Many variables in row width equation

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Spacing crop rows further apart can improve 'trash clearance'. It can also reduce yields.

The yield effect of wider-spaced rows is influenced by factors including available moisture, row spacing, seeding rate, spread of seed across the crop row, time of sowing, crop variety and crop type.

Changing row width has a multiplier effect across the paddock, so the greater the yield potential, the greater the yield impact of increasing – or reducing – row width.

In cereals, significantly increasing row spacing almost always results in yield loss.

Where yield potential is very low, around 1 t/ha, wider row spacing may increase yields. WA researchers have shown that, in very low-yield conditions, increasing row width from 300 mm to 600 mm can increase yields by about 30%.

However, where yield potential is high, increasing row spacing always reduces cereal yield.

WA research points to a 1% reduction in yield for every 25 mm increase in row width over 175 mm, but that effect can be reduced by spreading seed within the crop row to improve seedbed utilisation.

Some trial results appear to indicate that increasing inter-row space up to 300 mm has relatively little adverse effect on cereal yields. However, this is challenged by results from recent trials in the Riverine Plains region of northern Victoria and southern NSW, where researchers found that increasing row spacing from 225 mm to 300 mm reduced yield when yield potential was high. Increasing row spacing to 300 mm had little impact when at yields of 3 t/ha or less.

Researchers in Central Queensland identified a trend for lower cereal yields as row width increased from 250 mm to 375 mm and 500 mm, with the greatest losses in crops yielding more than 4 t/ha. There was no significant reduction in crops with potential up to 2 t/ha but a discernible effect in crops between 2 t/ha and 4 t/ha, with a yield decrease when row spacing was increased from 200 to 375 mm and another drop from 375 to 500 mm.

ROW SPACING IMPACTS ON MULTIPLE FACTORS FROM TRASH CLEARANCE TO GRAIN YIELD.

These findings, they say, suggest that long-term yield potential is a useful guide to the best row spacing for a farming system, with narrower rows best in high-yield situations. However, other factors to be taken into account include ease of stubble handling, seed bed utilisation, weed competition and optimum travel speed and soil throw, which impact on the efficacy of pre-emergent herbicides.

In medium to higher-rainfall districts in SA it appears that increasing row spacing from about 200 mm to 300 mm decreases yield by more than 10%, with the actual loss greatest when yields are highest. Whether or not this is compensated for by yield gains from more timely sowing is not clear.

University of Adelaide researchers Sam Kleemann and Gurjeet Gill, in trials at Roseworthy in 2006, 2007 and 2008, found that increasing row width reduces grain yield, crop biomass and the number of tillers per plant.

Grain yield declined by 5 to 8% when row spacing was increased from 180 mm to 360 mm and a further 12 to 20% with the increase from 360 to 540 mm, with the yield reduction 'strongly associated' with a reduced number of heads.

Over the three years of the study, in 2006, 2007 and 2008, growing-season rainfall was 21 to 51% below average and annual rainfall was 51, 26 and 21% of the long-term average, so it is likely the yield penalty for using wide row spacings would be greater with nearer to average rainfall.

The researchers also found that wider rows reduced water-use efficiency for grain production, which declined by six to 11% when row spacing was increased from 180 to 360 mm and another 12 to 15% with the further increase to 540 mm.

These findings suggest that, on heavy soil types like the red-brown earths at Roseworthy, growers are likely to experience some reduction in grain yield and water-use efficiency for grain production, Mr Kleemann said.

While wheat yield declined significantly as row spacing increased beyond 180 mm, the relative change in yield when the spacing was increased from 180 to 360 mm was small and tended to vary between five and 8% over the three years. The yield decline from 180 to 540 mm ranged from 16 to 26% across the three growing seasons.

The pattern for ear density was very similar to that for grain yield.

Crops sown in 180 mm and 360 mm rows intercepted more light than those on 540 mm spacing.

Peter Newman and Cameron Weeks, in trials in the Mingenew district, in WA's northern cropping belt, found that wheat sown at narrow row spacing yielded significantly more than wheat sown in wide-spaced rows.

In their trials, sowing 120 kg/ha of seed at 180 mm spacing produced the highest yield, lowest screenings and lowest number of grass tillers per square metre. Crop sown at 30 kg/ha on 360 mm spacing produced the lowest yield and highest grass tiller numbers per square metre.

Their results were not significant, but point to a 'convincing trend' suggesting that high seeding rates coupled with narrow row spacing is a much better alternative to wide row spacing and/or low seeding rates.

NSW researchers Barry Haskins, District Agronomist at Hillston, and Dr Peter Martin, who is based at Wagga Wagga, found in a 2008 trial that wider row spacing decreased tiller numbers, head numbers and yield. Increasing row spacing from 250 mm to 500 mm reduced wheat yield by 750 kg/ha, from 4 t/ha to 3.25 t/ha. Increasing row spacing from 500 mm to 750 mm decreased yield by a further 500 kg/ha.

Results in 2009 and 2010 followed a similar pattern but the yield potential was less in those years so the yield impact of wider row spacing was less than in 2008.

Findings from research for the Riverine Plains group over 2009, 2010 and 2011 by Nick Poole and Tracey Wylie, of the Foundation for Arable Research Australia, and John Seidel, from Agricultural Research Services, reinforce the fact that increasing row spacing decreases cereal yield, with the greatest effect when the yield potential is highest.

INCREASING ROW SPACING CAN SAVE MOISTURE, BUT IN AT LEAST SOME CONDITIONS, CEREAL CROPS ON WIDE ROW SPACINGS DON'T USE ALL THE MOISTURE AVAILABLE.

They also found that that increasing row spacing reduces tiller numbers, crop biomass, the number of heads and overall water use efficiency, and that there is a rotational effect, with the yield penalty for wider row spacing greater in wheat following a pulse or canola because of the higher yield potential of those crops. The impact of wider row spaces was significantly less in wheat following wheat.

Over the three years of this GRDC-funded project, in which the researchers compared 225, 300 and 375 mm row spacings, the yield penalty for increasing the inter-row space from 225 mm to 300 mm was less than 3% when wheat was grown on wheat but approximately 7.5% in wheat after a break crop.

Wheat sown after a break crop yielded significantly less at 300 mm row spacing than at 225 mm spacing in three out of four trials, with the exception a trial in 2009 at Coreen, in NSW, where only 234 mm of rain fell during the growing season and yields averaged 2.5 t/ha. In this trial, row spacing had no impact on yield.

Increasing row spacing from 300 mm to 375 mm significantly reduced yield in each of the three years of the trials irrespective of growing-season rainfall, which ranged from 234 to 570 mm. The average yield penalty for increasing row spacing from 225 mm to 375 mm was 12.5% in wheat following a break crop and approximately 9% in wheat following wheat.

The trial results also showed that wider row spacings can result in a higher harvest index, the proportion of the plant harvested as grain, Mr Poole said, but the lower overall biomass of crops sown at wider row spacings means yields are lower even when the harvest index is higher.

NSW DPI researchers John Smith and Peter Martin, in row-width trials in the Deniliquin region in 2009 and 2010, planted irrigated wheat on 180 mm, 240 mm and 360 mm row spacing.

They found that the 360 mm row spacing reduced tiller numbers and that the reaction to row spacing varied from variety to variety.

In 2009, grain yield was significantly higher in crops on the 180 and 240 mm row spacings than wheat sown on 360

ROW SPACING ON THE INCREASE

Until relatively recently, most crops in southern Australia were sown in rows spaced 150 to 200 mm apart. However, growers are increasingly widening row spacing to 300 and even 500 mm in some cases in efforts to improve 'trash flow' in stubble-retention systems, with the most common row widths in SA and Victoria tending to be between 225 and 300 mm.

Wider row spacing means less tines or coulters in the ground, so in addition to improve trash clearance and seeding speed, increasing the inter-row space can reduce power and fuel requirements and maintenance costs.

In a recent survey of members of the Riverine Plains farmers group, which has members from Nagambie in Victoria to Wagga Wagga in NSW, 52% of respondents indicated they are using wider row spacing now than they were five years ago.

Reasons given for this change include trash flow, stubble handling/stubble retention, less ground disturbance, machinery or contractor changes, adoption of inter-row sowing and introduction of controlled traffic systems.

mm row spacing but the yields from the 180 and 240 mm row spacings were not significantly different from each other.

In 2010, when the mean grain yield was 4.6 t/ha, row spacing had no significant impact on grain yield; a result the researchers found 'surprising' in light of earlier trial results and previous findings by other researchers that wider-spaced rows reduce grain yield when yield potential is more than 3.5 t/ha.

They also measured consistently fewer tillers at physiological maturity and lower grain yield in crop on the 360 mm row spacing; findings they suggest indicate that fewer tillers is the main factor in reduced grain yield at wider row spacing.

WA research suggests some wheat varieties may perform better in wide-spaced rows than others.

Mohammad Amjad and Dr Wal Anderson, who compared the performance of several varieties at different plant populations on row spacings of 180 mm, 240 mm and 360 mm on sandplain and mallee soils, found that the long-season variety Camm performed better on wide row spacing than the short-season variety Westonia and the mid-season variety Cascades, which points to a 'season length' effect in crops on wide row spacing.

In other trials in WA's south coast region from 2000 to 2002, wheat yield was consistently lower and grain protein and screenings consistently higher at row spacings of 240 and 360 mm than at 180 mm, with plant numbers also lower at wider row spacings. Camm was again the best-performing variety on wide row spacings.

The researchers also explored the impact of seeding time, nitrogen fertiliser and distributing seed more widely in the crop row and found yield at the 360 mm row spacing increased when seed was distributed across 50 or 75 mm in the crop row.

These findings suggest yield reduction due to wide row spacing can be minimised in southern WA conditions by sowing long-season cultivars in May, using adequate nitrogen fertiliser and increasing the spread of seed across the row.

Growers considering whether or not to change row spacing and plant populations to improve soil, weed or stubble management take account of the 'season length' effect and varietal reaction to plant population indentified in this work, the researchers suggest.

QUESTIONS OVER MOISTURE BENEFITS OF WIDE ROW SPACING

There is an intuitive belief that wider inter-row spaces should make more water available to each crop plant, but recent research suggests that might not be the case.

WA farmer and doctoral candidate Hayden Sprigg has shown that increasing row spacing can save moisture, but that cereal crops on wide row spacings are unable to use all the moisture available.

Hayden farms at Mukinbudin, about 250 km north-east of Perth, where summer rainfall has increased by about 43 mm and growing-season rainfall decreased by about 12 mm over the past 40 years or so. These changes in rainfall patterns prompted him to explore the potential for wider row spacing to conserve out-of-season rainfall and make it available to crops during flowering and grain fill.

He found that, across the five varieties and two rainfall scenarios he used in his doctoral research on this topic, wheat grown in rows 600 mm apart did conserve moisture, compared with crop on the district standard spacing of 230 mm, but could not take full advantage of it, with moisture still available in the soil when the crop was mature.

He also found that wheat in 600 mm rows produced less than crops sown at 230 mm spacing.

The two varieties that made best use of the available moisture both had good seedling vigour and broad leaves, resulting in good light interception. This finding suggests that vigorous varieties with wider leaves, a plant type being explored by University of Adelaide scientist Dr Gurjeet Gill in SA as part of 'competitive varieties' research, might perform better in wider-spaced rows than other plant types.

Varieties with good early vigour and wide leaves are better able to shade the inter-row space, reducing soil temperatures and evaporation and increasing crop competition on weeds.

Changes in row spacing impact differently on pulses and canola, with wider row spacing appearing to have no yield impact on canola and lupins provided the inter-row space is not greater than about 350 mm.

On Yorke Peninsula, a research team headed by Matt McCallum and Bill Long exploring the impact of row widths of 500 mm, 750 mm and 1,000 mm on a variety of pulses found that in faba beans, yield penalties for wide row spacing averaged 300 kg/ha across all treatments, with the yield of crop on 1,000 mm spacing reduced by 600 kg/ha at some sites in some years.

In chickpeas, yield penalties for wide spacing ranged from 200 to 700 kg/ha and averaged 400 kg/ha.

Sam Kleemann and Gurjeet Gill, in their Roseworthy row-width trials, found that faba beans in rows spaced 360 and 540 mm apart yielded significantly more than beans in 180 mm rows. In a crop with yield potential of 790 kg/ha, rows spaced 360 mm apart yielded 24% more and the 540 mm rows 20% more than beans on the narrow row spacing.

Beans on wider spacings used less water during early growth stages than those on 180 mm spacing, so the wider-spaced beans had more water available during flowering and pod fill, which the researchers suggest 'may have contributed' to their increased pod retention and higher grain yields.

The faba beans were less effective at extracting soil water than barley or wheat, leaving more than 50 mm of water in the soil profile even under the relatively low-rainfall conditions of the trial period.

WA researchers have found that lupins in wide rows are able to fill more grain because they defer use of moisture from soil between the crop rows until later in the growing season.

In the Riverine Plains district, Nick Poole and his team found that, in 2009, when the average canola yield was about 1.58 t/ha, canola sown on 300 mm row spacing produced more than crop on 225 mm or 375 mm spacings.