Australian Native Rice Newsletter

June 2022

Australian Native Rice Newsletter, 2022, Edition 3.

Welcome to our Australian Native Rice Newsletter.

We produce a newsletter two to three times a year to communicate recent research on the commercialisation of Australian native rice. If you have questions, or wish to unsubscribe from the newsletter, please email: nativerice@cdu.edu.au

Acknowledgement of Traditional Owners

We acknowledge the Traditional Owners of the lands where the Australian native rice project team undertake research, and we pay our respects to their Elders past, present and emerging. This includes the Ang Gnarra, Larrakia, Turrbal, Yuggera and Wulna peoples.

Australian native rice project background

In April 2020 we commenced a substantial project investigating the agronomy of Australian native rice. This project aims to lay the foundations for commercialisation of Australian native rice, particularly by Indigenous people and businesses, as a high-value, low-volume, culturally-identified, nutritious food. Our goal is to develop agronomic knowledge about native rices for Indigenous enterprises interested in cultivation and commercialisation of native rices. Australian native rice has potential as a high value product suited for tourism, gourmet food, First Foods and restaurant markets, and value-added products.

The project will:

- Collect samples of wild grown populations of three species of Australian native rice, *Oryza meridionalis, O. rufipogon* and *O. australiensis*, from wetlands in the NT and Queensland, for cultivation trials,
- Investigate the agronomy of native rice using controlled trials to develop and validate optimum approaches to cultivating Australian native rice,
- Scale-up native rice cultivation trials with CRC partner Indigenous enterprises and communities in the NT and Queensland,
- Analyse and compare nutritional values of Australian and Canadian wild rice species,
- Develop new milling techniques for Australian native rice, and
- Apply learnings from the Canadian Indigenous wild rice industry to commercialise Australian native rice as a gourmet/health food/First Food and inputs to nutritional supplements.

You can read more about the project at:

Future Food Systems CRC Website - https://www.futurefoodsystems.com.au/commercialisation-of-native-rice-for-indigenous-enterprise-development-agronomy-and-value-adding/ and the

CDU Project website - https://www.cdu.edu.au/riel/research/australian-native-rice-commercialisation

PhD student Gehan Abdelghany arrival in Darwin (Charles Darwin University)

At Charles Darwin University (CDU), Mrs. Gehan Abdelghany started her PhD journey in March 2020. She has been enrolled externally since then due to travel restrictions related to COVID-19. So we were thrilled when in late December 2021, she made her way from Egypt to Darwin to commence her experimental research work on the agronomy of Australian native rice species (Fig. 1).

This PhD project started with work on two review chapters. The first chapter has been published as a review paper, providing new perspectives on the potential commercialisation of Australian wild *Oryza* species.

Gehan's review article is available via open access publishing at:
Abdelghany, G.; Wurm, P.; Hoang, L.T.M.; Bellairs, S.M. Commercial Cultivation of Australian Wild *Oryza* spp.: A Review and Conceptual Framework for Future Research Needs. *Agronomy* 2022, 12, 42. https://doi.org/10.3390/agronomy12010042

The next chapters of Gehan's PhD project will test different management protocols for the cultivation of Australian native rice species under shade-house settings.

The first of these experiments, investigating effects of variation in planting density on yield, has been established in shade houses at CDU (Fig. 2).

Fig. 1. Gehan Abdelghany (CDU PhD student) at a field trial at Coastal plain Research Station, NT, in March 2022. (Source: Sonam Adhikari Rana).

Fig. 2. Gehan Abdelghany, setting up the planting density experiment at Charles Darwin University nursery. Preparation included preparation of planting tubes of floodplain soil, seedling establishment of two Australian native rice species, and the tanks being prepared and planted. (Source: Gehan Abdelghany, Sean Bellairs).

Integrated Pest Management of native rice grown in shade houses (CDU/NT DITT)

In native rice plants at the CDU nursery trials, there were pests found such as melon aphids, white fly, grasshopper and ginger ants. Ongoing bulking up activities and the 2021 yield trial were affected by aphids and white fly. This occurred during the beginning of wet season (September & October) when the temperatures were increasing and rainfall had started to occur in Darwin. A checklist was created to regularly record any pests, diseases and other observations about rice plant health, and the treatments done to control them.

For aphids and whitefly chemical control was applied by spraying pyrethrum once a week. However, it became less effective and spraying was increased to twice a week. We also found that if spraying was stopped an aphid infestation reoccurred rapidly and in higher numbers. Whitefly was found under the leaves of rice plants. Pyrethrum didn't have much effect on white fly as they flew away to return

a day later. In the shade house we could control the white fly by wiping leaves using strong paper towel moistened with 70% ethanol. Each day all the leaves of all the rice plants were thoroughly checked and wiped using ethanol solution if any white flies were found.

Eventually, biological control was added in the shade houses. Lacewings and lady beetle eggs and adults were bought from a commercial supplier in Queensland (Fig. 3). They were released around the shade house in the ratio of one lady beetle for eight to ten plants with aphids.

Overhead irrigation sprinklers were suspected to be one of the causes of increasing the aphids and white flies, as the water on the inflorescences of the rice plants was keeping the seeds and stems moist which was thought to be causing favourable environment for the aphids and white flies. As well as using biological control, the overhead sprinklers were changed to drippers which helped to reduce the pests. Using this integrated approach (chemical, physical and biological control of pests and irrigation methods) enabled us to manage these pests in our nursery trials.

Fig 3. Releasing the lady beetles in the rice plants at CDU nursery. (Source: Sonam Adhikari Rana).

Bulking up *O. meridionalis, O. rufipogon and O. australiensis* in 2022 (CDU)

The aim of this work is to collect minimum 2000 seeds per cycle, per species per accession of *Oryza meridionalis, O. rufipogon and O. australiensis.* Five shade houses at the CDU Casuarina Campus are being used for this activity. Separate shade houses have been used to grow *O. meridionalis, O. rufipogon* and each of the three accessions of *O. australiensis*.

Black circular tubs 80 cm in diameter have been placed in each shade house (Fig. 4). The pots are kept wet to within about 3 cm of the soil surface. The plants are being grown in 300 mm diameter pots filled to two centimetres below the top of the pot. Two plants per pot have been used. Fertilizer has been applied during seedling stage, one day after planting in pots, during booting stage and during flowering stage. Thrive fertiliser was also applied when growing the seedlings prior to transplanting. Each plant is monitored to detect diseases, disorders, or pest damage.

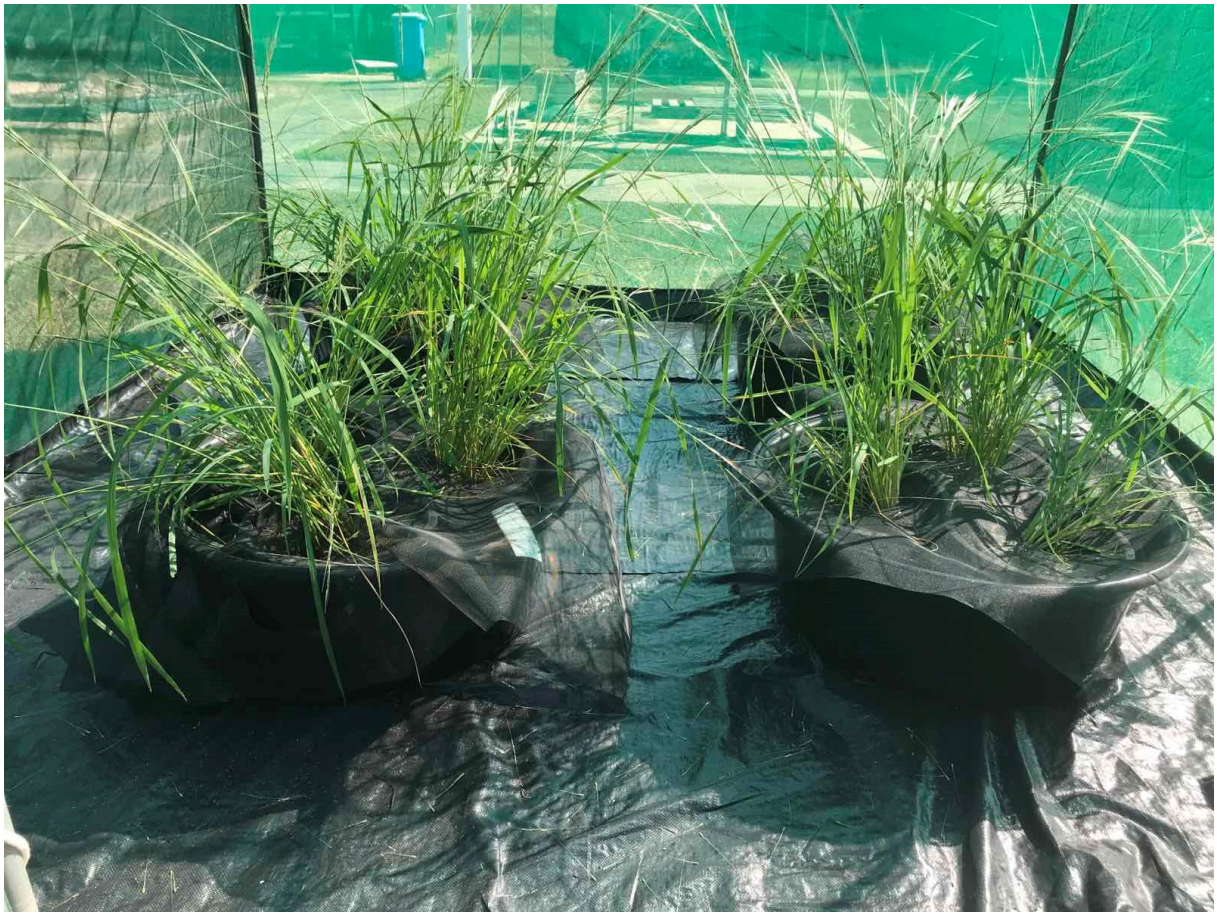

Fig. 4. Bulking up of seeds of *O. meridionalis* in June 2022. Weed mat has been place on the shade house floor and around individual plants to make it easier to collect any fallen seed. (Source: Sonam Adhikari Rana).

Field demonstration trial at Coastal Plains Research Farm (CPRF) (NT DITT/CDU)

Field demonstration plots were established this dry season at the Coastal Plains Research Farm, by Department of Industry, Tourism and Trade (NT DITT) and CDU. So we could create both flooded and non-flooded growing areas, half of the planting area was excavated (Fig. 5), lined with heavy duty pool liner, partially filled with soil and then flooded (Fig.6).

Seedlings were produced at Charles Darwin University nursery. Seeds of the three species were de-husked, cleaned and then incubated for three to seven days in Petri dishes that were lined with filter paper moistened with fungicide solution. When the 2mm long radicles were visible, the germinated seeds were transferred to a larger container in the incubator to give them room to grow a little. When the shoots of these seedlings were 3-4 cm long (measuring from the seed to tip of the leaf) they were planted into approximately 5 cm x 5 cm x 12 cm planting tubes. These seedlings were then taken to the field site and transplanted. At planting, *O. meridionalis* and *O. australiensis* seedlings were 8-15 cm tall and *O. rufipogon* seedlings were 5-8 cm tall (Fig.6). The three species of native rice were planted with 20 cm spacing between plants and rows into 2 m x 2 m plots, including flooded and aerobic plots, at Coastal Plains Research Farm.

Plots were irrigated by sprinklers or filling up the ponds four times a day. Fertilizer was applied before planting and additional nitrogen applied approximately one month and seven weeks after planting.

Fig. 5. Nick Hartley (NT DITT) measuring up a shallow excavation to create flooded demonstration plots, adjacent to irrigated but non-flooded plots. The shallow trench was lined with pond liner and soil placed back on top, prior to flooding and then planting. (Source: Sonam Adhikari Rana)

Fig. 6. Field demonstration area at planting on 7th March at Coastal Plains Research Farm. (Source: Sonam Adhikari Rana).

Fig. 7. Field demonstration area at planting on 13th April, 5 weeks after planting. Coastal Plains Research Farm. Image it taken looking along the three flooded and three unflooded plots. Foreground plots *O. australiensis,* middle plots *O. meridionalis* and far plots *O. rufipogon* plots. (Source: Sonam Adhikari Rana).

Fig. 8. Field demonstration area at planting on 13th May, 9 weeks after planting. Image it taken looking along the three unflooded plots. Foreground plots *O. rufipogon,* middle plots *O. meridionalis* and far plots *O. australiensis*. (Source: Penny Wurm).

Fig. 9. Field demonstration area at planting on 13th May, 9 weeks after planting. Image it taken looking along the three flooded plots. Foreground plots *O. rufipogon,* middle plots *O. meridionalis* and far plots *O. australiensis*. (Source: Penny Wurm).

Establishment was found to be good with very high survival of plants of all species in both plot types. Insect damage to some leaves was obvious for all species. Some possible early signs of rice blast on the stems of *O. australiensis* were noticed. The leaves of the rice plants in the flooded water were possibly a little less green possibly suggesting nutrient uptake issues, which may be due to anaerobic versus aerobic conditions. Tadpoles were present but did not appear to be harming the plants, unlike in some nursery studies.

Samples of several pathogens in the inflorescences of *O. australiensis* inflorescences were collected and are being identified by NT DITT plant pathology team (Fig. 10). We'll keep you posted on what we find.

We also hand collected seed from the site to add to our seed stock (Fig. 11).

Fig. 10. Sonam Adhikari Rana with *O. australiensis* seeds apparently affected by suspected fungus that causes a sticky exudate to coat the seeds and other structures in the inflorescence. Identification currently being determined. (Source: Troy Kippen)

Fig. 11. Ad hoc hand collecting of seed from flooded plots of *O. australiensis*. (Source: Troy Kippen)

Outreach activities

The native rice plots were presented at the Coastal Plains Research Farm information day on 13 May 2022. About 30 people took part, from a number of grower, research and supplier organisations (Fig. 12). Thanks to the NT DITT crew, led by Chelsea Moore, for organising such an enjoyable networking event.

Matt Brann (ABC Country Hour) kindly joined us at Coastal Plains Research Farm in late May to interview us about native rice on site (Fig. 13). For more information about the demonstration planting and project as a whole listen to the interview on ABC NT Country Hour

Fig. 12. Robyn Wing (CDU Team Leader VET Environmental Studies), Sonam Rana, John Grant (CDU VET Horticulture Workplace Assessor) Penny Wurm, Tieneke Trotter (Central Queensland University) and Gehan Abdelghany. (Source Penny Wurm)

Fig 13. Matt Bran (ABC NT Country Hour) interviewing Penny Wurm at the NT DITT Coastal Plains research farm, 25th May 2022. https://www.abc.net.au/radio/programs/nt-country-hour/native-rice-trial-near-humpty-doo/13898684

Yield trial under shade house conditions (Charles Darwin University /NT DITT)

In 2021 a trial was established to estimate the amount of grain produced per square metre for each of the species of native rice, as reported in the last newsletter. The plants were grown in pots standing in small tanks of permanent water (Fig.14).

Seed was collected in mesh baskets and protruded through larger holes in the mesh. This enabled clean grain to be collected when it gradually matured and was shed over six weeks.

The final harvest of the grain was in December 2021 and during 2022 all the grain has been processed and weighed. The plants were also weighed, the number of tillers counted and the number of inflorescences recorded.

Some of the seeds have been used further trials and we anticipate publishing the results later this year.

Fig. 14. The yield trials at the CDU nursery, with the seed catchers in place, and approximately half way through the trial. L-R: Alan Niscioli (NT DITT), Sean Bellairs (CDU), Tony Asis (NT DITT), Alireza Housmanfar (formerly of DITT), Lyn Lowe (CDU volunteer), Sonam Adhikari Rana (CDU). (Source: Penny Wurm)

Further information and next edition

You can read more about the CDU native rice project activities at https://www.cdu.edu.au/riel/research/australian-native-rice-commercialisation

There will be more of a focus on the research activities of other partners in the next newsletter.

To unsubscribe or subscribe to our Australian native rice newsletter, or if you have any questions about the project, please email: nativerice@cdu.edu.au