High wheat seeding rates and plant density do not go hand in hand

Kari-Lee R. Falconer[1] and DL Sharma[2]

[1] Department of Agriculture and Food, Moora District Office, PO Box 16 Moora, WA 6510
www.agric.wa.gov.au Email kfalconer@agric.wa.gov.au
[2] Department of Agriculture and Food, Centre for Cropping Systems, PO Box 483 Northam WA 6401
www.agric.wa.gov.au Email dsharma@agric.wa.gov.au

Abstract

Adoption of higher seed rates by farmers as part of an integrated weed management strategy is becoming more widely accepted but higher seed rates do not always result in the corresponding expected high plant density populations. Existing experimental data from variety specific wheat agronomy experiments were used to examine the influence of crop management factors on crop establishment. An analysis of these field trials in the Northern and Central Agricultural Regions over a number of years revealed that the percentage of crop plants established varied with time of sowing and seed rate. We found that; i) for time of sowing the effect was significant more often on lighter textured soils; ii) greater plant density was generally associated with the optimum sowing window; iii) an increased seed rate decreased the percentage of crop plants that established; and iv) with increasing seed rates there was an expanding variation in the actual plant densities achieved. These findings imply that higher seed rates will not always produce high crop densities sufficient enough to exert competition against weeds. While some of these observations may have already been reported, further research is needed to establish the reliability of using high plant densities to control weeds which has been touted as an important non-herbicide integrated weed management tool.

Keywords

Seeding rate, plant density, weed competition

Introduction

Increasing crop competitiveness by using higher crop plant densities offers a valuable non-chemical weed management technique. Wheat plant densities increased from 100 to 200 plants per m^2 have been found by Lemerle *et al.* (2004) to halve the biomass of weeds. This can translate into reduced weed seed set and seedbank replenishment (Radford *et al*. 1980). The increase in crop plant density has been found by Anderson and Barclay (1991) to have no negative effects on wheat crop yields in weed free situations and crop yield benefits have also been reported with increasing crop densities in weed pressure situations. Consistently achieving these higher crop plant densities is the major challenge to ensure that this technique is a reliable weed control tactic.

Methods

Measured seed rates and established plant counts from variety specific wheat agronomy experiments funded by the Grains Research and Development Corporation in conjunction with the Department of Agriculture and Food WA were used to examine the influence of crop management factors on crop establishment.

Results

Crop plant densities achieved in wheat time of sowing trials in the central and northern agricultural regions were examined over the 1998 - 2005 period to determine if sowing date had an impact on crop plant establishment. It appears that over a spread of sowing times crop plant establishment is effected more often by sowing date on lighter soil types than on the heavier soils (Table 1). Within the spread of

time of sowing dates greater plant density was generally associated with the optimum sowing window (data not shown).

Table 1 Statistical significance of sowing date as a factors accounting for variation in crop establishment in 12 experiments in the Central wheatbelt of Western Australia

Location	Soil type	F pr. (Time of sowing)
Nungarin	Clay loam	0.988
Mukinbudin	Clay loam	0.9
Merredin	Clay loam	0.224
Mukinbudin	Clay loam	0.034*
Mukinbudin	Clay loam	0.026*
Avondale	Clay loam	0.007*
Avondale	Sandy loam	<0.001*
Quairading	Loamy sand	<.001*
Wongan Hills	Loamy sand	<0.001*
Mingenew	Sandy	0.077
Quairading	Sandy	0.017*
Corrigin	Sandy	0.01*

Crop plant densities from 50 to 250 plants per square metre were targeted in trials in the central and northern agricultural region using seed rates that were calculated to consider the number of viable seeds and the expected crop emergence percentage. Actual plant density that established in these trials was found to decrease as the number of viable seeds sown increased or as higher seed rates were used (Figure 1). This effect was seen on contrasting soil types and in different seasons. One management strategy could be to alter the expected percentage plant establishment used when calculating higher plant densities. The variation in actual plant densities achieved between sites also increased as the targeted plant population increased (Figure 2). The highest targeted plant density of 250 plants per square metre showed a large degree of variation (40%) between sites in the actual number of crop plants that established. Implying that higher seed rates will not always produce high crop density sufficient enough to exert competition against weeds in all situations.

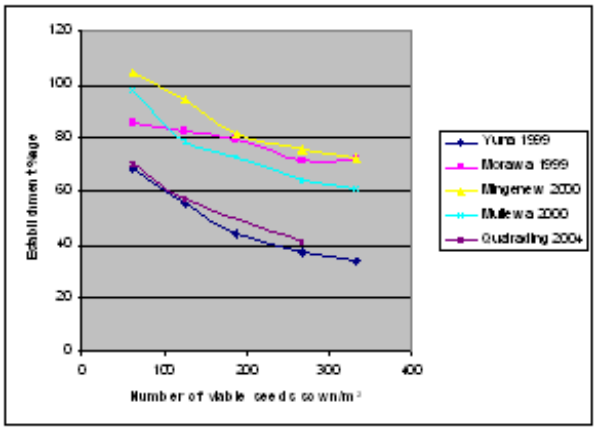

Figure 1 Effect of seed rate on plant establishment

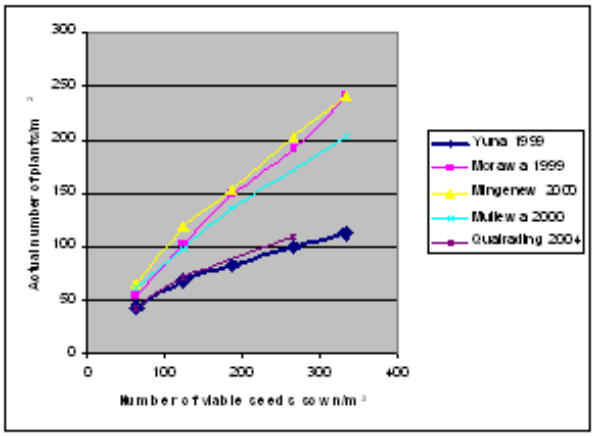

Figure 2 Effect of seed rate on actual plant numbers

Conclusion

The experimental data supports the conclusion of Cima *et al.* (2004) that wheat plant establishment declines as seed rates increase and lower establishment percentages should be used to produce high plant populations in the field. However, the expected establishment percentages may also need to take into account the time of sowing and the impact of soil type to target specific plant densities. Further research is needed to establish the reliability of using high plant densities to control weeds which has been promoted as a valuable non-herbicide integrated weed management tool.

References

Lemerle D, Cousens, RD, Gill GS, Peltzer SJ, Moerkerk M, Murphy CE, Collins D and Cullis BR (2004).

Reliability of higher seeding rates of wheat for increased competitiveness with weeds in low rainfall environments. Journal of Agricultural Science 142, 395-409.

Cima RD, D'Antuono MF, Anderson WK (2004). The effects of soil type and seasonal rainfall on the

optimum seed rate for wheat in Western Australia. Australian Journal of Experimental Agriculture 44, 585-594

Anderson WK, and Barclay J (1991). Evidence for differences between three wheat cultivars in yield response to plant population. Australian Journal of Agricultural Research 42, 701-713

Radford BJ, Wilson BJ, Cartledge O and Watkins FB (1980). Effect of wheat seeding rate on wild oat competition. Australian Journal of Experimental Agriculture 20, 77-81.