

New benchmarks and new opportunities

By John Barber, Consultant, St George

The season 2004–05 was notable because new products used and new knowledge gained will have lasting effects on cotton production methods. Several benchmarks relating to cotton yield, costs and value of the product were set during or after the season and I suspect will remain for at least a decade.

In addition, with Bollgard and two herbicide tolerance technologies soon to be available, there is a single best bet production plan for all farms. There are also some outstanding research questions to address.

Bollgard

First of all, 2004–05 was the first year of commercial scale Bollgard production. In an industry which has seen up to 550,000 and down to 200,000 hectares per year in the past decade, Bollgard was taken up on about 250,000 hectares or about 80 per cent of the 2004–05 area. Some people had preseason misgivings about its possible efficacy under high heliothis pressure. But by the end of the season, in the face of that high early pressure, its efficacy was as good as predicted. Heliothis control has never been so easy.

Only NuCotn 37 in 1996 and 1997 might have been as effective against heliothis when first released, but it was only grown on about 10 per cent of the total acreage. The majority of the cotton crop at that time was infested with moths which



either immigrated to the fields (*Helicoverpa punctigera*), or recycled as escapes from sprays on conventional cotton and poor quality Ingards (*Helicoverpa armigera*).

There were sufficient escapes before Christmas each year to cause large reinfestations in the following January and February. On one occasion I documented 30 white eggs, 30 brown eggs, 30 very small larvae and three small larvae on NuCotn 37 in a 30 plant sample, using the presence/absence sampling method, before a spray was necessary.

In contrast, when Bollgard occupied about 80 per cent of the total acreage in 2004–05 I did not inspect crops for heliothis. In 2004–05, the estimated frequency of resistance to both Cry genes in Bollgard was higher than expected but still very

low. There were apparently no, or very few, escapes from the Bollgard. The few insecticides used in January and February 2005 were to control escapes from sprays on conventional cotton in November and December 2004 and a few immigrants. For heliothis control, the bar is now as high as it gets.

Yields

The second important feature of 2004–05 was the record yield level obtained in both Bollgard and conventional crops across a range of varieties. Yields of 12.5 to 15 bales per hectare (five to six bales per acre) were recorded in the Gwydir Valley. At St. George, at least one field of conventional cotton over 100 hectares yielded almost 14 bales per hectare.



The high yields were a product of the excellent heliothis control, the superb season with adequate water and nutrition without excessive heat, and probably also the dry conditions during preparation and in some cases long fallows after drought.

It is always possible, but it is not probable, that these conditions will occur together again in the near future. Therefore the yields of 14 to 15 bales per hectare are probably the highest we will get with the existing varieties. We now know what is possible.

They represent about 20 bolls per plant or about 1.3 bolls per branch on 15 productive fruiting branches on 10 plants per metre. By comparison, research suggests that in most years, cotton averages one boll per fruiting branch.

The single most important effect of the good seasonal conditions in 2004–05 was therefore an increase in boll retention. Work by CSD supports this conclusion.

Having said that, I suspect that a higher proportion of yield is carried on vegetative branches in Bollgard varieties, than in conventional varieties — particularly at low plant populations. Larger boll size or higher turnout were not the major determinants of high yields in 2004–05. These are variety characteristics and will distinguish varieties in all years.

Bollgard licence fee

The third benchmark is the Bollgard licence fee, which is \$300 per hectare in 2005–06. Whether it is Monsanto's estimate of the average cost of heliothis control in conventional cotton, or what the company thinks the industry can bear, is interesting but not important. In fact, the real cost of Bollgard exceeds \$300 per hectare because the refuge is unprofitable.

Early estimates indicate that about 20 per cent of the total area planted in 2005–06 will be conventional cotton. If the cost of insect control in any part of the conventional cotton area exceeds \$300 per hectare, and Bollgard yields and quality are satisfactory, then the area of conventional cotton may decline in 2006–07.

On the other hand, if the low pressure in January and February 2005 is repeated in January and February 2006, then insect control on conventional cotton will cost less than \$300 per hectare and the area of conventional cotton will probably increase in 2006–07.

There are at least two circumstances already favouring this outcome. Firstly, the insecticide companies have substantially



reduced the prices of their products. Secondly, 2004–05 was a high pressure year. In fact the Heliothis pressure on conventional cotton in some areas was so great that pyrethroid use was brought forward to early December.

It cannot be claimed that conclusions drawn from last year may not apply in a so-called "high pressure year". In fact the reverse is the case. Only when 80 per cent of the area was planted to Bollgard have we experienced such low pressure in January and February.

If the cost of insect control on conventional cotton in 2005–06 is less than \$300 per hectare, then full Bollgard growers not in environmentally sensitive areas should plant some conventional cotton in 2006–07. Monsanto might then react to market forces and reduce the price of its product, just as the insecticide companies have. The convenience of Bollgard is valuable, but the three main larvacides — Affirm, Tracer and Steward — are soft, specific and have low toxicity to users and the environment. There is no real deleterious effect on lifestyle from their use.

Conventional cotton

It is very important to increase the area of conventional cotton, particularly on large farms. Bollgard is a sink or trap crop for heliothis. On farms with 95 per cent Bollgard, heliothis moths are under maximum selection pressure.

The five per cent pigeon pea refuge is also under pressure to produce sufficient Bt susceptible heliothis which will mate with escapes from the Bollgard and keep it viable. The smaller the area of Bollgard compared to the refuge area, the longer will be its effective life. Similarly, the more

susceptible heliothis the refuge produces, the better.

Provided it is profitable, 50 per cent sprayed cotton is therefore the best refuge. If post Christmas insect control costs remain low, then 10 per cent unsprayed cotton could also be a profitable refuge.

I have persuaded some growers to try a few rounds of unsprayed cotton in 2005–06. Others are growing 50 to 70 per cent Bollgard, while others have 95 per cent Bollgard.

By comparing average production costs across farms with different percentages of Bollgard, it will be possible to estimate a ratio of Bollgard and conventional cotton which maximises returns in the short term. The cost difference between that ratio and 95 per cent Bollgard will be the cost or value of lifestyle or convenience afforded by Bollgard.

Last but not least, profitable conventional cotton is desirable because the new Liberty Link herbicide tolerance technology may not be available in Bollgard. Monsanto would not sacrifice Bollgard Roundup Ready sales so that Bayer could establish Bollgard Liberty Link in the market. Why would any company give a competitor a commercial advantage?

Weed control will be as easy as heliothis control only when varieties with the Liberty Link and Roundup Ready genes are rotated in successive years. That will probably only be possible with a mix of Bollgard and conventional cottons.

Cotton price

The fourth benchmark set in the 2004–05 season was the price of cotton. Without a catastrophe in a major producing country it will stay around \$380 per bale for the foreseeable future.

World consumption is about 112 million bales per year with 50 million bales left over each year. Chinese growers probably have Bollgard and would be increasing it as quickly as possible.

Australian growers can succeed in this environment by producing high quality, high yielding cotton and reducing production costs. Neither of these objectives is new, but with high yielding varieties, Bollgard and the two herbicide tolerance technologies, the best ways to achieve them are new.

New production methods

The following principles apply to all areas. The ways and extent they are implemented, or practiced, will vary

according to local conditions such as soil type, temperature, farm size and availability of machinery and labour.

- Spread your risk. Choose some varieties for yield, others for quality, then use good agronomy to maximise yield. The base grade for length is now 36. In 2004-05, the staple length of approximately 25 per cent of Sicot71BR classed by Queensland Cotton was 35 or less. Early estimates indicate that the industry will plant about 70 per cent Sicot71BR in 2005-06, in which case we know before planting that about 17.5 per cent of all cotton delivered will be below base grade. Similarly, full Bollgard growers planting all Sicot 71BR know now that one quarter of their crop could be downgraded. Reasonable estimates for currency, basis, discount and yield indicate the downgrade could cost \$150 per hectare.
- Consider planting patterns. Bollgard planted around the perimeter of the farm will minimise, perhaps eliminate, spray drift to neighbours' properties, from conventional cotton planted within the farm.
- Try both Bollgard and conventional cotton without any insecticide seed dressing for sucking pests. We learned to

manage early tip damage when it was caused by grubs so early sucking pests which cause much less damage are not usually a problem. Controlling sucking pests in Bollgard before squaring is necessary only to protect plant vigour.

- Establish seven to eight seedlings per metre on one metre rows. Planting 10 seeds per metre on well prepared seedbeds is usually enough; 12 seeds per metre is necessary in rougher or variable conditions.
- To save water, sow dry or on good moisture and water up using Roundup Ready or Liberty Link varieties when they become available. Rotate the two types. Until Liberty Link is available, pre-irrigation will be needed to germinate conventional Roundup Ready volunteers in Bollgard fields, as well as weeds such as nutgrass, which can then be sprayed with Sprayseed or Roundup as desired. Decreasing Roundup usage will minimise the chance of resistance developing and probably decrease its price.
- Use shielded sprayers. Experience has shown that some drift of Roundup or Basta (used on Liberty Link cotton) to non or other herbicide tolerant cotton before squaring will not cause yield or quality losses in the affected cotton. Drift from both products probably will

cause economic losses on dissimilar cotton crops when it occurs after flowering and on other crops such as wheat. Farm planning and careful spraying will be important.

- Reduce the number of cultivations and the amounts of pre-emergent and layby herbicides in herbicide tolerant cotton. In most cases pre-emergents should be unnecessary. Grass herbicides will still be popular, particularly for post emergent spot spraying. There will be an indirect benefit. With less residual herbicide there will be more microbial activity in the soil, a gradual increase in soil organic matter and eventually, crop yields.
- Apply some fertiliser post sowing, even if water supply is certain. There is good evidence that this will increase yield directly, and indirectly, by minimising the negative effects of waterlogging. Higher yields require more nutrients at a quicker rate during boll filling, or, are most likely to occur when nutrients are more available during boll filling. With fewer cultivations more time will be available for other mid season operations, such as applying fertilisers.
- Aim to improve fruit retention in both Bollgard and conventional cotton by adjusting inputs and timing of water, nutrition and Pix, which affect the carbohydrate balance in the plant. Combine foliar sprays of nutrients and Pix with sucking pest insecticides where necessary.

The results of last season in Bollgard and conventional cotton prove that Bollgard does not have higher retention, higher yields or earlier maturity, simply because it controls heliothis. On farm trials are the only way to determine a best bet Pix and fertiliser (both ground and foliar) program.

- Finally, go looking for good ideas and give them a go. Basic agronomic research is less popular these days so information on alternatives like super singles and the effects of consecutive low Pix rates or foliar nutrients on retention may not be found at major research institutes.

These questions have been outstanding for years in conventional cotton, are asked across the industry, and are fundamental in Bollgard. Unfortunately only consultants and the farming community seem to notice.

I thank my clients for comments, Queensland Cotton and Cotton Australia for data on Bollgard quality and area.

