Factors influencing yield of Gungurru narrow-leafed lupins from different sources in Western Australia

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Seed source has been identified as a significant factor influencing yield in many crops. There is little knowledge of the effect of geographical origin of lupin seedlots on seed quality and yield, and little indication of what seed characteristics or environmental factors may be used to predict seed quality and yield. We assessed the yield of several Gungurru lupin seedlots from throughout the cropping region of south-west Western Australia to identify nutritional or physical parameters in the seed that may be useful to predict yield potential of seedlots.

Methods

Ninety-seven seedlots of *L. angustifolius* cv. Gungurru were selected from farmer samples from 14 region/ zone cells of the south-west cropping region, encompassing the range of rainfall regions and latitude zones, with 7 seedlots from each cell. Seedlots were chosen, where possible, for uniformity of seed size and germination percentage. However, this was limited by the necessity to obtain seed with relatively low cucumber mosaic virus (CMV) seed infection (mean 0.11%). Mean germination was 86.7% (range 57.0-99.0%) and seed weight ranged from 120-168 mg (mean 144 mg) among the seedlots. The 97 seedlots and four control varieties were sown at 100 kg/ ha in 10 m^2 four-row plots in replicated field trials at Badgingarra, Wongan Hills, Newdegate and Mt Barker in May 1991. Macro and micronutrents (N, P, K, Ca, Mg, S, Co, Cu, Fe, Mn, and Zn) were analysed in samples of each seedlot. Stand density was measured at 6 weeks, and seedlings were removed for measurement of *Pleiochaeta* root rot and dry weight. At first flowering, plants were assessed for brown spot defoliation and CMV infection. Grain yields were obtained.

Results and discussion

Seedlines varied significantly in plant density (40.0-77.6/m^2) and plant dry weight (115-160 mg/ plant) at 6 weeks. Establishment, as a percentage of expected (based on germination and seed weight), varied significantly among lines from 71.8 to >100% (mean 91.8%). *Pleiochaeta* root rot was generally low but varied significantly among seedlots, from 0.2-1.4 on a 0-5 scale. At first flower, no CMV was observed in plots at any site, and no significant differences were found among the seedlots for brown spot defoliation.

Grain yield varied significantly among seedlots at three of the four sites, with mean yield across sites ranging from 951-1478 kg/ ha. There was no significant seedlot x site interaction for yield. No lines were significantly greater in yield than the control seedlot of Gungurru from Department of Agriculture basic seed, but several lines were significantly lower in yield. There was no effect of geographical origin of seed (rainfall region or latitude zone) on yield.

Grain yield was significantly correlated with germination (r = 0.49**), stand density (r = 0.51"), and plant dry weight at 6 weeks (r = 0.33**), but not with seed weight (r = 0.09) or any seed nutrients except Fe (r = -0.26*). Stand density was correlated, as expected, with germination (r = 0.49**) and seed weight (r = -0.33**). Seed weight was associated with plant dry weight at 6 weeks (r = 0.58").

Regression analysis indicated that 46.4% of the variance in yield among seedlots was accounted for by few of the various seedlot characteristics, principally germination (t = 5.81 **) and CMV content of seed (t = -4.17**). Sowing seedlines at constant weight per hectare could account for the lack of correlation between seed weight and grain yield. The small seeded lines gave rise to smaller plants, which led to lower grain yield per plant. This was offset by higher stand density. The main predictors of high grain yield in seedlots were high germination and low CMV content, regardless of geographic origin of the seed.