

Row spacings and sowing rates on crop yield and quality

SUMMARY

Cereals and lentils are best suited to sowing with narrow rows (23cm or less). Faba beans performed best on wide row spacings (36cm). Row spacing appeared to make little difference for other broadleaf crops such as canola and other pulses.

Increased seeding rates improved yield and reduced screenings in Silverstar wheat in the 1998 trials. In the 1999 trials at Birchip reduced screenings were again observed when Silverstar was sown at the highest sowing rate.

Sowing rates used to be between 40 and 60 kg/ha (40 to 60lb/acre). Many growers have increased their sowing rates, as a response to new varieties like Frame, which has a much larger seed and often fewer tillers. The larger and heavier seed means that there are fewer Frame grains per kilogram of seed compared to a variety such as Silverstar. To achieve the optimum plant number and heads per square metre sowing rates have increased. Growers using trifluralin just prior to seeding also found they needed to increase the sowing rate to ensure that plant numbers stayed in the optimum range.

Row spacing is another area of great interest. There was a move in the 1980's to wider rows as more growers adopted minimum tillage and stubble retention practices. The question is "What is the optimum row spacing and sowing rate for cereals and other crops?"

BCG trials undertaken in 1997 and 1998 pointed towards improved cereal yield and quality when seeding rates were increased above the 60kg/ha rate and when row spacings were reduced to 18cm.

METHOD

In 1997, 1998 and 1999 trials on sowing rate and row spacing effects on cereal yield and quality were undertaken. In 1999, the trials included row spacing work on pulses and canola. The trials were replicated in a randomised design.

Birchip - Silverstar and Frame wheat and Sloop barley were sown at 60, 90 and 120kg/ha at 18, 23 and 36cm spacings. Grass weeds were sprayed out.

Sea Lake - Silverstar wheat and Sloop barley were sown at 60, 90 and 120kg/ha at 18 and 36cm spacings. Grass weeds were sprayed out.

Charlton – Pinnacle canola, Digger lentils, Dundale field peas, Ascot faba beans, Merrit and Albus lupins were sown at their normal sowing rates on 18 and 36cm spacings. Grass weeds were sprayed out.

RESULTS

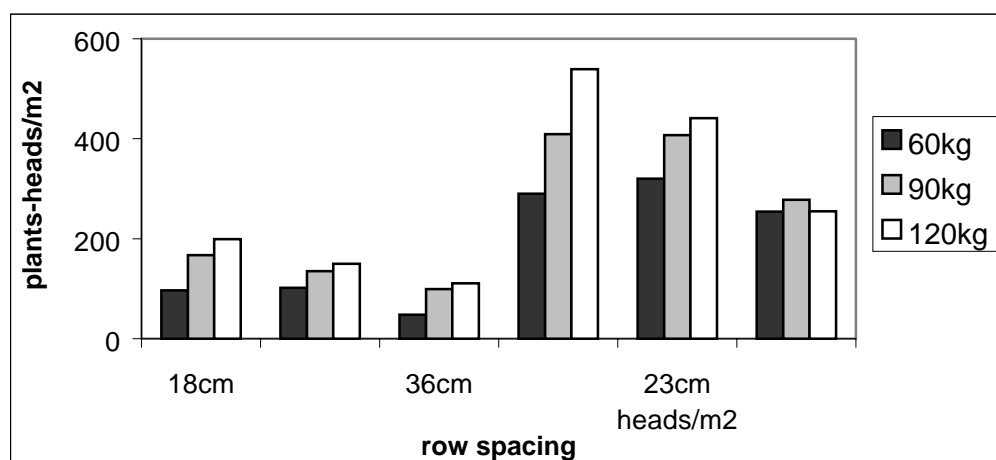
Plant establishment – higher sowing rates increase plant numbers, but the high sowing rate did not compensate for the loss of plants when sown on wider rows (Figure 5.1). The effect of low plant numbers is extreme especially at 36cm row spacings

(Frame establishment at a sowing rate of 120kg/ha: 199, 150 and 112 plants/m² when sown at 18, 23 and 36cm rows respectively). Low plant numbers cannot always be compensated for by increased tillering. In general, low plant numbers at establishment resulted in low head numbers at flowering, and a lower yield.

Grain Yield

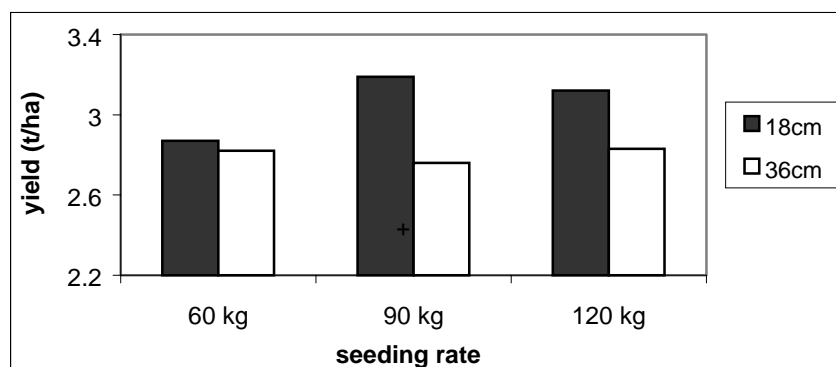
Birchip - There were no significant differences in grain yield from row spacings or sowing rate in Silverstar and Frame wheat. For Sloop barley there was a significant improvement in yield with the higher sowing rates (2.64, 2.87 and 2.99 t/ha for 60, 90 and 120 kg/ha respectively, $P<0.05$, $LSD=0.21$). There was no improvement in yield when Sloop was sown at narrower rows.

Figure 5.1 Plant and head number per square metre for Frame wheat at Birchip, for three sowing rates and three row spacings.



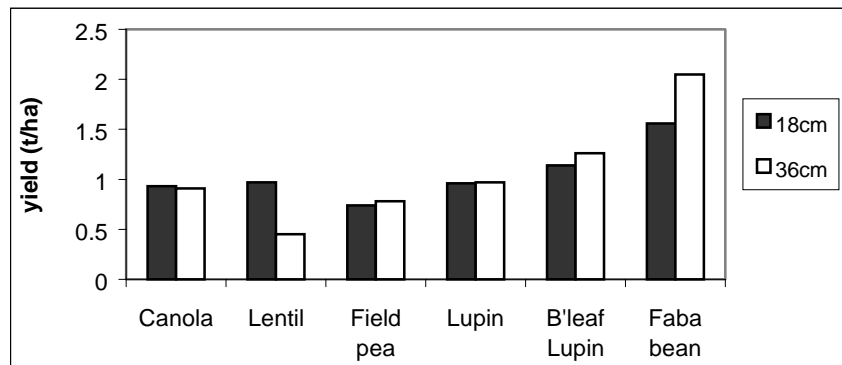
Sea Lake - in Silverstar wheat, there was a significant increase in yield ($P<0.01$, $LSD=0.16$) with narrower row spacings. The effect of seeding rate was not significant (**Figure 5.2**).

Figure 5.2 Yield of Silverstar wheat sown at 18 and 36 cm row spacings and 60, 90 and 120kg/ha seeding rate at Sea Lake.



Charlton - lentils performed significantly better ($P<0.05$) on narrow row spacings, faba beans responded significantly better with an improved yield ($P<0.05$) at the wider row spacings. For the other broad leaf crops there were no yield differences between narrow and wide row spacings.

Figure 5.3 Crop yield at Charlton as a response to row spacings

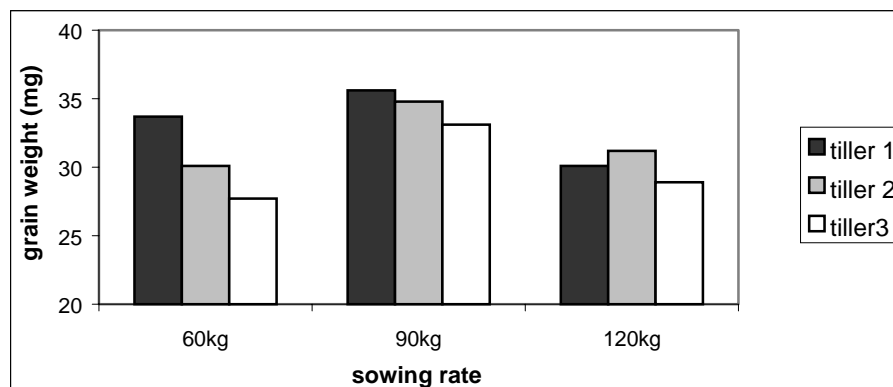


Grain Quality

At the Birchip site there was no significant effect of sowing rate or row spacing on protein in wheat. However, in Silverstar a significant decrease in the level of screenings was observed when it was sown at the highest sowing rate (8.9%, 8.3% and 7.6% for 60, 90 and 120kg/ha sowing rate respectively; $P < 0.05$, $LSD = 0.8$). Screenings for Frame were below the acceptable maximum level.

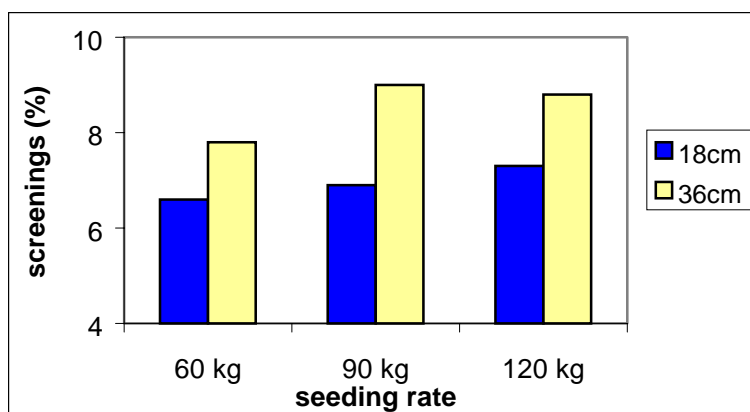
At the highest sowing rates, there were fewer tillers per plant at the highest sowing rate (Silverstar tiller number: 3.1, 2.2 and 1.7 tillers/plant for 60, 90 and 120kg/ha sowing rate). Grain size decreases with every tiller (ie. the main stem, or first tiller, has the largest grain, the second tiller has smaller grain, the third tiller even smaller etc) (Figure 5.4). The number of grains in the heads of the third and subsequent tillers is also less, therefore the effect of small grain on the third tiller is slightly less than expected.

Figure 5.4 Individual grain weights for Silverstar wheat on the first, second and third tillers



At Birchip, in both wheat varieties the screenings (2mm sieve) were the same for grain on the 1st, 2nd and 3rd tillers, protein contents were also similar for each of the tillers. At Sea Lake, the lowest screenings ($P < 0.01$, $LSD = 0.9$) in Silverstar wheat were obtained at the narrow row spacings (Figure 5.5). The effect of sowing rate on screenings was not significant.

Figure 5.5 Screenings of Silverstar wheat sown at 18 and 36cm row spacings and 60, 90 and 120kg/ha seeding rate at Sea Lake.



INTERPRETATION

Wheat

Plant establishment – As row spacing increases it is difficult to attain the optimum plant establishment density, even if sowing rates are increased. Optimum level for plant establishment in the 250 to 350 mm rainfall zone is 150 to 175 plants/m². In the trials, wheat sown at 120kg/ha at 36cm row spacing did not reach the required plant establishment density. Wheat often has difficulty in compensating for low plant numbers when, for example, the crop is sown late or if there are stresses on the crop early in the season resulting in reduced tillering capacity. A crop that has low plant numbers and does not tiller sufficiently will have low head numbers, which translates directly into reduced yield.

Yield – Highest yields were obtained for crops sown on 23cm row spacings or less, with a sowing rate of 90 kg/ha or more.

Protein – There does not appear to be a trend in differences in grain protein level resulting from row spacing or sowing rate.

Screenings – Silverstar often has high screening problems whereas Frame rarely has such problems. In the 1998 trials, Silverstar had lowest screenings when sown on narrow rows (18cm) at the highest sowing rate (120kg/ha). In the 1999 trials at Birchip, Silverstar again had the lowest screenings when sown at the highest sowing rate. The possible reasons for the decrease in screenings at high sowing rate are: (1) at high sowing rates wheat tillers less (more primary heads, fewer 2nd and 3rd heads); (2) grain size in the heads of 2nd and 3rd tillers is smaller

Broadleaf crops

Lentils are easier to harvest when sown on narrow rows, this resulted in the highest yields. Faba beans performed better on wide rows. For the other broad leaf crops (canola, field peas and lupins) there were no differences in yield between narrow (18cm) and wide (36cm) sown crops.

COMMERCIAL PRACTICE

Row spacing - cereals appear to perform better at narrow row spacings (23cm or less). With wider rows it is not always possible to compensate lost plant density with higher sowing rates because of competition within a row. A possible solution would be to sow with a small spreader at the outlet; this would have the effect of spreading the seed over a wider row (Concord seeder from CASE Corporation). When wheat is sown in wide rows without using spreaders, there is a risk of greater

evaporation (less ground cover) and more weed competition (see article on *Competitive crops to reduce weeds* in this issue).

Narrower rows may result in better quality grain (especially lower screenings). The trends from trial work are strong but not definitive.

Lentils perform better when sown on narrow rows because the plants tend to support each other and do not lodge, as is the case when sown on wide rows. Faba beans appear to perform better on wider rows. There were no differences in yield for the other broad leaf crops as a result of row spacings.

The best compromise in row spacings for those retaining stubble is to sow on 23cm spacings.

Sowing rate - Frame wheat weighs more than Silverstar (43mg/100wt versus 32mg/100wt respectively). Frame also appears to have fewer tillers compared to other wheat varieties. Both of these are sufficient reason to increase the sowing rate for Frame if the target plant population and yield is to be obtained.

In 1998 improved yield and quality of the grain were obtained with increased sowing rates in cereals. This result was repeated in 1999 at the Birchip site with less screenings in Silverstar when sown at the highest sowing rate. There is also anecdotal evidence from many paddocks in the 1999 season where Silverstar sown at high rates (90kg/ha or more) on narrow rows (less than 23cm) yielding well. More importantly they did not appear to have the screening problems that Silverstar had when sown at lighter rates. The BCG will do more work on this in 2000.

Note: Some farmers are reporting that using a mesh screen around the repeat auger in the header also helps in reducing the screenings problem with Silverstar wheat.