Department of Primary Industries

Summer cropping options for northern and central NSW 2022

Introduction

High winter rainfall has inhibited some growers in central and northern NSW being able to plant their full program of winter crop, as such many producers are looking to summer cropping to take advantage of full moisture profiles.

This guide aims to explore summer cropping options that might suit your farming system.

The benefits of summer crops

- Enables the use of alternate modes of herbicides to control or prevent resistant weeds
- An effective disease break for some of the major winter cereal diseases, including Fusarium crown rot
- Improves utilisation of labour and machinery
- Provides an alternative income stream at a different time of the year
- Spreads the risk of adverse weather conditions, such as frost at flowering or weather damage at harvest
- Legumes are an alternative source of nitrogen (N)
- A double cropping option if the summer crop harvest is early.

dpi.nsw.gov.au

Crop options

Table 1: *Key requirements for mungbean, sorghum, sunflower, maize and soybean.*

CROP	Mungbean	Sorghum	Sunflower	Maize	Soybean
Planting soil temperature[a]	>15 °C	12 °C[a] minimum, 16–18 °C	10–12 °C[a]	12 °C[a]	13–15 °C
Ideal soil pH_{Ca}	6.2–7.2	5.5	6.0–7.5	5.6–7.5	5.2–6.6
N removal per t grain	36 kg	25 kg	40 kg/t grain	15 kg/t grain	67 kg
Total N fixation[b]	34 kg/ha	–	–	–	180 kg/ha
Target plant pop – dryland	20–30 plants/m^2	4–6 plants/m^2	2–4 plants/m^2	2–5 plants/m^2	Wide row: 15–20 plants/m^2
Target plant pop – irrigated	30–40 plants/m^2	10–15 plants/m^2	5–7 plants/m^2	6–8 plants/m^2	Wide row: 25–30 plants/m^2 Narrow row: 30–40 plants/m^2
Days to maturity	90–120	115–140	100–120	130–150	130–160
Herbicide options	Cost effective options for grasses Limited broadleaf control	Cost effective options for grass and broadleaf weeds	Cost effective options for grasses Limited broadleaf control unless using Imi tolerant hybrids	Cost effective options for grass and broadleaf weeds	Cost effective options for grasses Limited broadleaf control
Advantages	No N required at planting Legume = N benefits Quick growing crop, suited to double cropping Good grass weed control options	Reliable Good weed control options Good stubble cover left	Good at extracting moisture Lower N requirement compared with sorghum and winter cereals Good grass weed control options	Grows on a wide range of soil types Can tolerate weathering	Little to no N required at planting Legume= N benefits Good grass weed control options Tolerates waterlogging and wide range of soil types High N stubble
Disadvantages	Low ground cover post-harvest Susceptible to heat/drought stress during flowering/ podding Broadleaf weed control difficult and expensive Difficult to meet premium grade	Depletes soil N Atrazine residues may restrict winter cropping	Depletes soil N Low ground cover post-harvest Vulnerable to birds Poor broadleaf weed tolerance	Depletes soil N Do not follow with durum due to risk of head blight Does not like saline soils	Susceptible to heat/ drought stress during flowering/ pod development Limited options for broadleaf weed control
Marketing	Some marketing expertise required	Established markets	Recommended to negotiate contracts before planting	Recommended to negotiate contracts before planting	Good marketing options when human consumption standards are met

[a] Minimum temperature and rising for 3 or more days

[b] Estimated average total N fixation by crop before grain is removed. How much nitrogen is fixed by pulse crops and what factors affect fixation?, GRDC Update 2018.

Getting the basics right

Water use and water use efficiency (WUE)

One of the major factors affecting yield potential of crops in the northern grain's region is water. Ways to manipulate soil water use to produce the highest WUE (kg grain/ha/mm water used) are key profit drivers for growers. Use of no-till for dryland crops increases stored fallow soil moisture. Target yields should be based on moisture availability, seasonal outlook and local yield expectations.

Weed control

Fallow weed control is critical to ensure seedbed soil moisture is not used by weeds prior to sowing. Pre-sowing knockdowns and residuals should be used to minimise competition, especially at establishment. Check previous herbicide applications for residues or plant back issues and the risk of herbicide damage as some summer crops are very sensitive to chemical residues.

Table 2: *minimum recropping interval of some commonly used herbicides.*

Product	Metsulfuron	Terbyne®	Lontrel®	Pixxaro® Arylex®
Active	Metsulfuron-Methyl	Terbuthylazine	Clopyralid	Fluroxypyr + halauxifen-methyl
New group	Group 2	Group 5	Group 4	Group 4
Former group	Group B	Group C	Group I	Group I
Maize	14 months	6 months	14 days	1 month
Mungbean	n/a	4 months	n/a	4 months
Sorghum	14 months	0 days	14 days	1 month
Soybean	14 months	4 months	6 months	4 months
Sunflower	14 months	6 months	6 months	4 months

Fertiliser

The fertiliser regime for summer crops should be based on your target yields, soil tests and previous crop yields and protein levels. Forage crops will have a higher demand for potassium (K) than grain only crops.

More information on plant backs: Rotational crop constraints for herbicides used in Australian farming systems - GRDC

Seed quality

Successful establishment starts with seed that has both good germination and vigour percentages. Match the plant population and row spacing to the target yield. To assist with decisions on ideal plant populations and row spacings, growers should seek information from an agronomist or NSW DPI. Plant uniformity is critical with most summer crops.

Source high quality seed.

Know the germination.

Soil temperature

Soil temperatures fluctuate widely during late winter and early spring. These fluctuations are exacerbated by shallower soil planting depths, where there is less insulation against the changing day/night temperatures. Growers looking to plant summer crops early in their sowing window need to be measuring soil temperature. This should be measured at the intended sowing depth and at the same time of the day e.g., 8 am EST (which is close to the soil daily minimum temperature).

Measure soil temp at 8am at planting depth

Planting rates

Planting rates are typically calculated on establishment percentages of around 80%. NSW DPI sorghum experiments have shown that early sowing can result in much lower establishment percentages. Use your actual seed germination % and seed size information to calculate your planting rate. Cold soil temperatures are an additional stress on seedlings, so use only the best quality seed available.

How to calculate planting rates (mungbean used as an example)

100 seed weight[#] (grams)	×	target plant population (plants/m²)	x	1000	÷	establishment* (%)	×	germination (%)	=	planting rate (kg/ha)
Mungbean example										
6.7	×	30	×	1000	÷	80	÷	90	=	28 kg/ha

[#] To determine your 100 seed weight, weigh 100 seeds in grams

* Establishment percentage – 80% is a reasonable estimate, unless sowing into adverse conditions

Test seed for germination and weigh 100 seeds to determine size.

Soil moisture around the seed

Early sowing of summer crops into cooler soils results in the seed taking longer to emerge compared with normal sowing. A mid-August planting for sorghum results in an emergence time of 2–3 weeks. While for normal sowing times, i.e. mid September to November plants emerge in 5–7 days and in as little as 3 days when planting in summer. There needs to be adequate moisture around the seed at planting to ensure the seed does not dry out and stop the germination process.

Grain sorghum

Grain sorghum is a major summer crop of northern NSW, which allows growers to include a summer crop in their predominantly winter based rotations.

The benefits of sorghum

- Provides an important disease break as it is not a host of Fusarium crown rot and is resistant to the root lesion nematode *Pratylenchus thorneii* but susceptible to *P. neglectus*
- A relatively reliable summer crop with some drought tolerance
- Increases chance of double cropping with a winter crop with an early planted sorghum
- A good range of herbicide options
- If the crop looks like failing due to low rainfall and stored moisture, the crop can be cut and used for forage
- Established markets.

Key management issues

- Growers looking to plant early sorghum should target soil temperatures of at least 12 °C and rising for a period of 3 days. NSW DPI experiments have shown that early sowing into these cooler soil temperatures can result in reduced establishment percentages so use good quality seed. Soil temperatures of 16–18 °C have traditionally been recommended.
- No-till farming has been shown to consistently yield approximately 0.5–1.0 t/ha more than sorghum grown under conventional tillage
- A wide sowing window in most areas. Avoid sowing too early (frost) or too late (ergot and frost). Reduce the risk of ergot by planting crops so that they finish flowering by mid-March. Aim to avoid flowering during the extreme heat of late December to early January.
- Salinity >2 ds/m is not ideal; semi-tolerant of sodicity but not as tolerant as barley
- High dependency on arbuscular mycorrhizal fungi (AMF, formerly known as VAM)
- Use effective weed control, especially for grasses
- Select at least 2 high yielding hybrids that have the desired characteristics for your conditions
- Monitor and control insects (if necessary), especially wireworms (planting), midge, Helicoverpa and Rutherglen bug (flowering - grain fill)
- Use registered knockdown herbicides at physiological maturity to hasten dry down, improve harvesting and commence the recharge of the fallow

- Be mindful of potential prussic acid (HCN) poisoning issues if considering grazing grain sorghum, the risk is lower in sweet sorghum and millets
- Be prepared to dry grain from late sown crops.

Planting time

In NSW, sorghum planting usually starts in mid-September in northwest NSW and late October on the Liverpool Plains when soil temperatures reach 16–18 °C. NSW DPI in collaboration with GRDC, UQ/QAAFI and QDAF have been experimenting with planting sorghum when soil temperatures are greater than a minimum of 12°C. This is around mid-late August at Mungindi, north of Moree and mid-September on the Liverpool Plains.

Moving the planting date of sorghum earlier shifts the flowering and grain fill periods forward. Early sown sorghum can flower in mid- late November (Moree/ Mungindi regions) and early–mid December for the Liverpool plains, avoiding the risk of extreme heat. There is still an inherent risk of frost (either killing or mild damage) from sowing earlier than traditionally recommended, but the occurrence is low. Grain yields are comparable or above those of normal sowing times.

Sorghum: *planting date experiment at Moree*

Table 3: *Suggested sowing times for sorghum in NSW.*

Region	Early plant										Late plant											
	Aug		Sept				Oct				Nov				Dec				Jan			
	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
North west plains	◀	★	★	★	★	★	★	★	★	★	▶				◀	◀	★	★	★	★	▶	
North west slopes, Liverpool Plains						◀	◀	★	★	★	★	★	▶		◀	★	★	★	★	▶		
Central west									◀	★	★	★	★	★	▶							
Southern irrigation areas									◀	★	★	★	★	★	▶							

◀ Earlier than ideal, but acceptable. ★ Optimum sowing time. ▶ Later than ideal, but acceptable.

Row spacing and configurations

- Research in north-western NSW has shown that once the yield potential is above 3.5–4.0 t/ha, there are significant advantages of 100 cm solid plant rows over single and double skip configurations
- This research showed that solid plant row spacings of 100 cm can yield up to 50% more than double skip configurations in good seasons (yield potential ~6 t/ha)
- The advantages of solid row configuration decrease as planting soil moisture profiles decline, especially in more marginal areas
- Skip rows are useful for conserving water during the vegetative stage of crop growth, which can be used at flowering and grain fill
- Plant population should be the same for skip row as for solid plant configuration (same plants/ha).

Table 4: *Row spacing and expected yield.*

Expected yield	Optimum row spacing
Greater than 4 t/ha	≤0.75 m solid plant
3–4 t/ha	≤1.0 m
Less than 3 t/ha	≥1.0 m or skip rows

Recent NSW DPI experimental work and other information

Early planting grain sorghum in northern NSW. https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/1343982/Early-planting-grain-sorghum-in-northern-NSW.pdf

Podcast: Early sowing sorghum, with Loretta Serafin. https://soundcloud.com/user-889937785/early-sowing-sorghum-with-loretta-serafin

Can winter planted sorghum be successfully established at Mungindi? Northern NSW research results 2020 (nsw.gov.au)

Optimising sorghum production, Moree 2020–2021. Northern Research Results 2021 (nsw.gov.au)

Forage sorghum

Forage sorghum is another option for mixed farming operations. It can provide high quality feed when summer pastures are less productive, enabling livestock to be finished more quickly. The crop can also be used for hay, silage or green chop. These end uses are also an option if soil moisture becomes limiting.

Management tips

- Plants under stress, in particular moisture stress, will have higher prussic acid levels which can lead to stock poisoning, especially if the plant is less than 0.5 m. Prussic acid levels decrease as the plant gets older. Do not introduce starving stock onto forage sorghum and provide sulfur lick blocks. These assist with the detoxification of prussic acid and toxins
- Forage sorghum silage and hay are best cut at 0.8–1.3 m height, a reasonable compromise between quality and yield.

Information on prussic acid poisoning

Prussic acid poisoning in livestock (nsw.gov.au)

Maize

Maize is a summer-growing, multipurpose cereal crop that needs warm, but not hot, daytime temperatures and mild nights, to maximise yield. The growing season is usually 130–150 days from planting to harvest. Maize is primarily grown as an irrigated crop, but is suited to favourable dryland areas as well. Maize can be grown to produce grain for a range of human food and stock feed markets, or the whole plant can be harvested green for fodder or silage. Maize will grow on a wide range of well-drained soil types.

The benefits of maize

- Grows well on a wide range of soil types
- Moderately resistant to both species of nematodes
- Can tolerate weathering and will stand well in the paddock if harvest is delayed
- Maize is a premium silage crop, producing a large bulk of high-energy forage without the need for wilting before ensiling or adding silage additives
- Does not require desiccation.

Irrigated maize

Key management issues

- Organise marketing contracts before planting. Growers should discuss specific quality requirements with end users when negotiating contracts. Human consumption market sectors have strict specifications.
- Plant at the optimum time to avoid early frosts, extreme heat at tasselling with cool, slow dry down conditions at crop maturity
- Use of a precision planter is desirable
- A pH range of 5–8 can be tolerated, but the best growth is achieved in the range of pH 5.6–7.5
- Much more susceptible to saline soils than sorghum, wheat and barley (> 2.0 ds/m)
- Very high dependency on AMF
- Plant inland, dryland crops when there is at least 1 metre depth of wet soil. Dryland yield potential tends to be slightly less than sorghum as it is less tolerant of moisture stress than other summer crops such as grain sorghum.

- For dryland production in drier areas such as the north-western plains, single skip on 100 cm rows is suggested
- For irrigated crops calculate water budgets, matching the crop area to water allocation. Do not plan to stretch irrigation intervals to increase crop area, in particular from just prior to tasselling to the start of the milk line stage. Maize plants uses the majority (70%) of its moisture requirement 3 weeks either side of tasselling.
- Good yields of grain or silage require high levels of soil fertility. Accumulation of N, phosphorus (P) and K is rapid in the early stages of maize growth. Nitrogen is the main nutritional limitation to yield in maize.
- Maize is most susceptible to weed competition in the early stages of growth until the crop reaches 0.8 m in height, ~8 weeks after planting
- Requires specialised corn fronts for harvest
- Grain destined for milling markets requires special care during harvest and preparation for storage.

Planting time

Sowing time and hybrid selection determine whether the crop will be exposed to hot conditions during pollination, which can significantly reduce yield. Tasselling and silking occurs ~10–12 weeks after planting for mid maturity hybrids on a spring plant and shorter on a later plant.

Early sowing balances the risks of frost soon after emergence and excessive heat at tasselling. Late sowing avoids excessive heat at tasselling but increases the risks of insect attack by heliothis and mites, disease in late summer and slow dry down periods in cool autumn temperatures.

Commence sowing when the soil temperature reaches 12°C and is rising for 3–4 days. For irrigated crops, the temperature of water used for pre-irrigation or watering-up can influence sowing time. If watering-up, allow for a 3°C to 4°C drop in soil temperature following watering. The application of cold irrigation water can damage or reduce seedling emergence.

Table 5: *Suggested sowing times for maize.*

Region	Early plant												Late plant											
	Aug				Sept				Oct				Nov				Dec				Jan			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
North inland	◀	◀	★	★	★	★	★	★	★	★	▶	▶					◀	◀	★	★	★	▶	▶	
Central inland					◀	◀	★	★	★	★	★	★	▶	▶										
Southern inland							◀	◀	★	★	★	★	★	★	▶	▶								
Tablelands							◀	◀	★	★	★	★	★	★	▶	▶								
North and central coast				◀	◀	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	▶	▶		
South coast								◀	★	★	★	★	★	★	★	★	▶	▶						

◀ Earlier than ideal, but acceptable. ★ Optimum sowing time. ▶ Later than ideal, but acceptable.

Recent NSW DPI experimental work and information

Manipulating maize genetics and agronomy for improved yield and reliability in northern NSW – Breeza 2017/18. Northern NSW research results 2019 (nsw.gov.au)

Manipulating maize genetics and agronomy for improved yield and reliability in northern NSW – Gurley 2017/18. Northern NSW research results 2019 (nsw.gov.au)

For chemical use permits: Maize Association - Maize Association Australia (maizeaustralia.com.au)

Sunflower

Sunflower is a good rotation crop, highly suited to sowing into standing cereal stubble. Sunflower is most often sown after a long fallow following a winter cereal. Sunflower is also suitable for use in a short fallow following sorghum, or as a double crop option provided the soil moisture profile is near full. Sunflower does not leave behind much stubble following harvest so planting into paddocks with existing cereal stubble helps to prevent erosion.

It is most suited to deep clay soils, with high water holding capacities. It does not tolerate lengthy periods of waterlogging without suffering yield penalties.

The benefits of sunflowers

- Deep taproot that can extract moisture and nutrients to a depth of 2–3 m making the soil softer and more friable and breaking up compacted layers with the deep roots
- Option of early or late planting window
- Not a host of major cereal diseases such as Fusarium crown rot
- Resistant to both *P. thornei* and *P. neglectus*
- Sunflower has a lower requirement for N compared with sorghum and winter cereals.

Key management issues

- Only plant sunflower if there is >135 mm plant available water
- For early sowings, the soil temperature at 10 cm depth should exceed 10–12 °C at 8.00 am EST after heavy frosts
- Precision planter essential
- Double cropping is an option in dryland areas when there is a positive seasonal outlook and a full soil moisture profile
- For dryland production in more marginal areas, single-or double skip on 100 cm rows is recommended
- Not tolerant of sodicity; moderate tolerance of salinity (4–5 dS/m); not tolerant of acidic soils with pH_{Ca} 5.0 or below
- High dependency on AMF
- Be aware of herbicide residues. Sunflower is particularly sensitive to sulfonylurea (SU) herbicides
- There are only a small number of sunflower hybrids available. Select a hybrid based on end use firstly and then on yielding ability (seed and oil)
- Use herbicide tolerant (Group B; imi-tolerant) sunflowers to broaden herbicide options and rotate chemistry
- Monitor and, if necessary, control insects especially wireworm during crop establishment and Rutherglen bug and Helicoverpa from budding through seed filling. Assess the potential for mice and bird damage.
- Check intended paddocks for previous incidence of sclerotinia stem rot, potentially using a PREDICTA® B test
- Do not sow too late in the cooler areas, e.g., south of Gunnedah as the risk of disease, in particular Sclerotinia, is higher
- Crops sown in late January are likely to be slow drying down. Be prepared to harvest at higher moisture contents and use aeration where necessary.

Planting time

Sunflower is adapted to a wide range of planting times, which are grouped into an early and a late plant. The preferred soil temperature for planting is 10–12 °C.

The early planted or spring planting window commences in mid-late August in the most northern parts of the state and closes at the end of October on the Liverpool Plains. **Monounsaturated** sunflower (>85% oleic acid) is preferred for spring sowings, but can also be sown in the summer.

The late planting window starts at the beginning of December and finishes at the end of January. **Polyunsaturated** sunflowers (>62% linoleic acid) is best suited to these later plantings so that crops are filling in the cooler autumn months.

Sunflower tolerates light frosts in the early and late stages of growth. It also tolerates high temperatures, except during the critical stages of flowering and seed-filling.

Table 6: *Suggested sowing times for sunflower.*

Region	Early plant												Late plant											
	Aug				Sept				Oct				Nov				Dec				Jan				Feb	
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2
Goondiwindi, Moree, Narrabri	◀	◀	★	★	★	★	★	★	▶	▶							◀	◀	★	★	★	★	★	★	▶	
Gunnedah, Quirindi					◀	◀	★	★	★	★	★	◀	◀				◀	◀	★	★	★	★	★	▶	▶	
Southern irrigation areas										◀	◀	★	★	★	★	★	★	★	★	▶	▶					

◀ Earlier than ideal, but acceptable. ★ Optimum sowing time. ▶ Later than ideal, but acceptable.

Recent NSW DPI experimental work and other information

Sunflower row configuration × population × hybrid – Pine Ridge 2014–15 Northern grains research results 2016 (nsw.gov.au)

The Australian Oilseeds Federation: About AOF - Australian Oilseeds Federation Inc.

Mungbean

Mungbean is a summer legume with the shortest growing season of all the summer growing pulses, flowering approximately 45 days after planting and reaching maturity in 90–120 days. The bulk of the crop is exported for the human consumption market and as such quality is paramount.

Mungbean in Australia consists of two main crop types:

- green seeds called green gram (*Vigna radiata*), the most common species in Australia e.g., varieties Jade$^{\Phi}$, Opal$^{\Phi}$.
- black seeds called black gram (*Vigna mungo*), a minor crop.

The benefits of mungbean

- Short growing season, suited to double cropping
- A legume so can fix N but in low quantities compared with other grain legumes
- Can be grazed if crops fail (good quality, small quantity)
- Moderately resistant to *P. neglectus*; susceptible to *P. thornei*.

Key management issues

- Variety selection should be based on yield, height, disease tolerance (e.g., tan spot, halo blight), grain quality, market opportunities and seed availability

Mungbean: *at Canowindra in January 2021.*

- Avoid paddocks with major variations in soil type or evenness; harvest losses can be as high as 50%. Mungbean prefers well-drained soils with a medium to heavy texture. It does not tolerate soil compaction or waterlogging.
- Avoid sodic soils (ESP >3%) and soils with salinity levels > 2 dS/m in the rooting zone
- Subsoil acidity can also be a problem where the pH_{Ca} is below 4.8
- Inoculate seed with Group I inoculant
- Resistant–moderately resistant to *P. neglectus*; susceptible to *P. thornei*
- Very high dependency on AMF
- Mungbean is sensitive to several residual herbicides including sulfonylurea, triazine and picloram herbicides.
- Mungbean is well suited to no-till situations, planting into standing cereal stubble encourages taller crop growth, increasing the height to the lowest pods and making harvesting easier
- Wide rows (>50 cm) offer more flexibility in planting, weed and insect management, but narrow rows (25– 40 cm) offer yield advantages and greater weed competition
- Narrow row spacing (25–40 cm) has delivered positive yield responses in Jade-AU[Φ] compared with wide (100 cm) row spacing
- Precision planter desirable
- Mungbean is a poor competitor with weeds and there are limited in-crop broadleaf herbicide options
- Be aware of maximum residue levels (MRLs) of pesticides in mungbean, due to its end use in human consumption export markets
- Insect damage can downgrade quality
- Being a relatively small summer crop, more specialised marketing is required
- Critical temperatures for mungbean are a base temperature of 7.5 °C, optimum at 28–30 °C and a maximum temperature of 40 °C. Mungbean is both chilling (cold) and frost sensitive.

Planting time

Mungbean offers 2 planting time options, a spring plant and a summer (main season) plant. Choose a planting time to avoid extreme heat at flowering. Spring-planted mungbean are less exposed to heatwave conditions during flowering and pod fill. Howeverit tends to produce plants with more vegetative biomass. Summer-planted mungbean risks hotter conditions during establishment and flowering and can be at risk of powdery mildew during pod fill. Ensure that soil temperature is at least 15 °C and rising to enable timely germination and vigorous crop establishment.

Table 7: *Suggested sowing times for mungbean*

Region	Early plant								Late plant																	
	Sep				Oct				Nov				Dec				Jan				Feb				Mar	
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2
Goondiwindi, Moree, Narrabri			◀	◀	★	★	★	★	★	★	▶	▶	◀	◀	★	★	★	★	▶	▶						
Gunnedah, Tamworth			◀	◀	★	★	★	★	★	★	▶	▶	◀	★	★	★	★	★	▶							
Warren, Narromine		◀	★	★	▶								◀	★	★	★	★	★	★	★	▶	▶				
Darling Downs				◀	◀	★	★	★	★	★	▶	▶	◀	◀	★	★	★	★	★	▶	▶					
Western Downs			◀	◀	★	★	★	★	★	★	▶	▶	▶	◀	◀	◀	★	★	★	★	▶	▶				
Central Queensland	◀	◀	★	★	★	★	★	★	★	★	★	★	▶	▶	◀	◀	★	★	★	★	★	★	★	★	▶	▶

◀ Earlier than ideal, but acceptable. ★ Optimum sowing time. ▶ Later than ideal, but acceptable.

Recent NSW DPI experimental work and other information

Mungbean and soybean agronomy - time of sowing, row spacing and plant population: findings from combined trial analysis 2013–2018. https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2019/08/mungbean-and-soybean-agronomy-time-of-sowing,-row-spacing-and-plant-population-findings-from-combined-trial-analysis-2013-2018

QDAF Mungbean management guide, 2nd edition. https://www.daf.qld.gov.au/__data/assets/pdf_file/0005/57623/mung-manual2010-LR.pdf

For chemical use permits: Pulse Australia –Crop Protection Products

For variety management packages, Australian Mungbean Association: AMA HOME (mungbean.org.au)

Soybean

Soybean crops are particularly profitable where the grain attains the human consumption quality standard. Significant premiums are paid for grain suitable for these markets. Newer varieties offer a wide range of planting windows in northern NSW from spring (Gwydir$^{\Phi}$), to mid season (Richmond$^{\Phi}$), to mid February on the coast (Hayman$^{\Phi}$).

The benefits of soybean

- Nitrogen fixation: soybean has a very high capacity to fix N compared with other grain legumes. In a well nodulated crop, for each tonne of grain produced approximately 35 kg of plant available N/ha will be left for the following crop or pasture.
- Options to clean up problem grass weeds prevalent in cereals
- Very high protein grain (>40% dry matter basis) with premiums paid for edible quality
- Good crop for IPM: hosts many beneficial insects and effective 'soft' options for most pests
- Rapid stubble breakdown and improved soil structure resulting in improved establishment for following crops or pastures
- Grazing or hay options if the crop fails (good quantity, high feed values).

Key management issues

- Select a variety according to location, disease resistance, maturity, yield potential and suitability for the target market
- Use good quality planting seed. Soybean seeds are relatively short-lived and even that produced under optimum conditions, can lose germination and vigour after a few months in storage.
- Inoculate with Group H inoculant
- Precision planter desirable
- Seed should be planted into moist soil no deeper than 5 cm in dryland situations. Shallower planting (2–3 cm) is preferred in irrigated systems
- Adapted to acid soils and prefer pH_{Ca} levels from 5.2 to 6.5
- Susceptible to *P. thornei*; resistant to *P. neglectus*
- High dependency on AMF
- Soybean is successfully grown on a wide variety of row spacings. In cotton rotations, soybean crops will yield well on a row spacing of 100 cm, but yields are up to 10–20% higher using narrower, 50–75 cm row spacings, and can be higher again in narrow (30 cm) row spacings in high rainfall or irrigated situations.
- In southern NSW, irrigated crops grown on raised beds have been shown to produce higher yields than crops planted on a traditional border check layout
- High demand for nutrients, in particular N, P, K and sulfur (S). A small amount (up to 15 kg N/ha) of starter N can be beneficial in some situations (e.g. high stubble cover) until the N fixing bacteria become established. Zinc deficiency can occur

in heavy grey clays and trace amounts of molybdenum is required in acid soils to ensure nodule function.

- Reduce the risk of phytophthora root and stem rot by using resistant varieties and selecting paddocks with good drainage and a disease-free history
- To maximise grain quality, harvest as soon as grain is mature. This reduces the risk from weather damage or harvest losses from over-dry grain. Soybean seeds have a thin seed coat, making them more susceptible to damage at harvesting and storage. Use belt elevators not augers when handling seed.

Planting time

Table 8: *Recommended planting times for soybean varieties in NSW (updated June 2022).*

Region of NSW	Variety	November				December				January			
		1	2	3	4	1	2	3	4	1	2	3	4
Northern inland – dryland	Gwydir	★	★	★	★	▶							
	Hale, Ivory		◀	★	★	★	★	▶					
Northern inland – irrigation (Macquarie Valley and north)	Gwydir	★	★	★	★	★	▶						
	Richmond, Moonbi, Cowrie, Soya 791, Hale, Ivory		◀	★	★	★	★	★	★	▶			
Northern Tablelands and Slopes	Gwydir, Moonbi, Richmond, Soya 791, Cowrie, Intrepid, Hale. Hayman[1] (silage or hay)	◀	★	★	★	★	▶						
North Coast – Clarence, Richmond and Tweed rivers	Gwydir[2] (see note re spring planting)	★	★	★	★	★	★	▶					
	Moonbi, Soya 791. Hayman (silage or hay)[1]	◀	★	★	★	★	★	▶					
	Cowrie			◀	★	★	▶						
	Zeus, Richmond, Manta				◀	★	★	★	★	▶			
	A6785					◀	★	★	★	▶			
	Poseidon, Surf, New Bunya HB1						◀	★	★	★	▶		
	Hayman (grain)[1]				◀	★	★	★	★	★	★	★	★
Mid North Coast – Manning, Hastings and Macleay rivers	Hayman (silage, hay or grain)[1]	◀	★	★	★	★	★	▶					
	Richmond, Gwydir, Moonbi, Soya 791		◀	★	★	★	▶						
	Zeus				◀	★	★	▶					
	Manta				◀	★	★	★	▶				
	Poseidon					◀	★	★	★	★	▶		
Central West – irrigated	Moonbi, Gwydir, Soya 791		◀	★	★	★	★	▶					
Southern NSW Riverina – irrigated	Burrinjuck, Djakal, Bidgee, Snowy		◀	★	★	★	★	★	▶				

◀ Earlier than ideal. ★ Optimum planting time. ▶ Later than ideal

[1] Hayman(ф) planting times differ depending on the objective of the crop, i.e., forage or grain. Hayman(ф) is slow maturing and therefore, not recommended for grain production on NSW's Northern Tablelands and slopes due to risk of early frost damage before harvest.

[2] Gwydir(ф) is also suited to spring (September/October) planting in frost free areas of NSW North Coast

Soybean: *variety Richmond(P) ready for harvest.*

Recent NSW DPI experimental work and other information

Spring soybean evaluation, Grafton, NSW 2020–21. Northern Research Results 2021 (nsw.gov.au)

Soybean variety evaluation Narrabri, NSW 2019–20. Northern NSW research results 2020 report (nsw.gov.au)

For chemical use permits: Pulse Australia - Crop Protection Products

Cover crops

Growers may consider the option of a summer cover crop for increased ground cover for a number of reasons such as:

- Erosion prevention
- After a low biomass winter crop (e.g, chickpea) leaving little stubble cover
- Wet harvests necessitating tillage and leaving country bare
- Increasing fallow moisture storage
- Use of alternative chemistry to control problem weeds
- To maintain/improve soil organic matter and increase biological activity
- To provide additional N when legumes are utilised as the cover crop.

In the north of NSW, the cover crop of choice is traditionally millet or sorghum, which is sprayed out at ~60 days to allow the soil profile to recharge before the winter crop. Soybean can also provide a high biomass cover crop, which could also be cut for hay or silage.

More information

Cover crops can boost soil water storage and crop yields. https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2019/03/cover-crops-can-boost-soil-water-storage-and-crop-yields#:~:text=Cover%20crops%20in%20the%20northern%20region%20Growers%20typically,to%20provide%20additional%20nitrogen%20when%20legumes%20are%20used

Cotton

This guide does not cover the valid option of dryland cotton as a summer crop. For more information on cotton, head to one of the links below.

https://cottoninfo.com.au/

Raingrown cotton booklet - 23 June.pdf (cottoninfo.com.au)

More information

Further reading

The NSW DPI Summer crop management guide is available at: https://www.dpi.nsw.gov.au/agriculture/broadacre-crops/summer-crops/general-information/summer-crop-management-guide.

Insect and mite control in field crops 2022: Insect and mite control in field crops 2022 (nsw.gov.au)

Good Bug Bad Bug? An identification guide for pest and beneficial insects in summer pulses, soybean, peanut and chickpea: https://thebeatsheet.com.au/wp-content/uploads/2012/04/GoodBadBug-FINALscreen22Feb3.pdf

Summer cropping options to manage root lesion nematodes: https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2016/07/summer-cropping-options-to-manage-root-lesion-nematodes

Weed control in summer crops 2012–13: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/248471/Weed-control-in-summer-crops-2012-13.pdf

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