Changes in grain size did not associate with chickpea genetic yield gain in Australia

Dr Mariano Cossani, Dron, N. Hobson, K. Lake, L, Sadras, V.O

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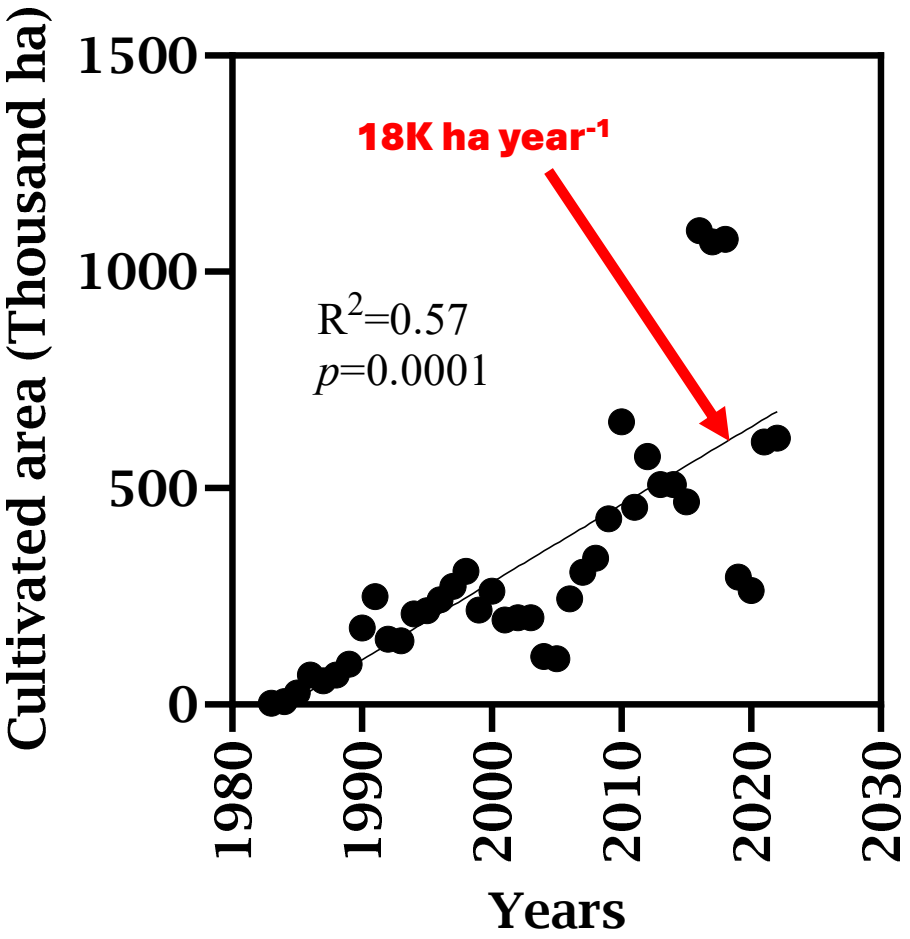
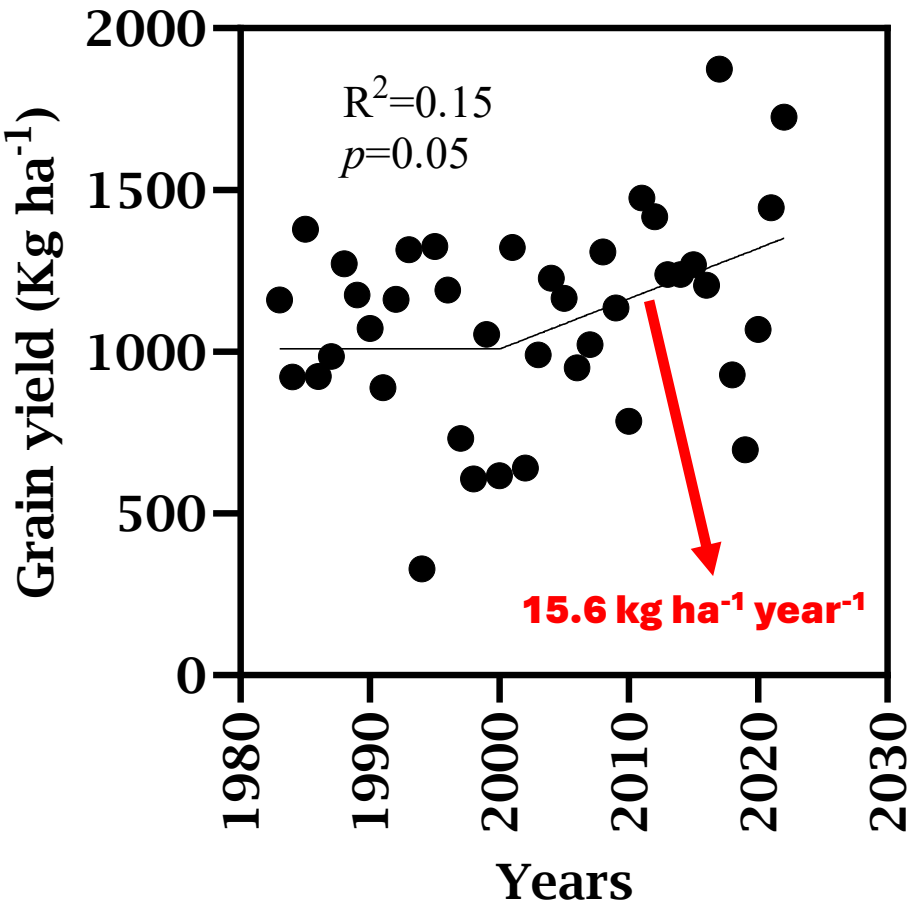
Australian chickpea production increased during the last 40 years (FAOSTAT, 2024)





Quantifying the rate of genetic gain in chickpea and associated shifts in phenotype

19 desi (1978-2023) and 6 kabuli (1988-2020) lines adapted to the Northern and Southern areas to represent the history of chickpea in Australia

Trials in NSW (Tamworth) and SA (Kapunda)

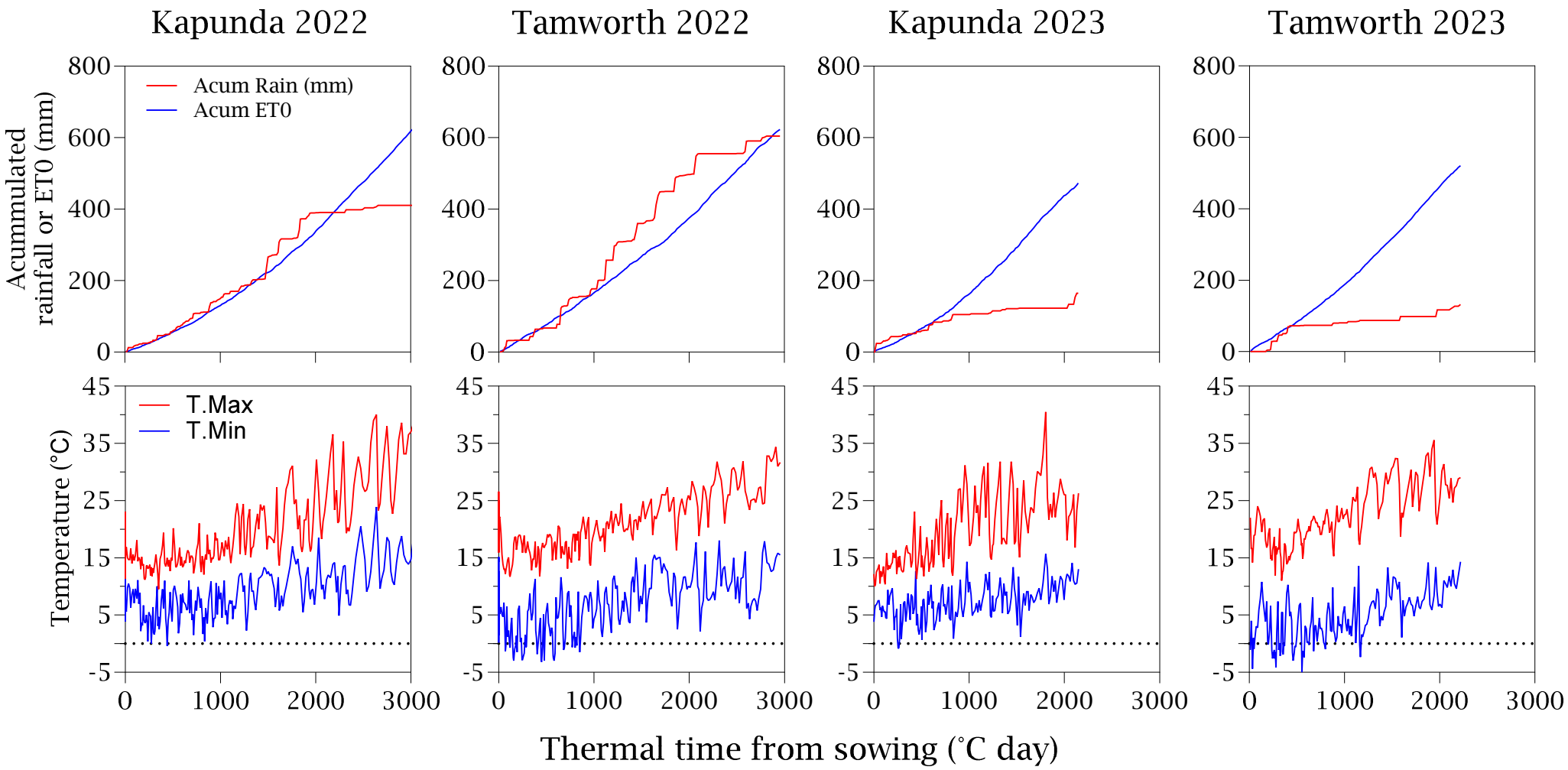
Sowing time 25/27 May (NSW) – 14/20 June (SA)

30-35 pl m^{-2} Kabuli and Desi NSW

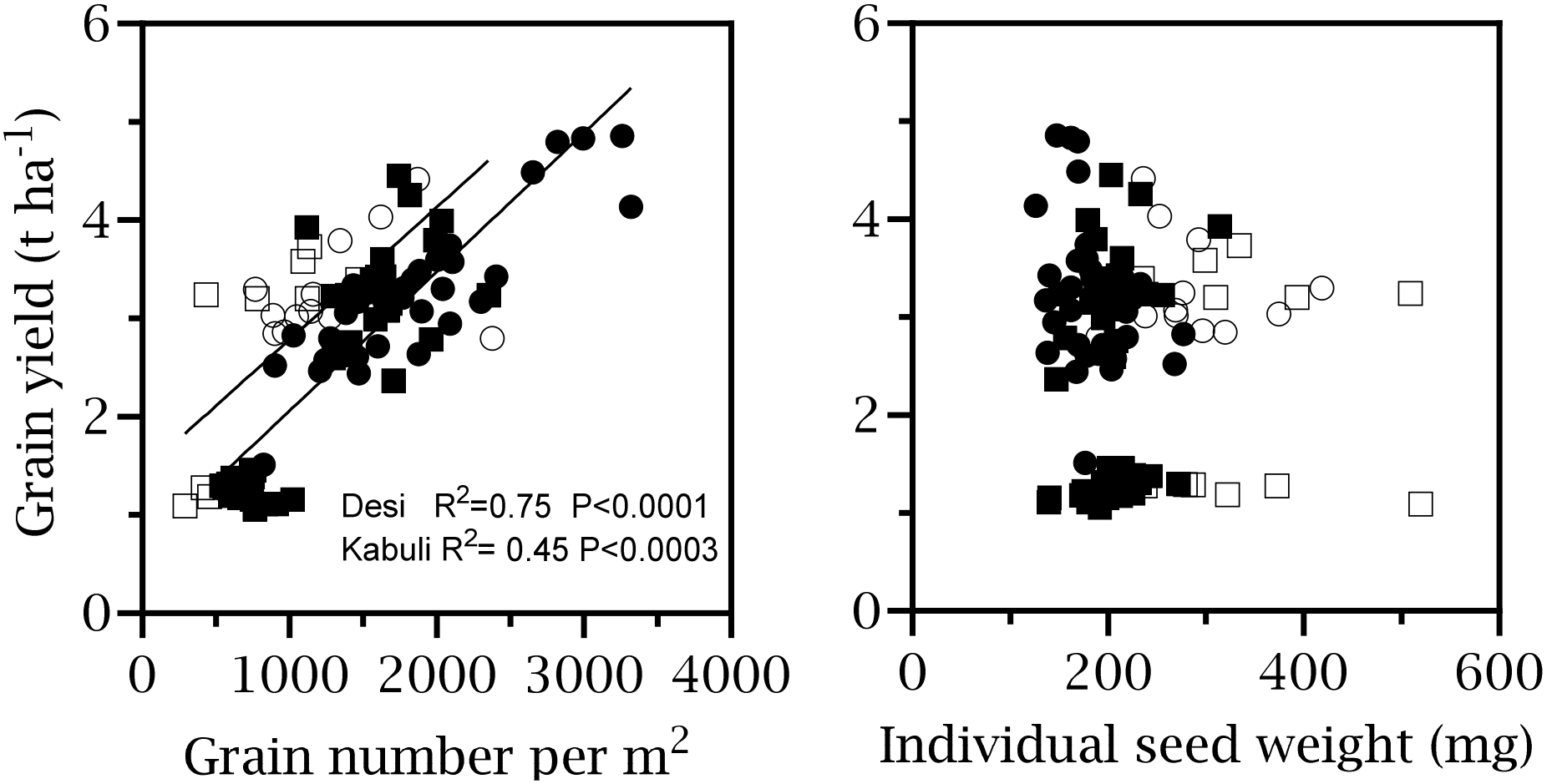
45 pl m^{-2} SA

RCBD

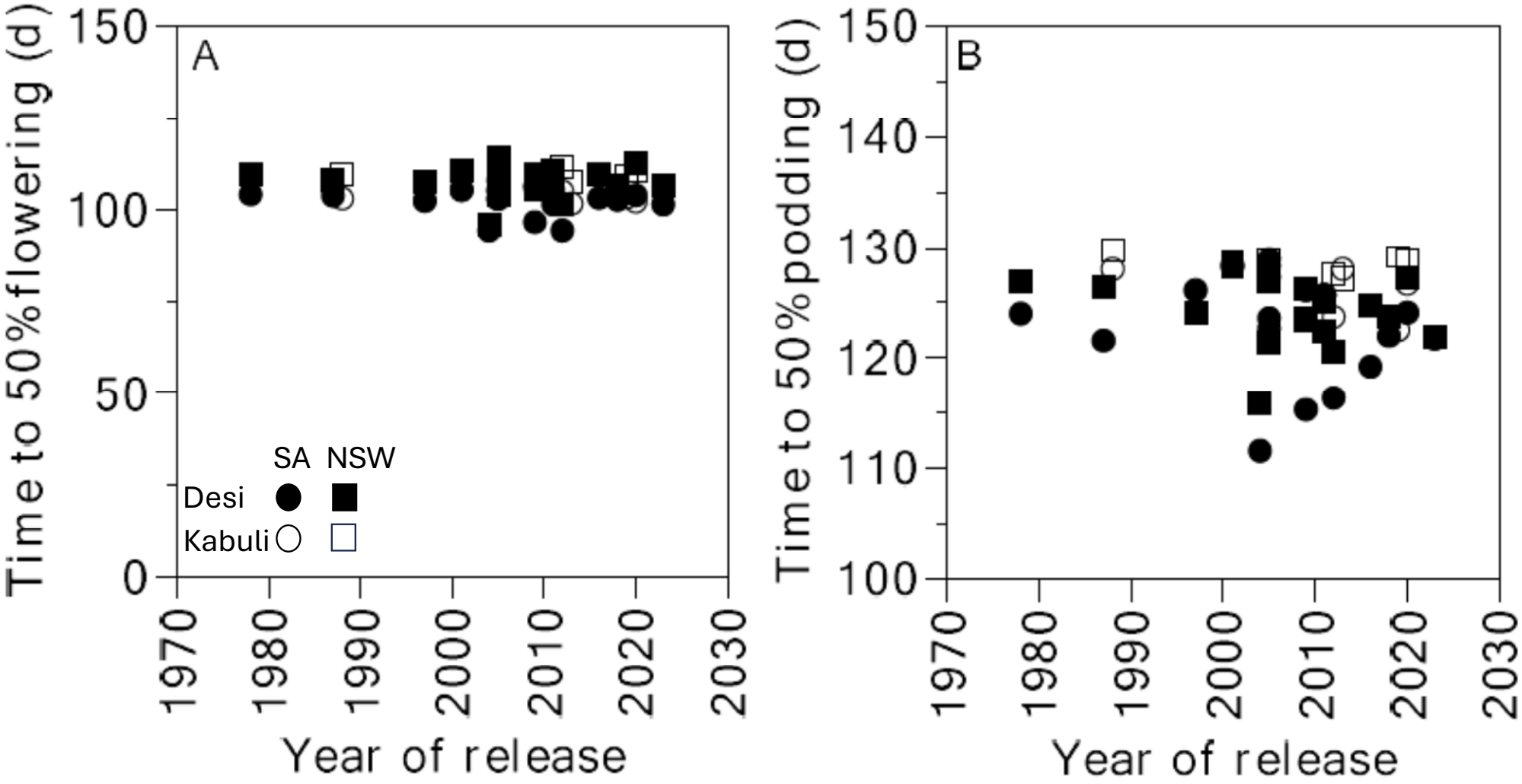
Rain and temperatures differed between environments



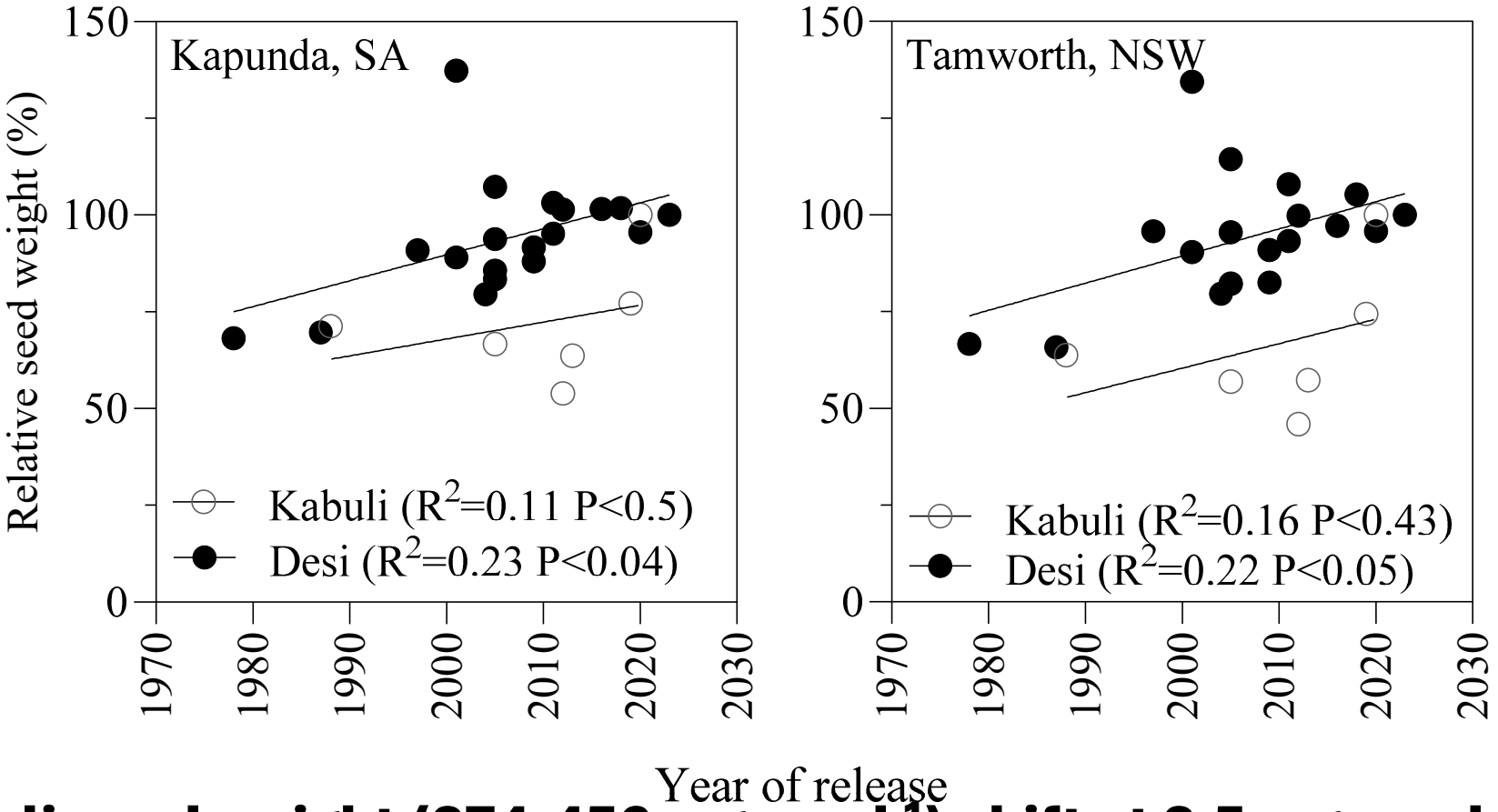
Yield was mostly determined by grain number and aboveground biomass for both desi and kabuli



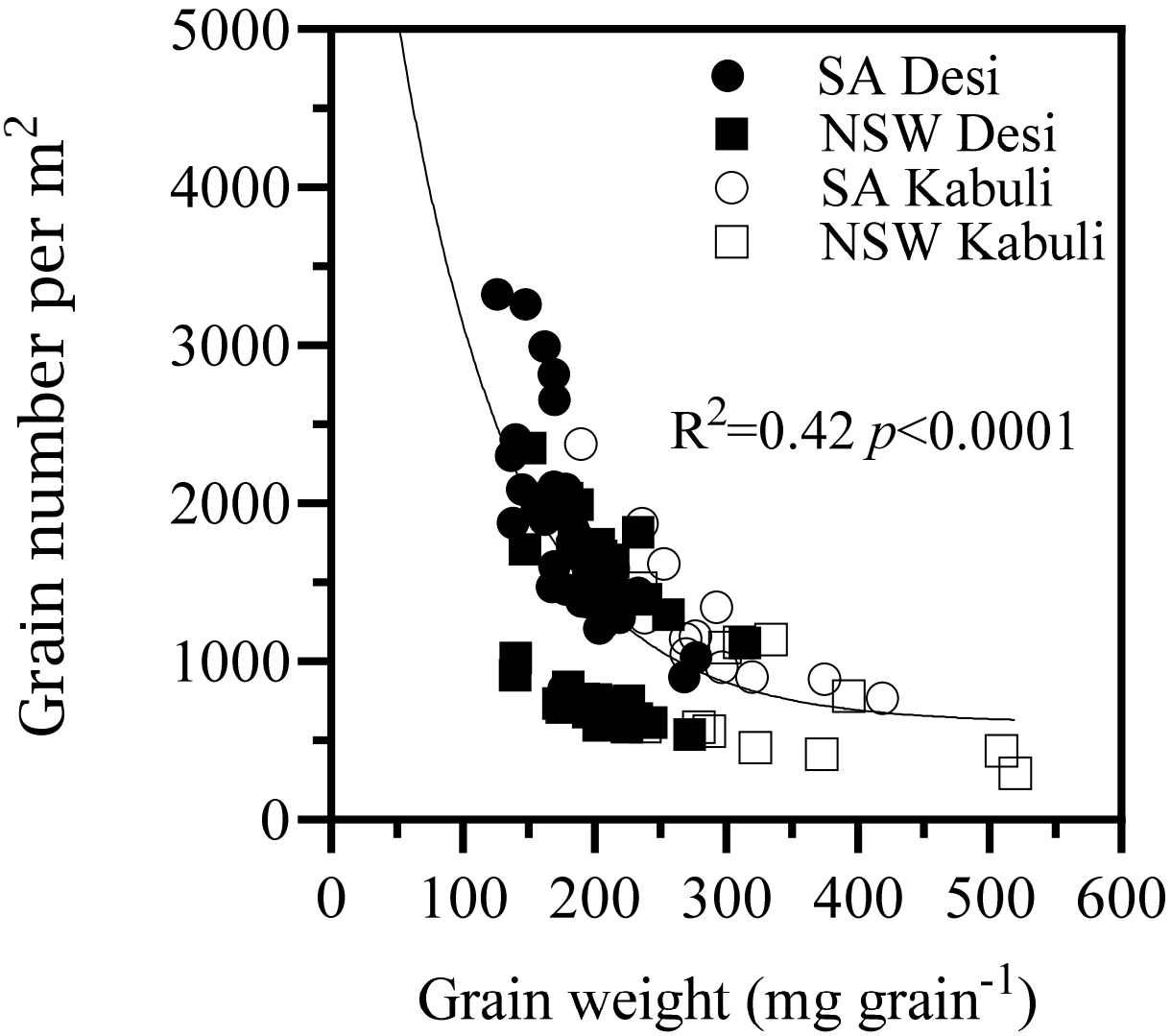
No association between YOR and Phenology



Desi cultivars increased seed weight (141-231 mg seed^{-1}) at 1.3-1.5 mg year^{-1} or 0.67-0.7 % y^{-1}

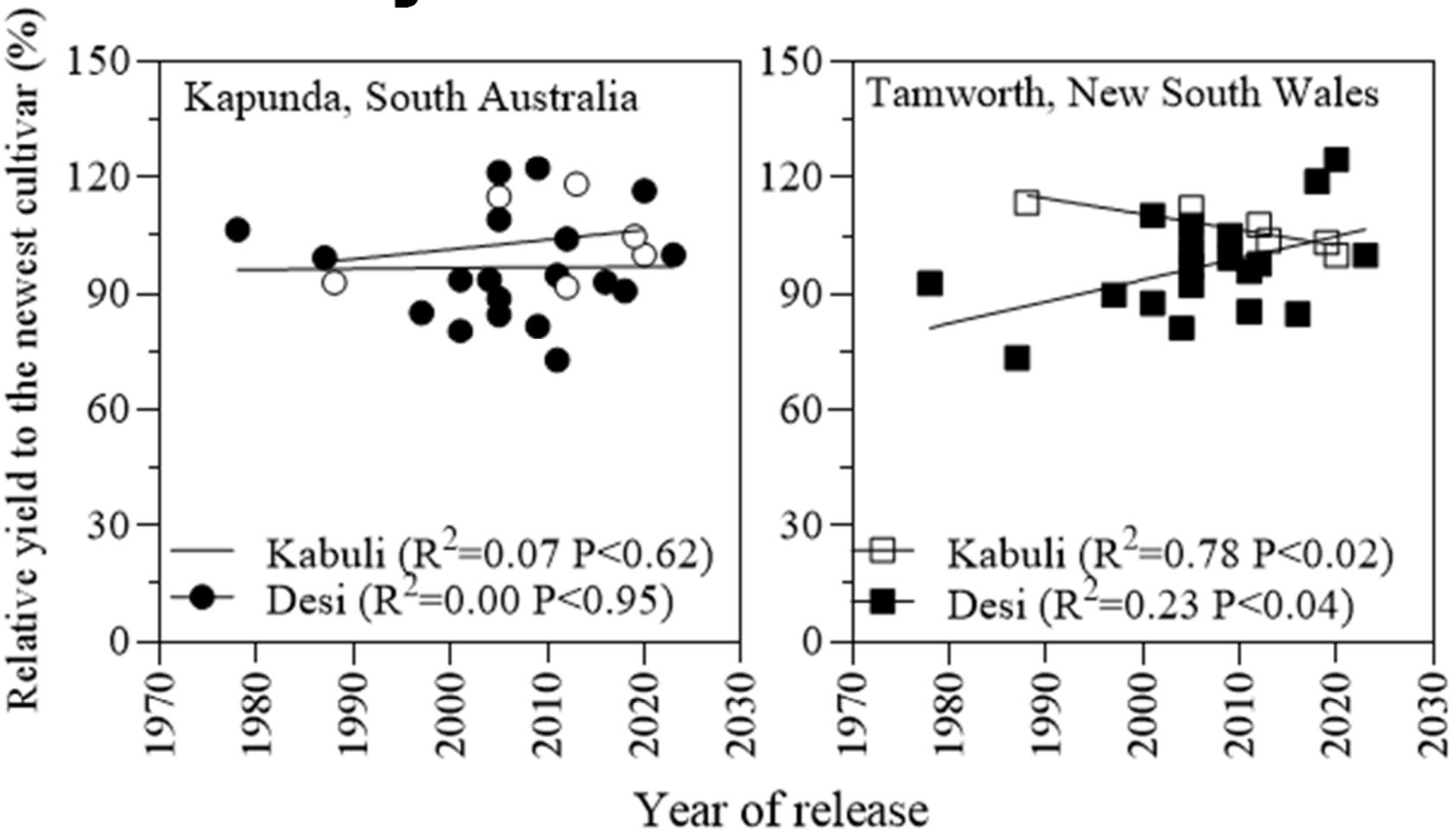


Kabuli seed weight (274-456 mg seed^{-1}) shift at 2.5 mg seed^{-1} year^{-1} mostly due to PBA Magnus

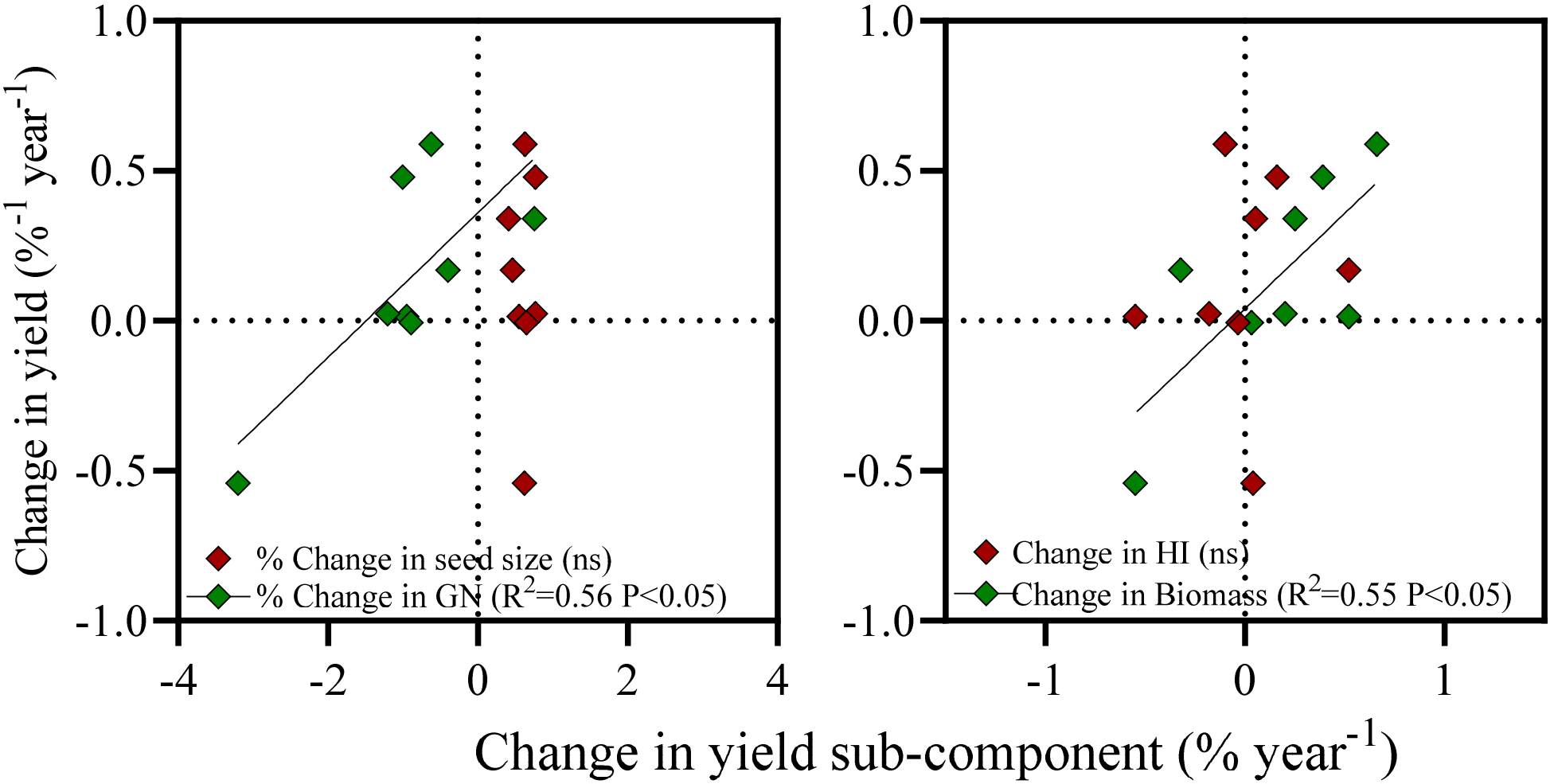


There is a strong negative relationship between grain number and grain weight for both Desi and Kabuli types

There was only 1 (NSW) in 4 environments where yield increase with the YOR



Shifts in yield were associated to GN and Biomass



Take home message

- **Improving the seed size does not increase genetic yield gains.**
- **The improvement in size is at the expense of grains per m^2.**
- **The low rates of genetic increase in yield were partially related to (1) market demand for large seed, which attracts a premium particularly for seed diameter above 8 mm, and (2) the high heritability of seed size that makes selection for this trait highly effective.**
- **Given the associations between GN and Biomass to yield, selection process needs to prioritize them in order to improve genetic yield gains.**
- **Physiological understanding of the trade-off between seed weight and seed number could help to improve yield and keep market standards ensuring the profitability of chickpea in Australian farming systems.**

Questions?

mariano.cosssani@sa.gov.au

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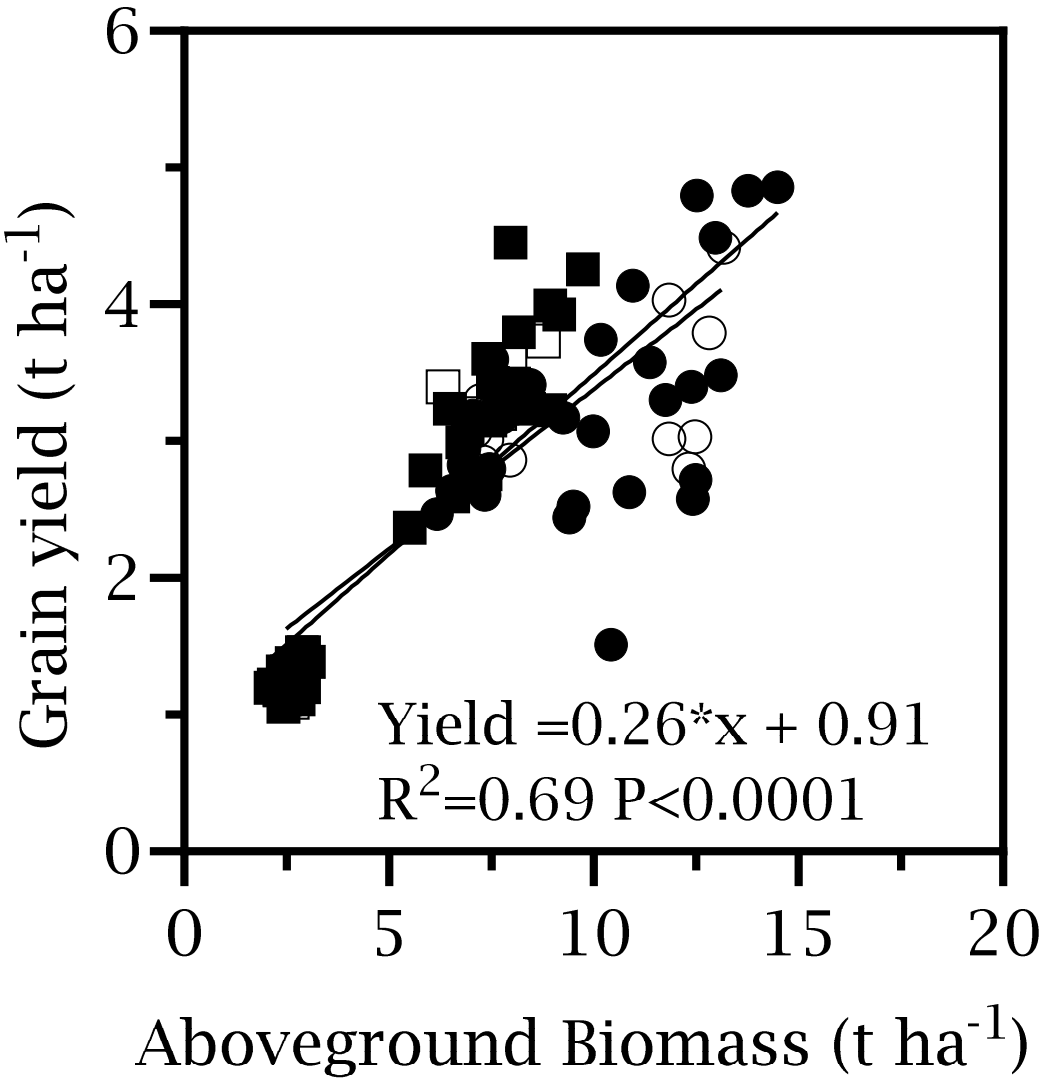
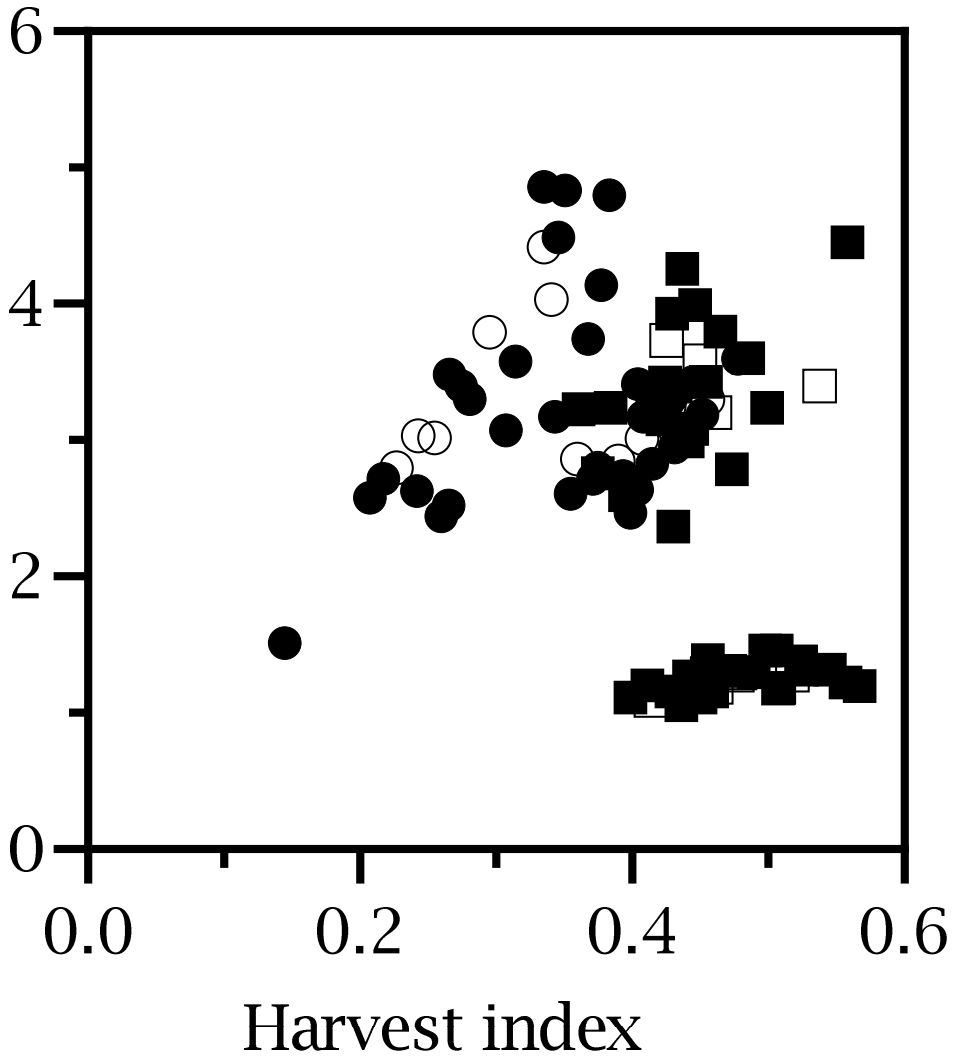

Grain yield (t ha-1)
6
4
2
0
0
5
10
15
20
Aboveground Biomass (t ha-1)
Yield =0.26*x + 0.91
R2=0.69 P<0.0001


6
4
2
0
0.0
0.2
0.4
0.6
Harvest index