The effect of seed size, seed protein and genotype on seedling vigour in some grain legumes

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Grain legumes often have poor seedling vigour which may reduce their competitiveness with weeds and pests. Low seedling vigour can also cause low water use efficiency because of the long time to full canopy closure. Efforts that lead to improved seedling vigour among grain legumes may therefore be useful to improve yield and water use efficiency. The aim of this experiment was to investigate the relationship between seed size, seed protein, genotype and seedling vigour in 3 species of grain legumes.

Methods

The experiment was conducted in a glasshouse, with pea, *Pisum sarivum*, lupin, *Lupinus angusnfolius*, and chickpea, *Cicer arierinum*. Within each species there were 3, 4, and 3 varieties, respectively, of different seed size. The varieties of pea were Alma, Derrimut and Dinkum; lupin: Gungurru, Illyarrie, Warrah and Yorrel: chickpea: Amethyst, Dooen and Tyson. Seeds of each variety were separated into 2 size classes, small and large, based on weight. Protein content was determined for each seed size class of each cultivar using the Kjeldahl method. Plants were sampled 21 and 35 days after sowing and leaf area, shoot and root dry weights were measured. The efficiency of dry matter production between and within species was assessed using the index, Varietal Efficiency (VE= growth rate/seed weight).

Results and discussion

There was a highly significant positive correlation between seed size and seedling dry matter in all varieties. Partial correlation coefficients showed a significant positive effect of seed protein concentration on seedling dry matter in pea, but not in lupin and chickpea (Table 1).

Table 1. Partial correlation coefficients of seed weight and seed protein concentration with	h
seedling dry matter and growth rate of three species of grain legumes.	

Species		Seedling DM 1 (mg)	Seedling DM 2 (mg)	Growth rate (mg/day)
Pea	seed weight seed protein (%)	0.88 * * * 0.81 * *	0.77 * * 0.78 * *	0.48 0.63 *
Lupin	seed weight seed protein (%)	0.69 * * 0.06	0.86 * * * - 0.15	0.81 * * * - 0.19
Chickpea	seed weight seed protein (%)	0.97 * * * 0.49	0.88 * * * - 0.18	0.81 * * * - 0.27

* P< 0.05, * * P< 0.01 and * * * P< 0.001

The VE of pea was higher than those of chickpea and lupin. There were also significant differences in VE between varieties within a species. In pea Derrimut showed the greatest VE, while Tyson was the chickpea cultivar with greatest VE; Yorrel and Illyarrie were the lupin cultivars with the highest VE. This difference could not be directly related to seed size and protein concentration which suggests that there may be inherent genetic differences in seedling vigour both between species and between varieties. Consequently, seed size can affect the seedling vigour in grain legumes but this effect may be greater in varieties with higher VE. Large seeds are able to produce more vigorous plants and may affect yield. In

pea, seedling vigour may, partly, be due to seed protein concentration, but this was not apparent in the other grain legumes.