NORTHERN TERRITORY

DEPARTMENT OF PRIMARY PRODUCTION

DIVISION OF AGRICULTURE & STOCK

RICE RESEARCH AND DEMONSTRATION PROGRAM FOR THE N.T. - A PROTOCOL

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TECHNICAL BULLETIN NO. 50
JUNE 1981

Agdex 116/911

ISSN 0158-2763

"Three farms were set up on the Marrakai Land System adjacent to the Government's Upper Adelaide River Experiment Station.* One was to be a rice farm, the 2nd would have combined rice growing with cattle fattening and the 3rd would have conducted a cattle breeding and fattening operation, utilizing improved pastures.

After 2 seasons, rice production was abandoned, the rice farm shut down and the 2 others reorientated to cattle breeding operations. It is not the purpose of this forum to hold a post-mortem on the pilot farms. Nevertheless, I should like to point out that the results of the scheme were inconclusive; in other words they did not prove or disprove anything. Had we persevered with rice production despite the early failures, we would today be much further down the road towards the establishment of a rice industry in the N.T."

J. MAILATH

[From an address to a public forum, 'Strategies for the Development of Plant and Animal Production in the Wet Monsoonal Areas of the N.T. in the 1980s', held at the Travelodge Motor Hotel 25th March 1981]

*Upper Adelaide River Experiment Station has been subsequently renamed Tortilla Flats Research Farm.

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RICE RESEARCH AND DEMONSTRATION PROGRAM FOR THE N.T. - A PROTOCOL

1. PROPOSAL

It is proposed that existing rice work be expanded into a comprehensive research and demonstration program providing biological and economic information necessary for decision making on the establishment of a full scale rice industry on the Adelaide River.

2. BACKGROUND

There are a number of reasons why this program should be undertaken:-

1. The Adelaide River region has the soil and water resources necessary for the establishment of a rice industry.

   Preliminary estimates by the Conservation Commission indicate that there are approximately 5 000 ha in the Upper and 40 000 ha in the Lower Adelaide River regions suited to rice production. This is more than adequate for a rice industry.

   The region has a high and reliable annual rainfall. This, with some supplementary irrigation from an unregulated Adelaide River, is adequate for a full scale irrigated rice industry of at least 12 000 t per year production. Minor regulation of the river would increase this figure considerably. The possibility of growing rice entirely under natural rainfall also exists. If this is proven, the potential size of a wet season rice industry is limited only by soil resources and yielding ability of the rice.

   With major regulation of the Adelaide River, together with improved drainage of the sub-coastal plains, an intensive 2 season rice industry is possible.

   If the soil and water resources of this region are to be used intensively, rice gives by far the best possibility for doing so.

2. Rice has shown a lot of promise in research work. Mechanically harvested plot yields of up to 7 000 kg/ha in the wet season and 13 000 kg/ha in the dry have been obtained at the Coastal Plains

Research Station (C.P.R.S.), while at the Tortilla Flats Research Farm (T.F.R.F.) bulk areas this wet season produced 3 000 kg/ha of rice despite poor levelling which left large areas with poor or absent plant stands. Hand harvested plots yielded up to 6 000 kg/ha.

The yields obtained in the N.T. are as high as any achieved in the tropical world.

3. Given the N.T. environment, rice has a number of advantages as a crop for the region.

(a) Unlike upland crops, rice forms a stable system in relation to the soil erosion, since the kinetic energy of rainfall is harmlessly dissipated when the soils are flooded. The inherent stability of rice as a crop is borne out by the fact that it has been grown in terraces in quite steep regions for many hundreds of years throughout Asia.

(b) Rice has an advantage over upland crops in that it is possible to store water both above and within the soil profile, and thus is able to withstand extensive periods of drought within the wet season. It is possible to store at least 150 mm of water on top of the soil. This would allow the crop to withstand any likely dry period with no moisture stress, whereas upland crops would experience considerable yield loss in the same circumstances.

(c) A rice industry would be situated close to the port of Darwin which will minimise transport costs both for the export of the finished product and the import of inputs such as fertilizers.

(d) The product is processed. By-products of the milling process (bran, pollard, broken grains, etc.) could by used locally in stockfeed formulations. Nurseries will use significant proportions of the rice husk for their potting mixes.

All this brings with it accompanying benefits in rural employment and diversification.

(e) The relatively high fertilizer usages by the rice crop makes the stubble valuable for grazing in a joint rice/cattle enterprise.

(f) The size of the rice cropping area is relatively small compared with that of rain-grown cereals, so the land is more intensively used. This leads to intensive development and maximum utilization of the soil and water resources of the region.

(g) Once the rice is milled, it has a relatively high value (in the order of $400/t) and so the export costs are relatively low per unit compared, for example, with the coarse grains. This means that exports would be possible with smaller volumes than with the coarse grains where amounts of around 12 000-15 000 t would be needed to create a viable export volume. Thus the problems in making the jump from a small industry, supplying the local market, to the export stage is not as acute with rice as with these other groups.

(h) The existence of a rice mill at Kununurra means that we are not forced to invest in a fully commercial mill immediately an industry is started. This will assist the industry in expanding at a steady rate.

(i) We are close to potential export markets, in Asia for example, in comparison to the NSW industry.

In addition to these advantages, the possibility exists for wet and dry season rice, given water storage. In this case further advantages accrue. For example:-

(a) The unit cost of storage of grain for milling is halved because the silos can be used twice per year.

(b) There is better utilization of machinery, particularly harvesters. The dry season crop would be grown at a time when no other crops are being produced, so there would be minimal pressure on harvesters.

(c) Dry season rice yields are higher than those of the wet which would improve the average annual yield per crop.

(d) The stubble from the dry season crop would give excellent grazing during the normal "horror stretch" in the feed year (i.e. October, November, December).

The above, together, greatly improve the overall economics of the industry.

4. The development of a rice industry would bring benefits to the N.T.

(a) There would be considerable economic development due to the establishment of a rice industry. For example, 12 000 t of paddy rice, the minimum feasible to produce, is worth around $2.5m. If a wet and dry season industry were set up, it is easy to see the value of rice produced as being as high as $20m.

To this must be added the ancillary benefits associated with processing the crop, provision of inputs, servicing and selling of machinery and the like, and the multiplier effect through the economy of all these. Rice would be used as an export earner and so would deliver national benefits.

(b) Since a viable rice industry would have a very considerable demand for fertilizer, there would be significant increases in the bulk imported, which would reduce the unit cost of this product, thus benefitting the whole of the rural industry.

(c) The rural development that would accrue would mean decentralisation away from the capital city which is a good thing in itself and that infrastructure would be developed progressively through the region.

3. OPTIONS FOR INDUSTRY DEVELOPMENT

A range of options exist in relation to development of a rice industry, as follows:-

(a) Rice grown entirely under natural rainfall.
(b) Irrigated rice grown only in the wet season using an unregulated or minimally regulated Adelaide River.
(c) Irrigated wet and dry season rice. This would require major regulation of the Adelaide River if done on a full industry scale. It may be possible for individual farms, which are favourably placed, to store their own water for dry season rice.

All of the above could be done with or without an ancillary animal production enterprise.

The more intensive the option considered, the greater will be the need for infrastructure development, but greater benefits would also be accrued. Obviously a close economic analysis will be needed before a final recommendation can be made on which option should be preferred.

4. PROCEDURES

To provide information on which a decision can be made regarding industry development, a research and demonstration program will be necessary. Because of the potential for rice in both the Upper and the Lower Adelaide River regions, and because of the considerable soil and water differences between the 2 regions, it will be necessary to mount programs at both T.F.R.F. and C.P.R.S.

4.1 Research

Despite the fact that we have enough technical information to grow rice in the region, research is needed to:-

- refine existing recommendations for wet season rice;
- develop new techniques, particularly for wet season crop establishment, that will improve flexibility and reliability of establishment;
- demonstrate and refine agronomic techniques for the dry season;
- develop improved cultivars for wet and dry seasons;
- provide information on how best to handle the bird problem and other potential biological pests;
- quantify the value of rice stubble for animal production and thus assess the place and value of animals in a rice farming system;
- refine information on the soil and water resources of the region;
- design schemes for economic harnessing of water resources for wet and dry season rice; and
- provide economic data on the whole project.

A more detailed statement on proposed D.P.P. research programs is found in appendix 1.

4.2 Demonstration Areas

The setting up of commercial scale demonstration areas is necessary to:-

- test the practical applicability of research results on a commercial scale;
- provide feedback to researchers on practical problems that need further investigation;
- gain accurate data on the costs of growing the crop and yield levels to be expected; and
- provide experience in the handling, storage, processing and selling of rice;

It must be recognised that the demonstration or project farm stage is an integral part of work leading to industry development. It is the link between research and full commercial production, and cannot be ignored.

As the 2 research sites are used, so will 2 demonstration farms be necessary. The undertaking of the project farm phase could be done either by A.D.M.A. or by the D.P.P.

Research and demonstration work would initially commence at T.F.R.F. and then extend to the C.P.R.S. region as soon as resources allow.

5. RESOURCES REQUIRED

An effective research program and the commercial demonstrations as outlined above will both call upon a number and variety of human, physical and financial resources.

5.1 Human Resources

2 Research Agronomists
1 full-time Technical Officer
1 ½ or 3/4 time Technical Assistant

For the 1981/82 wet season we shall need an additional Technical Officer who will be required full-time on varietal improvement programs as the number of introductions increases to several hundred lines.

For trials on stubble grazing to be performed effectively on wet and dry season rice, an Animal Production team consisting of an Animal Production Officer and a Technical Officer as assistant will be necessary.

T.F.R.F. will need in the 1st year:-

- 3 Plant Operators, so that 2 will always be on hand
- 1 Mechanic
- 2 extra Labourers - for approximately 120 days for wet and dry crops

All these are on hand at T.F.R.F. except one Plant Operator and one Mechanic.

These research station requirements will double when C.P.R.S. enters the plan. That station will then have extra requirements above present staff of 2 Plant Operators and one Labourer.

Support staff from Scientic Services and the Economics group will have to be called upon from time to time. The following is estimated:-

Entomologist	- 50%	
Plant Pathologist	- 25%	
Chemistry	- 25%	in year 1,
	50%	in year 2 (technician)
Soil Scientist	- 10%	
Economist	- 20%	

It is possible that the Chief Scientist could fill the role of Soil Scientist.

Co-operation of others outside the D.P.P. will be required to perform special functions, as follows:-

(a) Conservation Commission would be asked to:-
- conduct a soil survey at T.F.R.F.;
- describe more accurately the soil resources of the Adelaide River plains in order to provide a better estimate of the final size of a rice industry and to predict soil problems that would need attention; and
- study the ecology of bird pests in the area with a view to their effective management.

(b) Department of Transport and Works would be asked to:-

- advise on the repair and upgrading of Harrison dam;
- report on the supply of supplementary wet season water for a rice industry at both locations;

- report on the feasibility and costs of supply of dry season water for the experimental project farms and full industry development at both sites; and
- advise on flood mitigation measures.

(c) Consultants will be used as the need arises.

(d) A local farmer might be contracted to grow rice on a project farm basis or someone else may have to be brought in.

5.2 Physical Resources

Upgrading of research facilities will be necessary as follows:-

(a) T.F.R.F.	Cost ($)
Proper levelling and field layout of south-east paddock for small plot research work with good fencing around, efficient channel stops, etc.	21 2000
Proper levelling of all the rice bays - purchase of a Laser system and Carry Grader Leveller is recommended.	39 000
Improved roads to provide access during the wet season for bird control (Transport and Works).	40 000
Sufficient water storage to conduct wet and dry season experimental work, including a semi-commercial area (cost will depend on Department of Transport and Works' recommendation).	cost unknown
Fitting out of a field shed to process threshing of hand harvested materials from varietal improvement programs and also to store a small rice mill.	5 000
Improvement of field laboratory to store and use instruments such as pH meter, conductivity bridge, moisture meter and small grain quality assessment machinery	30 000

Bird proof field cage for small scale variety testing.	9 000
Improvement of existing cool grain storage facilities for rice seed.	2 000
Establishment of suitable workshop facilities (cost depends on final detail).	30 000
Research equipment needed:-	
i) cone seeder (some parts available)	2 000
ii) harvester	30 000
iii) grain cleaner	4 000
iv) weather station	10 000
v) small rice mill	10 000
(b) C.P.R.S.	
Improvements of existing field layout, channels, roads, etc.	10 000
Sufficient water storage for wet and dry season rice experimental work, including the semi-commercial rice area (cost dependent on the Water Resources' recommendation).	cost unknown
Upgrading of the weather station (ideally automatic recording).	10 000
Research equipment needed:-	
i) thresher	5 000
ii) seed cleaner	4 000
iii) cone seeder	3 000
iv) transplanter and tractor	11 000
Cost of setting up 2 project farms may also be involved.	cost unknown

6. SUMMARY OF D.P.P. RESOURCES REQUIRED IN EXCESS OF PRESENT ALLOCATIONS.

Of the resources listed, some are available within present staff and financial allocations. Others will require extra funding. These are listed below:

(i) Human Resources

1 Animal Production Officer
2 Technical Officers (1 rice breeding, 1 animal production)
1 Plant Operator, T.F.R.F.
1 Mechanic, T.F.R.F.
2 Plant Operators, C.P.R.S. (1982/83 Wet season)
1 Labourer, C.P.R.S. (1982/83 Wet season)

(ii) Material and Financial

Vehicles and other on costs for extra staff	cost unkown
Transplanter	11 000
Laser Leveller purchase	59 000
Water storage, wet and dry season, T.F.R.F.	cost unknown
Extensions to T.F.R.F. laboratory	30 000
Establishment of workshop, T.F.R.F.	30 000
Small rice mill, T.F.R.F.	10 000
Water storage, C.P.R.S.	cost unknown
Weather station, C.P.R.S.	10 000
Research equipment, C.P.R.S. 1982/85 (thresher, seed cleaner, cone seeder)	12 000
Cost of 2 project farms, one at T.F.R.F. and one at C.P.R.S. may need to be found.	cost unknown

FINAL COSTING

It is impossible at this stage to give an accurate total costing of the program, due to:-

(a) lack of knowledge of resources to be committed from other Departments.

(b) lack of information on many capital programs, especially water supplies.

(c) the fluid state of the project farms aspect. We do not know whether they will be controlled by D.P.P. or A.D.M.A., or whether sited on land partly developed or undeveloped for rice at this stage.

7. APPROVAL

Early approval is sought for those aspects of the program which the D.P.P. can fully control and cost. (This includes the direct and station rice research work).

Negotiations with other Departments leading to the finalisation of this proposal should also be undertaken.

D.R. AIREY

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N.R. DASARI

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D.P. DROVER

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N. WILLIAMS

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APPENDIX 1

D.P.P. RICE RESEARCH AND DEVELOPMENT PROGRAM

A quite considerable body of knowledge already exists from research previously undertaken by C.S.I.R.O. and the Department of Primary Production, and recent attempts have demonstrated that good crops can be achieved on a semi commercial scale.

Based on this information and experience further research is proposed in order to improve the efficiency of rice production.

The following are some of the more important research priorities.

a. Varietal Improvement

Further yield increases can be obtained by planting suitable and well adapted varieties. Varietal improvement also enables us to grow varieties which are more tolerant to insects, diseases and adverse soil conditions. For these reasons we will need to give top priority to selecting a number of varieties suitable for the local environmental conditions (including soil, water and quality requirements).

In the absence of feedback from markets, we are aiming to produce long, slender grain types that have good appearance and cooking qualities. These understandably yield slightly less than some other grain types, but because of their high demand in international trade, will be a good start to break into this competitive area. It will, however, be most useful to involve our marketing agencies and request them to do some research into available markets and their requirements so that our research objectives for varietal improvement can be altered accordingly.

(b) Crop Establishment

Plantings for the wet season rice crop will have to be completed between mid-December and the first week of January in the absence of irrigation facilities. This limited time for planting makes it important to improve and diversify seeding techniques. At the present time we have only dry seeding techniques available for commercial practises.

While these have proved adequate at T.F.R.F. in the past, the development of alternatives will give very useful flexibility at planting time, enabling harvest time also to be spread out, thus minimising sun checking.

Possible approaches are:-

- minimum tillage;
- mud sowing;
- water seeding; or
- mechanical transplanting.

Each of these will be investigated to a greater or lesser extent.

Associated projects on soil trafficability and seed manipulation will also be necessary.

c. Efficient Use of Fertilizers

Fertilizer costs are a major component of crop budgets and any improvement in their usage will result in a direct benefit for the farmers. Experience indicates that soils at T.F.R.F. and C.P.R.S. are deficient in nitrogen and therefore require fertilizer nitrogen addition. We intend to study the response curve for nitrogen at these locations and optimise fertilizer use through appropriate application times when crop usage will be maximum. We will also examine the requirement for phosphatic fertilizers and their residual efficiencies at these locations. In addition to these 2 nutrients, tests will be carried out to identify future nutritional problems.

d. Efficient Use of Herbicides

Next to the cost of fertilizers, herbicides take a large proportion of the budget required every season. We intend to screen new chemicals to identify cheaper and more effective chemicals. We will also examine the weed ecology and synergistic effects of chemicals to control various weed species.

e. Efficient Use of Insecticides

During the wet season, rice stem borer is a major insect pest, warranting control and thus increasing the cost of growing the crop. We intend to introduce varieties that are more tolerant to this insect and also adjust our cultural practices so that we can minimize chemical usage, producing direct savings. On the chemical control side, we intend to screen newer, more effective and cheaper chemicals for future usage.

f. Cultural Practises

We intend to improve cultural practises of rice crops which can increase the yield or sustain high yield potential. These will include water management, time of planting (and therefore harvesting times), etc. We will also examine alternate systems such as "ratoon cropping" to increase water use efficiency.

g. Quality Assessment

Quality of produce is very important when trading on world markets, especially when there is a surplus of rice in occasional years. We intend to learn as much about quality as possible, as affected by cultural, environmental, harvesting, milling and storage conditions.

h. Lowland Rice under Natural Rainfall

There is significant evidence pointing to the fact that lowland rice could be grown in the N.T. under natural rainfall and still produce yields approaching those of irrigated rice. Since such a system would be a cheap means of growing the crop, it is planned to set up a demonstration plot using this practice at T.F.R.F.

i. Upland Rice

There are some areas suitable for upland rice in the general rice areas of the upper Adelaide River region. Though this is of low priority, upland rice may supplement an existing irrigated/rain-fed lowland rice industry at some future time.

j. Alternate Crops

Suitability of upland crops, including some legumes, during the dry season will need to be assessed. We will have to investigate and formulate suitable crop rotation programs for rice. If a grain/pasture legume is rotated with rice, there may be further benefits in terms of nitrogen nutrition.