Seeding rate a complex calculation

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Significant changes to cropping systems and practices mean growers using long-standing sowing-rate 'rules of thumb' could benefit from re-thinking their seeding rates.

However, arriving at the right seeding rate for a particular set of circumstances is not easy.

Wheat's ability to react to growing conditions makes it the most reliable broadacre crop for SA farmers. It also makes achieving a specific number of heads per hectare a complex business.

To calculate the seeding rate needed to achieve a desired number of heads per hectare growers first have to arrive at a target crop plant population; a figure influenced by crop type and variety, soil type and nutrition status, sowing date, soil moisture at seeding and growing-season rainfall.

Plant population is also influenced by the establishment rate, which is influenced by germination percentage, seeding depth, seed-soil contact, soil temperature, seed treatments, insects and disease and herbicide residues.

According to NSW researcher Dr Neil Fettell, establishment rates rarely exceed 90% and can be as low as 30% depending on sowing conditions, including the distance between seeds in the crop row.

Participants in the recent SANTFA bus tour to NSW found growers there use lower seeding rates than many SA growers.

YP-based consultant agronomist Bill Long, principal of Ag Consulting Co, believes the time is right to re-think seeding rates, which at 150 to 180 plants/m^2 in medium to high-rainfall districts tend to be higher than those used in many areas interstate.

He advocates that growers re-evaluating their seeding rates start with production and yield objectives, the number plants and heads per hectare needed to achieve those objectives, and work through the related issues from there.

FARMING SYSTEMS AND PADDOCK CONDITIONS HAVE CHANGED A LOT IN THE PAST 20 YEARS BUT SEEDING RATES HAVE REMAINED LARGELY UNCHANGED.

"Farming systems have changed a lot in the past 20 years but many SA growers are still using seeding-rate 'rules of thumb' developed for a quite different farming system, with cultivated seed beds and only post-emergence herbicides.

"Most growers now use no-till methods and seed into undisturbed soil, so seed placement is much more accurate than it was even a few years ago. As a result, crops sown into moisture are emerging within five or six days of seeding, resulting in even establishment and good seedling vigour.

"With cultivated seed beds seed it was difficult to control seeding depth and seed was often placed too deep, resulting in slow emergence and seedlings with low early vigour because the seed reserves were used up reaching the surface.

"Weed control has also changed, with the post-emergence herbicides of 15 or 20 years ago replaced by effective pre-emergence herbicides that give six weeks or so of weed control. Consequently, most modern crops emerge without significant weed competition.

"Before pre-emergence herbicides became available weeds emerged with or ahead of the crops and growers were advised to increase seeding rates to establish more plants so a full crop canopy developed as early as possible to 'shade out' weeds.

"Now herbicides provide that early weed control, so most cereal crops don't face much weed competition until about tillering, and we know that excess early vegetative growth can use up moisture and nutrient resources needed later in the season for grain production.

"These changes all suggest there could be potential to reduce seeding rates below those indicated by the old 'rules of thumb'.

Time of sowing has changed too, with crops being sown much earlier now than a few years ago.

"May to early June has long been considered the ideal seeding window for cereals in SA but many growers are now seeding any time from late April, when conditions allow.

"It is important to reduce the seeding rate when sowing early because of the potential for excess early vegetative growth that can use up moisture and nutrients early in the season, making them unavailable for flowering and grain fill later in the season.

"Good growers continually adjust their seeding rates across the season.

"For example, someone seeding dry in late April with no significant rain forecast

might use a rate designed to give a crop density of 150 plants/m^2, in anticipation of emergence early in the conventional 'seeding window'.

"In the same circumstances but with good rain forecast to fall within a few days of seeding he might reduce the rate to one calculated to achieve say, 100 plants/m^2, with the aim of reducing the bulk of early vegetation.

"Crop type and varietal characteristics are also part of the seeding rate equation. Durum typically produces less tillers than wheat and wheat less than barley, and some varieties tiller more or less than others.

"These factors, plus seed size, regional characteristics and seasonal conditions all need to be taken into account when working out the rate needed to achieve the desired number of heads per hectare.

"Seed size is often overlooked, but has a direct impact on plant numbers because the smaller the seed the more plants per kilogram of seed. Larger seed means more kilograms a hectare will be needed to achieve a target population. With smaller seed the kilogram rate will need to be reduced.

Steve Heinrich, who crops about 3,650 ha around Wunkar, in the SA Mallee, said what he saw on the SANTFA bus trip to NSW has prompted him to think about his seeding rates.

He is unlikely to make wholesale changes at his stage but the variable rate (VR) capability of his seeding equipment means he can change rates 'on the go' and may decide to trial lower rates in some areas next season.

"We do fertiliser trials all the time and usually try something different every year so we could easily do some seeding rate trials, using the VR capability to change the rate and the yield monitor to measure the results in terms of yield."

Steve, who uses 300 mm row spacing, usually seeds at a rate of about 45 kg/ha, targeting a crop density of about 90 plants/m^2. Some of the NSW growers visited during the bus trip are using about 30 kg/ha of seed, targeting a plant density of 50 to 60 plants/ m^2.

He says wheat plants adjust to conditions in the paddock, producing more tillers and bigger heads if there is plenty of moisture and fewer heads if conditions are tough, so he is less concerned about yield potential than he is about a possible increase in erosion risk if he was to reduce his seeding rate, particularly on light, sandy soils.

Before he switched to no-till and stubble retention he used a high seeding rate to compensate for plants lost to sand blast during early growth stages, with the aim of having enough survivors to hold the soil and produce a crop without him having to re-seed.

He no longer has a sand blast problem, but drift remains an ever-present threat he fears could be increased by reducing his seeding rate.

Barry Haskins, NSW DPI district agronomist at Hillston, in central NSW, and Peter Martin, a research agronomist based at Wagga Wagga, in trials exploring the relationship between wheat varieties and seeding rate, found that changing the seeding rate from 20 to 40 kg/ha increased tiller numbers but had no impact on yield or grain quality.

Sowing at lighter rates around 20 kg/ha will be of benefit only when sowing early.

This result, achieved across 'good' and 'bad' seasons, suggests that the 50 plants/m^2 achieved with the 20 kg/ha rate were enough to maximise yield in their conditions, Mr Haskins said.

"The main reason for targeting lower seeding rates is that yield is maintained and commonly more consistent across all seasons, including the severe drought years common in the past decade. This is not the case at higher seeding rates, which result in crops simply burning off in spring.

"However, sowing at lighter rates around 20 kg/ha will be of benefit only when sowing early, late April to early may in our district, into soils with adequate nutrition and minimal weeds."

Seeding rate can impact on grain quality.

WA agronomists Peter Newman and Cameron Weeks, found that in the Mingenew district, in WA's northern cropping belt, increasing seeding rate reduced screenings, with wheat sown at 90 kg/ha having significantly less screenings than wheat sown at 30 kg/ha or 60 kg/ha. This runs contrary to many farmers' beliefs, the researchers said, but is in line with other research findings. It is thought higher plant populations result in fewer tillers per plant that are likely to produce a higher percentage of plump grain.

In the Mallee in 2010, Richard Saunders found that increasing seeding rate improved grain yield for two wheat varieties, Gladius and Peake, with 70 kg/ha the best average seeding rate; producing 16%, 9% and 3% more than crops sown

SEEDING RATE PLAYS A MAJOR ROLE IN ACHIEVING THE DESIRED NUMBER OF HEADS A HECTARE; A KEY DETERMINANT OF GRAIN YIELD.

at 25, 40 and 55 kg/ha respectively.

In previous drought years, lower seeding rates had resulted in the best yields.

Results from Birchip Cropping Group trials in the Wimmera in the early 2000s suggest wheat seeding rates need to be between 175 to 200 plants/m^2 to optimise yield and quality in 'normal' seasonal conditions. The optimum rate for barley is about 150 plants/m^2.

The researchers found that sowing rate has little impact on wheat yield or quality in dry seasons, and that sowing wheat at 200 plants/m^2 has little or no impact on wheat yield. In barley, however, 200 plants/m^2 reduces yield and grain quality.

They also found that crop densities of 175 to 200 plants/m^2 in wheat and 150 plants/m^2 in barley improve crop competition with weeds.

Queensland information says the chances of optimal yields are improved by establishing at least 70 plants/m^2, with populations of at least 100 plants/m^2 recommended in some conditions including irrigated crops, high-yielding dryland conditions or very early or very late plantings.

Data from wheat agronomy experiments in WA's northern and central districts from 1998 to 2005 show that increasing seeding rates does not always result in higher crop densities.

DAFWA researchers Kari-Lee Falconer and D.L. Sharma found that establishment varies with time of sowing and seeding rate, which suggests growers need to use lower establishment percentages when calculating seeding rates for high plant populations.

Good growers continually adjust their seeding rates across the season.

Other WA research has identified soil type and seasonal rainfall as major influences on seeding rates for wheat, with 61 kg/ha the optimum seeding rate where growing-season rainfall is less than 325 mm and 75 kg/ha the optimal rate for clay loam soils where in-season rainfall is 325 to 450 mm. The pattern is similar in sandy soils, the researchers found, but the rates are lower, with the ideal rate for sandy conditions 41 kg/ha where rainfall is less than 325 mm and 67 kg/ha where in-crop rainfall is more than 450 mm.

Agronomists exploring the influence of seeding rate on barley yield and quality in WA found that barley yield increases up to a density of approximately 150 plants/m^2, but that populations of more than 150 plants/m^2 can lead to reduced seed weight and increased screenings.

However, higher plant densities may be beneficial in barley paddocks where there are high levels of herbicide-resistant weeds, non-wetting soil, waterlogging or insects likely to kill seedlings, they suggest.

They also found that varieties differ in their ability to perform well at higher plant densities, with narrow-grained varieties like Gairdner more sensitive to high plant densities than varieties such as Stirling, which have plumper grain, and that there is a relationship between seeding time and sowing rate, with lower seeding rates advisable if malting varieties are sown late.

Feed grain varieties should always be sown at 150 plants/m^2 or more to maximise yield because hectolitre weight is the only quality factor for feed barley.