Broadacre Cropping in Northern Queensland

Savannah Ag Consulting
Northern Cropping Solutions

Queensland Government

The University Of Queensland
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Queensland Alliance for Agriculture and Food Innovation

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Broadacre Cropping in Northern Australia
Newsletter #1, May 2020

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Queensland Government

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Business Cooperative Research Centres Program

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Developing an oilseed industry for Northern Australia

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Project Summary

Oilseed crops, both Summer and Winter have been trialled on a very small scale in Far North Queensland (FNQ), with promising results. This includes but is not limited to; sesame, soybeans, sunflowers, safflower, linseed, canola, mustards and nigella. We are targeting high-value oilseed crops that can be utilised in a range of market segments from whole seed to food-grade vegetable oil , health and wellbeing products and high value industrial applications. With the range of climates and farming systems present in FNQ, oilseeds will play an important role in northern Australian cropping systems as broadacre cropping expands.

Key Messages

- Oilseeds have a good fit in the sugarcane system of northern Queensland. Yield decline is a major issue for long term monoculture crops, oilseeds can offer a cash crop in their own right whilst providing significant benefits in the sugarcane system.

- As the project continues, we will be pursuing opportunities to take commercial production trials to pilot market development. This will assist in our understanding of processing, supply chain and infrastructure requirements.

- Oilseeds can provide a cash crop in their own right, their end use options are diverse. They also play a key role in ensuring profitable and sustainable farming systems for northern Queensland.

What's Next?

When the current round of Summer crop trials, primarily on soybeans and sunflowers wraps up, we will refine our research on the most successful varieties and the key management factors that contribute to increasing productivity. This will be on attributes such as time of sowing, planting density, nutrition as well as pest and disease management.

Our 2020 Winter crop program is underway, and our trials and work have been informed by the results achieved in 2019. Fewer varieties, better soil management and refined planting times and densities should see our small crop and pre-commercial test crops deliver results that gives growers confidence to start to plan future farming systems.

Q&A with Tony Matchett

Questions from the webinar

1 *On the wet tropical coast, what would be the best options for fallow in a sugarcane system?*

Typically, this would be soybeans grown over Summer to suit a last cut of cane, and take advantage of the wet season rains, with a May harvest period. There is strong market demand, and current prices for soybeans are attractive. Whilst being a cash crop in their own right, soybeans and other grain legumes are valuable in fixing atmospheric nitrogen, providing a disease break and providing weed control with alternative chemical control options.

If an extended fallow is being considered, I suggest crops like safflower and sunflower which can fill in gaps seasonally around when the cane is cut. The Summer fallow crops will provide positive cash flow, as well as soil structural improvements through its big root system, breaking soil compaction layers. Safflower can handle some salinity. In all cases, ensure soil pH has been addressed before the rotational crop, targeting a pH of 6 or greater.

2 *When you mentioned you will incorporate an extended fallow rotation, how long roughly do you mean? And will this be for all crops?*

The thinking is an 18 month fallow with up to three to four fallow crops (particularly if irrigation is available). We see this adding significant productivity gains to sugar, and the extra 12-month fallow cycle will be captured back by higher cane yields during the next cane phase.

One example of an extended fallow rotation would start with Summer planting of soybeans, followed by safflower over Winter, a short season Spring mungbean crop, and then depending on location, another Summer crop choice such as sesame or rice before replanting the cane in May. That's four, diverse crops that includes grain legumes and oilseeds which will assist in addressing a range of soil health factors that is important to address to enable sustainable cane productivity.

3 *When you say canola did work, where in the north did it work? Were some sites better than others?*

The Atherton Tablelands area was better than the coastal regions. This was particularly the case where soil pH was more balanced (neutral), and there was lower humidity than the coast. The early-mid maturing types performed the best with an 18-week production cycle. It will work extremely well in even the coolest regions in the north, with less extended frost risk than traditional growing regions.

4 *What are the best oilseed options under irrigation?*

Those likely to best respond to irrigation and generate the highest return per megalitre are sesame, safflower and Brassica carinata. They may also not require full irrigation. Irrigation in a Summer crop scenario ensures crops can be planted at their optimum time, and then allow rain to carry the crop through so there are no planting delays. This would be a great option for planting soybeans in early December if rains were delayed.

5 *To develop a sustainable oilseed industry in northern Australia, what will be the one or two key hurdles that need to be addressed?*

Localised processing and value-adding will significantly contribute to the expansion of the oilseed industry. Not only can higher value goods be created, but the co-product of oil extraction (seed cake) is a valuable protein meal in its own right and would support local livestock feed sectors, including an expanding aquaculture sector. The required supportive infrastructure such as storage and handling must also be developed alongside this production expansion.

6 *Have you any comments on the trends you are seeing in terms of oil quality compared to more traditional oilseed areas?*

We are seeing canola yielding the same as in southern regions in comparable conditions. However the oil content is lower, if the soybean is going to stockfeed this is not such an issue. We have undertaken no research on oil quality, currently we are focussed on canola's fit in the farming system and on ensuring we are exploiting the genetic potential for yield. Sesame has produced oil yields as high as 58%.

7 *Which crops – dryland vs irrigation?*

The Winter and Spring oilseeds will typically require irrigation, particularly on the drier Atherton Tableland areas, to make this commercially viable. The coastal area is more forgiving, but the risk of rain at harvest is higher. All the Summer oilseed options (sesame, soybeans and sunflowers), will be viable in both rainfed and irrigated farming systems.

8 *What do you mean by "full potential of linseed not realised yet?"*

In earlier stages of the trials in 2019, the linseed was not planted early enough and I would like to trial it with an April sowing window as opposed to May. I'd like to test the hypothesis that it wasn't sown densely enough and hence significant yield was potentially lost. We also didn't address the crop's nutritional requirements. It is anticipated that last year 's results can be improved on by 20-30% by addressing these key management practices.

9 *Have you noticed a large difference in phenology across regions (for all the oilseed crops in the different environments)?*

Yes, there is a stark difference between the regions with regards to time to maturity, and there seems to be a location by water interaction too. For instance, the same variety of sunflower planted in the same week in Walkamin and Lakeland will mature 10 days earlier at Lakeland. The implications of this change in days to maturity mean we would need to tweak our rotational crops and timings to address these differences.

10 *Are soybeans also of interest to the protein market or mostly to the oil market?*

Very much the protein market, with a big move to the alternate protein space for humans, and more plant-based proteins and lipids into the aquaculture sector. The oil itself is a minor consideration, we are focussed on yield and protein content.

11 *What is the current and likely future availability of Sunn Hemp seed*

Sunn hemp may be a useful cover crop of the future but is not being considered in this oilseed project. Significant work and private investment are going into local seed production of sunn hemp to supply growers in the future but with some specific challenges.

Savannah Ag Consulting
Northern Cropping Solutions

Developing a broadacre sector in Northern Queensland

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Project Summary

This Department of Agriculture and Fisheries Queensland (DAF) project works with new and existing croppers and the agri-business sector to develop profitable cropping systems and agronomic skills in the northern Gulf. Understanding crop performance variability assists local landholders and potential investors to develop appropriate cropping systems for the region.

A replicated cropping trial site has been established on Forest Home Station. This season, varieties of cotton, mungbean, sesame and soybean have been planted. A rain-grown versus overhead irrigation cotton demonstration is also being evaluated thanks to the support of Ken and Brendan Fry.

This project builds on the past two years of DAF research at Forest Home Station.

Key Messages

- Appropriate timing of seedbed preparation in response to seasonal conditions needed to minimise soil structural damage.
- A delayed wet season start impacted weed management and the optimal timing for crop planting.
- Local grower experience and support has been invaluable in successfully establishing the trial crops and on-farm demonstrations.

What's Next?

The replicated trial crops and demonstration site will be harvested in May-June 2020. Once harvested, the results will be analysed and reported through trial reports, newsletters and future webinars.

The reference group (comprising local landholders, agri-business, local council and project partners) will meet in September to review the 2019-20 trials/demonstration sites, and to plan the trials/demonstration sites for the 2020-21 season.

We are seeking interest from other landholders interested in planting further on-farm cropping demonstration sites next season – please call Lance Pendergast on 0448 601842 for further information.

Q&A with Lance Pendergast

Questions from the webinar

1 *What yields are you targeting this year, for new mung bean varieties?*

The focus this season has been on commercially available mungbean varieties – the target yield is 2.5 t/ha. This is consistent with previous research at Forest Home:

- In the 2017-18 trials, Crystal and Jade-AU yielded in excess of 2.5 t/ha.
- In 2018-19 mungbean lines tested yielded 1.7 to 2.5 t/ha.

2 *How important do you think exclusion fencing is to the success of the crop? Is the cost of this a potential barrier?*

Exclusion fencing is critical for the successful conduct of replicated small scale trials. Commercial broadacre crops vary in their susceptibility to impacts by wild pigs and other pest species. The use of exclusion fencing will be an expensive option for many such crops. Other whole-of farm and regional approaches will be needed to manage the impact of these species locally.

3 *Do you think pigeon pea has a fit in the farming systems in northern Queensland?*

Pigeon pea has historically been used as a refuge crop in the management of *Helicoverpa* resistance in cotton. However, it has the potential as a valuable crop in northern Australia in its own right, once further GxExMxM (genetics, environment, management, markets) research is completed. DAF is currently investigating the crop's potential as part of a sustainable cropping industry for northern Australia.

4 *Your trials this year are focused on irrigation. Do you intend investigating dryland crops as well?*

Yes this year we have focused on irrigating the trial crops grown. This was necessary because of the dry start to the season which delayed establishment of the trial site. It also restricted opportunities to plant raingrown treatments as well. Last season at a different site here on "Forest Home Station" we did plant the four crop types in both irrigated and raingrown configurations. In the next two years we intend planting both irrigated and raingrown treatments of the crops being assessed. This season the Frys have also planted cotton which includes dryland and overhead irrigated areas – we will be assessing the performance of this cotton as well.

5 *You indicated that this is the third year of crop trials on "Forest Home Station". Can you provide any detail on how these trials have gone?*

We have planted varieties of cotton, mungbeans, sesame and soybeans in the 2017-18 and 2018-19 cropping seasons in replicated trials. In 2017-18 the yields achieved were:

- Mungbeans – greater than 2.5 t/ha
- Soybeans – 3.1 to 3.9 t/ha
- Sesame – 1.8 to 2 t/ha
- Cotton – 8.4 to 9.4 bales/ha

In 2018-19 similar yields were achieved, with mungbeans ranging from 1.7 to 2.5 t/ha, and soybeans around 3.4 t/ha.

6 *You indicated that you want to work with co-operators to run on-farm demonstrations in future years. What will this involve?*

We are keen to work with landholders currently cropping or considering cropping. Ideally the growers will have commercial equipment that can be used to run large-scale commercial strip trials. We will work with co-operators to look at crops and agronomic practices of interest to them. We will provide some monitoring of these crops and collect yield data when harvested. If you are interested please contact Lance Pendergast or Graham Harris.

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De-risking broadacre cropping options for North Queensland

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Project Summary

The potential for dryland cropping in Northern Queensland relies on its high though variable rainfall, large areas of productive soils, and the opportunity to add value to the predominant extensive rangeland activities while diversifying farmers' sources of income. However multiple risks need to be managed working in collaboration with farmers and industry.

In a partnership between NQ farmers, Radicle Seeds Australia, Elders, Northern Gulf Resource Management Group, AgForce, and The University of Queensland (UQ-QAAFI), we are:

- identifying best adapted maize, grain, and forage sorghum cultivars, cropping systems and agronomic practices;
- identifying optimum combinations of hybrid characteristics likely to confer adaptation to Northern Queensland environments and markets; and
- communicating project outputs with farmers and agribusinesses.

Key Messages

- The impact of variable rainfall across the region can be managed by maximising rainfall infiltration and moisture retention in the soils.
- Lack of rainfall infiltration through the soil surface is the main constraint limiting soil moisture storage and root exploration.
- Dryland grain sorghum has a key role to play in the region when grown in rotation with pulses, oilseeds, cotton and forage crops.
- Some commercial sorghum hybrids have shown good adaptation, and some of the 40 tested experimental hybrids have shown exceptional performances.

What's Next?

After an extremely dry 2019/20 season, significant amounts of ground cover have been produced at all sites providing an opportunity to restart soil biological processes. Sites have been already selected for the 2020/21 season when trials will be repeated further investigating the effects of ground cover, above and below-ground biomass production, increasing soil organic carbon and enhance soil biological activity on rainfall infiltration and moisture retention.

Q&A with Dr Joe Eyre

Questions from the Webinar

1 *Is the issue seed quality which relates to germination and purity or is it early seedling vigour and vegetative growth you need in sorghum varieties?*

Hybrid seed with high germination rate, rapid emergence and vigorous seedling growth in high soil temperature environments is required. An important issue to consider with seed in northern Queensland might be seed storage. The seed needs to be stored in a cool and dry container, not exposed to sunlight, rain or high temperatures. It is also important to remember that rapid ground cover is only one management tool to protect the soil from rainfall compaction and subsequently reduced infiltration. Complementary technologies such as cultivation, landscape engineering, soil amendments, surface residue management will be required to maximise rainfall harvesting.

2 *I'm interested in sorghum selections suited to the northern region that may be worth including in silage work.*

Biomass samples and/or seeds can be provided for silage research. These trials include five grain sorghum hybrids with enhanced digestibility, two new white grain sorghums and seven forage sorghums.

3 *With regard to reporting moisture infiltration issues due to subsoil constraints; has any work been done for spatial soil characterisation with the likes of Electromagnetic induction?*

We have used EM38 sensors, though more interesting, this last season we acquired a new EM system from DualEM that has the capacity to give EM readings at multiple soil depths and down to 3m. We have a research program calibrating this new instrument and last season we used it in the Gilbert to identify an uniform trial location. We hope to use it more extensively next season.

4 *Has strip tillage been considered as an option to trial for rapid sub soil ripping in narrow seasonal windows when conditions are suitable?*

We are having discussions for the coming season to trial strip tilling at least at one of the sites. The problem we see is that soil ripping in itself is unlikely to provide a permanent solution. The idea is to combine deep ripping with the use of different amendments and soil biology activators, including the use of biochar. Combination of cultivation with landscape engineering, soil amendments, surface residue management and a diverse crop rotation including deep tap rooted crops, is most likely to maximise rainfall harvesting.

5 *What is current best practice land management for soil erosion protection and carbon sequestration?*

Some poorly structured sandy loam soils have very low levels of soil carbon ~0.2% and the region has a very well defined wet and dry and hot seasons. Most of the carbon in these systems were originally in timber with very small values of primary net production or carbon sequestration. Our main objective is to increase primary net production, that is, increase biomass production both above and below ground by promoting rainfall harvesting, carbon sequestration and soil biological activity. We expect that the original low values of carbon in the soil will allow for rapid step increases, over time, the systems is expected to reach a new more positive equilibrium.

6 *What is the role of dryland cropping and cereals in particular across northern Australia's livestock dominated farm businesses?*

In the last 10-15 years, farmers from northern Queensland have incorporated tens of thousands of hectares of rangelands into dryland Summer cereals cropping activities with the objective of diversifying sources of income and adding value to their main rangeland grazing enterprises.

The magnitude of the area indicates that most of this land will need to be managed as a dryland cropping system. In that respect, dryland cropping of Summer cereals like sorghum and maize plays a significant role in producing grain for the local feed industry but also "domesticate" these soils for agriculture. This can be achieved by growing large volumes of biomass and ground covers to stabilise erosive processes, increase levels of soil organic matter, and rainfall infiltration. Dryland cereals are one component of a cropping system that needs to incorporate pulses, oilseeds, and cotton in a diverse rotational system. In short, expect to see the adoption of a wider range of crops to increase the profitability, sustainability and resilience of northern Queensland agriculture.

7 *What are the main constraints to dryland cropping in northern Queensland?*

Constraints are multiple and include soil, climate, biological, labour, logistics, and even policy shortcomings. Soil constraints, primarily sandy loamy soils that have low soil carbon and poor structure limit rainfall infiltration and are prone to erosion. Maintaining ground cover, increasing crop root biomass, and promoting soil biological activity are probably the main issues we need to work on. Soil constraints interact with large, intense and infrequent rainfall events in a highly variable climate. The concept of maximising rainfall harvesting and soil moisture retention is as important in northern Queensland as in the southern dryland cropping environments.

8 *What are the main biological constraints?*

So far, we have managed to control weeds using pre and post emergence herbicides with excellent results. Vertebrate pests (primarily wild pigs, wallabies and birds) can be a problem if the cropping area is small and close to rivers or bush areas. More recently, the discovery of Fall Army Worm has caused significant problems in maize, though it has had a much smaller impact on other crops.

9 *Do we have the varieties needed for the north?*

Even though there are well-adapted sorghum and maize varieties for the central and southern regions across eastern Australia, breeding programs haven't focused on the more specific environments and farmers' needs from Central and northern Queensland. In this project, we are working with two breeding companies interested to develop germplasm better adapted to the dry and hot environments of Central and northern Australia. Our trials this season included 45 different grain sorghum hybrids tested across three sites in northern Queensland. The trials included the most successful commercial hybrids from the southern zone as well as a large array of experimental lines that are expected to perform well across the region.

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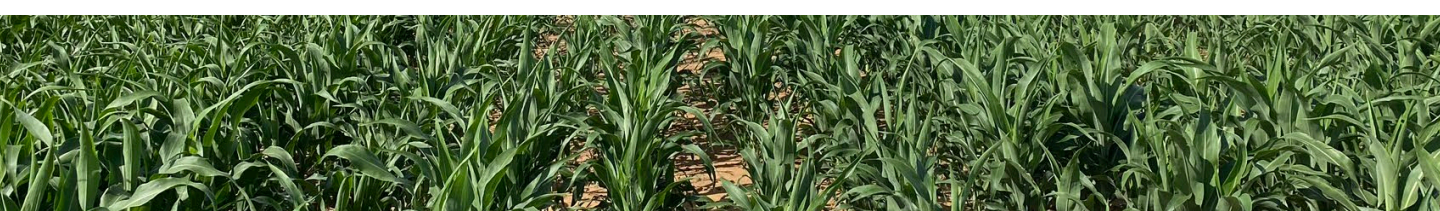

FAQ for Broadacre Cropping in Nothern Australia

1 *Is there a push or desire for the northern industry to reduce the insecticide and herbicide resistance increasing levels and who is going to champion these real problems?*

There is always a strong desire to decrease the use of insecticides and herbicides, not only from an environmental and sustainability point but also to decrease input costs for growers. Increasing resistance to a range of chemicals is a well-recognised problem. One of the champions for minimising the adverse impact of herbicide resistance and crop weeds on Australian cropping is the Australian Herbicide Resistance Initiative (AHRI), you can find out more at https://ahri.uwa.edu.au/

In addition, the GRDC has numerous investments in these areas and to find out more we suggest you contact GRDC directly.

2 *Particularly interested in what the key insect pest problems are looking to be that may limit production, and what the research priorities might be in that regard?*

The identification of Fall Army Worm or *Spodoptera Frugiperda* (FAW) across northern Australia early in the year is likely to be the most significant insect pest problem, primarily to maize growers. FAW will become endemic in tropical Australia. FAW was detected initially in January 2020 in Torres Straights Islands (Lat 9.87° S), and then, 1,000 km south within weeks. By April 2020, infestations were detected 2,000 km south in Central Queensland (23.5° S) as well as in the Northern Territory and Western Australia. Eradication is not a viable option. The likely permanent populations of FAW will be restricted to north of the 'Brisbane Line' (Lat 27.47° S). Many crops are at risk during local outbreaks, while seasonal migratory range could be expected to reach Tasmania (Lat 41.4° S).

Even though the pest is very recent in Australia, a number of chemical controls are available at the DAF FAW portal https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease/fall-armyworm

3 *What is the market access and costs for chosen crops?*

This is a very broad statement, the short answer is it depends, it depends on the crops, area and end-use based on the enterprise mix. However, CRCNA will shortly, post June 2020 publish a report on a baseline study for broadacre cropping across northern Australia. To those subscribed to the mailing list you will be sent a copy of this report. If you are unsure if you are on this list you can subscribe here or email croppingNA@gmail.com. As highlighted elsewhere in the questions, having appropriate supply chain infrastructure in place and investment in the north to enable products to reach markets competitively is a key issue.

4 *What are the likely / anticipated production areas?*

In northern Queensland, the main areas are the Flinders, Mitchell, Gilbert and Burdekin catchments. There will be some smaller areas outside of this, but these are the main broadacre cropping regions where cropping is established or there are opportunities to establish further broadacre cropping.

5 *How much research is being conducted on the viability of wheat cropping in the north?*

There are many reports on wheat viability in northern Australia that may be useful. The focus of the current CRCNA and GRDC projects is on oilseeds, grain legumes and for cereals, the focus has been maize and sorghum. The R&D is driven by growers' needs and industry pull and to date, there has been less interest in growing wheat in northern Australia in comparison to other cereals, such as sorghum and maize. It may be interesting to contact the private wheat breeding companies and gauge their level of interest in investing specifically for northern Australia. Having said that, wheat cropping in Northern Australia is likely to offer some benefits, in particular is likely to be less preferred by pests, and it might be able to grow just on stored soil moisture.

6 *How is Buchanan wheat going?*

Wheat is not a focus of the current CRCNA and GRDC co-funded projects. We suggest you contact the breeder directly, Buchanan is an introduced line from CIMMYT.

7 *Access to labour for not only growers but also researchers to run trials, is this an issue? What suggestions do you have to either address or assist in alleviating this issue?*

Access to skilled labour is a major constraint for farmers across northern Queensland. Travelling distance is one of the biggest issues/cost and can impact trials based on how often you can afford to visit/manage trials. It is very hard to attract and maintain skilled labour and we do not have any easy answers to this. Through these trials, it is hoped that this encourages and generates more interest in cropping in northern Australia and slowly builds some momentum in scale, which will help support further growth in capacity building. CRCNA and GRDC are both interested in building capacity and capability for and in the grains industry.

10 *What do you think is the role of technology (eg drones, smart technology) in cropping in the north? If it's difficult to "get on the crop" because of climatic conditions, can drones assist? Can drones assist in managing pests? What can we learn from international forays in this regard?*

Drones have some role to play supporting research and development activities. UQ-QAAFI and Savannah Ag Consulting uses drones to help with trial monitoring and the applications of insecticides (ULV) and desiccants and other herbicides. The use of drones by farmers is usually limited to their limited fly capacity given the large areas of fields. In most the fly time of most off the shelf drones is limited to a few km and no more than 30'. Though the technology will have value for farmers that crop smaller areas, or need imagery from inaccessible areas. An issue for greater uptake of this technology is how to commercialise and expand when the scale is not there yet.
https://www.facebook.com/pages/category/Agricultural-Service/AgTech-Drones-344083296233792/

11 *What are the agronomical and crop physiological aspects?*

If you could contact us with more detail or a specific research question it would be helpful. For example, what crops, cultivars, in what regions and exactly what aspects? Please email us at croppingNA@gmail.com

A recording of the Webinar can be found:

https://youtu.be/M81_GPcEx40