Heterosis and hybrid mimics in lentil

Jiafu Tan[1]
Limin Wu[2], Elizabeth Dennis[1,2] and Jim Peacock[1,2]

[1] Faculty of Science, University of Technology Sydney
[2] Agriculture and Food, CSIRO, Canberra

Heterosis has been used in agriculture for decades making significant contributions to secure global food supply. However, there are drawbacks to using heterosis. One of them is that the hybrid vigor in the F1 generation can only be used for one generation. It is lost because of segregation in the F2 generation. Through strict selection of the best plants over a number of self fertilised generations in Arabidopsis, we have overcome the F1 restriction by generating stable lines with comparable vigor to the F1 hybrid in the F5 and subsequent generations; we designated these lines ‘hybrid mimics’. To extend our success to production agriculture, we are attempting to generate hybrid mimics in crops, especially those where a hybrid breeding system does not exist. Our current research is focused on lentils. Lentil is one of the important legumes serving as a main protein resource for a large number of people in many developing countries. As a typical self-pollinated legume, the lentil flowers do not open during flowering until after pollination, which makes it difficult to achieve a hybrid breeding system.

We asked is there any heterosis in lentil? In the evaluation of more than forty different hand pollinated hybrid combinations, including commercial varieties, pre-breeding material and wild species, we found there is seed yield heterosis in lentil. Some hybrids have more than 30% heterosis. We also found that parents differing in flowering time are more likely to have yield heterosis. The next question is whether we can produce stable hybrid mimics. Our results so far are promising. We found several F2 plants which are comparable in yield to the F1 hybrids. A high yielding F3 generation with reduced variation is expected. A more confident statement could only be made when the results of the F5 generation in the middle of next year are available. It would be a great benefit to know if hybrid mimics selection is successful in lentil. It is likely that success in lentil could lead to hybrid mimics in other grain legumes.