Glossary

Aphid colony	4 or more aphids within 2 cm on a leaf or terminal.
Area Wide Management (AWM)	Growers working together in a region to manage pest populations. AWM is a cotton industry vehicle driving adoption of on-farm IPM.
At-planting insecticide	Insecticides applied in the seed furrow with the seed during planting. The insecticide may be applied as a granule or as a spray into the seed furrow.
BDI	Beneficial Disruption Index – the sum of scores for the entire cotton season of the impact of each insecticide on beneficial insect populations. The BDI helps benchmark the 'softness' or 'hardness' of an individual fields' insecticide spray regime.
Beat sheet	A sheet of yellow canvas 1.5 m x 2 m in size, placed in the furrow and extended up and over the adjacent row of cotton. A metre stick is used to beat the plants against the beat sheet. Insects are dislodged from the plants onto the canvas and are quickly counted.
Beneficial insects	Predators and parasitoids of pests.
Biological insecticides	Insecticides based on living entomopathogenic (infecting insects) organisms, usually bacteria, fungi or viruses, or containing entomopathogenic products from such organisms i.e. Gemstar, Vivus and Dipel (BT).
Boll	Cotton fruit after the flower has opened and fertilisation has occurred (after the flower has turned pink). Bolls typically have four or five segments, known as locks, each containing about 6 - 10 seeds. The lint, or cotton fibre, is produced by elongated cells that grow from the surface of the seed coat, hence the 'seed cotton' in the boll is a mixture of seed and lint.
Bollgard II® cotton	Genetically modified cotton variety containing the insecticidal proteins Cry1Ac and Cry2Ab which provides control of *Helicoverpa* spp., rough bollworm, cotton tipworm and cotton looper under field conditions.
Broad spectrum insecticide	Insecticides that kill a wide range of insects, including both pest and beneficial species. Use of broad spectrum insecticides usually reduces numbers of beneficials (predators and parasites) leading to pest resurgence (see below) and outbreaks of secondary pests.
Buffer zone	A boundary of land or crop set up within or outside the cotton farm to collect spray droplets that may otherwise drift onto sensitive areas, such as rivers or pasture.
Calendar sprays	Insecticides sprayed on a calendar basis, e.g. every Friday, regardless of pest density or the actual need for pest control.
Cold shock	Is when the daily minimum temperatures fall below 11°C. When this occurs, cotton growth and development the following day can be reduced regardless of the maximum temperature reached. Cold shocks have greatest impact on early plant development and will delay the timing of emergence, squaring and flowering and increase the susceptibility of plants to diseases.
Consecutive checks	Refers to successive insect checks taken from the same field or management unit.
Conventional cotton	Strictly a cotton variety that does not contain transgenes (genes from other species), but used in this guide to indicate varieties that do not include genes to produce insecticidal proteins (i.e. Bollgard II®) but which may include herbicide resistance genes (i.e. Round-up Ready®).
Cotton bunchy top (CBT)	A relatively new disease spread by the cotton aphid (*Aphis gossypii*, Glover). Symptoms of CBT include reduced plant height, leaf surface area, petiole length and internode length. Pale angular mottling of the leaf margins is the most reliable diagnostic feature.
CottonLOGIC	A suite of software packages developed by the Australian Cotton CRC for the Australian cotton industry which includes EntomoLOGIC, HydroLOGIC and NutriLOGIC.
Cotyledons	Paired first leaves that emerge from the soil when the seed germinates.
Crazy cotton	Multi-branched cotton caused by excessive and repeated tipping out.
Crop compensation	The capacity for a cotton plant to 'catch-up' after insect damage without affecting yield or maturity.
Crop maturity	This usually occurs when 60-65% of bolls are mature and open. Cotton bolls are mature when the fibre is well developed, the seeds are firm and the seed coats are turning brown in colour.
Cut-out	As the cotton plant continues to develop bolls, the demand for carbohydrates that are produced in the leaves increases. Eventually the demand by the bolls exceeds supply, resulting in the production of new fruiting nodes ceasing and the shedding of excess bolls, less than 14 days old. This point is known as "cut-out". An approximation of the timing of cutout is when a crop has reached on average 4 nodes above white flower (NAWF).

Damage threshold	The level of damage from which the crop will not recover completely and which will cause some economic loss of yield or delay in maturity. Damage thresholds are usually applied in conjunction with pest thresholds to account for both pest numbers and plant growth. For instance a plant which has a very high fruit retention (see below) may be able to tolerate a higher pest threshold (see below) than a crop with poor fruit retention.
Day Degrees (DD)	A unit combining temperature and time, useful for monitoring and comparing crop development. To calculate your DD visit the Australian Cotton CRC website.
Deep drainage	Water from rainfall or irrigation that has drained below the root zone of the crop. A certain amount of deep drainage helps flush salts form the soil, but excess deep drainage means water and nutrients are being wasted.
Defoliation	The removal of leaves from the cotton plant in preparation for harvest. This is done by artificially enhancing the natural process of senescence and abscission with the use of specific chemicals.
Denitrification	A biological process encouraged by high soil temperatures. Denitrification occurs when there is waterlogging, such as during and after flood irrigation and/or heavy rainfall sufficient. The process converts plant available N (nitrate) back to nitrogen gases which are lost from the system.
Diapause	A period of physiologically controlled dormancy in insects. For *Helicoverpa armigera*, diapause occurs as the pupal stage in the soil.
D-Vac	A small portable suction sampler or blower / vacuum machine used to suck insects from the cotton plants into a fine mesh bag. D-vac samples are collected by passing the tube of the vacuum sampler across the plants in 20 m of row. When plants are small this may be a single pass, but when plants are bigger a zig zag pattern from the bottom to the top of the crop with each step of the operator may be required to sample the canopy more effectively. Samples from the d-vac bag are transferred into a plastic bag and counted.
Earliness	Minimising the number of days between sowing and crop maturity. Within a cotton variety earliness usually involves some sacrifice of yield.
Early season diagnostic (ESD) tool	A web-based tool to graph and display day degrees and node counts against a theoretical optimum crop development rate to determine where the crop development is at compared with where it should be.
Efficacy	The effectiveness of a product against pests or beneficial insects (predators or parasites).
Egg parasitoids	They are parasitoids that specifically attack insect eggs. E.g. *Trichogramma pretiosum* attacks the egg stage of *Helicoverpa*. The wasp lays its eggs in the egg, and the wasp larvae which hatch consume the contents of the host egg. Instead of a small *Helicoverpa* larva hatching, up to four wasps may emerge from each host egg. Thus the host is killed before causing damage.
EntomoLOGIC	Pest management software available from CSIRO and the Australian Cotton CRC.
Flat fan nozzle	A spray nozzle with an outlet that produces spray droplet distribution that spreads out of the nozzle in one direction but which is thin in the other direction, much like the shape of a Chinese or Japanese hand fan.
Flush	A high volume irrigation carried out in minimal time.
Food sprays	They are natural food products sprayed onto cotton crops to attract and hold beneficial insects, particularly predators, in cotton crops so they can help control pests. Two types of food sprays are available for pest management. They are the yeast based food sprays which attract beneficial insects and the sugar based ones which retain predators which are already in the crop.
Fruit load	Refers to the number of fruit (squares or bolls) on a cotton plant.
Fruit retention	Refers to the percentage of fruit (squares or bolls) that the cotton plant or crop has maintained compared with number it produced.
Fruiting branch	Grows laterally from the main stem in a series of segments. Each segment finishes at a node at which there is a square and a leaf. At the base of the square next segment originates, and so on.
Fruiting factor	Is a measure of the number of fruit per fruiting branch. A method to check if the total fruit number produced by the crop is on track. Fruiting factors which are too high or too low can indicate problems with agronomy or pest management which may need to be acted on. To calculate the fruiting factor divide the fruit count made in 1 metre of cotton row by the number of fruiting branches in that area.
Habitat diversity	A mixture of crops, trees and natural vegetation on the farm rather than just limited or single crop type (monoculture).
Hill	Refers to the risen bed where the crop is planted in a furrow irrigated field.
Honeydew	A sticky sugar rich waste excreted by feeding aphids or whiteflies. It can interfere with photosynthesis, affect fibre quality and cause problems with fibre processing.

HydroLOGIC	Irrigation management software available from CSIRO and the Australian Cotton CRC.
In-furrow insecticide	Insecticides applied in the seed furrow with the seed during planting. The insecticide may be applied as a granule or as a spray into the seed furrow.
Insecticide resistance	Where a pest develops resistance to an insecticide, the insecticide will no longer kill those individuals that are resistant. This usually results in poor control and may lead to failure of control with the insecticide in the worst cases. The resistant insects develop a mechanism for dealing with the insecticide, such as production of enzymes which break the insecticide down quickly before it kills the pest.
Insecticide Resistance Management Strategy (IRMS)	An industry regulated strategy that sets limits on which insecticides can be used, when they can be used and how many times they can be used. This helps prevent the development of insecticide resistance.
Larval parasitoids	A wasp that lays their egg on or in a larva and use the lifecycle of the larva in order to reproduce. Parasitoids usually cause the death of their host whereas parasites do not.
Leaf crumpling	Leaves that are wrinkled, cupped and smaller than normal. This can be caused by thrips.
Lint	Cotton fibres. These are elongated cells growing from the surface of the cotton seed coat. See also 'Bolls'.
Main stem node	A point on the main stem from which a new leaf grows. At these points there may also be fruiting or vegetative branches produced.
Management unit	An area on the farm that is managed in the same way i.e. same variety, sowing date, insect management.
NACB	The number of main stem **N**odes **A**bove the first position **C**racked **B**oll. This is an indication of the maturity of the plant and can be used in making decisions about the final for irrigation or defoliation..
Natural enemies	Predators and parasitoids of pests.
Natural mortality	The expected death rate of insects in the field mainly due to climatic and other environmental factors including natural enemies.
NAWF	The number of main stem **N**odes **A**bove the first position **W**hite **F**lower that is closest to the plant terminal.
Neutron probe	An instrument used to measure soil moisture.
Node	A leaf bearing joint of a stem, an important character for plant mapping in cotton where nodes refer to the leaves or abscised leaf scars on the main stem.
Nursery	A crop or vegetational habitat which attracts and sustains an insect (pest or beneficial) through multiple generations.
NutriLOGIC	Nitrogen fertiliser management software in CottonLOGIC or on the Australian Cotton CRC website.
NUTRIpak	An information resource for cotton nutrition, including critical levels for soil tests, and interactions between different nutrients.
Nymph	The immature stage of insects which looks like the adult but without wings. Eg. nymphs of mirids. Nymphs gradually acquire adult form through a series of moults and do not pass through a pupal stage. In contrast, 'larvae' are immature stages of insects, such as the *Helicoverpa* caterpillars, that look quite different to the adults, which in this case is a moth.
Okra leaf type	Cotton varieties with deeply lobed leaves that look very similar to the leaves on the Okra (*Abelmoschus esculentus*) plant, which is related to cotton and hibiscus.
OZCOT model	A cotton crop simulation model that will predict cotton growth, yield and maturity given basic weather, agronomic and varietal data.
Pest flaring	An increase in a pest population following a pesticide application intended to control another species. This usually occurs with species that have very fast life cycles such as spider mites, aphids or whitefly. It occurs following the use of broader spectrum insecticides which control the target pest but also reduce the numbers of predators and parasites. This allows these 'secondary' or non-target pests to increase unchecked, often reaching damaging levels and requiring control.
Peak Flowering	The period of crop development where the plant has the highest numbers of flowers opening per day.
Pest damage	Damage to the cotton plant caused by pests. This can be either damage to the growing terminals (known as tipping out), the leaves, or the fruit (including squares or bolls).

Pest resurgence	An increase in a pest population following a pesticide application intended to reduce it. This usually occurs because the insecticide has reduced the numbers of beneficials, which normally help control the pest, thereby allowing subsequent generations of the pest to increase without this source of control.
Pest threshold	The level of pest population at which a pesticide or other control measure is needed to prevent eventual economic loss to the crop. See also 'Damage threshold'.
Petiole	The stalk that attaches the leaf to the stem.
Phase 1	The period between planting and the start of flowering (one flower per metre).
Phase 2	The period between flowering to first open boll.
Phase 3	The period between first open boll to harvest.
Plant available water	The amount of water in the soil that can be extracted by plants, usually full point (when the soil can hold no more water) minus wilting point (point at which the plant can no longer extract sufficient water from the soil and begins to wilt).
Plant growth regulator	Chemicals which can be applied to the plant to reduce growth rate (see also 'Rank growth').
Plant mapping	A method used to record the fruiting dynamics of a cotton plant. This can be useful for understanding where the plant has held or is holding the most fruit in order to interpret the effects of factors that may affect fruit load such as pest damage, water stress, heat.
Plant stand	The number of established cotton plants per metre of row.
Post-emergent knockdown herbicide	A herbicide used to rapidly control weeds after they emerge.
Predator to pest ratio	A ratio used to incorporate the activity of the predatory insects into the pest management decisions. It is calculated as total number of predators per metre divided by the total number of *Helicoverpa* spp. eggs plus very small and small larvae per metre.
Premature cut-out	Premature cut-out is when the production of bolls exceeds the supply of carbohydrates too early in the crops development and therefore the production of new fruiting nodes stops. This results in a less than ideal boll load.
Pre-plant knockdown herbicide	A herbicide used to rapidly control weeds prior to planting.
Presence/absence	The binomial insect sampling technique that records the presence or absence of a pest rather than absolute numbers on plant terminals or leaves, depending on the pest species being sampled.
Prophylactic	Refers to regular insecticide sprays applied in anticipation of a potential pest problem. Spraying on a prophylactic basis runs the risk of spraying to prevent pest damage that would not have occurred anyway, thereby increasing costs, selection for insecticide resistance and the risk of causing secondary pest outbreaks due to reductions in predator and parasite numbers.
PSO	Petroleum Spray Oil – are petroleum derived oil commonly used to control insect pests such as *Helicoverpa* spp., mirids, mealy bugs, aphids, thrips, scales and mites. PSOs can also be used to deter egg lay of some pests such as *Helicoverpa* spp.
Pupae	Once larvae of *Helicoverpa* have progressed through the larval (caterpillar) stages they will move to the soil and borrow below the surface. Here they will change into a pupae (similar to a butterfly chrysalis). In this stage they undergo the change from a caterpillar to a moth.
Rank crop	A rank crop is usually very tall (long internode lengths) with excessive vegetative plant structures. This can be caused by a number of factors including excessive fertilizer use, pest damage and crop responses to ideal growing conditions especially hot weather. Rank crops can be difficult to spray and to harvest and may have delayed maturity or reduced yield. Seed company web sites detail methods to assess plant growth to test if a plant growth regulator might be needed to prevent such rank growth.
Ratoon cotton	A cotton crop in which the stalks are cut down after harvest, but the crown and rootstock are left in the ground to regrow the following season. For pest and disease reasons, this form of cropping is not used in Australia.
Refuge	This term is used to refer to crops grown specifically as a requirement of the Bollgard II® licence to produce *Bacillus thuringiensis* (Bt) susceptible *Helicoverpa* spp.
Rotation crops	Other crop types grown before or after the cotton is grown.
Secondary pests	Pests such as spider mites, aphids or whiteflies which do not usually become a problem unless their natural enemies (predators or parasites) are reduced in number by insecticides. See also 'Pest Flaring'.
Seed bed	A type of mound on which furrow irrigated cotton is grown.

Seed treatment	An insecticide / fungicide used to coat cotton seeds to offer a period of protection during germination and establishment against some ground dwelling pests eg. wireworm and some early foliage feeders such as thrips or aphids.
Selection pressure	The number of times insecticides from a particular chemical group are sprayed onto a cotton crop. Each of these spray events will control susceptible individuals, leaving behind those that are resistant. More selection events means that there is greater 'pressure' or chance of selecting a resistant population.
Soil water deficit	The difference between a full soil moisture profile and the current soil moisture level.
Square	Cotton flower bud.
Squaring nodes	A node at which a fruiting branch is produced, which is defined as a branch with a square which has a subtending leaf that is fully unfurled and on which all central veins are visible.
Standing stubble	Stalks from a crop that has been harvested or sprayed out and left to stand in the field.
Sucking pests	Pest, usually from the group of insects known as hemiptera or bugs which have piecing tubular mouthparts which they insert into plant parts to obtain nutrition. Key among these are green mirids, which feed on cotton terminals, and young squares and bolls. Some bugs inject toxins into the plant when they feed, which if bolls are fed on may cause seed damage and staining of lint.
Sweep net	A large cloth net (approximately 60 cm deep) attached to a round aluminum frame which is about 40 cm in diameter with a handle (1 m in length) used to sample insects.
Synthetic insecticides	Non-biological insecticides. They may be man made versions of natural insecticides (i.e. pyrethroids are synthetic, light stable versions of naturally occurring pyrethrum) or they may simply be man made molecules with insecticidal or miticidal (controls mites) activity. In this guideline we have used the term to encompass most insecticides with the exception of Bt sprays, virus sprays, food sprays and petroleum spray oils (PSOs).
Terminal	The growing tip of a cotton stem, particularly the main stem.
Tip damage	When the plant terminal has been damaged, also known as tipping out.
Top 5 retention	The percentage of first position fruit maintained on the top 5 fruiting branches.
Trap crop - last generation	A crop grown to concentrate *Helicoverpa* moths emerging late in the cotton season from the non-diapausing component of pupae from the last generation in autumn. These pupae are likely to be more abundant under conventional cotton and will have had intense insecticide resistance selection. The aim is to have these moths lay their eggs in the trap crop where the resulting pupae can be controlled by cultivation.
Trap crop – Spring	A crop grown to concentrate *Helicoverpa armigera* moths emerging from diapause, usually between September and October. These moths will establish the first generation of larvae in these crops, where they can be killed using biological insecticides (ie. virus sprays) or by cultivation to kill the resulting pupae.
Trap crop – Summer	A crop grown to draw *Helicoverpa armigera* away from a susceptible crop like cotton, and which can also produce large numbers of beneficial insects. The aim is to have these moths lay their eggs in the trap crop where the resulting larvae can be controlled using biological insecticides (i.e. virus) or the pupae controlled by cultivation.
True leaves	Any leaf produced after the cotyledons.
VAM	Vesicular Arbuscular Mycorrhiza: A partnership between soil borne fungi and most crop plants, including cotton (but not brassicas). Vesicular arbuscular mycorrhizal fungi colonise the roots of the plant without causing disease. The VAM fungi act as an extension of the root system and transfer extra nutrients, especially phosphorus, from the soil to the plant. In return the plant provides the fungi with sugars as a food source.
Vegetative growth	The roots, stems and leaves as distinct from the reproductive growth of flowers and bolls.
Visual sampling	Sampling insects in the field with the naked eye without the use of other equipment. See also 'Beat sheets', 'Sweep net' and 'D-vac'.
Water stress	When the demand for water to maintain plant function exceeds the amount available to the plant from the soil.
Waterlogging	When the plant roots endure a prolonged period under water, the lack of oxygen impairs water and nutrient uptake, both of which will have a direct effect on growth and yield.
WATERpak	An information resource for cotton water use and management.