Influence of stubble height on broad bean physiology and disease

Background

In recent years, the standard cropping rotation on Kangaroo Island has resonated around wheat - broad beans - canola. This sequence confers the nitrogen hungry crop - canola to take full advantage of any residual nitrogen left over by the beans and it ensures that the soft/biscuit wheat is grown in soil with low nitrogen reserves. Furthermore, this succession of crops, reduces the likelihood of emergence problems that may arise from sowing small seeded canola into heavy wheat stubble loads. Rather farmers opt to sow bigger robust broad beans into this nitrogen depleted and high stubble environment.

Research on the mainland has shown that sowing lentils in the inter-row in wheat stubble encourages the plant to grow taller in pursuit of sunlight, enabling easier harvest for what is normally a short crop. Although broad beans can be a tall crop, the bottom pods contain the largest beans as these set the earliest and thus have the longest time to fill. However, in many cases these large seeded pods are too close to the ground for the harvester to pick up and yet it's these big beans that are worth the most.

Like the lentil story above, local farmers are curious as to whether the height of the previous year's wheat stubble may influence the distance from the ground of the first pod. There was also contemplation as to whether the stubble height had an effect on disease incidence in the bean crop.

What was done

The trial was set up at the time of harvesting the 2016/17 Impala wheat on Ben and Sarah Pontifex's property on Elsegood Road, Macgillivray. The wheat was harvested at three different heights – one as close to the ground as possible, one at standard height, which is approximately 30cm off the ground and the other, just below head height, much like a stripper front would leave behind.

The site was sown to broad beans on the 27th May with a Tobin disc seeder at 175kg/ha with 40L of liquid fertiliser – PulseAider™ and the appropriate rate of Strain F EasyRhiz™ freeze dried inoculant. Prior to sowing, the site received 2L Glyphosate + 20ml Nail. The post sowing, pre-emergent application consisted of 1kg Terbyne® Xtreme® + 100ml Spinnaker® + 1L Gramoxone 360 PRO®.

The soil was classified as a sandy clay loam. Soil test readings revealed a pH_{CaCl_2} 4.4, phosphorous reading of 51ppm, PBI of 62, potassium 149ppm and 10ppm of sulphur.

The site received 391mm of rain for 2017, with 271mm falling in the growing season (April to October). June was an extremely dry month with only 11.8mm being recorded with the highest daily reading being 3.8mm on the 25th.

The measurements taken prior to sowing included:

1) height of standing wheat stubble
2) stubble load

There were intentions to measure:

3) disease score
4) height of first pod from the ground
5) grain yield

However as discussed below the trial was not pursued post emergence.

Results

TABLE 1: *Measurements.*

Intended Stubble Height	Stubble Height (cm)	Stubble Load (t/ha)
Low – ground level	8	3.54
Standard	25	"
Tall - heads only	50	"

Unfortunately due to a variety of factors, there was inconsistent establishment of broad beans across the three stubble heights and resultantly the measurements pertaining to disease incidence, height of first pod to the ground and grain yield were abandoned. One could say, the trial instead provided a learning opportunity on stubble handling and disc seeder set up.

Hair pinning and consequently poor placement of bean seed was the culmination of various factors that led to the poor establishment. These factors included heavy stubble laying on the soil surface, moist stubble at sowing, blunt disc blades, all topped off with decile 1 rain falling in June post sowing.

For seeds to imbibe they need to be surrounded in 100% humidity, meaning burial and seed soil contact is critical. Large seeds need to be placed deeper since they have a higher moisture requirement to imbibe and germinate. The deeper they are placed, the lower the likelihood of the soil drying out. Placing the seed in high humidity/moist conditions is also important for the survival of the rhizobia bacteria that subsequently infect the root hairs to form nodules and fix atmospheric nitrogen.

If large seeded beans are only partially sown/covered in soil, they require follow up rain or constant moist conditions to imbibe and germinate. Given that the June rainfall was a decile 1 meant that the topsoil had a drying trend and hence beans that may have otherwise persisted and survived in 'normal' KI June rainfall perished.

Although one would expect the 'tall' stubble height treatment to have been more immune to hair pinning, due to the wet summer the wheat was not harvested until March and resultantly the crop had begun to fall over by this stage.

As a general rule of thumb, if sowing with a disc seeder, the aim is to leave as much stubble standing as possible at the previous harvest. For this reason, stripper fronts which just take the grain heads off and leave the stubble standing, coordinate well with disc seeders.

In a similar vein, if livestock are to graze the stubble, they should be limited in the length of time they are allowed to trample the stubble, if at all. Standing stubble facilitates better penetration and hence efficacy of the knockdown and pre-emergent sprays.

FIGURE 1: Inconsistent establishment of beans across the trial site coinciding with heavy residue.

FIGURE 2: 'Tall' stubble height that had lodged and resultant poor establishment.

FIGURE 3: Where there was little stubble, establishment was adequate.

Lodged or fallen stubble can be cut by discs provided they are sharp and the residue is dry. Much like a blunt knife, when discs become blunt due to wear, they no longer slice stubble with ease and instead push the stubble into the slot. This is made worse when the straw is moist causing it to be tougher.

Another consideration that would assist in cutting through lodged straw when using a disc seeder is having sufficient down force on the bar to assist in forcing the disc into the ground. This is especially the case when sowing large seeds that need to be placed at their optimum seeding depth.

Take Home Messages

Whilst the trial didn't go according to plan there were still some key messages that arose:

- Maximising seed-soil contact is the aim at sowing especially for the larger seeds that require more moisture to imbibe and germinate compared to small seeds.
- Unseasonably low June rainfall hindered establishment of partially sown beans due to a drying topsoil. These may have been OK under normal June rainfall conditions.
- Hair pinning can be a serious issue when using a disc seeder especially when sowing into wet/moist lodged stubble.
- Solutions to avoid hair pinning – sow when stubble is dry (good in theory), keep stubble standing, use sharp discs and ensure bar has sufficient down force to cut through tough stubble.

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