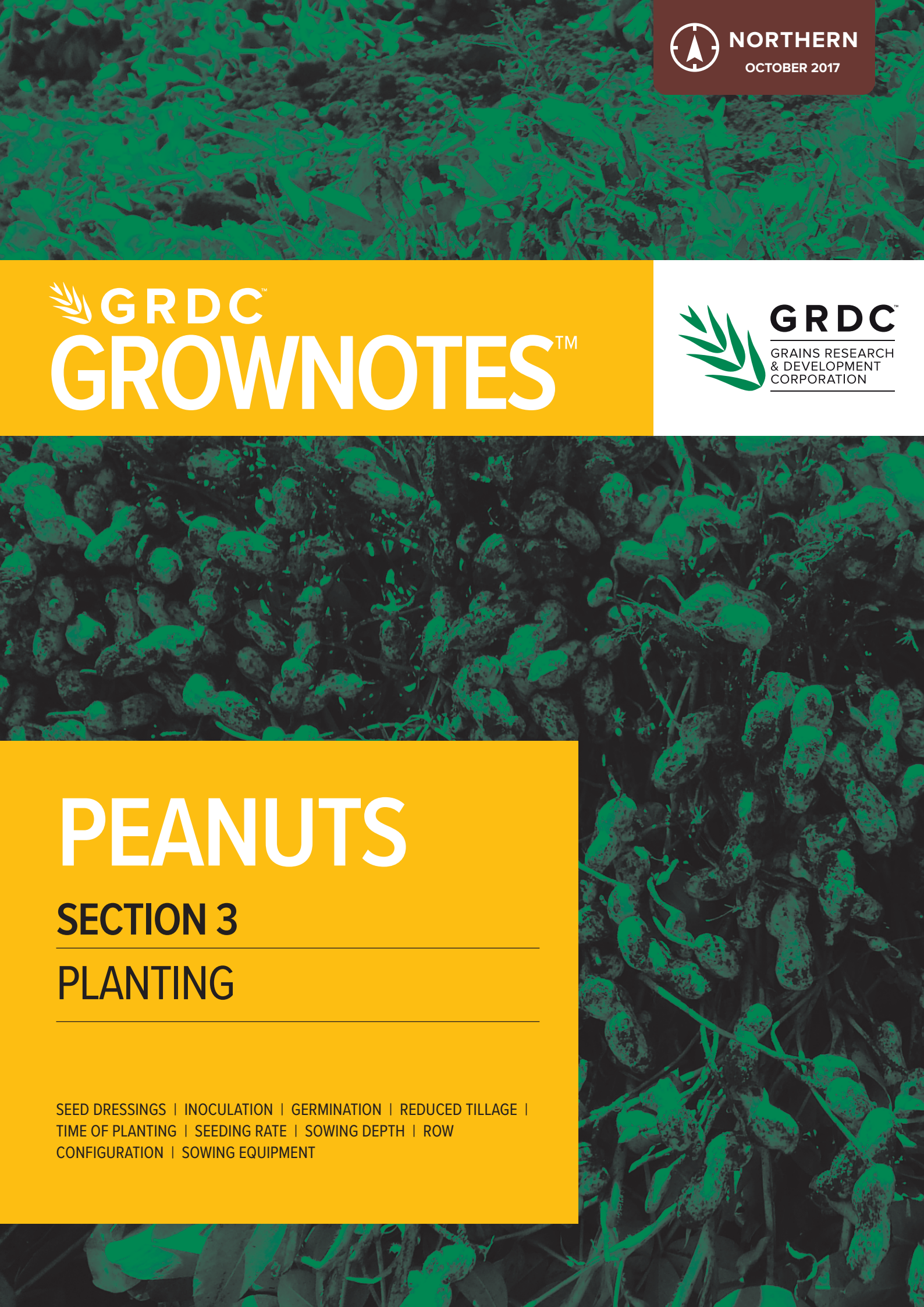

NORTHERN
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PEANUTS

SECTION 3

PLANTING

SEED DRESSINGS | INOCULATION | GERMINATION | REDUCED TILLAGE | TIME OF PLANTING | SEEDING RATE | SOWING DEPTH | ROW CONFIGURATION | SOWING EQUIPMENT

Planting

Peanuts in northern NSW and Queensland are usually grown through summer, planted anywhere from September to early January. In the Northern Territory, irrigated peanuts can also be planted in March and harvested in September. The crop usually takes 18–24 weeks from planting to digging. Growing through the summer months means that the crop can take advantage of available rainfall.

Planning for the harvest is essential when determining when to plant. Planting should be timed to avoid rain at harvest and the likelihood of frosts.

Soil temperatures should be monitored regularly as planting approaches. Keep track of the soil temperature at the desired planting depth (e.g. 50 mm). Measure the soil temperature at 9 a.m.

A minimum soil temperature of 18°C is required for germination (measured at 50 mm depth at 9 a.m.). Soil temperatures can be measured using a probe thermometer, or likely soil temperatures can be found at the Bureau of Meteorology (Agricultural observations bulletins: NSW, Northern Territory, Queensland).

Temperature has a major influence on peanut growth and development. Peanut growth is favoured by warm temperatures >25°C. Dry matter production drops by ~25% when night temperatures reach 15°C and by 50% when night temperatures drop to 9°C.

Care should always be taken when handling peanut seed. The seed is large and fragile and easily damaged. Never drop or walk on bags of peanut seed and do not leave the seed in direct sunlight. [1] Once a seed is split, the two halves will not germinate. [2]

3.1 Seed dressings

Seed must be treated with a recommended fungicide seed dressing (check registrations at APVMA) to reduce the incidence of seedling diseases. It is not worth planting untreated peanut seed because germination is often <20%. [3]

3.2 Inoculation

Peanuts are a legume. They are able to fix nitrogen (N_2) from the atmosphere via nodules on their root system. These nodules are caused by a type of bacteria called rhizobia, which infect the plant's root system. Failure of the plants to nodulate will reduce N-fixing ability and lower yields.

Native rhizobia exist in many soils, but it is recommended that growers inoculate their peanuts to ensure good nodulation and an adequate supply of N. The rhizobial strain used in the inoculant is an improved strain, designed specifically for peanuts (Group P), and is regarded as more effective than the native strains in the soil.

Growers striving for maximum yields should inoculate their peanuts every season.

Water injection is the best method for applying the peat inoculant. Do not mix the inoculant into a slurry and apply to the seed; this will damage the seed.

Granular inoculant (when available) can be applied via granular application boxes, commonly used for applying granular soil pesticides, etc. However, the application of granular inoculant and granular pesticides together is not recommended. [4]

1 G Wright, L Wieck, P Harden (2015) Peanut production guide, August 2015. Peanut Company of Australia, http://www.pca.com.au/wp-content/uploads/2016/11/PWH-Peanut-Production-Guide-2015.pdf

2 PCA. Soil preparation. Peanut Company of Australia.

3 PCA/DPIF (2007) Crop establishment. Peanut Company of Australia/Department of Primary Industries and Fisheries Queensland, http://www.pca.com.au/bmp/pdfs/3d_establish.pdf

4 G Wright, L Wieck, P Harden (2015) Peanut production guide, August 2015. Peanut Company of Australia, http://www.pca.com.au/wp-content/uploads/2016/11/PWH-Peanut-Production-Guide-2015.pdf

3.2.1 Treat inoculum well

When it comes to improving the nitrogen-fixing capacity of pulse crops, the best approach is to treat inoculum well by transporting, storing and applying it according to the manufacturer's recommendations.

Rhizobia are living organisms that need to be kept cool before application and mixed with good-quality water to ensure maximum rhizobia survival.

The more rhizobia in the inoculum, the greater the chance that effective nodules will be formed and the greater the chance that more nitrogen will be fixed.

As part of ongoing QDAF research, different inoculation methods and forms have been compared for soybeans and peanuts. Peat-based inoculum applied as a seed coating or as a liquid injected into the soil, freeze-dried inoculum either applied as a seed coating or liquid-injected, and granules were all tested.

For soybeans and peanuts, researchers found that plants responded positively to all forms of inoculum equally, when applied according to label recommendations.

Inoculated seed needs to be planted within hours into moist soil to ensure adequate numbers of rhizobia are still alive when the seed germinates. Rhizobia survival will be compromised if crops are sown into hot, dry soil.

Care needs to be taken when mixing rhizobia inoculum with products such as liquid fertilisers or pesticides. For example, zinc and other heavy metals can be detrimental to rhizobia when the two are in direct contact. [5]

3.3 Germination

In Queensland, certified peanut seed must have a minimum germination rate of 80%. [6]

3.4 Reduced tillage

Peanuts are more difficult to grow using reduced tillage or no-tillage methods than most other crops. Peanuts need loose soil for the crop to peg into and to make digging easier. This is generally achieved through deep ripping prior to planting.

Field trials of no-till peanuts planted into wheat stubble in the Burnett area of Queensland have yielded mixed results. On sandier soils, outcomes are likely to be better, particularly if the soil is hardsetting with poor water infiltration. Commercial evaluation of no-till planting into sugarcane residue shows little or no difference in yield compared with conventional planting. No-till in the sugarcane rotation will become more beneficial as controlled traffic practices increase.

Weed control is often more costly in terms of chemical use under a minimum-tillage system because inter-row cultivation is not used. However, this can be offset by reduced machinery and fuel costs.

On the lighter red scrub and forest soils of the Burnett region, pod losses from cutting and pulling the crop from reduced-till and no-till blocks were much less than expected.

Some growers use strip tillage, where the plant bed is cultivated and the inter-row is left uncultivated. GPS-controlled machinery enables the operator to maintain the beds in the same position from one season to the next. [7]

MORE INFORMATION

R Mason *et al.* Using minimum tillage and controlled traffic to reduce the risk of cropping in the Burnett.

Y Dang *et al.* (2013) Tillage impact in long term no-till GRDC Update Paper.

GRDC (2007) Why Australia has the world's greatest herbicide resistance problem. GRDC Ground Cover Issue 68.

EA Roesner (1998) Minimum tillage effects on soil structure measured using image analysis. Australian Agronomy Conference.

5 GRDC (2017) Commercial inoculants compatible with new varieties. Ground Cover Issue 127, March–April 2017, https://grdc.com.au/resources-and-publications/groundcover/groundcover-issue-127-marchapril-2017/commercial-inoculants-compatible-with-new-varieties

6 PCA/DPIF (2007) Crop establishment. Peanut Company of Australia/Department of Primary Industries and Fisheries Queensland, http://www.pca.com.au/bmp/pdfs/3d_establish.pdf

7 PCA/DPIF (2007) Crop establishment. Peanut Company of Australia/Department of Primary Industries and Fisheries Queensland, http://www.pca.com.au/bmp/pdfs/3d_establish.pdf

Considering that water is the most limiting resource in the rainfed environment of the Burnett, minimum till reduces the amount of rainfall required to prepare a seedbed. [8]

3.5 Time of planting

Planting can start any time after the soil temperatures at planting depth reach 18–20°C at 9 a.m. for 3 days in a row. Delay planting if the soil is cool or if rain is expected within 3–4 days.

Planting should be timed to ensure that the crop is ready for harvest at the end of the wet season and before the first frost (Table 1). Spanish and ultra-early types mature earlier than Virginia and Runner types, so they can be planted 2–3 weeks later. In some parts of coastal and northern Queensland (near Cairns), and the Northern Territory, peanuts can grow over the winter months but growth is limited. [9]

Table 1: *Preferred and possible planting times for Virginia and Runner peanuts.*

Region	Preferred	Possible
Northern NSW and southern Qld	Mid Oct–late Nov	Start Oct–mid Dec
Central Qld	Mid Nov–mid Dec	Mid Sept–early Jan
Atherton Tableland and Lakeland	Mid Nov–mid Dec	Mid Nov–late Jan
Bundaberg	Early Sept–mid Dec	Mid Sept–end Dec
Mackay	Sept (ultra-early varieties) mid Nov–mid Dec	Sept–Jan

3.6 Seeding rate

Although peanuts can compensate for suboptimal plant populations, the crop cannot make up for poor plant stands or large gaps.

To achieve the correct plant density, calculate the required seeding rate to ensure that adequate numbers of seeds are planted regardless of seed size (Table 2). For Virginia and Runner types, an acceptable plant population under full irrigation is 130,000–150,000 plants/ha. Aim for populations of up to 180,000 plants/ha for Spanish or ultra-early varieties under full irrigation. Table 3 provides the seed numbers per metre of row needed to achieve the desired plant population.

Under dryland conditions, Virginia and Runner types require rates of 50,000–60,000 plants/ha in southern Queensland and 80,000–90,000 plants/ha in North Queensland. Plant Spanish or ultra-early types at a rate to give 120,000–150,000 plants/ha in North Queensland and 80,000 plants/ha in southern Queensland.

A field establishment of <80% is typical. There are several reasons for this low establishment rate, including peanut susceptibility to seedling diseases despite seed dressings, soil insect damage to seed during production and planting, and the difficulty of producing good-quality seed. [10]

8 R Mason, J Page, M Cloete. Using minimum tillage and controlled traffic to reduce the risk of cropping in the Burnett, http://actfa.net/wp-content/uploads/2014/07/Using-minimum-tillage-and-controlled-traffic-to-reduce-the-risk-of-cropping-in-the-Burnett-R-Mason-et-al..pdf

9 PCA/DPIF (2007) Crop establishment. Peanut Company of Australia/Department of Primary Industries and Fisheries Queensland, http://www.pca.com.au/bmp/pdfs/3d_establish.pdf

10 PCA/DPIF (2007) Crop establishment. Peanut Company of Australia/Department of Primary Industries and Fisheries Queensland, http://www.pca.com.au/bmp/pdfs/3d_establish.pdf

Table 2: *Planting rates (kg/ha) required for different-sized peanut seed to achieve desired plant populations, assuming 80% field establishment.*

Plant population (no. of plants/ha)	No. of seeds per kg					
	750	1060	1300	1400	1600	1800
60,000	100	71	58	54	47	42
80,000	133	94	77	71	63	56
100,000	167	118	96	89	78	69
120,000	200	142	116	108	94	84
140,000	233	165	135	125	109	97
160,000	266	188	154	142	126	112

Table 3: *Seed numbers per metre of row required to achieve desired plant populations.*

Plant population (no. of plants/ha)	Row spacing (cm)			
	86	91	96	102
60,000	5	5.5	6	6
80,000	7	7	8	8
100,000	9	9	10	10
120,000	10	11	12	12
140,000	12	13	14	14
160,000	14	15	15	16

3.7 Sowing depth

Depth of planting is not as critical for peanuts as it is for most other crops. The ideal is 50–70 mm deep, but planting depths may range from 35 to 100 mm. Where peanuts are to be planted into dry soil and then furrow-irrigated, plant at 25–35 mm depth to avoid waterlogging the seed.

The peanut seed is large, and in order to germinate, it must absorb 35% of its weight in water. Large-seeded varieties such as Wheeler and Middleton need better soil moisture at planting than small-seeded varieties such as the Spanish and ultra-early types. All seed must be placed into moist soil, with no dry bands of soil in the profile.

If moisture and temperature are acceptable, the emerging seedling is very strong and can break through soil surface crusts.[11]

3.8 Row configuration

Field trials have shown that growing ultra-early varieties in twin-row configurations and at increased plant populations can lead to yields comparable to those of full-season varieties.

Trials have shown that with irrigation, or in good rainfall years, twin-row planting can result in significant improvement in pod yield and kernel grades compared with single-row planting, due to better synchronisation of flowering and podding, and more even crop development (Photos 1–3, Figure 1).[12]

11 PCA/DPIF (2007) Crop establishment. Peanut Company of Australia/Department of Primary Industries and Fisheries Queensland, http://www.pca.com.au/bmp/pdfs/3d_establish.pdf

12 RCN Rachaputi, S Krosch, G Wright. Optimising row spacing for the ultra-early Tingoora. GRDC, Peanut Company of Australia, the Queensland Government.

Photo 1: *Single rows (conventional practice) of peanuts are planted with 90-cm spacing between the rows.*

Photo: PCA

Photo 2: *Twin rows of peanuts are planted 20–30 cm apart under a 90-cm arrangement.*

Photo: PCA

Photo 3: *A field trial with peanuts, comparing a single-row (foreground) and twin-row (background) configurations.*

Photo: PCA

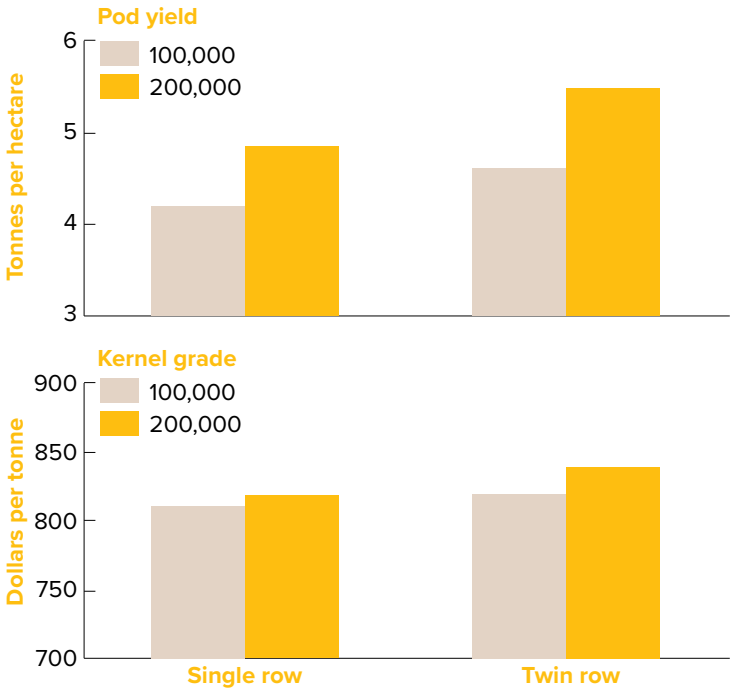

Figure 1: *Pod yield and kernel grade of peanuts at Tingoora grown under single- and twin-row configurations under irrigated conditions (Bundaberg, 2009–10 season).*

In 2002, researchers from the University of Georgia in the United States released the results of 6 years of study on twin-row planting patterns. Work in the 1970s in

Alabama by E Hauser and G Buchanan had already shown that twin rows allowed for better weed control.

The Georgia research was carried out from 1996 to 2001 on numerous small plots and on-farm demonstration sites throughout the state, comparing 17.5–35.5-cm twin rows with 1-m single-row patterns. Seeding rates were kept constant: 3 seeds/30 cm on each twin row or 6 seeds/30 cm on single-row planting patterns.

Several positive conclusions were drawn:

- twin rows result in quicker canopy coverage than single rows.
- yields increased by 549 kg/ha, averaged over early to late plantings.
- grades increased an average of 1–2%.

The researchers estimated that if 50% of the Georgia peanut acreage was planted to twin-row patterns, there was a potential economic return of US$28 million in increased yield and another $4 million in increased grade value to producers.

In 1999, ~35% of the Georgia peanut acreage was in twin-row patterns; by 2002, 50% was in twin-row patterns.

Trials on planting twin rows under strip-tillage methods showed that a major factor for success was to centre the subsoiler between each set of twin rows. The yield response was not as great as with conventionally tilled twin rows it but was still positive compared with single rows.

With strip tillage, it was difficult to achieve an adequate plant stand and avoid excessive digging losses due to planting on level soil and lack of good row definition for digging efficiency.

For twin rows, it was important to use a 76-cm cut-frog on the digger to avoid pulling peanuts off the inside twin rows.

Since 2000, the University of Georgia has recommended planting 6 seeds/30 cm on single rows and 3 seeds/30-cm row on twin rows. Their research indicated no advantage to exceeding 6 seeds/30 cm on single rows or 3 seeds/30 cm on twin rows, and that 2 seeds/30 cm was insufficient. [13]

3.9 Sowing equipment

Peanuts must be planted with a row-crop planter (Photo 4). Combine planters are not suitable. The peanut seed is large and fragile. Plate planters such as the Covington and Janke are commonly used, as well as rotary cone and finger pick-up planters (e.g. Mason Deere and KMC). Vacuum precision planters such as John Deere and Monosem are gentle and well suited for peanuts. Nodet and Gaspardo vacuum planters must be modified to plant peanuts. Kinze planters with ‘edible bean’ cups are not suitable.

Recommended planting equipment includes:

- John Deere MaxEmerge vacuum precision planter; Mason Deere-type planter with rotary cones
- Nodet and Gaspardo pneumatic planters, with modifications
- Covington box or some inclined plate planters, or flat plate planters such as the International 186 and 184 series
- Monosem vacuum precision planter. [14]

13 PCA. Twin rows boost yields and grades. Peanut Company of Australia.

14 G Wright, L Wieck, P Harden (2015) Peanut production guide, August 2015. Peanut Company of Australia, http://www.pca.com.au/wp-content/uploads/2016/11/PWH-Peanut-Production-Guide-2015.pdf

Photo 4: *A 4-row planter modified to plant two twin rows.*

3.9.1 Press-wheels

The use of press-wheels is essential (Photo 5). They give better seed–soil contact, which promotes faster and more uniform emergence. Soft-centred or twin-inclined press-wheels are preferred, particularly on soils that form surface crusts. Hard-centred press-wheels can be used on some soils that do not crust, although the pressure may have to be reduced.[15]

Photo 5: *Press-wheels on the planter are essential for good seed–soil contact.*

15 PCA/DPIF (2007) Crop establishment. Peanut Company of Australia/Department of Primary Industries and Fisheries Queensland, http://www.pca.com.au/bmp/pdfs/3d_establish.pdf

3.9.2 Planters

The soft-skinned peanut seed is easily damaged. Therefore, the seed-metering mechanism of the planter must accurately distribute the seed without excessive agitation or shearing action. Many different seed-metering mechanisms are available. None of the combine planters has acceptable seed meters but row-crop planters have more suitable metering methods (Table 4).

Correct-sized plates will minimise damage to seed, and nylon (or similar) plates generally accumulate less seed dressing than do metal plates.

On all peanut planters, maintain an accurate planting rate even if placement depth varies, because the peanut plant can only compensate for small gaps.

The horizontal or flat plate planter is renowned for its tendency to shear off kernels. This destroys seed and causes missed plant spaces where a non-viable portion of seed filled the plate cell. Precision is not high.

The inclined plate planter (e.g. Covington) is very reliable for planting peanuts, even the larger seed sizes. Although seed placement is often not precise, planting rates are usually reasonably accurate. These planters are not suitable for rough seedbeds or operating at high speed (maximum speed 6 km/h).

Rotary cone planters are reasonably reliable and provide accurate seed placement. However, very large kernels can cause bridging—a blockage in the chute opening.

Vacuum planters (e.g. John Deere MaxEmerge) are widely used for planting peanuts. These planters can make skin slippage worse on over-dried kernels, leaving a 'bald' kernel exposed with no fungicide treatment. Loose skins can also block the air-holes. This mechanism gives accurate seed placement, and adaptation to peanut planting is reasonably straightforward.

Brush meters have been developed by Kinze but are not suitable for peanuts because of the size of peanut seed. Combine planters should not be used.[16]

Table 4: *Seed-metering mechanisms for row-crop planters.*

Metering	Precision	Agitation	Suitability	Comments
Horizontal plate	Low	High	Low	High potential to shear peanut kernels (IHC 184 and IHC 186)
Inclined plate	Low	Med	High	Commonly used (Covington, Janke)
Rotary cone	Medium	Medium	Medium–high	Suitable for peanuts (Mason Deere, KMC)
Finger pickup	High	Low	Low	Not easily adapted to large peanuts (Mason Deere finger pickup)
Vacuum pneumatic plate	High	Low	High	Very accurate. High potential to remove kernel skins (Nodet, John Deere, Gaspardo, Monosem)
Brush meter	High	Low	Low	Available models not readily adaptable
Combine planters	–	–	None	Unacceptable, will not work

16 PCA/DPIF (2007) Crop establishment. Peanut Company of Australia/Department of Primary Industries and Fisheries Queensland, http://www.pca.com.au/bmp/pdfs/3d_establish.pdf