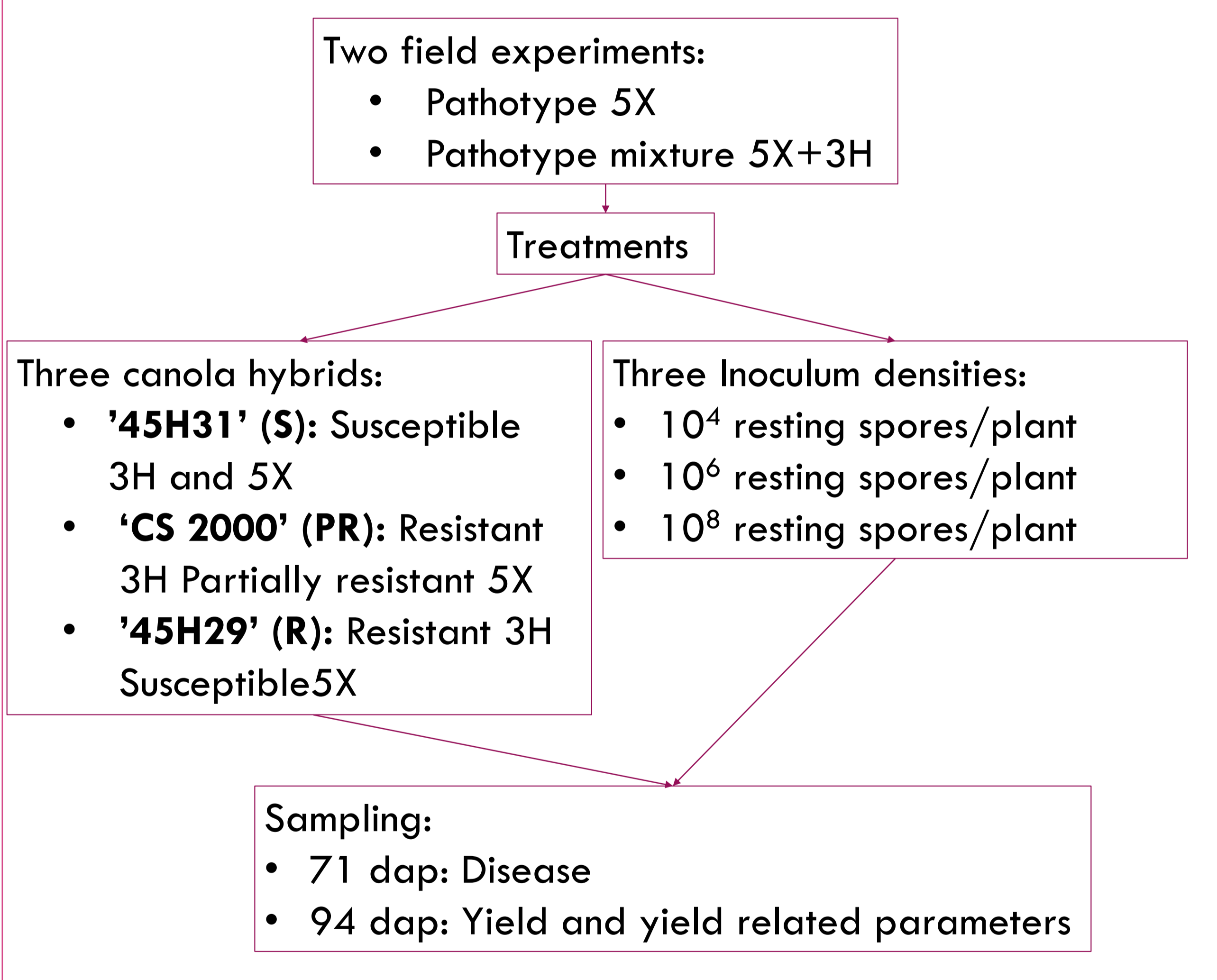
## ABSTRACT

Clubroot, caused by *Plasmodiophora brassicae* Wor., is a major constraint to canola (*Brassica napus* L.) production on the Canadian Prairies. Nevertheless, reliable estimates of the relationship between yield and *P. brassicae* inoculum density under western Canadian conditions are not available. This research aimed to evaluate the effect of clubroot on yield and yield-related parameters of three canola hybrids (S, PR and R) with different levels of resistance under field conditions in Alberta, Canada. Experiments were conducted in biosecure nurseries inoculated with *P. brassicae* pathotype 5X or a mix of pathotypes 5X and 3H at rates equivalent to  $10^8$ ,  $10^6$  and  $10^4$  resting spores per plant. Clubroot incidence and severity, along with seed weight, thousand-seed weight, productive branches, pods per branch and pods per plant, were measured. As *P. brassicae* inoculum density increased, so did clubroot incidence and severity. When only the pathotype 5X was inoculated, the number of branches per plant, pods per plant and per branch were diminished as the inoculum increased in all the hybrids. In the mix of 5X and 3H, the number of branches per plant, pods per plant and per branch were reduced only in the S hybrid. Yield declined in all three hybrids with increasing inoculum density of 5X or the 5X and 3H mixture, although greater yields were obtained with the R hybrid. The yield of the PR hybrid was comparable to that of the R hybrid when grown in the 5X and 3H pathotype mix. Yield reductions caused by *P. brassicae* are affected by inoculum density and specific host-pathotype interactions, reflecting the impact of host resistance on clubroot development.

## INTRODUCTION

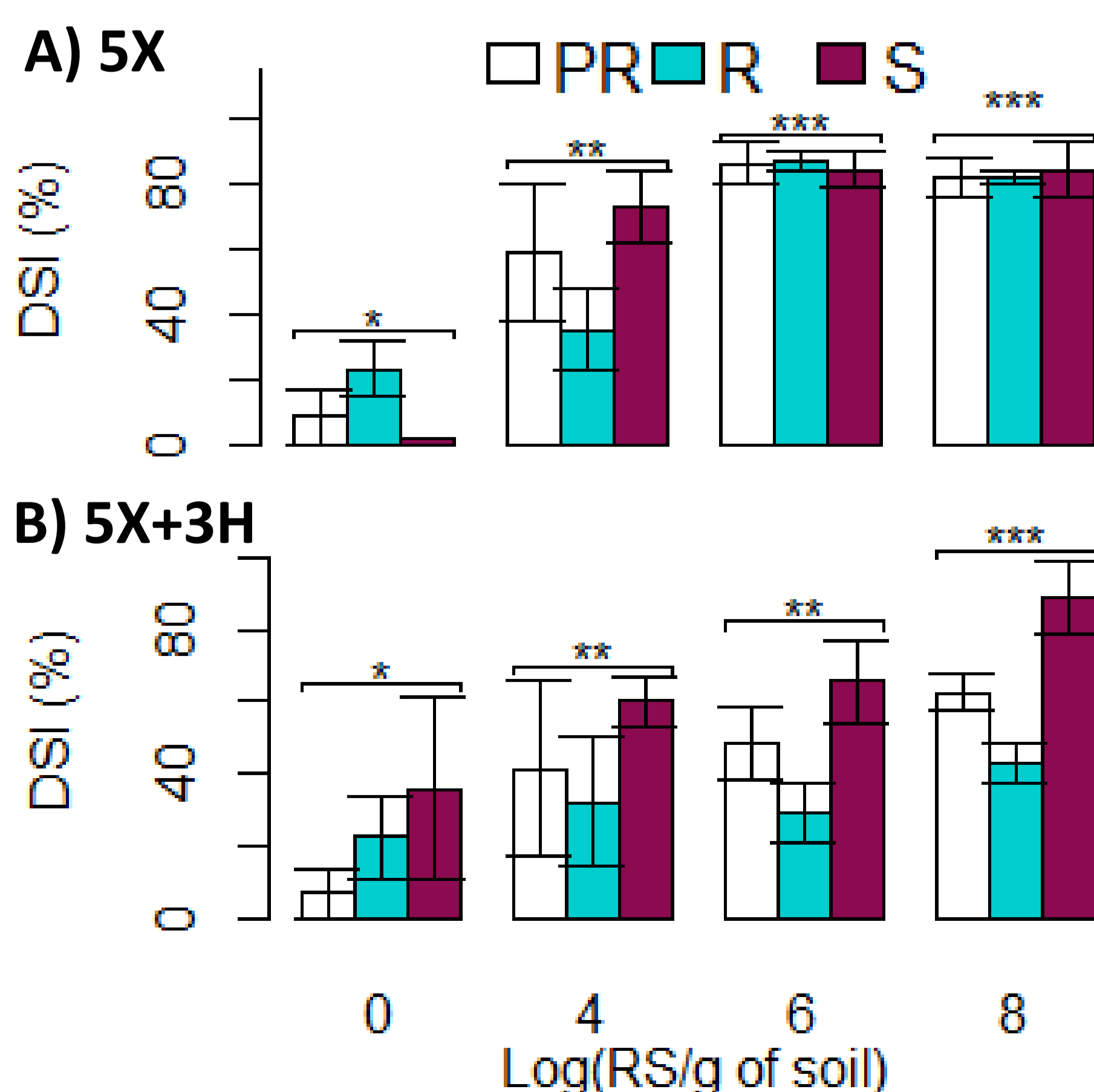
- Canola contributes 26.7 billion each year to the Canadian economy
- One of the most significant threats in canola crops is clubroot disease. Reported yield losses 30-100%
- There are not reliable estimates for yield and economic losses caused by the fields' infestation
- 17 different pathotypes have been identified in Canada, the first one in overcome plant resistance was 5X and one of the most commonly found in the Canadian prairies is the pathotype 3H (classification based in the Canadian Clubroot Differential Strelkov et al. 2018)

## METHODS



## RESULTS

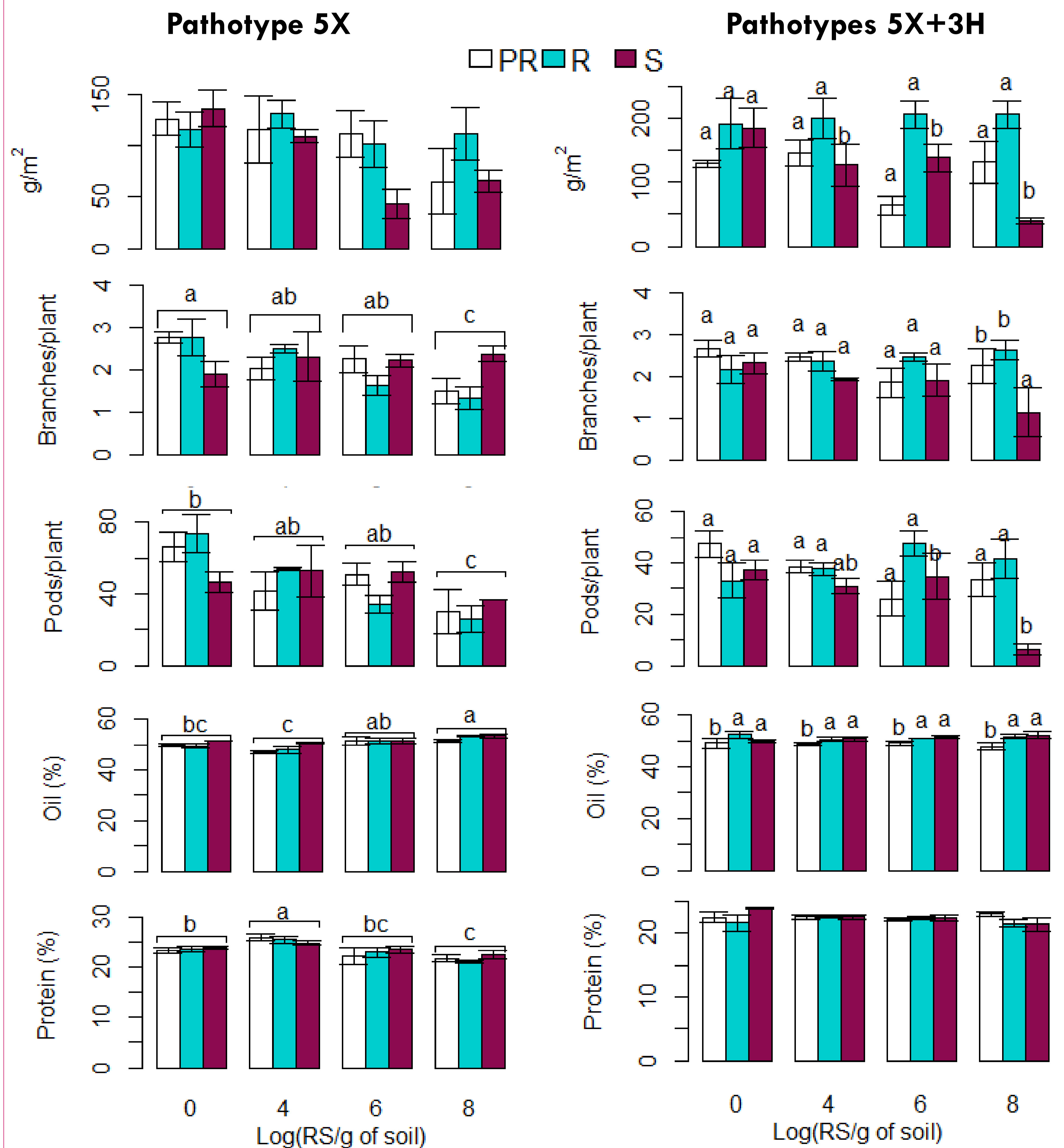
### DISEASE SEVERITY INDEX



**Figure 1.** Clubroot disease severity index (DSI) of three canola hybrids grown under different *P. brassicae* inoculum densities of the pathotype 5X (A) or with a mixture of the pathotypes 5X and 3H (B). Asterisks represent differences among treatments according to the Tukey's test with a significance level of  $p < 0.05$ . White bars represent the canola hybrid 'CS2000' (PR), blue bars represent the hybrid '45H29' (R) and purple bars represent the hybrid '45H31' (S).

## RESULTS

### YIELD PARAMETERS



**Figure 2.** Yield and yield parameters of three canola hybrids grown under different *P. brassicae* inoculum densities of the pathotype 5X (Left graphs) or with a mixture of the pathotypes 5X and 3H (Right graphs). Different letters indicate differences among treatments according to the Tukey's test with a significance level of  $p < 0.05$ . White bars represent the canola hybrid 'CS2000' (PR), blue bars represent the hybrid '45H29' (R) and purple bars represent the hybrid '45H31' (S).

## CONCLUSIONS

- Clubroot severity increases with increasing inoculum density
- Disease more severe when only 5X is inoculated
- Yield and yield parameters more greatly reduced when 5X inoculated alone
- Oil content is reduced and protein increases when only 5X is inoculated
- When pathotypes 5X and 3H are inoculated together protein and oil content does not change