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North Australia Research Bulletin

TWO NORTH AUSTRALIAN CROPPING STUDIES

June B. Bauer
W.S. Mollah

BULLETIN NO. 7

December 1980

TWO NORTH AUSTRALIAN CROPPING STUDIES



Map of Australia showing areas in which NARU has interest

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JUNE B. BAUER AND W.S. MOLLAH

The North Australia Research Unit
The Australian National University
Darwin, December, 1980

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EDITOR'S PREFACE

It is indeed gratifying to us of NARU to see in print the tangible results of our first and continuing research project. Readers will note that these two North Australian Cropping Studies carry the numbers II and III and well may wonder: "Where is No. 1?" It was Dr P.J. Skerman's monograph on cropping in western Queensland which appeared as Bulletin 2 of this series, before we had got around to deciding on a general title to cover the series of publications to come from the project.

June Bauer began her research into Darwin's Botanic Gardens in preparation for their centenary, planned for 1979. She soon found that that year was either too late or too early for such an observance to be strictly accurate, but this proved to be beside the point, for it was held anyhow, thus initiating another minor historical myth. The Gardens have played a major role in plant introduction and promotion of horticulture in the Territory and its story is in many ways typical of a Territory institution.

Wayne Mollah's account of the first of the large-scale sorghum developments in the Territory gives chapter and verse of how Texan oilmen turned farmers came to grief at the hands of the northern environment and bad luck. It makes fascinating, if discouraging, reading. The fact that the cycle may have begun all over again in Western Australia gives his account added piquancy.

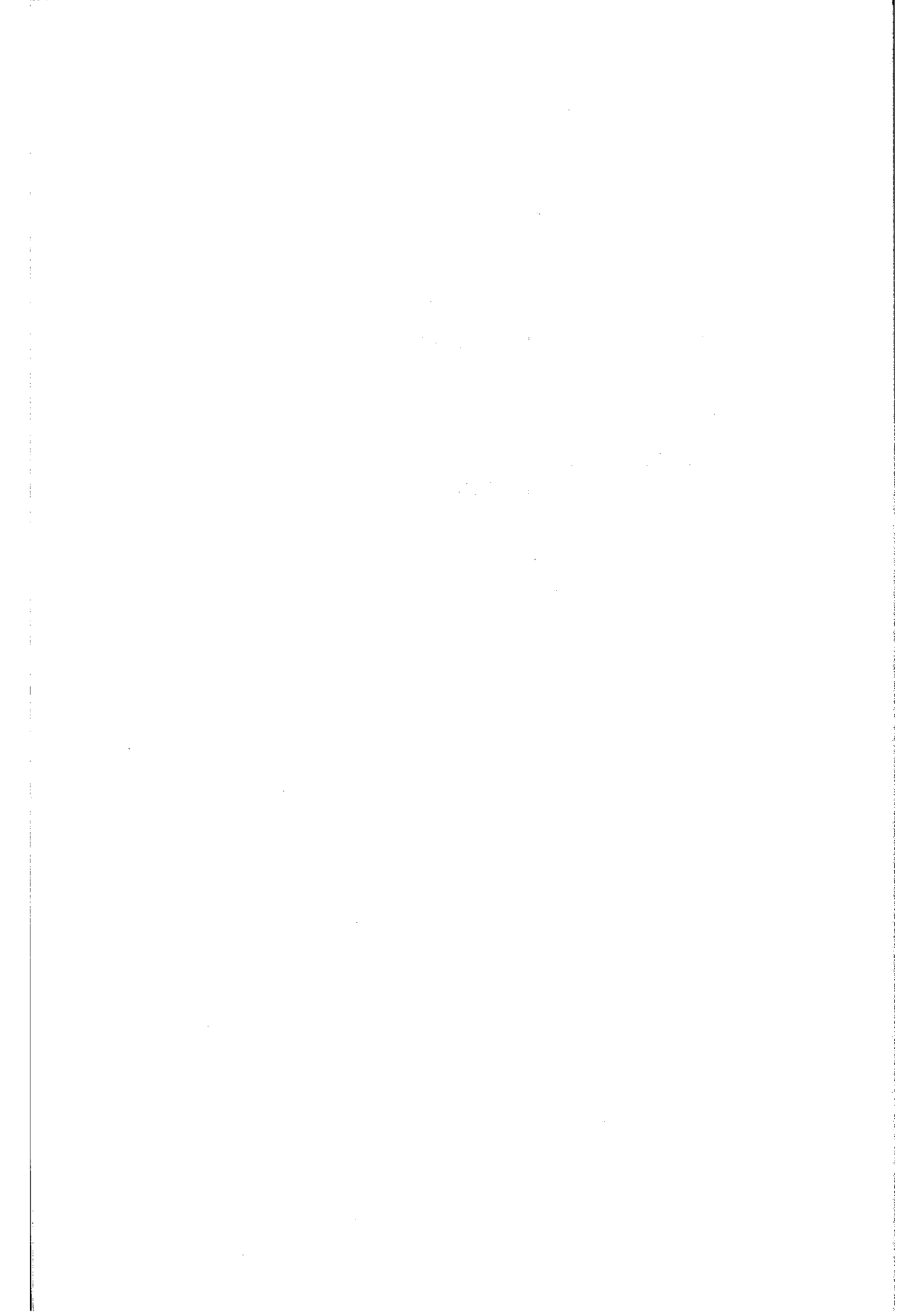
F.H. BAUER

Editor

NORTH AUSTRALIAN CROPPING STUDIES, II.

SOME OTHER EDEN: A HISTORY OF THE
DARWIN BOTANIC GARDEN

June B. Bauer



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ABBREVIATIONS

AA	Australian Archives, Canberra
CPP	Commonwealth Parliamentary Papers
<i>N.T.T.G.G.</i>	<i>Northern Territory Times and Government Gazette</i>
SAA	South Australian Archives
SAPP	South Australian Parliamentary Papers
VPHASA	Votes and Proceedings, House of Assembly, South Australia

SOME OTHER EDEN: A HISTORY OF THE
DARWIN BOTANIC GARDEN

The history of sustained cultivated agriculture in the Top End goes back as far as the establishment of the first permanent settlement. The Surveyor-General of South Australia, G.W. Goyder, arrived in Port Darwin on 5 February 1869 to found Palmerston, destined to become the first permanent town in the Territory, and within a week of his arrival the first official Garden was planted. Largely because it made sense to make the new settlement as self-sufficient as possible, the expedition included in its company an official Naturalist, Frederick Schultze, who brought a variety of vegetable seeds, including tomatoes, cucumber, peas, kidney beans, pumpkin and onion, to name but a few.¹ Also in the party was one William B. Hayes, who planted the seeds and established the first garden.

This Garden was originally referred to as "the Garden," but later was referred to variously as the Experimental Garden, the Government Garden, the Experimental Nursery, the Government Nursery, the Botanical Garden and the Botanic Garden. These terms were used interchangeably, in official documents, until the 1890s, when the term Botanic Garden was used exclusively. The first Garden lay on the foreshore of Frances Bay, close under the slope leading up to the Tableland, between Fort Hill (now levelled) and

¹SAA-790/1868/4.

Stokes Hill, about where Kitchener Street starts up from the wharf area (see Map 1).¹ Before Goyder left the new settlement in May 1869 Hayes asked to be put on the permanent staff, and when approval was granted he became the Territory's first official Gardener.²

Hayes did his work as Gardener well, and when Captain H.B. Douglas, the first Government Resident, arrived on 24 June 1870 he found the garden in good shape. He was impressed by the growth of bananas, tamarind, tapioca, coconut and other trees and plants. He had brought with him plants, canes and seeds supplied by the Botanic Gardens at Brisbane, and planted half the canes at Doctor's Gully, about one mile north-west of the Camp, and the other half at what was known as the Paper Bark Swamp, north of Doctor's Gully.³ Later on some plants were brought from the abortive settlement at Escape Cliffs.⁴ The three gardens did well, and their produce, mostly fruit and vegetables, was for the consumption of the men in the camp. It was, in fact, essentially a subsistence garden.

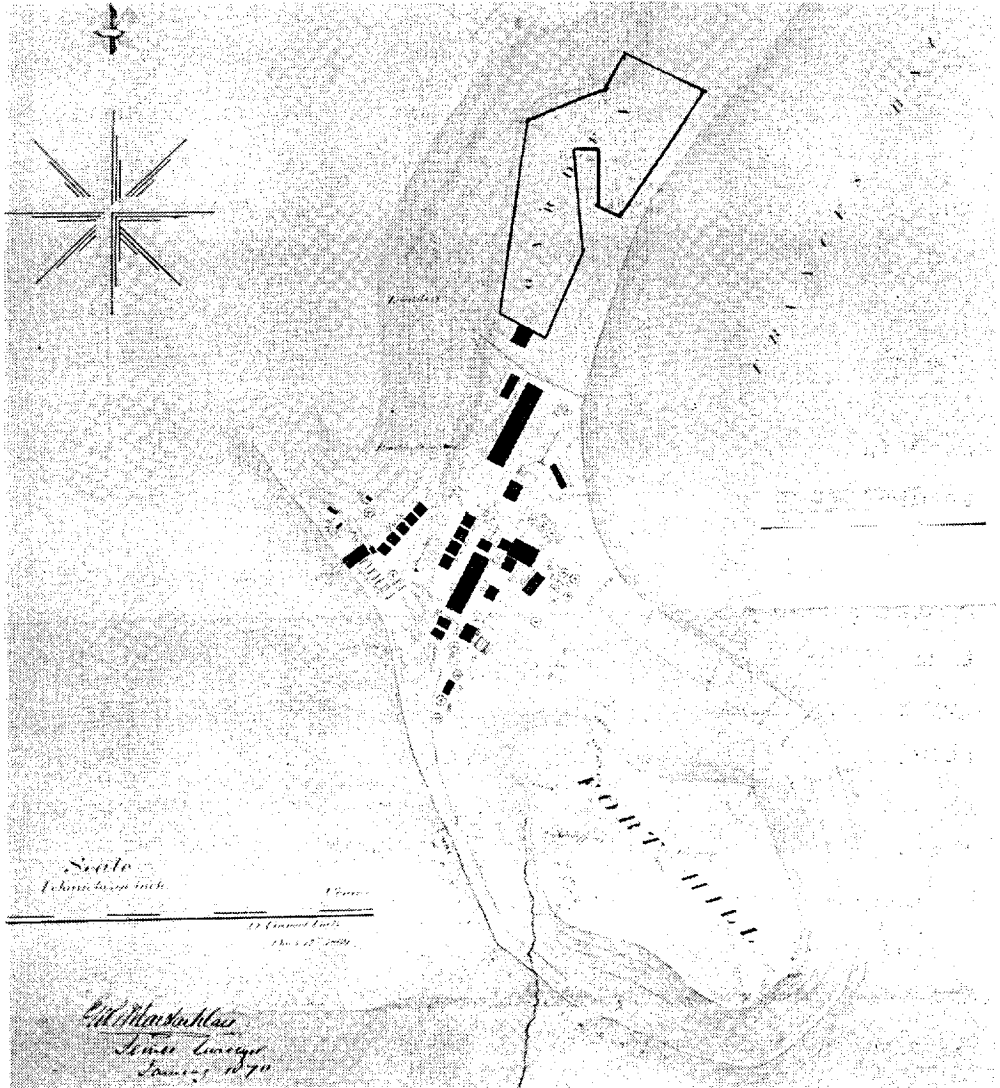
In August 1870 Mr A.F. Lindsay moved in the Legislative Assembly of South Australia that the Government take steps to establish an experimental plantation, to ascertain the capabilities of soil and climate in the Northern Territory

¹AA-CP811/1, item 66. The original of this map was drawn by D. Daniel Daly in December 1869 and shows Goyder's main camp in such fine detail that reduction to the page size of this journal was impossible. So far as is known the map has not been previously published. Approx. scale: 3½ ch./inch.

²SAA-790/1869/94.

³SAA-790/1870/81.

⁴SAA-790/1870/92.



MAP 1

with a view to growing "sugar, cotton, and other tropical productions." While the record of the debate indicates that all Members were willing to concede the sense of the proposal, the motion was lost, simply because there were insufficient funds.¹ This plea of "insufficient funds" was to be a recurring theme throughout the history of the Gardens and they were always low on the list of priorities when Government Estimates were drawn up. In 1871, however, money was found, and the first *experimental* garden was established, in August of that year, on six acres of ground about a mile from the Telegraph Station; the exact location is today uncertain. Hayes was appointed Government Gardener of the new garden.²

In spite of the fact that it was intended as an experimental garden, its main purpose continued to be the production of fruit and vegetables, as Hayes put it, "for the government and sick people."³ The Government Architect in Palmerston, Mr J.G. Knight, noted that while it was not ornamental, it promised to be exceedingly useful.⁴ Hayes was assisted by two coolies, Chinese labourers who had come into Palmerston from the goldfields.⁵ This practice was continued, with numbers varying from the original two to as many as a score or more. The aborigines were by this time becoming a nuisance for they had become adept at stealing

¹VPHASA, 1870-71:23.

²SAA-790/1874/137.

³*ibid.*

⁴*ibid.*

⁵*ibid.*, p.511.

the young vegetables, particularly sweet potatoes.¹

The local residents, however, were not all happy about the administration of the gardens. The private sector, which was growing by this time, resented the fact that government officers were the chief beneficiaries of Hayes' efforts. In March 1875 there was a move by the District (i.e. Town) Council, spearheaded by Mr R.H. Fiveash, to take control of the Garden. They felt that the produce should be distributed to *all* residents of Palmerston, not just government officers. Moreover, they felt strongly that the Garden should be more than just a vegetable plot--it should be used for experiment and recreation. As the editor of the *Northern Territory Times and Government Gazette* pointed out, however, the Council really did not have the funds necessary to employ a gardener, to say nothing of the other expenses involved.² Still, argument continued, and over a year later the Government Resident, G.B. Scott, reported to South Australia that Hayes was supplying the public with all the plants they needed, as well as a share of the produce. The Minister replied that the more fruit and vegetables raised the better, as long as they were freely distributed among the officers!³ Moreover, the Government Resident, G.B. Scott, reported that he had ordered sweet potatoes and other vegetables planted at the Garden, "to avoid the importation of further supplies of Chinese vegetables."⁴

¹*N.T.T.G.G.*, 5.6.1874.

²*ibid.*, 6.3.1875; 13.3.1875.

³SAA-790/1876/86, Minute dated 27.3.1876.

⁴SAA-790/1875/602.

In fact, Hayes *was* experimenting, and doing more than raising fruit and vegetables. In April 1876 samples of indigo and a fibre made from "the grass used for grass-cloth" (*Bohmeria nivea*) were sent south for expert opinions on their quality. Neither was considered to be of commercial quality, which was not surprising considering that Hayes had to process both plants by hand, and had no real knowledge of how to do so; but at least this proved that Hayes was concerned with establishing plants which might be commercially successful.¹ In addition to these crops, of course, he was still growing sugar-cane.

Even with vegetable-growing he had problems with the South Australian bureaucracy. It was his custom to requisition all his seeds from Adelaide, but in October 1876, when the list of seeds for the following year was submitted, the Minister of Agriculture and Education, who was also responsible for the Northern Territory, pointed out that a great deal of time--and, it goes without saying, money--would be saved if Hayes kept seed each year for replanting purposes. Hayes, supported by the Government Resident, insisted that seeds from a cooler climate were better stock. He won his point; his seeds continued to be sent from the South, and the Garden continued to do well.²

In January 1877 the editor of the *Northern Territory Times and Government Gazette* visited the Garden and was very much impressed, noting that it was a credit to the Gardener. There were about nine acres of gardens, of which three were under sweet potatoes, "so that in future the civil servants

¹SAA-790/1876/213, 214, 264, 268, 382, 476; SAA-790/1877/30.

²SAA-790/1876/436.

need fear no lack of this vegetable." He saw other fruits and vegetables, too, all of which appeared to be thriving. He went on to state that, in his opinion, the Garden was a success as an *experiment*.¹

Nevertheless, in May 1878 Government Resident Price wrote to the Minister that the Garden needed "a fair botanist and florist," because while Hayes was an old Government servant he was not trained, and lacked "skill and perseverance." To criticize Hayes for lack of perseverance seems extraordinary--he had persevered for ten years, trying to grow temperate climate vegetables such as lettuce in a tropical situation, with a fair degree of success. It seems even more remarkable when Price's next statement was that there were plenty of fruit and vegetables for distribution. As Government Resident, however, he felt that to extend the usefulness of the Garden a Head Gardener should be sent up from Adelaide. Hayes could then be kept on as an assistant, drawing his existing salary of 10/- a day, with 3/- a day ration allowance and a two-roomed stone cottage. If the proposed expenditure were considered too high, however, Hayes' services could be dispensed with and coolies used in his place--obviously, in 1878 tenure of position was a sometime thing.²

On 18 June, Hayes himself solved the problem: he died.³ The Government was then faced with the problem of replacing him. The Director of the Botanic Garden in Adelaide, Dr Schomburgk, strongly recommended one Angus McDonald, whose

¹N.T.T.G.G., 27.1.1877.

²SAA-790/1878/301.

³SAA-790/1878/346.

"qualifications as an experienced gardener are known throughout the Colony," by which, of course, he meant South Australia, and it did not necessarily follow that McDonald was experienced in tropical horticulture. McDonald seems, however, to have cooked his own goose as far as the appointment was concerned, although the Government came close to giving him the position. The difficulty was that he wanted a salary of £200 a year, 3/- a day ration allowance, plus a house for his wife and children--Hayes' two-roomed cottage at the Garden was not large enough.¹ On the other hand, there was an applicant in Palmerston who was willing to work for the same salary as Hayes had drawn--and he had his own house. This was Maurice Holtze, and he became the successful applicant on 16 July 1878.²

At the time of his appointment as Government Gardener Holtze was a guard at the Gaol. Born in Hanover in 1840, Holtze was certainly well-trained in temperate land horticulture. He was a graduate of the school at St Petersburg, now the Komorov Institute at Leningrad, still a leading botanical centre in the USSR. According to the information he supplied to the Government Resident in his application for the position, he had served four years as an assistant in the gardens at Hildesheim, followed by three years in a nursery at Hanover. Apparently he was efficient, because he was then given an appointment as First Class Assistant at the Herrenhausen Royal Garden, near Hanover. In 1872 he brought his wife and children to Australia, settling in

¹SAA-790/1878/366.

²SAA-790/1878/422.

Palmerston, where he obtained land near the present Berrimah Farm.¹

His appointment as Gardener, however, was for a trial period of a year. The *Northern Territory Times and Government Gazette*, announcing the name of the new appointee, hoped that at the end of the year's trial he would have shown "such proof of his ability as will enable him to hold the appointment with honor to himself," but reminded him that, if he were not to prove satisfactory, his imperfections would not be "glossed over!"² A month later, in August 1878, the paper was complaining that the site of the Garden was the wrong one: the soil was most poor, water was inadequate and the exposure was useless for crops such as tea and tobacco.³ Moreover, as the editor noted in October, there was not much research going on:

A cottager's small garden usually contains more specimen plants than [the Garden], as we include cabbage and potatoes among our noble specimens.⁴

Holtze was not satisfied with the position either. He made some improvements, such as "rustic seats" for the public to use while admiring the view (such as it was), new plantings of bananas and ornamental shrubs around the old cottage, and a new plant house.⁵ But he, too, wanted a new site, and in March 1879 Holtze, in company with the Government Resident (Price), the Supervisor of Works (McMinn) and

¹SAA-790/1878/353.

²*N.T.T.G.G.*, 20.7.1878.

³*ibid.*, 17.8.1878.

⁴*ibid.*, 12.10.1878.

⁵*ibid.*, 4.1.1879.

William Owsten, a Melbourne entrepreneur who planned to grow sugar-cane in the Territory, selected a site at Fannie Bay¹ (see Map 2). The newspaper described it as

About 30 acres of land at Fanny Bay...including portion of the Overland Telegraph maize paddock. It has rich black and chocolate soil with loamy marl substratum.²

The site chosen was covered with dense tropical jungle, and the first task was clearing. For this purpose some 350 Chinese, who had come to Palmerston from the goldfields seeking relief work, were employed at 1/- a day. Seven wells were sunk and by September 1879 clearing and trenching were completed.³ Within weeks, however, it was obvious that the Gardener would have to live on the new site; on 30 October the Government Resident sent the following telegram to the Minister:

Relative experimental nursery it is absolutely necessary for safety of plants that Gardener should reside on ground otherwise Chinese will steal the plants.

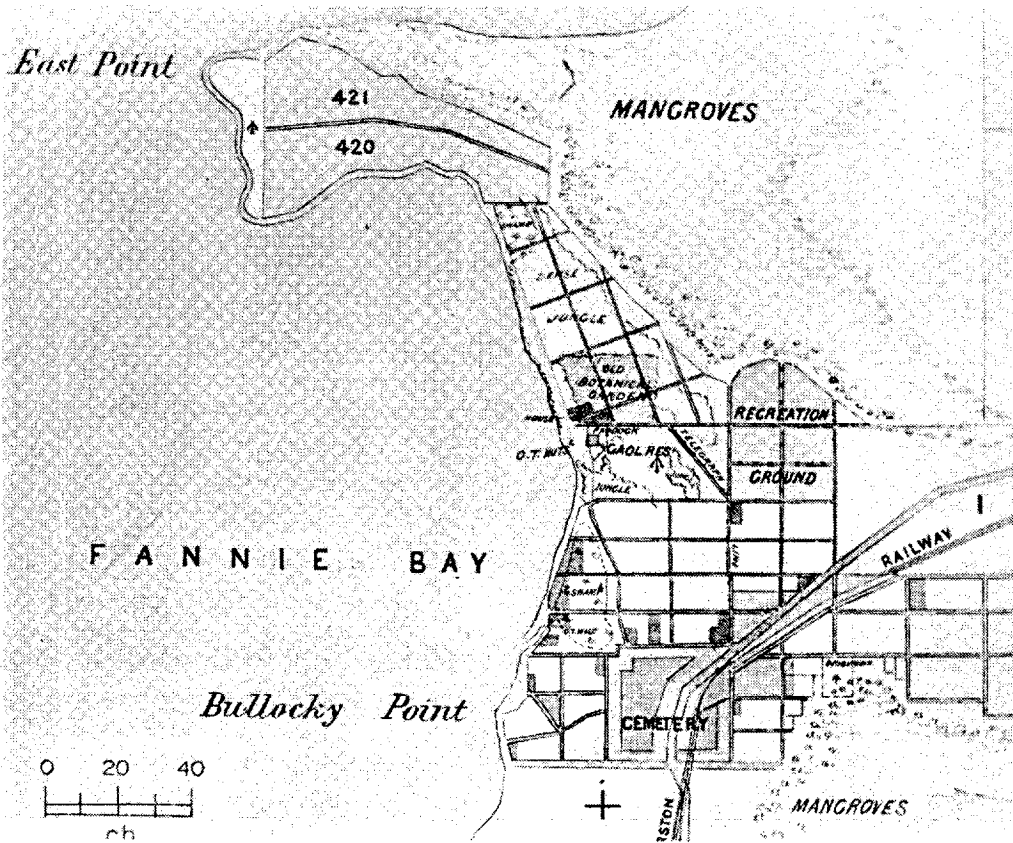
Accordingly, permission was given for a house to be built.⁴

¹SAA-790/1879/161; AA-CP811/1, item $\frac{NT}{MS} \frac{R}{129C}$. The portion of this map shown is the only direct evidence discovered which indicates the location of this, the first (1879) garden at Fannie Bay. The map bears no title but is described in the Australian Archives Accession note as "Plan of Port Darwin & Palmerston, c. 1890." The garden occupied land now a residential area directly north of the former Fannie Bay Gaol.

²N.T.T.G.G., 19.4.1879.

³SAA-790/1879/261, 229, 219, 420; SAA-790/1880/161.

⁴SAA-790/1879/488.



MAP 2

Planting commenced on 1 November; almost the whole thirty acres were planted, but lack of rain meant that much was lost and had to be replanted.¹ By March 1880, however, things were well under way and Holtze reported everything was doing well, including arrowroot, cotton, sesamoil and several tropical fruit trees. In fact, in May 1880 the newspaper could report that Holtze had won a Gold Medal at the Sydney Exhibition with his cotton.² Holtze noted, however, that he had not been able to do much in the way of work with ornamentals, because he had no assistant.³

At the same time he was experimenting with vegetable oils. He produced both sesame and ground nut (peanut) oil, the latter, according to the newspaper, "very clear and tasteless."⁴ In 1970 Holtze's daughter, then almost 100 years old, remembered that her father had pressed the oil using his wife's mangle! Nor were oils the only success he was having.

In March 1881 Government Resident Price noted:

The following tropical plants may be looked on as a most perfect success:- Sugar, cotton, rice, maize, jute, tobacco, ground nut, sesame, indigo, grass-cloth, arrowroot.

Indeed, he was convinced that in time the soil and climate of the Territory would prove more than adequate for "many other valuable tropical plants," an opinion shared by Holtze. Price contended, as well he might, that this was

¹SAA-790/1880/43.

²N.T.T.G.G., 1.5.1880.

³SAA-790/1880/161.

⁴N.T.T.G.G., 14.8.1880.

"not a bad list in eighteen months, which is just the time that has elapsed since the first plant was put in [the new Garden]." Further, both Price and Holtze were convinced that the Territory was on the verge of a booming sugar industry. By April 1881 approximately 100,000 acres had been taken up by southern investors interested in sugar and Price had asked Holtze to concentrate on sugar-cane for planting material; as a result 500 tons were available for that purpose.¹ Both admitted that this was far more than would be needed locally, but hoped that it would encourage some of the companies to hurry and get planting done by October. On 16 September 1880 the cane at the Fannie Bay Garden was tested with a saccharometer and the result, as reported by Price, "was beyond all expectation and proves not only that the Territory can grow cane, but...of extra high density."²

While the Garden seemed to be progressing satisfactorily, according to the newspaper there were still problems. On 2 July 1881 the following item appeared: "The amiable Government Gardener is eaten out of house and home by casual visitors. Why doesn't someone put up a regular pub at Fannie Bay?" Three weeks later there was another item on the Garden, this time noting that it was, certainly, a Garden "that South Australia might feel proud of." On the one hand, the reporter somewhat prematurely noted, the white ant problem had been solved by "perseverance and activity;" on the other hand, kangaroos were a pest and the Gardener was going to have to ask local sportsmen at the "rising of the coming moon" to come and shoot 'roos for him. This, it was

¹SAPP 33/1881.

²SAA-790/1880/496, 646.

facetiously suggested, would at least provide a change of diet, for "...men cannot always live on beef and mutton."¹

In spite of such difficulties, however, Holtze was making progress with sugar-cane growing. While producing ample supplies of planting stock for southern investors who might be induced to establish plantations in the Territory, by August 1881 it was obvious that there would be a surplus available for crushing in that year. The DeLissa Pioneer Sugar Company, which had erected a mill on Cox Peninsula earlier in 1881, offered to crush any such surplus. After much discussion, the Government accepted the offer, but the result was a fiasco. On the day of crushing there was insufficient steam power available at the mill and only nine tons, out of the thirty sent, were, in fact, crushed. As Government Resident Price reported, "The result of the crushing was what might have been expected--namely, a failure."²

Not only was this first crushing a failure; the sugar empire dreamed of by Price and Holtze also failed. Perhaps the principal reason for this was the fact that suitable soils were limited and the main areas tried (Daly River and Cox Peninsula) were highly unsuitable. Furthermore, much of the land which was thought to be suitable was taken up by individuals or firms who waited to see the results obtained by Owsten at Daly River and DeLissa on Cox Peninsula. When these two ventures failed, few further attempts were made. Ironically, Holtze himself was partly responsible for the

¹N.T.T.G.G., 2.7.1881; 23.7.1881.

²SAA-790/1881/450 (Minute dated 22.8.1881); SAA-793/1881/646a, 660, 662; SAA-790/1881/491, 725.

failure. The exceptionally favourable reports issued by the Government, based on the success Holtze achieved at the Garden, which was by no means representative of the Top End as a whole, led to inflated hopes. Early failures turned these hopes to suspicion and condemnation.¹ Nevertheless, Holtze had shown that sugar-cane could be grown successfully on the relatively poor soil of the Gardens.

And there was no doubt that the soil of the site then being used was poor. In April 1882 the *Northern Territory Times and Government Gazette* noted that "the soil of the Garden is poor, but a surprisingly vigorous growth of cane had been produced."² A year later, speaking at the opening of the new Town Hall, Price himself stated that the garden site which had been chosen by McMinn, Holtze and himself (no mention of Owsten, whose name by this time was in disrepute) was not a soil suitable for sugar-cane.³

Holtze suggested several improvements which should be made to the existing Garden. His first requirement was manure, "to keep the soil in a fit state of fertility." He also noted the need of a water cart, since the wells at the Garden were too salty to use at the end of the dry season. Other requirements were glass frames for the propagation of plants, renovations to the bamboo plant houses and an increase in labourers' wages to attract better workmen. Finally, he wanted a salary increase for himself--from £200 to £400 a year.⁴

¹Bauer, 1964:102.

²*N.T.T.G.G.*, 22.4.1882.

³*ibid.*, 3.3.1883.

⁴SAA-790/1883/212.

These requests were not granted because, as usual, the Government was not prepared to find the extra funds. Not only that, if Holtze had hoped to get an extra half a loaf by asking for a whole, his scheme completely backfired. In the following year, 1884, the Minister of Education commanded that the area of the Experimental Garden was to be reduced by half; expenses were to be reduced by a like amount; Chinese prisoners were to be used as labourers. Moreover, there was a decided threat: "If there is any difficulty raised the Office of Government Gardener [is] to be abolished and the Garden...to be worked by the prison authorities."¹ This was in spite of the fact that Holtze had won Gold Medals at the Exhibition in Calcutta in 1884 for his tapioca, arrowroot and preserved bananas.²

The spectre of abolition of the office of Government Gardener reappeared several times over the next year, even though the Garden was reasonably successful. In August 1884 the Government Resident, J.L. Parsons, reported that the crushing of surplus cane from the Garden had produced two tons of sugar.³ Furthermore, the cane had been grown without irrigation. Writing of the Garden in October the same year, Parsons said:

To it, over the rough and, in the dry season, desolate road, every visitor to Palmerston is taken and is then marched along its banana and pineapple fringed walks to see sugar-cane, rice, tapioca, arrowroot, ground nut, and other tropical and subtropical plants growing and flourishing.⁴

¹SAA-801/1884/118t.

²N.T.T.G.G., 22.4.1884.

³SAA-790/1884/750.

⁴SAPP 53B/1884.

Yet in March 1885 the Minister announced, "When next the Northern Territory Estimates are under revision I shall consider the advisability of abolishing the office of Government Gardener."¹ When, the same month, Parsons requested permission for Holtze to accompany him on a fact-finding tour of South East Asia, the telegraphed reply was again "...with next estimates it will be matter for consideration whether office of Government Gardener should be retained, it is therefore inadvisable for Mr Holtze to proceed to Java."²

This brought a spirited reply from the Government Resident, who immediately, but "respectfully," pointed out to the Minister the need for an experimental nursery and garden in a new country, given what he conceived to be the agricultural future of the Northern Territory. He also reminded the Minister that Holtze had won Gold Medals at several Exhibitions and was preparing entries for the forthcoming Colonial and Indian Exhibition. He further pointed to the unsuitability of the present site, having earlier broached the subject in a report dated 1 January 1885, in which he indicated that it was "quite apparent" that a mistake had been made when the current site was chosen in 1879. There was available, however, a portion of the Park Lands, known as the Paper Bark Swamp, "which consists of vegetable soil." This, he maintained, and Holtze concurred, would be a better site for the beginning of a permanent Botanic Garden and Experimental Nursery of the Northern Territory.

¹SAA-793/1884/365.

²SAA-801/1885/244t; SAA-790/1885/582.

Two months later, in June 1885, Parsons requested permission to set up a small experimental garden in the Swamp.¹ He got no reply to his telegram and in November 1885 repeated the request. This time the only response was, "Must wait till estimates are passed."² Apparently this cut no ice with Parsons, who had himself once been Minister of Education, and as such the Minister in charge of Northern Territory affairs. On 2 January 1886 the newspaper announced that the Fannie Bay site currently occupied by the Garden was to be abandoned and a new site, then occupied by Chinese gardeners who had no claim to the land, would be cleared. The site of the old Garden would be surveyed and cut up into suburban blocks for auction. A week later Parsons sent a telegram to the Minister, stating that he proposed to take ten acres of the Paper Bark Swamp for a garden.³ Finally, the Minister, J.A.C. Cockburn, gave up.

One of the factors involved in his capitulation was the fact that, according to Parsons, the new site was closer to the prison and prison labour could be used--which meant a cut in expenses for labour. Even so he warned the Government Resident that "of course [the] vote must on no account be exceeded." Again, there was a reluctance to grant any extra funds, which indeed underlay all his conditions of approval:

...[the] Garden may be removed to Paper Bark swamp provided estimates be not exceeded; that vote next year will not exceed £750; prison

¹SAA-790/1885/725.

²SAA-790/1885/1204.

³SAA-790/1886/24, 31.

labor will be available at new site without additional cost for guards; that new residence will not be required for Gardener; that season is not too far advanced for safe removal of plants.¹

Four days after the receipt of this telegram, on 22 February 1886, the gardener had commenced planting the new garden, and the Government Resident requested written sanction from the Government to use prison labour. This was duly granted--prisoners could work to any distance from Fannie Bay Gaol not exceeding three miles.²

By June of the same year the newspaper reported that the transfer of plants and buildings from the old to the new site was almost complete; it should be remembered, however, that both sites were in Fannie Bay. The new garden, the paper noted, was "fast assuming all the features of a well-laid out public garden." The reporter went on to wonder how the two earlier sites had ever been chosen, since the new site had such good soil that it would grow almost anything.³

Meanwhile the Government Gardener continued to give plants to all who requested them. Indeed, this was one of its more important functions. Beginning with Hayes', and continuing through the administrations of both Holtzes, the Garden had always been the chief source of plant introduction in the Territory. Even today, the Curator regularly gives ornamental trees and shrubs to those who want them. Thanks to this fact, Darwin has always had the lush greenery more commonly associated with more frankly tropical areas.

¹SAA-801/1886/87t.

²SAA-790/1886/198a.

³*N.T.T.G.G.*, 12.6.1886.

In July 1886 the Government Resident asked permission to make a charge for such plants. The Minister replied that prices should certainly be charged, such prices to be fixed by the Gardener.¹ With that problem solved, however, another soon developed. The site of the new garden had been occupied by a number of Chinese gardeners who had, as already noted, no claim to the land. They had all removed themselves when informed that the area was to be taken over as a Government Garden, with one exception, a man named Yoke. In September 1886, seven months after planting had started, Yoke was still occupying land in the new garden. Parsons finally decided the only way to deal with the situation was to issue a Proclamation for the Botanical Garden, which was done on 1 October 1886. The Hon. J.A.C. Cockburn, Minister of Education and responsible for the Territory, queried the necessity of proclaiming the garden boundary, but was assured by Parsons, in a telegram dated 27 October, that this was the only way "to effectually deal with Chinese squatters."²

Thus the last barrier to removal of the Garden to what is its present site was gone. In a report dated 1 January 1887, the first he wrote after the move, Holtze found himself "in a position to report very favourably on the state of all the plants at present in the garden," of which there were already 519. He admitted that he was still unable to grow the opium poppy with any success, but noted that he had been successful in introducing two plants, *Voandzega subterranea* (ground pea) and *Phaseolus formosus* (Assab-bean).

¹SAA-790/1886/694.

²SAA-790/1886/820,923.

These, he felt sure, would become useful in the southern colonies.

In spite of such successes, his real concern was that "all efforts of cultivation [in the Territory] have as yet been limited to sugar-cane." He professed himself astonished that no one had tried anything else. He felt that the fact that indigo, cotton, jute, arrowroot, tapioca, ginger, rice, teal oil, ground nuts and other plants grew so well in the Garden, year after year, should by now have convinced someone that these plants would be commercially viable. He had, he noted, won eight Certificates of Merit at the recent Calcutta Exhibition, as well as two Gold, one Silver and three Bronze Medals, and these should convince "croakers who say that because other countries do grow these plants there is no use for us to compete with them" that the Territory should, in fact, compete.

He did, however, have one very real complaint. Prison labour was being used in the Garden as an economy measure, and Holtze noted, "I can only describe this class of labor as thoroughly unsuitable, the men employed being the scum of the scum." In addition, the prisoners worked only seven hours a day and never in the rain, "so that even this short time is often reduced considerably." While he realized that he should be thankful even for this "inadequate labor," nevertheless it was his considered opinion that the small sum saved was "counterbalanced a hundredfold by the injury done to the progress of the Territory."¹

¹SAPP 53/1887.

The progress of the Territory, and particularly agriculture in the Territory, was always Holtze's main concern. Although a trained horticulturalist, his background and training were European--and northern European at that. His work in the tropics was essentially a matter of trial and error, which was why Parsons wanted him to visit South East Asia. When Parsons had first proposed such a trip, it had been refused, as we have seen, on the grounds that the office of the Government Gardener was likely to be abolished. In January 1887 Parsons tried again and this time, after a certain amount of argument, he succeeded in convincing the Minister of Education, J.A.C. Cockburn, that it would be useful for Holtze to "look into the methods of tropical agriculture in order to be able to give better advice both to the Minister himself and to people making enquiries about agriculture in the Northern Territory."¹

Parsons and Holtze left Port Darwin on 11 February 1887, and visited Hong Kong, Macao, Canton, Saigon, Singapore and Batavia. Holtze presented the opinions he formed during the trip in a report dated 3 May 1887. In this document he stated that he was convinced the soil of the Territory was "not inferior to that of any of [the countries visited]," although he warned that he was not suggesting that all Territory lands were fit for agriculture, and the sooner people realized this the better. However, he strongly recommended rice, sugar-cane, cotton, indigo, sesame and ground nuts for general cultivation. Coconut, he believed, would do well on the islands and coastline. He further recommended that indiarubber, babool tree

¹SAA-790/1887/73.

(*Acacia arabica*) for its gum and catechu (*Acacia catechu*), which is a dye plant, should be planted "on the inferior and stony grounds by the Government in large forests." This, he thought, would make such areas profitable and useful. These were the plants he considered of more general utility. In addition, he noted, it was likely that small plots of "nutmegs, clove, cinnamon, pepper and vanille [*sic*]" might be tried on sites which had been carefully tested for suitability and "situation of the land." As he pointed out, his own experiments with the spices had been unsuccessful, "although this failure is easily accounted for by the thoroughly unsuitable soil and situation of the old Government Garden." Nevertheless, he warned that these plants should be tried with caution.

As well as being concerned that the right plants should be planted in the right situation, Holtze felt that more liberal land laws were essential in order for agriculture to succeed, and was wholeheartedly supported in this opinion by Parsons. As Holtze noted, prices were reasonable, but "what is the use of this if our most suitable lands are practically locked up against the *bona fide* settler?" Both Parsons and Holtze advocated free selection before survey; as for whether it should be leasehold or freehold, Holtze did not think it mattered.

Finally, he felt strongly that "the Territory cannot compete in the world's market successfully with her present class of labor." European labour, he maintained, could not compete with the cheap labour employed in the countries he had seen, and as far as agriculture was concerned, this was the only labour to be profitably used in the Territory.

Since he realized that there might be objections to Chinese labour, then "our Indian Coolie Act should cease to be dead letter as soon as possible."¹

Labour was one of Holtze's biggest problems. Three weeks after writing this report he complained, "I am at the present time without prison labour." Moreover, the Keeper of the Palmerston Gaol and Labor Prison had informed him that he was likely to be without any--much as he despised it--for some considerable time; the prisoners were occupied building an infirmary at the gaol. As a result, Holtze wanted an increase in the Garden estimate, to cover the cost of free labour. He requested £800, but the Minister informed the Government Resident that such a sum was out of the question, adding, "It would be well just now not to draw special attention to the garden by proposing such a sum."² A year later, in April 1888, Holtze still complained of shortage of funds and this time the Minister, J.C.F. Johnson, relented. As Minister controlling the Northern Territory he wrote, in May 1888, "The public gardens I consider after careful examination to be a very useful institution and...Mr. Holtze...a valuable officer who is a perfect enthusiast in his work...." Accordingly, Johnson recommended that the Garden vote be raised to the £800 Holtze wanted, but added, "In the management of gaol matters I propose to utilize the labor of the prisoners as much as possible in

¹SAPP 166/1891 (dated 3.5.1887; not printed at that time by error). The Act to which Holtze referred was No. 240 of 1882, an "Act to encourage the introduction of Indian Native Immigrants into the Northern Territory of the Province of South Australia." Reserved 30 August 1882.

²SAA-790/1887/475.

carrying on the work of the gardens."¹

While pleased with the increased vote, Holtze was still adamant that prison labour was not satisfactory; as he put it, "I can only speak with the greatest contempt of this sort of labour." He elaborated on his earlier objections:

I have in my last report mentioned the large waste of time (nearly one and a-half hours per day) incurred through the distance of the gaol from the garden; in addition to this these men are not allowed to get wet, therefore they are at the slightest shower of rain marched under shelter, and many hours, and sometimes nearly whole days are spent by them in this way in idleness. I may remark that it requires a very hard shower indeed to drive me and my free laborers under shelter. In addition to this I have now been informed by the guard in charge that orders have been issued that prisoners have to cease work as soon as the thermometer (which is always kept alongside of them) shows 112° (one hundred and twelve degrees) in the sun. I should really like to know how many of the farmers of South Australia enjoy such easy lives and motherly care as our Chinese and Singhalese prisoners....I cannot employ them in growing crops such as maize, sugar-cane, jute, sun-hemp, dhol, &c, because they cannot be seen by the guard. They must not get wet, they must not get hot, and they cannot be driven to work...in fact, I do not exaggerate when I assert that the demoralising effect of their laziness on my free laborers more than counterbalances the help they afford me.²

In spite of these reservations, however, the Gardens prospered. Holtze's reports for both 1888 and 1889 indicate

¹SAA-790/1888/421.

²SAPP 28/1889.

that rice, sugar-cane, maize, sesame, oil palms, fibre plants and Liberian coffee, to name just a few, were all doing well. By 1890, alas, things were rather less rosy. The Garden vote had been cut again, because it was proposed that as much prison labour as possible should be used. The Government Resident, J.G. Knight, added his protests to those of Holtze, but the Minister was unmoved.¹ Not that it really seemed to matter, because Holtze in his annual report for 1890, while bemoaning the "great reduction made in the yearly grant to the gardens," went on to state that the chief plants in the Garden had done well, with the exception of peanuts and Liberian coffee, which both suffered as a result of a short wet season. On the other hand, he was very enthusiastic about tobacco, which he saw as one of the crops likely to be most successful commercially.² The Governor of South Australia, Lord Kintore, had visited the Territory during 1890 and he, too, was impressed by the progress made:

The experimental gardens, admirably managed by Mr. Holtze, in the face of great difficulties, gave evidence of the variety of products that can be profitably raised, of which I need mention only sugar-cane, pineapples, bananas, tobacco, rice, maize, and tapioca.³

In this the Governor echoed Holtze's own opinion:

...the garden is at present the only place where the agricultural capabilities of the Territory can be seen, an ill-timed saving of a few hundred pounds may mean the loss of many thousands, should the Government have the

¹SAA-790/1890/320, 527.

²SAPP 28/1891.

³SAPP 79/1891.

intention to construct the transcontinental railway on the land grant system.¹

As always, Holtze's chief concern was proving the "agricultural capabilities" of the Territory.

Nor was he concerned only with agriculture. In 1888 he was very much alarmed by the indiscriminate cutting of cypress pine by Chinese wood cutters. What Holtze referred to as "the valuable cypress pine" was, he maintained, the only wood which resisted the attacks of white ants and hence should be protected. In Hong Kong he had found that the Director of the Botanic Gardens was also head of the Afforestation Department, and he considered this a practice which the Government of South Australia might well emulate. As a result of his proposal he was appointed Forester for the Northern Territory in June 1888--a position which carried with it no extra salary, but one which he took very seriously, as a series of telegrams dealing with cypress pine in 1889 indicate.²

In all of his concerns Holtze was supported wholeheartedly by Government Resident Parsons. The two enjoyed a long friendship and mutual respect. When, in 1889, Holtze was honoured with a prestigious Fellowship of the Linnaean Society, for "his services to botany in Australia," no one was more delighted than Parsons. When Parsons left the Territory in 1890 Holtze was anxious to follow him, and Fate played into his hands--in March 1891 Dr Schomburgk, Director of the Botanic Gardens in Adelaide, died and Holtze

¹SAA-790/1890/527.

²SAPP 166/1891; SAA-790/1888/415; SAA-790/1889/179.

was appointed his successor.¹ After nineteen years in the Territory, twelve of them as Government Gardener, Holtze settled in Adelaide, leaving behind a reputation as a man of dedication to anything which would promote the Territory. He was convinced that the possibilities for agricultural development were enormous.

The three crops which had impressed him as being most likely to prove commercially viable were tobacco, cotton and peanuts. Indeed, his tobacco was so successful that a visitor to the Gardens who was given one of his homemade cigars to smoke wrote:

Although new, they smoked as well as the best Manilla, and they were milder, or at least they seemed to be--smoked as a variation of the exercises of sugarcane and maize and peanut and chili chewing.²

In spite of his success with peanuts--and in 1890 he obtained a yield of 26 cwt from one acre--they were never popular as a crop. Nor was cotton, at least until the early 1900s, at which time Holtze wrote from Adelaide, "There cannot be the slightest doubt that the climate and a large part of the soil of the Territory are eminently suitable for this culture."³ There were, of course, other crops which he considered suitable, indeed desirable. Rice, to which he did not give the attention his successor would, was one. On his return from South East Asia he had written:

I have before this strongly and repeatedly recommended that the Territory should be encouraged

¹*N.T.T.G.G.*, 27.3.1891; SAA-790/1891/336.

²Sowden, 1882:102.

³Curteis, 1965.

in every way to grow rice, but since I have seen Saigon and its rice country I am more than ever convinced that only cheap labor and liberal land laws are required to make the Northern Territory the great rice-field for the Australian colonies.¹

As we have seen, there were minor crops which he thought held promise. Fruits, vegetables, starch and dye plants, spices, oil and fibre plants would all be useful, in his opinion. He introduced and propagated a number of fodder grasses to be distributed to pastoralists. As the *Northern Territory Times and Government Gazette* indicated in 1881, this was a vital introduction:

...it would be well for our pastoral lessees to obtain seed of the grasses which have proved [in the Garden] most suitable for the Territory to replace some of the coarse grasses indigenous to the country.²

The best of his new grasses were Guinea grass and Natal grass. In spite of his successes, however, and his never-failing enthusiasm, Holtze, even with the help and support of Parsons, was unable to engender sufficient enthusiasm in others to permit the establishment of viable tropical agriculture.

Nor is it difficult, with a century of hindsight, to see why he failed. Although it was not realized at that time, the Territory does not have entirely the same kind of tropical climate as the countries with which it was compared. The dry season is very dry, and can be very long; at the same time the wet can also be highly variable, in both length and amount of moisture available. It was all

¹SAPP 166/1891.

²*N.T.T.G.G.*, 6.8.1881.

very well for Holtze to insist that Territory soils were in no way inferior to the soils he had seen in South East Asia, and to stress the fact that the soil of the Botanic Garden at Saigon was a gravelly poor ironstone on a heavy clay sub-soil, as is much of the soil of the Top End.¹ The fact remains that the Top End does not enjoy a true monsoon climate and rainfall is much too variable for safe agriculture without irrigation.

When Maurice Holtze left for Adelaide these climatic facts of life were not understood, and the wonder is that he was able to achieve as much as he did. As already noted, part of this was the result of the role played by J. Langdon Parsons, a man whose enthusiasm for the Territory was as unbounded as that of Holtze. He was succeeded as Government Resident by J.G. Knight, a long time Territory resident then serving as Secretary and Accountant to the Government Resident. As a result of his untimely death, less than two years after taking up office, Knight was succeeded by C.L. Dashwood, who lacked the interest and drive of Parsons. On his departure Maurice Holtze left more than a reputation as a fine horticulturalist and a confirmed champion of the Territory; he left his son Nicholas, who succeeded him as gardener.

Nicholas Holtze was born in Russia and in 1872, as a child of four, came to the Territory with his parents. He commenced his working life in March 1879, when he was appointed a messenger with the Overland Telegraph office in Port Darwin; his salary was £2/2/- a week, surely a princely sum for a twelve-year old. He was later transferred, still

¹SAPP 166/1891.

as a messenger, to Southport, then back to Port Darwin. In May 1882 he was re-assigned to Southport, this time as Assistant, but in August of that year he resigned from the Postmaster's Department to become a Clerk, Fifth Class, in the office of the Government Resident, with a salary of £130 a year.¹ This was his position in May 1891 when the Government Resident, Knight, recommended he should be appointed Curator (a title which, contrary to popular belief, was never officially given his father) of the Botanic Garden. In his telegram Knight noted:

Nicholas is an enthusiastic botanist and collector spending all spare time and holidays in pursuit of new specimens. Knows habits of plants in gardens. Recommend his appointment as Curator and allow him £50 a year for his extra services mornings, evenings and spare time.

There was a further note that the appointment of Nicholas would save the Government £500 on Garden expenditure--a telling point. The appointment was promptly approved and duly gazetted.²

This arrangement did not go unnoticed by the *Northern Territory Times and Government Gazette*, whose editor, admittedly with some justification, labelled it a "hanky-panky kind of arrangement," but understood no other suggestion had been made. Although it was noted that Nicholas had some knowledge of botany and other general features of a tropical nursery (although it is worth remembering that he was still only twenty-three and his father must have been his only tutor, presumably in *his* "spare time"), nevertheless, the

¹SAA-790/1900/405; SAA-793/1883/489.

²SAA-790/1891/336.

editor complained, such absurd economizing was "sure to be treated with ridicule by everyone who holds the opinion that if a Government Garden is of any utility at all it is surely worth independent management."¹ One is sorely tempted to add "and full-time management."

In fact, as the years went by, the position of Curator of the Palmerston Botanic Garden, as far as Nicholas Holtze was concerned, became more and more a part-time occupation. In March 1892, less than a year after his appointment to the Gardens position, he became Acting Secretary to the Government Resident, during the absence of Mr F.C. Ward, who went on sick leave. As it transpired Ward never returned, and Holtze remained in this acting capacity until April 1894, when he was appointed Secretary and Accountant to the Government Resident. Meanwhile, in April 1892, he had been appointed Acting Deputy Registrar of the Northern Territory and in the following year was gazetted as Deputy Registrar (with no increase in salary). In June 1892 he was appointed Public Trustee of the Northern Territory and after a year of these duties he requested an increase in salary by virtue of the extra work involved; failing an increase, he requested at least the 2½% fee charged by the Government for administering intestate affairs. Both proposals were denied. At that time an account of his salary and allowances was given to the Minister of Education:

Secretary and Accountant to the Government Resident.....	Salary	£220/	-/-
	Allowances	£60/15/-	
Curator Botanic Gardens.....	Salary	£50/	-/-
Total Emoluments.....		£330/15/-	

¹N.T.T.G.G., 5.6.1891.

In addition to these monies he received free housing. The Minister refused his request for a rise in salary.¹

Further positions were added: in 1894, he was appointed Inspector of Vine Fruit and Vegetables and in 1896, Returning Officer for the electoral district of the Northern Territory; in 1906, he became Deputy Sheriff after the death of J.A.G. Little, who had earlier been an employee on the Overland Telegraph; the following year, Holtze was gazetted Sheriff. By 1908 his salary as Secretary and Accountant to the Government Resident was £480, which included the £50 from the Gardens position, and still a free house. Even though the last two were his only paid positions, he was the third highest paid officer in the Territory, after the Government Resident and the Medical Officer. Three years later, when the transfer of the Northern Territory from South Australia to the Commonwealth was imminent, Holtze applied for promotion to First Class, pointing out that he had been employed in the Territory for over thirty-one years. His concern was that in the event of the transfer of the Territory he would lose his electoral salary and fees. By this time, his salary as an unclassified officer amounted to £485/15/-, including free housing. Once the transfer was effected, all his allowances were abolished, he was charged rent for his house and his salary was fixed at a net £525p.a. His title was then designated as Government Secretary.²

In spite of being a part-time Curator, however,

¹SAA-790/1893/344.

²SAA-790/1892/158, 189, 275; SAA-793/1892/79; SAA-790/1892/284; SAA-790/1893/344; SAA-790/1894/744; SAA-801/1896/46; SAA-793/1896/510; SAA-790/1906/564; SAA-793/1908/541; AA, CRS A-1 11/11002.

Nicholas Holtze managed to get a great deal done at the Gardens. In his Annual Report for 1892 he noted:

a straight avenue, nearly half a mile in length, has been laid out on the sandy beach at the bottom of the garden, and planted on either side with cocoanuts. A large mangrove swamp between this place and the garden has been reclaimed, cleared of timber, and planted with all the cocoanut plants on hand.¹

This was done in accordance with his father's plan. In 1888 Maurice Holtze had requested, and received, permission to spend £25 on importing a thousand coconuts from Singapore. His idea was to "plant them on the salt flat, and seacoast adjoining the garden."² By 1895 Nicholas could report that the avenue in the garden was already a feature of the place "and will in a few years be a splendid sight."³ As anyone who visited Darwin prior to Cyclone Tracy can attest, he was quite right.

Like his father, however, his main interest was finding ways to promote tropical agriculture and his first choice was always rice. In his first Annual Report, dated 1 February 1892, he wrote, "This crop cannot be too strongly recommended for cultivation on the banks of our many rivers." He went on to note that the fact that there was indigenous wild rice indicated that it was likely to be a success but, he added, "apart from this it has been so invariably a success, whether grown by the Chinese or in the garden, that doubt seem[s] impossible." During 1891, he reported, a block

¹SAPP 158/1893.

²SAA-790/1888/346.

³SAPP 24/1895.

of a third of an acre yielded at the rate of a ton to the acre. This was the Saigon variety, grown "in a bad season and on land that had been continually cropped with rice for the past eight or nine years, during which time not a particle of manure had been used." He went on to explain that in spite of such success Europeans were reluctant to turn to rice growing because the culture was strange and the paddy had to be cleaned thoroughly before it was marketable. Again, the government's refusal to grant funds was another problem because, he added, to clean it properly required the use of expensive machinery and skilled labour to operate it; "...in other words, capital, and unfortunately this is lacking at present."¹

Nevertheless he continued his work with rice, although there were, of course, always problems of one kind or another. The crop of 1893 was almost completely destroyed, he reported, by horses; however, a "small sum" was allowed him for fencing and he expected to have no more trouble of that sort.² In 1898 he noted that the cyclone of January 1897 had ruined most crops, "but, strange to say, the rice, though beaten to the ground, quickly recovered and yielded a first-rate crop."³ By 1898 he had eleven varieties under trial, "including one kind of seed which was sent from Canton by a syndicate of Chinese desirous of undertaking its cultivation here."⁴ In the following year he had thirteen varieties, and explained his interest in the crop:

¹SAPP 181/1892.

²SAPP 53/1894.

³SAPP 45/1898-9.

⁴SAPP 45/1899.

...I am convinced that its cultivation on the extensive swampy plains bordering our tidal rivers will be a great industry in the future. These much-abused swamps are the very thing required by the rice plant, which will luxuriate in soil producing only a sour growth of swamp grass.

Holtze went on to provide a "perfect" example of his claim. He had planted rice in a newly cleared plot surrounded by a "poor sour growth of wild grass," and it was doing very well. In addition, some of the indigenous rice had "taken possession" of a swampy patch in the Garden and there it was reproducing itself annually; it was, he stated, a source of great interest to Garden visitors.¹

In spite of such setbacks as the depredations of goats, of which between seventy and eighty were destroyed in 1901, and a fire in October of the same year, the rice continued to do well.² In 1903 Holtze noted that the area of the Garden which he used for rice had been "continuously cropped with that cereal for the past sixteen years without the least manure," and the crop had always been successful. He was convinced that it would do well, but realized that planting in swampy ground, where it did best, precluded any possibility of mechanical cultivation. This was the real difficulty, for it

made it impossible that it could be cultivated by European labor....Moreover, no European could live and maintain his health in such places surrounded by miasmatic tropical swamps, and a prey day and night to swarms of mosquitoes and sandflies.

¹SAPP 45/1900.

²SAPP 45/1901.

For this reason he began to think in terms of upland rice, which could be grown on dry land.

The introduction of an upland variety was preceded by the first failure in the rice crop; the wet season of 1906 brought "a want of sufficient rain." In his Annual Report for 1906 he wrote:

This is the first failure recorded here, and the rainfall returns show that such another season has not been experienced since the records were commenced - 35 years.

He went on to note, however, that he had finally discovered a variety of upland rice which should be suitable for the Territory. The plot in which it was growing

[was] about the driest piece of ground in the garden and for this crop (in similar land) all the machinery used in the production of wheat could be utilised - from the first preparation of the ground to the final harvesting by the stripper or binder.¹

This was indeed what he had been looking for--a variety of rice which could be cultivated mechanically. Certainly his idea came from the United States, where rice had been successfully cultivated and harvested mechanically in Louisiana and Texas, but there the machinery used was a rice-binder and thresher especially adapted for use in rice. Nevertheless, according to the U.S. Department of Agriculture, these machines were similar to those used in wheat-fields. With this in mind, Holtze had the gaol reserve cleared and "made ready for the plough," using prison labour. The Government, however, would not make available

¹SAPP 45/1908.

the funds necessary for the experiment, and Holtze was left with his ideas, but nothing proven.¹ Still, the plot he had in the Garden prospered, even though considerable damage was done by horses in 1908. He was, with good reason, impressed by the fact that the damaged crop yielded almost a ton to the acre. Three years later, in 1911, it seemed that he would finally be able to realize his dream of harvesting rice mechanically. He had arranged that a crop at the farm of Messrs Milton and Fernee would be so harvested, but on the day appointed for the demonstration Milton, the only one who could operate the machine, broke his arm while trying to start the motor, and that was the end of that--"the crop... had to be reaped by sickle."²

Nicholas was never to see mechanical harvesting of rice--his death in 1913 intervened. However his faith in rice was still evident in what proved to be his final report, dated 21 January 1913:

Upland rice, introduced by me in 1907, is the most promising of such crops [i.e. those which might be dealt with by machinery] and in my judgement - and I say it with a full knowledge of our conditions and all the facts, it will, in conjunction with a system of "mixed farming," prove the solution of the profitable utilization of our tropical coast country by a European race.³

He went on to note that a sample of rice grown in the Garden had been sent to rice millers in Sydney, and they were prepared to offer £8/15/- a ton, while Burmah rice was valued

¹SAPP 45/1909.

²CPP 54/1912.

³CPP 45/1913.

at £6/10/- a ton. As Holtze commented:

On the basis of our results this crop at that price, if cultivated and harvested by machinery in the same way as wheat, would be a more profitable proposition than wheat.¹

Basically, he was right in his assessment of rice as a viable commercial proposition for the Territory. Modern agronomists agree with him; but today there are still problems, the most important of which are engineering problems connected with irrigation, for the crop must be sown and grown in standing water, which has to be drawn off before harvest, to permit the ground to dry out in order to let the machinery in. A further drawback is the fact that the Coastal Plains soils are too saline for successful rice-growing.

Sisal hemp was another crop which Holtze saw as a likely commercial success. He put two plants in the Garden in 1891, largely because "much has been written [of it] lately," and they did well. In fact, Thomas Playford, MLA, had visited the Territory in the early nineties and had promised a Mr D. Daniels that he would have some plants imported for him. In 1893, as a result of this promise, and on the recommendation of Holtze, 6,000 plants were ordered from Florida. Of these, 700 did not survive the journey, but since they had been from Florida to London then on to Adelaide before reaching Palmerston, this was not surprising. Sisal hemp was difficult to obtain: it was cultivated almost exclusively in Yucatan, and the farmers there were understandably reluctant to have it cultivated elsewhere.

¹CPP 45/1913.

In 1890 the Kew Gardens authorities had managed to get a consignment of forty-one plants from Yucatan, but on their arrival it was found that thirty were dead and the remainder so badly packed (deliberately, one suspects) that they did not survive. On that basis, 5,300 in the Northern Territory were riches indeed.¹

Such a plentiful supply made it possible for Holtze to satisfy the considerable local demand for this promising crop, and he sold 5,000 plants immediately, although they were left in the Garden nursery for a year to recover from the effects of having been shipped three-quarters of the way round the world. By 1897 Holtze reported that he had 2,000 plants in the Garden, the progeny of the 300 he had retained from the original shipment. In 1905 he had a further thirty acres planted, at the rate of 537 plants to the acre. He expected a crop of leaves during the fourth year, and every year after, for the lifetime of the plant. He noted that in 1900 the United States had imported raw fibre worth two and a half million pounds sterling; by 1907 this figure had increased to eight and a quarter million pounds sterling. At the same time, it had been estimated that Australia could consume 10,000 tons of fibre annually, just to satisfy the domestic market for binder twine. In 1906 he visited the sisal hemp plantation at the St Helena penal establishment in Queensland and reported that the Queensland product, cultivated, harvested and cleaned by prison labour, realized £37/10/- a ton. Moreover, he added, after careful examination of the crop in Queensland, he was convinced that the Territory plants were superior in every way. Further,

¹SAA-793/1893/458, 482, 526, 554, 588; SAA-793/1894/726.

"the sample lots of fibre produced by us by hand are superior to the fibre produced at St. Helena during my visit."¹

What was lacking in the Territory was suitable machinery for the extraction of the fibre from the leaves. By 1908 it was obvious that this situation would have to be remedied--there was such great interest in the crop that during the past year Holtze had supplied, free, over 30,000 plants for planting purposes. In view of this demand, the Government agreed to supply the necessary machinery, which arrived in Palmerston in September 1909. Since it was worked solely with prison labour, however, and all of that inexperienced, there were problems. Experience, Holtze reported, "has to be gained by trial and practice." There was also the fact that the manufacturers had overestimated the daily output. In spite of these drawbacks, results were satisfactory:

I may say, however, that a very fine sample of fibre is being produced, and the results so far show that the leaves here contain a larger percentage of fibre than has been obtained in Queensland.

Furthermore, by this time Holtze had issued 150,000 bulbils sufficient to plant 350 acres, to local agriculturalists. Much of this local interest was due to the fact that the then Government Resident, C.E. Herbert, had won approval for the relaxation of stringent fencing laws. As a result, a sisal hemp hedge was now deemed sufficient.

In 1911 Holtze attended a conference on fibre production in Java, hoping to learn solutions to some of his

¹SAPP 53/1894; 45/1898-9; 45/1906; 45/1907.

problems. The machinery, for example, had never worked properly, and this was one of his major difficulties. Unfortunately interest in sisal hemp evaporated with the takeover of the Territory by the Commonwealth Government, and this fact, coupled with his untimely death in 1913, meant his ideas were never implemented.

The other fibre plant in which Holtze was particularly interested was cotton. His father had experimented with it in the Garden, and in 1888 had expressed the opinion that with cheap labour it could be a commercial success in the Territory.¹ However, he warned, it would still be necessary to compete with countries with a steady supply of cheap labour. This was, he considered, the main drawback to establishment of a viable cotton industry.² It was not, as with rice, a matter that Europeans could (or would) not grow cotton in the tropics, but rather that it would have to be sold in open competition with cotton produced with cheaper labour in the United States, China, India and Egypt. Nevertheless, he continued his work with cotton, especially the Sea Island and Egyptian varieties.

In 1904 there was sufficient interest in cotton-growing for the South Australian Government to send an expert, Mr John Bottomley, to report on the prospects for cotton in the Territory. He, too, expressed the opinion that a plentiful and cheap labour supply would be essential, in spite of the fact that it was his opinion that

...the Northern Territory possesses unlimited possibilities for the cultivation of the highest

¹SAPP 28/1889.

²SAPP 181/1892.

grades of cotton over a very large area of coastal country, and of upland varieties further inland.¹

Again, however, despite the support of the Government Resident, Herbert, and the success Holtze continued to have with his cotton in the Garden, interest in it waned, and by 1910 it was almost forgotten.

Herbert also supported Holtze's work with tobacco, noting, in 1906, that it probably offered the best advantages for cultivation in the Territory.² One of its major advantages was the fact that it could, Holtze considered, be grown with European labour: in 1909 he wrote, "I believe we can produce as high class cigar leaf as any part of the world, and any grower who can grow a cabbage is sufficiently expert to grow tobacco." He warned, however, that processing was all-important, and none of the local residents seemed to have any knowledge of or interest in tobacco-curing. After all, although it was as easy to grow tobacco as to grow cabbages, unless the leaves were properly cured they were also as useless as cabbage leaves!³ All of his enthusiasm, and that of his father before him, however, did not raise any real interest in the crop, at least among local agriculturalists.

Nicholas Holtze was only forty-five when he died in the old cottage at the Gardens in 1913, and Top End agriculturalists lost a man dedicated to their success. Nicholas, as his father had been before him, was convinced that tropical agriculture could be a viable industry in the

¹SAPP 45/1905.

²SAPP 45/1907.

³SAPP 45/1908.

Top End, and both Holtzes had spent their years at the Gardens trying to establish such an industry. That they did not succeed was due, in no small part, to the bungling administration of a Government situated some 2,000 miles away and composed of men who had little or no understanding of their problems--the tyranny of distance indeed! Yet both persevered and never lost their confidence in the Territory and enthusiasm for the work they were doing. Nor were they interested only in agriculture. Both introduced a host of useful and ornamental trees and other plants to the Gardens, with the result that the Palmerston Botanic Gardens were a constant source of delight to all who visited them. With the passing of Nicholas Holtze the Gardens were to enter on a period of comparative neglect--albeit benign.

This was not, however, intended. When Holtze died the Administrator, Dr J.A. Gilruth, undertook the reorganization of the Gardens. In an effort to convert them to a true botanical garden--that is, a scientific and educational institution, with a trained botanist in charge--he decided to place them under the control of the Director of Agriculture. Gilruth then divided the gardens into two parts--a vegetable garden, under the control of a man named Yeadon, and another "portion under someone whose knowledge fits him for the position." He recommended that the Minister for External Affairs, who controlled the Territory, advertise for a Curator of the Botanic Gardens, the "other portion," at a salary of £300 a year and free housing. He was adamant that the successful applicant have a thorough training in botany, for it would be part of his duties to advise the Department of Agriculture on botanical matters. Moreover, few of the plants in the Garden were labelled and Holtze

had been the only man who knew their names, so a botanist was essential. The subsequent advertisement, which appeared in June 1913, noted that qualifications required were "a thorough practical knowledge of Horticulture and of Botany...."

The position attracted a field of eleven applicants, all of whom were experienced men. On 21 August, Gilruth wired that he considered G.W. Cooper, of Melbourne, the most suitable man for the position and on 4 September the position was offered to him. By this time, however, Cooper had withdrawn his application and an offer was made to the second choice, C.E.F. Allen. Allen, who had trained at the Royal Botanic Gardens, Kew, had had ten years' experience in Africa--six with the British South Africa Company and four with a rubber company in East Africa. He had made a special study of forestry and tropical agriculture in Rhodesia and, in fact, was recommended for the position in Darwin by the Director of Agriculture in Southern Rhodesia. Gilruth recommended his appointment on 15 September 1913, on probation, and Allen accepted.¹

Darwin Botanic Gardens (the name change occurred when the Commonwealth took over in 1911) finally had a full-time Curator. Unfortunately, before he had been in Darwin long enough to do anything really useful at the Gardens, Allen joined the Australian Expeditionary Force and an Acting-Curator, G.F. Hill, was appointed. Hill, however, was an entomologist, with no professional knowledge of gardening, and in any case soon took an appointment in Townsville.² In

¹AA, CRS A-1 35/7727.

²CPP 129/1917-18-19.

January 1918 H.M. Trower, Director of Lands, took control and noted: "I...found a manager there who was neither competent or [*sic*] industrious, and who had allowed these beautiful gardens to become a rank wilderness." In addition, the citrus trees, along with most others in Darwin and the country districts, were infected with citrus canker, which took some years to eradicate.¹

When Allen returned from the war in 1919 he was appointed Superintendent of Agriculture, as well as Curator of the Gardens, so once more the Gardens had a part-time Curator. This time, however, the Curator had far less time than had Nicholas Holtze, even using only "mornings, evenings and spare time." Allen found that the years of his absence had been ones of almost complete neglect, so that the first task facing him was cutting out dead trees and stumps, restoring the lawns, re-trenching and manuring borders and propagating plants in the nursery, preparatory to filling the gaps which had appeared.² In subsequent years very little was written concerning the Gardens; in fact, far from producing a separate and detailed Annual Report on the Gardens, Allen was sometimes wont to write a single paragraph as part of his Annual Report as Superintendent of Agriculture. To add to the problem, he was on leave for thirteen months in 1924-25, so once again there was an Acting-Curator, M.C. Goode, who was also Acting-Superintendent of Agriculture. Little was done in the way of agricultural experiment during the twenties, with the exception of a few small plots of peanuts--the Gardens were becoming more and more ornamental. Allen

¹CPP 129/1917-18-19.

²CPP 119/1920-21.

was gone for another four months between November 1932 and March 1933, and this time the Acting-Curator was W.L. Stanley, Chief-Inspector of Pearling! Small wonder that, as Allen noted in his report for 1933, "no experiments were undertaken."¹

In 1935, when Allen's retirement was imminent, it was recognized that it was not only the fact that the Inspector of Agriculture was frequently absent that little or no experimentation was undertaken. In a memorandum dated 21 August 1935 J.A. Barrenger, the Acting Secretary of the Department of the Interior, stated:

It is generally recognised that the present Inspector of Agriculture would be quite unfitted to take charge of agricultural and botanical activities on a large scale. He has no particular qualifications for the position.

Barrenger went on to note that while there was at one time a Director of Agriculture, and later the title of Superintendent was adopted, in 1928 the designation of Inspector was approved, with a salary scale of £396 - £468. It was considered that when Allen retired a properly qualified person should be appointed Superintendent of Agriculture, one "capable of inaugurating an agricultural policy for the Territory." It was recognized, however, that a suitably qualified applicant would not be obtained for the salary then offered. As a result, the advertisement for the position offered a starting salary of £366 (actual), but indicated that a higher salary would be offered to an applicant with special qualifications. Furthermore, applicants were

¹CPP 27/1926; 203/1932-33-34.

asked to state the salary they desired. From a short list of nine, the final choice was H.K.C. Mair, a young botanist with First Class Honours from the University of Sydney, who was then employed as Assistant Research Officer with CSIRO.¹

Mair's first annual report, for the year 1937-38, was the first of any length and consequence since World War I. It is a very detailed report, covering five printed pages of the Administrator's Annual Report. In it Mair notes that the horse which had been used for pulling the lawn-mower and dray "died of senescence at the close of the last wet season;" nor was it to be replaced, since it had been rendered obsolete by a tractor and trailer. These, along with a rotary hoe, were new additions during the year, as was a tobacco curing barn. In the same year the nursery, shade-house, implement shed and garage at the Curator's cottage were all rebuilt, since the originals were either destroyed or badly damaged in the cyclone of March 1937. Mair's report makes it obvious that things were looking up at the Gardens.²

But not for long, because soon there was another war. During World War II the Gardens were occupied by the Army, and were left in something of a mess--generally overgrown, with barbed wire entanglements throughout. In addition, as Administrator Abbott complained to Brigadier Dollery in a letter dated 4 January 1944, the local dairyman, one Brooker, was using large areas of the Garden as a pasture, with six calves penned in the bush house!

¹AA, CRS A-1 35/7727.

²CPP 150/1937-38-39.

As a result of the Administrator's complaints, Brigadier Dollery undertook the rehabilitation of the gardens. In September 1944 he wrote to Army headquarters in Queensland, New South Wales, Victoria, Western Australia and South Australia, in an effort to obtain a "supply of plants and shrubs, [for the Gardens] which have been almost entirely denuded and destroyed, and to plant a nursery for post-war supply." He asked the Commanding Officer of each area to "contact your local authority, e.g. Botanical Gardens, Government or Private Nurseries etc. with a view to donating plants and shrubs for this purpose. It may be regarded in the light of a national project." The response was such that Dollery was moved to tell the Commanding Officer in Queensland, "For what we have received we are most grateful and 'for what we are still to receive may the Lord make us truly thankful.'" He went on to note

Re the Curator of the Cairns Gardens. I have no funds, public or otherwise, from which to purchase plants - I just have to beg, borrow or steal, so must regretfully refuse his offer of supply on repayment, for the present at any rate.

Still, enough plants and seeds were received from other sources, free of charge, for substantial replanting to be done, and a nursery set up.¹

Things did not improve very rapidly after the war, however. When civil administration returned to Darwin in 1945, it was found there were no funds for the Gardens. Supplies for replanting were solicited from Municipal bodies in other states, and the results were gratifying. The restoration of the Gardens was largely supervised by Mr J. Agostini, who

¹Australian War Memorial, File 337/3/2.

was Foreman Gardener; there was no Curator appointed until 1955, when the appointment was given to Mr J. Worland, from the Toowoomba Botanic Gardens. In 1957, however, the administration of the Gardens became a municipal responsibility.

Under municipal administration, the position of Curator of the Botanic Gardens became part of the duties of the Director of Parks and Gardens, a position which in 1971 became that of Superintendent of Parks and Recreation. The present incumbent, George Brown, was appointed Foreman, Botanic Gardens in 1969 and in 1971 he succeeded Brian Edwards as Superintendent of Parks and Recreation, so that the Gardens once more have a part-time Curator. Mr Brown is the first to agree that the position of Curator should be a full-time occupation, but there is simply not money enough to allow the Gardens to function as anything but a recreation park. This is precisely why Nicholas Holtze was appointed as a part-time Curator, so there is nothing new in the situation. Still, like the younger Holtze, George Brown gets a great deal done.

In December 1974, however, much of what he had already achieved was destroyed by Cyclone Tracy. At that time there were 1,344 plants in the Gardens, of which 214 were indigenous plants, while the remaining 1,130 were exotics, and the damage inflicted was shattering: eighty-nine per cent of the plants were either lost completely or extensively damaged. Among the native plants melaleucas and leptospermums, relatively small plants, seemed to survive better than the larger species; of the undamaged exotics, palms suffered much less damage than coconuts, many of which were twisted from the root-system at ground level. One survivor was a Palmyra palm which, George Brown has calculated, was planted by Maurice Holtze, so there is still a link with the past.

Since the cyclone, a great deal has been achieved by the Curator and his staff. There are now eight per cent more plants than there were in December 1974 and the water reticulation system has been upgraded. A good start has been made on a new palm collection, and visitors can now see the first of what will become a water feature, which will greatly enhance the attractions of the Gardens. A new plant display house has been built and stocked; this is the Holtze Memorial Display House, which was officially opened in September 1977 by Mr John Womersley, who had donated his own collection of orchids to the Botanic Gardens in order to help with the recovery from the cyclone. In addition, the Northern Territory Government has funded additional seating and lighting, as a contribution to the first Bougainvillea Festival celebrations, held in 1979.

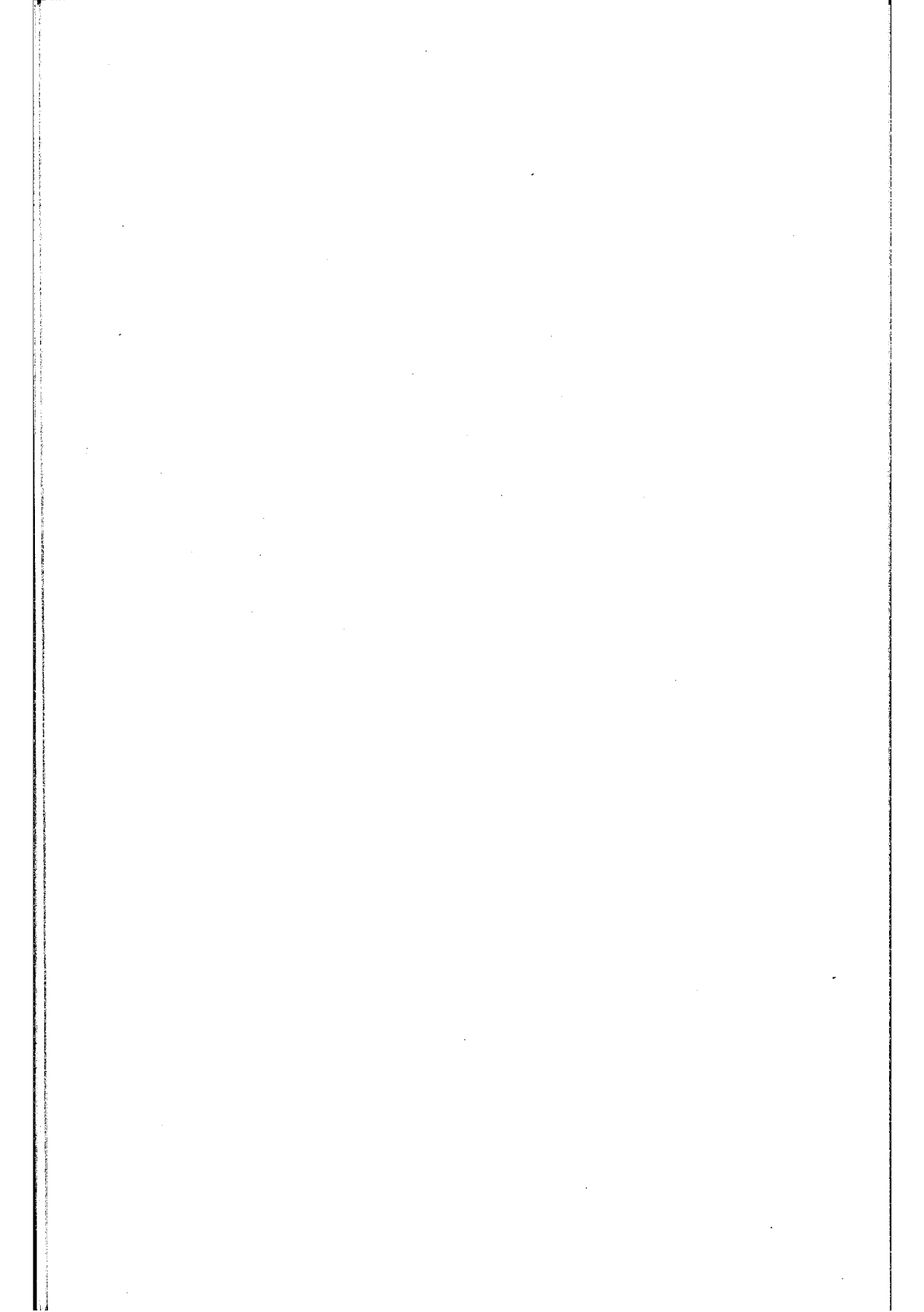
At the moment the City Corporation has a new proposal, prepared by Mr Allen White, of the Northern Territory Parks and Wildlife Commission, to put to the Government of the Northern Territory. The Corporation will propose that the Gardens should be staffed and funded by the Government, and run as a true Botanic Garden. This would mean that the Gardens will still provide a major public park as a recreational facility, but in addition staff will undertake the scientific research which is an integral part of most other botanical gardens throughout the world. If this proposal is accepted the Gardens will once more have a full-time Curator -- then perhaps it can once more become the "umbrageous paradise" it was under Maurice Holtze.

In July 1979 Darwin celebrated the "centenary" of the Botanic Gardens. As this paper shows, however, 1979 was not the true centenary year. Such a celebration could have been

held in 1969, to observe the centenary of the establishment of the first garden in what was to become Darwin. Alternatively, 1986 could be chosen as the centenary of the establishment of the Gardens on their present site. In 1979, however, all that could be observed was the fact that it was a hundred years since the Gardens were moved to a site in Fannie Bay, certainly not the present site. It is rather sad to think that some student of history, working with old newspaper files in the next century, will be delighted to discover that in the year 2079 the Darwin Botanic Gardens will be two hundred years old. Thus are historical errors compounded.

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NORTH AUSTRALIAN CROPPING STUDIES, III.

THE TIPPERARY STORY: AN ATTEMPT AT LARGE-SCALE GRAIN
SORGHUM DEVELOPMENT IN THE NORTHERN TERRITORY

W.S. Mollah

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In the compilation of data for this documentation of the cropping development at Tipperary Station help was received from numerous individuals and organizations. Sir William Gunn gave freely of his time, recollections and files. Ready access to the station was permitted by the present owner, Sir Frederick Sutton. Mr A.D.L. Hooper, then Assistant Secretary, Animal Industry and Agriculture Branch, Department of the Northern Territory, allowed perusal of files on work conducted at Tipperary. Past and present officers of AIAB recounted their experiences with the program. Former employees and officers of Tipperary Land Corporation and Gunn Rural Management, by searching their records, diaries and memories and by extending 'Territory hospitality' helped greatly in finding out what happened. Finally, several former officials of the TLC submitted to personal interviews and answered specific questions by correspondence. The debt to them all is readily and gratefully acknowledged.

W.S. MOLLAH

ABBREVIATIONS

AIAB	Agricultural & Animal Industry Branch
cm	centimetres
CPD(R)	Commonwealth Parliamentary Debates (Representatives)
CSIR	Council for Scientific & Industrial Research
CSIRO	Commonwealth Scientific & Industrial Research Organization
ha	hectares
hrs	hours
KEF	Katherine Experimental Farm
kg	kilograms
km	kilometres
m	metres
mins	minutes
mm	millimetres
NTLCD	Northern Territory Legislative Council Debates
sq	square
t	tonnes
TLC	Tipperary Land Corporation
TLEC	Tipperary Land & Exploration Corporation

Note: Unless otherwise indicated, \$ are Australian.

THE TIPPERARY STORY: AN ATTEMPT AT LARGE-SCALE GRAIN
SORGHUM DEVELOPMENT IN THE NORTHERN TERRITORY

Introduction

It is possible that, like Texas, the sheer size of the Northern Territory leads its champions to think big. If so, this may go some way toward explaining why large-scale efforts to grow crops there have been a persistent, if not particularly successful, feature of its history, especially in the Top End.

By the latter third of the nineteenth century British experience in tropical plantation agriculture elsewhere in the Empire, reinforced by explorers' reports of the Far North, convinced South Australian governments that bountiful harvests of all manner of tropical and sub-tropical products would soon flow from her newly acquired Territory. Sugar-cane was the first crop for which high hopes were held, and by mid 1881 more than 40,000 ha had been selected by southern investors for cane growing.¹ Three years later sugar was dead, a victim of poor soils, lack of appreciation of the northern environment, a shortage of labour and speculation. It was to be seventy-five years before another large-scale effort was made and Humpty Doo became first the password to success and then a synonym for failure.

The next assault came more quickly, from a different quarter and with a different crop. In May 1967 it was announced that Tipperary Station (Map 1), then the largest

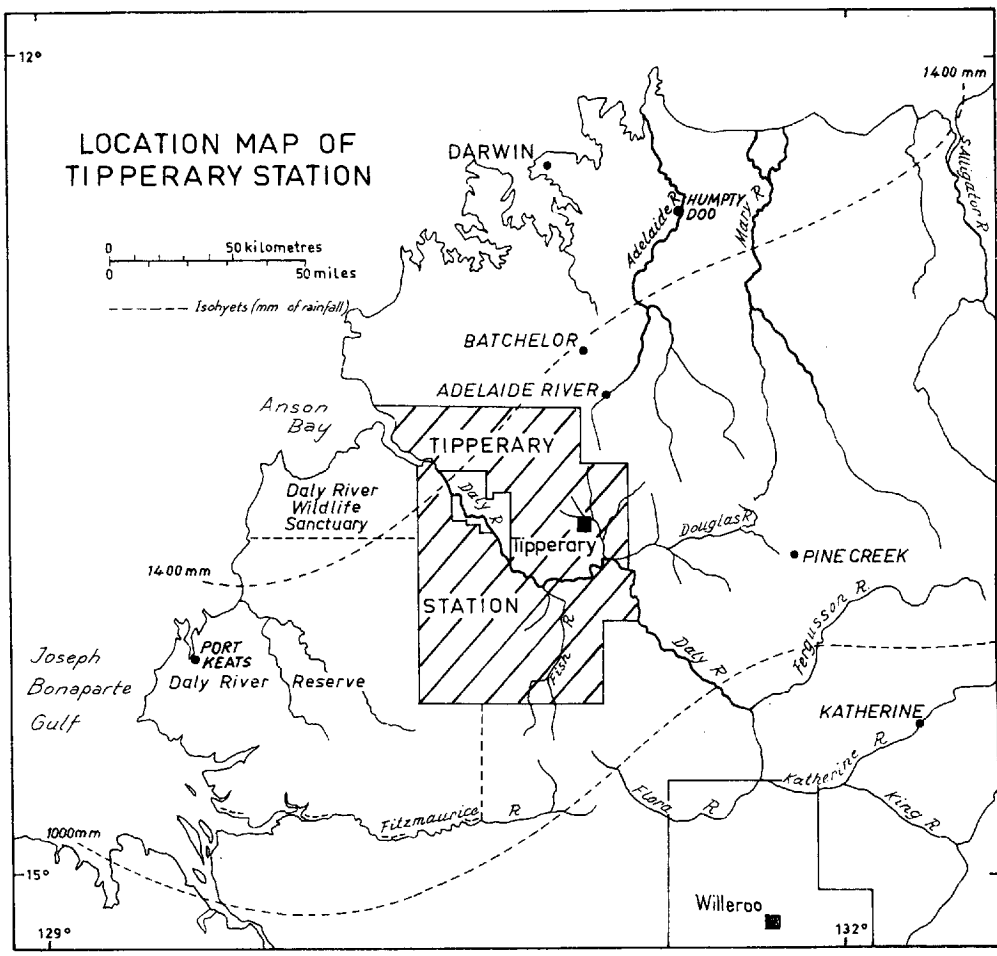
¹SAPP 33/1881.

property in the Top End, had been sold to a group of Texan investors operating under the name Tipperary Land Corporation (TLC). The new owners lost little time in making known their plans, and on 24 July the *Northern Territory News* broke the story with the headline:

TIPPERARY — BIGGEST AGRICULTURAL PROJECT
ATTEMPTED IN AUSTRALIA

Twenty million dollars were to be spent over a period of five years to establish a farming community of 15,000 people, producing annually 300,000 t of grain sorghum and high quality beef cattle. Quite naturally these proposals generated interest and excitement throughout Australia, for they were in keeping with the size of the Territory and the nature of traditional expectations held for its agriculture. The scheme was to be the beginning of the complete transformation of dryland cropping and beef production in the North.

These great expectations were never realized. After three years of trying to grow grain sorghum at Tipperary, farming was all but abandoned, and in 1973 the station was sold back to Australian interests. The lack of success resulted from the interaction of numerous complex factors, among which the most important were the vagaries of the climate, failure of management to understand fully the limitations imposed by the environment and the type of financial backing for the program. Disappointment at the failure to achieve the stated goals was as profound as had been the original hopes for their success. Champions of Territory development had once again been frustrated.



MAP 1

Prologue

The Corporation's decision to grow sorghum at Tipperary was not undertaken in a complete agronomic vacuum. From the first days of permanent settlement in the Top End (1869) numerous efforts had been made to grow a variety of crops¹ and in the years before the First World War many plants were introduced via the Darwin Botanic Garden, where small-scale trials were carried out.²

Attempts at experimentation reached their zenith when the Commonwealth Government, in its new-found enthusiasm for administering the Territory, initiated the first farm-scale trials in an attempt to show the way for an anticipated influx of commercial growers. Demonstration farms were set up in 1912 at Batchelor and Daly River, but were closed in 1919, the victims of war-time restrictions and an officialdom with little understanding of what was needed for success. Although these farms produced few positive findings, they had demonstrated the problems of the North--clearing and fencing operations were far more expensive than had been budgeted, labour was scarce, inefficient and easily lured away from farming to other work, wet season conditions made access to the farms difficult or even impossible and floods and "droughts" severely restricted crop production.

None of this led to a continuing agricultural industry, and notable successes were few. While the early attempts have interest and some relevance, events taking place after 1940 are of most concern here and it is the purpose of this

¹Bauer, 1964:93-103; 175-9; 229-35.

²Bauer, this volume.

section to review efforts made and the development of agronomic experimentation after the Second World War.

One of the successes noted above was the Army Farm program. These farms were set up to provide fresh fruit and vegetables to troops stationed in the Territory during the Second World War. From the initial cultivation of approximately one hectare at Adelaide River in 1940, the scheme expanded to a series of farms situated at Adelaide River, Hayes Creek, Katherine, Elliott, Wycliffe Well and Spinifex with an aggregate area, in 1944, of over 120 ha and production of 1,670 t.¹ Council for Scientific and Industrial Research (CSIR) personnel and officers from the Waite Research Institute in Adelaide, acted as technical advisers. In addition to the production of a wide variety of nutritious fruit and vegetables, an experimental farm at Comalie Creek was used for trials in tropical horticulture. Their success was achieved because labour and other resources were not limiting factors, a large "captive" market was at hand and commercial economic constraints did not apply.

The bombing of Darwin in over 50 raids during 1942 and 1943, and the deployment of a large defence force in the Territory during the war, stimulated national interest in the strategic importance of the area. It was believed that development and closer settlement of these northern regions were vital in order to deter or defeat any future attack on this part of Australia. After the war, successful agriculture was seen as the first step in the move to populate the

¹Fairclough, 1962:84.

North, and recent experience with the army farms demonstrated that farming could succeed.

In 1945 the Northern Australia Development Committee was formed by the Commonwealth Government and the State Governments of Queensland and Western Australia. The Committee's first move was to authorize systematic surveys of the main northern regions in order to make an assessment of available natural resources. These surveys were undertaken by the Land Resource and Regional Survey Section of CSIR (Later the Commonwealth Scientific Industrial and Research Organization (CSIRO)), and the first area surveyed in 1946 was the Katherine-Darwin region. For descriptive and comparative purposes, and because the large areas to be covered dictated the use of reconnaissance methods, a new technique involving the use of *land systems* was developed. A land system was defined as "...an area, or group of areas, throughout which there is a recurring pattern of topography, soils and vegetation."¹ Land systems were considered to be of three types--simple, complex and compound--and most of the nineteen land systems defined for the Katherine-Darwin region were either complex or compound. The most extensive of these was the Tipperary Land System of an area of 17,845 sq km and located "...to the north and south of the middle section of the Daly River and...southwards beyond the Katherine and Flora Rivers."² In the discussion of the agricultural prospects of this system it was considered that "...because of its accessibility and general suitability, the possibilities of dryland agriculture and associated

¹Christian & Stewart, 1953:21.

²*ibid.*, p.100.

animal industries in this area should be fully explored...."¹ Field trials were recommended before development was attempted. Further pedological information on the soils of the region followed three years later.²

After the war two new initiatives accelerated experimental work on agriculture. In 1946 the CSIRO formed the Katherine Research Station by taking over a 40 ha army farm,³ two years later adding a further 445 ha some 5 km distant, while in 1953 the Northern Territory Administration established the Katherine Experiment Farm (KEF). It was at these research stations that the foundations were laid for experimental agriculture in the Tipperary region. Of the variety of crops grown peanuts and grain sorghum showed the most potential for commercial production. Investigations into pastures revealed that better management could improve production from native pastures, and that the quality of feed available to stock could be improved by the use of sown pastures, fodder crops and crop residues. Land preparation, soil fertility and moisture relationships and other agronomic aspects of crop production were also investigated by workers at these centres.

However, the first major cropping developments attempted in the Territory did not take place on the Tipperary Land System. Following the Second World War a "food for Britain" campaign was initiated throughout the Commonwealth to assist

¹Christian & Stewart, 1953:103.

²Stewart, 1956.

³CSIRO, 1959:4.

the rehabilitation of war ravaged Britain. Inspired by this sentiment and the efforts of the Queensland-British Food Corporation,¹ William Alexander attempted to grow grain sorghum at Sturt Plains near Newcastle Waters in 1949-50. Average rainfall for the district, over 300 km south of Katherine, was 480mm, but 450 mm fell in late December 1949, which ruined the seedlings on most of the 3,240 ha planted. Further heavy rains in early February inundated the areas which had been re-sown, with the result that the first year's crop was a failure. After a similar fate befell the 1950-51 crop no further commercial production was attempted. A valuable lesson in the vagaries of the northern environment went completely unheeded.

In 1954 the Territory Rice development was sponsored by a group of investors from the United States, with the aim of producing enormous amounts of rice on the natural floodplain of the Adelaide River. Development of 200,000 ha over 15 years was proposed, but the maximum area planted was about 2,000 ha in the 1958-59 and 1959-60 seasons. Thereafter the company ceased operations, although rice growing by independent farmers continued on a smaller scale until 1963. During its lifetime this development dominated agriculture in the Territory, and such was its impact that Humpty Doo, the settlement for the project, became a household name throughout Australia (Map 1). Equally widespread was the belief that the failure was due to the voracious feeding of magpie geese (*Anseranas semipalmata*), but the reasons for failure were far more complex and included a poor choice of site, lack of knowledge of rice agronomy in this area, a too

¹Rogers, 1960.

rapid expansion of the program and inadequate water control.¹ These failures set a poor precedent which was followed by other large-scale projects.

In 1959 Professor H.C. Forster, Dean of the Faculty of Agriculture, University of Melbourne, was commissioned by the Minister for Territories to head an inquiry into agriculture in the Northern Territory. The terms of reference were:

To survey the present state of agriculture in the Northern Territory, including the results of experiments and field trials, and to report to the Minister for Territories on:

- (a) the prospects of promoting agricultural settlement on an economic basis in the Territory; and
- (b) the major factors to be considered in shaping an agricultural policy for the Territory....²

In 1960, after wide consultation with technical experts and people with practical experience in the Territory, the Committee released its report, *Prospects of Agriculture in the Northern Territory*, often referred to as the Forster Report. This considered expansion of research into the Tipperary region to be worthwhile. Among its recommendations was the need for a further survey into the suitability of soils for cultivation and pasture improvement in the Tipperary Land System. This was quickly acted upon and the survey was completed by CSIRO in 1961.³ In the 19,420 sq km

¹Fisher, 1977:49-50.

²Forster, Kelly and Williams, 1960:1.

³Speck *et al.*, 1965.

surveyed, 20 smaller land systems were identified and of these, 10 occur on Tipperary Station. Of these the Jindara, Wriggley and Blain systems were considered to hold the most potential for cultivation; these systems, described in Appendix I, were those upon which cropping was eventually carried out.

Another recommendation of the Forster Report was for the establishment of pilot farms in the Top End; on the Tipperary Land System these should assess the fattening of cattle on improved pastures. In addition, the report emphasized the need to determine suitable crop and pasture rotations. Although no pilot farms were established in the Tipperary region, pasture trials were conducted by CSIRO on Tipperary Station and this work showed Townsville lucerne (*Stylosanthes humilis*) and sabi grass (*Urochloa mosambicensis*) to be the most suitable legume-grass pasture then available.¹

The Committee also instituted the clearing of 80 ha of bushland at Katherine and another 60 ha on the Daly River road on Tipperary Station which indicated the cost of pulling to be about \$5/ha and revealed aspects of the process which required further investigation. In its consideration of land tenure matters the Committee recommended that agricultural leases should only be granted for lands which could be developed into commercial farming units and that, after certain developmental conditions had been met, conversion of these leases to freehold should be made possible. Many of these recommendations were important in the subsequent development by the TLC.

¹Fisher, 1971:43-47.

The experimental results from the Katherine Research Station have been summarized,¹ and the annual reports of the Agricultural and Animal Industry Branches of the Northern Territory Administration (AIAB) from 1953 until 1966 recorded the progress at KEF. Varietal testing showed Texas 610, a new hybrid sorghum, to be the best yielding type and it replaced the variety Hegari as the recommendation for the district. Table 1 shows the yields obtained from these two sorghums on large experimental areas at KEF and indicates the yields to be anticipated from commercial production. Costs of production for four of these trials averaged slightly in excess of \$62.50/ha. Investigations on virgin soils indicated the value of deep ploughing to 15-20 cm and, depending upon seasonal conditions, the need for approximately 376 kg/ha of superphosphate and 90 kg/ha of nitrogen to obtain maximum sorghum yields. Other work revealed variations in yields with different crop spacings, and plant establishment problems which resulted from surface sealing of Tippera loams as they dried after rains. A depression in yield resulted from sorghum monoculture, showing the advantages of a grain sorghum-legume rotation.² In addition, work at Katherine had made available information on land clearing, land preparation and planting techniques.³

Shorthorn cattle grazed on introduced forages gained weight throughout the year, in contrast to those grazing on native grasses, which during the dry lost approximately

¹CSIRO, 1959; Norman, 1966.

²*ibid.*, p.43.

³*ibid.*, pp.9-24; Richardson *et al.*, 1967:5-9.

TABLE 1
Yields of Grain Sorghum from Katherine Experiment Farm
1957-58 to 1966-67

Season	Area (ha)	Soil	Variety	Grain Yield (kg/ha)	Comments
1957-58	23		Hegari	2690	
1959-60	20	Brown sandy loam	Hegari	739	sown dry
1960-61	30	Red clay loam	Hegari	595	dry March
1961-62	37	Red sandy loam	Hegari	1120	
1962-63	26	Red clay loam	Texas 630	1513	
1963-64	23	Red sandy loam	Hegari	70	after grass pasture
1963-64	5	Red clay loam	Texas 610	2241	after cowpea
1963-64	5	Red sandy loam	Texas 610	1524	after cowpea
1963-64	8	Red clay loam	Texas 610	890	after bulrush millet
1963-64	5	Red clay loam	Texas 610	1434	after cowpea
1963-64	12	Red sandy loam	Hegari	1008	after bulrush millet
1964-65	20	Red brown alluvial	Texas 610	2140	
1964-65	23	Red brown alluvial	Hegari	2522	
1965-66	12	Red clay loam	Texas 610	1569	
1966-67	17	Red brown alluvial	Texas 610	3340	after Townsville stylo

Source: Richardson, Woods and Edey, 1967.

20 per cent of liveweight gains achieved during the wet season as a result of protein and phosphorus deficiencies in the pasture.¹ Brahman and Afrikander cattle performed better on native pastures and all stock improved weight gains on Townsville stylo, a self-seeding annual legume which could be grazed as standing hay during the dry season, when its higher protein content prevented weight losses. Norman² showed similar value in dry season feeding of protein supplements. However, it was not believed that intensive dry season feeding of cattle on conserved roughages or concentrates would become common practice in the then economic climate. Experimental work had progressed to the stage where further assessment of agronomic and economic aspects of a cropping-cattle fattening system of farming would be best conducted under trials in simulated or real commercial operations. This work also foreshadowed a trend away from fattening of store cattle towards breeding and raising younger cattle to marketable condition.

The decision to grow sorghum in preference to other crops such as peanuts was dictated by market conditions at the time. Clearly the local market could not absorb large quantities of any crop, whereas the export market for sorghum looked especially bright. A review by Sault³ showed that the future demand for grain sorghum would increase greatly. An improved standard of living in Japan had increased consumption of livestock, dairy and poultry products. Larger amounts of grain were required as livestock feed and

¹Norman and Arndt, 1959.

²Norman, 1963:280-3.

³Sault, 1967:165-7.

grain sorghum had price and quality advantages over maize. Japan was keen to reduce its dependence on the United States for its supplies and domestic American policy was not aimed at greater production.

As is shown by the AIAB annual reports of 1964-65 and 1965-66, production of grain sorghum in the Territory at that time was neither on a large scale nor successful. In the extracts quoted below the significance of the weather in affecting yields is underlined, and in the 1964-65 extract mention is made of the role of sound management and farming techniques.

For the second successive year seasonal conditions were very poor for grain sorghum production. Land preparation activities prior to the wet season indicated that some 15-1600 acres of sorghum would be sown in the Katherine/Pine Creek/Adelaide River area. Due to the dry January-February period much of the cultivated land was never sown.

16 farmers sowed a total of 813 acres of which 80 acres were sown twice. Of this area, 408 acres was harvested for grain and 80 acres of good crop were baled for hay. The remainder was too poor to harvest for grain, although some areas were baled for hay. Total grain yield was approximately 200 tons (a further 100 tons were produced on the Katherine Experiment Farm). Varieties used were Brolga, Texas 610 and Hegari.

Not all the complete failures and poor yields can be blamed on the unfavourable weather conditions. In some cases inadequate land preparation and bad farming practices were a major contributing factor.¹

Sorghum. Owing to inclement weather only two farmers sowed sorghum in the Darwin district. From 120 acres sown, 90 acres were harvested

¹*Annual Report AIAB, 1965:108.*

yielding 32½ tons. The stubble was baled for feed. At Katherine the crop was almost a complete failure. Of 550 acres planted by nine growers, 64 acres were harvested for a total of 22 tons. With two adverse years in a row, some growers will be discouraged from continuing with this crop.¹

The Physical Environment

The physical environment of the Top End has always exerted a strong limiting influence upon man's activities there, and the operations at Tipperary were no exception. Climate and its associated phenomena certainly played a dominant role, followed by soils into which, of course, climate also enters. Topography and drainage exerted little influence initially, and the natural vegetation, since it was eliminated in the clearing process, almost none at all.

Topography and Drainage

The areas selected for clearing and cropping were all of moderate relief, averaging between 10 and 20 m/sq km. Slopes were smooth and comparatively gentle (range, 1:25 to 1:250) and created no problems in the clearing stages. However, they were quite sufficient to lead to gullying once clean-cultivated, and in the northern part of the area cleared land was often backed by abrupt, rocky residual hills from which runoff was occasionally very heavy.

Drainage of most of the cleared area is to the Daly River, particularly by Green Ant Creek and its tributaries.

¹*Annual Report* AIAB, 1966:11.

Only the northwestern Forster Block drains to the Reynolds River. Stream gradients are modest, rarely exceeding 15 m/km, and swampy areas few.

Climate

Detailed analyses of the climate of the Katherine-Darwin region have been made by Christian and Stewart,¹ Slatyer² and Fitzpatrick.³ Wherever possible data from Tipperary Station are presented here, but more detailed information is available for conditions at Katherine⁴ and this has been used to illustrate general patterns. However, because Tipperary Station is closer to the coast and farther north, the long-term range of the climatic elements tends to be smaller.

The climate of the region is typical tropical savannah in which a marked seasonality of rainfall is the most obvious characteristic. A warm, virtually rainless winter (May to September), during which southeast winds are dominant, is followed by four to six weeks (October to early November) of transitional conditions, during which temperatures and humidity increase and the convectional thunderstorms which herald the coming "wet" become more frequent. During the summer months (November to March) air movements over North Australia are largely controlled by the Asiatic monsoonal circulation, and by January its influence is

¹Christian & Stewart, 1953:27-31.

²Slatyer, 1960.

³Fitzpatrick, 1935:39-52.

⁴Slatyer, 1960.

usually fully established. Northwest winds then dominate and over 90 per cent of the average rainfall is recorded between November and March, while the heaviest falls occur between January and March (Table 2). April is another transitional period of light showers, occasional thunderstorms and clearing skies which lead into the next "dry".

Division of the year into two seasons, the wet and the dry, although true in general terms, is a deceptively simple explanation when the effects of the climate on cropping are considered. Weather conditions are not uniform throughout a season and each season differs from all others. Although in annual terms the region enjoys a greater rainfall reliability than do most other agricultural areas in Australia (deviation 17 to 20 per cent), wide variations in monthly rainfall totals occur from year to year.¹ At Tipperary homestead the average annual rainfall is 1,083 mm, with 2,203 mm and 633 mm being the extreme high and low recordings for the 1935-66 period; Table 2 shows these values and the monthly averages and ranges.

The rainfall and number of raindays for three years at Katherine, Tipperary homestead and Daly River Police Station are shown in Table 3. Patterns at all three sites are similar but the amount received at Tipperary is intermediate between the lower recordings at Katherine and that recorded at Daly River, which is closer to the coast. Rain does not fall on every day throughout the wet season, which means dry spells can occur.² Slatyer, writing from the more

¹Fitzpatrick, 1965:43.

²Slatyer, 1960:11.

TABLE 2
Monthly Rainfall Figures for Tipperary
for the Period 1935-66
(in mm)

Month	Mean	Max.	Year	Min.	Year
Jan.	243	448	1942	129	1964
Feb.	286	681	1942	48	{ 1965 1953
Mar.	179	612	1944	31	1936
Apr.	126	188	1953	0	*
May	0.6	4	1964	0	*
June	2	21	1935	0	*
July	0	3	1938	0	*
Aug.	0.5	13	1947	0	*
Sept.	7	45	1943	0	*
Oct.	49	198	1954	6	1936
Nov.	117	367	1941	25	{ 1951 1940
Dec.	198	700	1942	14	1938
Year	1083 Δ	2203	1943	633	1952

* occurred in more than 2 years

Δ average for 21 years

Source: Bureau of Meteorology.

TABLE 3

Rainfall (mm) and Number of Raindays for Three Selected Sites during Three Seasons of Cropping at Tipperary

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Year
<u>Katherine</u>													
1967-68 Rainfall Raindays	0 0	0 0	0 0	0 0	104 9	155 11	367 17	444 24	176 10	7 2	40 8	0 0	1293 81
1968-69 Rainfall Raindays	48 3	0 0	2 1	3 3	86 9	109 7	220 18	430 22	158 11	0 0	0 0	2 2	1058 76
1969-70 Rainfall Raindays	0 0	0 0	2 1	87 7	4 3	256 14	75 6	133 13	12 7	69 2	1 1	0 0	639 54
<u>Tipperary</u>													
1967-68 Rainfall Raindays	0 0	0 0	0 0	8 1	87 5	184 9	426 *	595 *	94 *	8 *	72 *	0 0	1474 -
1968-69 Rainfall Raindays	44 *	0 0	0 0	36 *	102 *	158 *	267 *	492 *	178 *	2 *	0 0	0 0	1279 -
1969-70 Rainfall Raindays	0 0	0 0	0 0	36 7	46 7	184 13	130 13	173 15	78 8	70 6	0 0	0 0	717 69
<u>Daly River</u>													
1967-68 Rainfall Raindays	0 0	0 0	0 0	0 0	44 8	156 12	528 16	563 24	145 16	18 2	188 10	0 0	1642 88
1968-69 Rainfall Raindays	* *	0 0	16 1	3 2	180 9	126 11	236 13	445 22	236 14	0 0	0 0	0 0	1242 -
1969-70 Rainfall Raindays	0 0	0 0	0 0	99 6	72 6	235 9	183 11	240 13	90 7	13 12	0 0	0 0	932 64

*not recorded

Source: Bureau of Meteorology records.

detailed records at Katherine Research Station, noted that "droughts" of eight or more days are almost certain to occur any fortnight throughout the November-April period each year and a dry spell of 20 or more days will probably occur one year out of four. Probabilities for such long dry periods increase at each end of the wet season and in drier years. Comparison of the recordings at Daly River for January and February 1968 with those of January and February 1970 shows the differences in intensity of rainfall within a season and between seasons. Because of the size of the catchment of the Daly River system, in excess of 50 sq km, and the intensity of rain during the wet season, flooding is a common occurrence around the lower reaches of the Daly which is under tidal influence up to the Daly River Police Station.

Table 4 compares the average maximum and minimum temperatures for Tipperary with the averages for Katherine, and extreme values from Katherine show the range of temperatures possible. The coolest months are June and July, and highest temperatures are recorded in November at the start of thunderstorm activity. Increases in minimum temperatures with the onset of the wet are greater than the increases for maximum temperatures, which leads to lower daily ranges between December and February. After a small increase in maximum temperatures in March-April the weather becomes cooler with progress into the dry.

Humidity levels are low from May to October; the August average relative humidity in Katherine of 24 per cent is the lowest recorded in the year. Fluctuations about the higher relative humidity levels of 60 per cent in the wet season result from variations in higher temperatures and rainfall

TABLE 4

Daily Temperature Data for Katherine Post Office
and Tipperary Station, 1957-66
(°C)

Month	Tipperary		Katherine			
	Av. Max.	Av. Min.	Av. Max.	Av. Min.	Abs. Max.	Abs. Min.
Jan.	35.3	23.8	35.1	23.7	41.1	18.3
Feb.	33.8	23.8	34.4	23.3	40.6	13.3
Mar.	34.2	22.1	35.2	22.5	40.0	12.8
Apr.	35.0	21.8	34.3	19.8	40.0	10.6
May	33.2	17.4	32.8	16.4	37.8	7.8
June	30.8	13.1	30.2	13.5	36.1	3.4
July	30.6	12.4	30.6	13.2	35.6	2.8
Aug.	33.0	15.8	32.4	14.9	38.9	4.4
Sept.	34.5	17.2	35.5	19.3	40.8	8.3
Oct.	36.1	22.6	38.0	23.6	42.2	11.3
Nov.	37.8	24.0	37.8	24.4	45.6	16.1
Dec.	35.6	24.0	36.6	24.3	43.3	17.2
Year	34.2	19.8	34.4	19.9	-	-

Source: Bureau of Meteorology.

incidence. Monthly evaporation rates peak at 220 mm in October and November, and of the average annual rate of 2,240 mm, 1,150 mm occur from October to March. Day length at Katherine varies from 11½ hrs/day in the dry to 13 hrs/day in the wet, with short twilight periods differing little from 25 mins/day.

This climatic regime in the Tipperary region is suitable for grain sorghum, which requires an average annual rainfall in excess of 760 mm. Although higher temperatures will be tolerated, optimum temperature for sorghum growth is 27°C and below 16°C growth is minimal. Within the wet season, rainfall distribution is important in determining planting times, length of the growing season, production levels and the time of harvest. Ploughing and planting must be carried out when the soil is sufficiently moist to be worked, but not so wet as to prevent the operation of machinery. Interactions between rainfall, temperature, humidity and evapotranspiration rates determine the severity and duration of periods of water stress. Although sorghum has some ability to withstand these stress periods, reductions in yield will occur.¹ In the Tipperary region vital stages of plant growth at which stress may be most severe are emergence, head formation, flowering and grain filling.² In addition, excessive rainfall can have equally harmful effects, as proven by the experience at Sturt Plains (see p. 72). Queensland experience quoted by Slatyer³ shows the interaction between temperature and rainfall: grain yields

¹Richardson, Woods and Edey, 1967:4.

²Robbins, 1970:17.

³Slatyer, 1960:24.

were greatly reduced by temperatures over 38°C occurring for three consecutive days when rain had not fallen within the previous week. Ripening of grain requires hot, dry conditions and therefore late rains can interfere with harvesting. Temperatures during the wet season are suitable for sorghum, but minimum temperatures in the dry will inhibit sorghum growth.

After studying the climate at Katherine, Slatyer¹ devised a method, based on soil water storage levels and evapotranspiration rates, which indicated the agricultural growing period. Using this method Fitzpatrick² estimated the mean potential growing season at Pine Creek (Map 1) to be 22.2 weeks (standard deviation of 3.2 weeks), after an estimated ploughing date of 16 November (standard deviation of 3.2 weeks) and an estimated mean sowing date of 7 December (standard deviation of 2.8 weeks). Similar values could be anticipated for Tipperary.

The same climatic constraints which influence sorghum growth effect the growth of native pastures. As a result cattle weights fluctuate markedly, with partial loss during the dry of liveweight gains made during the preceding wet.

In the sections which follow it will be readily apparent how these climatic elements and their variation operated to deny the Corporation success.

¹Slatyer, 1960:35-9.

²Fitzpatrick, 1965:44.

Soils (Map 2)

Any account of cropping, successful or otherwise, must include consideration of the soils in which the crops are grown, and at Tipperary they played a substantial role in the failure of the scheme. While some of the reasons for that failure lay in the nature of the soils themselves, other equally important factors were related to how the developers viewed and used them.

Until the CSIRO survey of 1946 no attention had ever been paid to the soils on the property; cattle grazing, based on natural pastures, was the only use made of them. While the survey drew attention to possible potential for cropping, the soils themselves were but one element in the land system classification.

The 1961 survey¹ focussed more closely on the Tipperary Land System, and although the observational net was tighter, the methods used were still basically of a reconnaissance nature. It was from this work that the first reasonably detailed descriptions of the soils upon which the TLC operations were based came, and of them Speck said:

Most of the soils of the area are "earth-type" profiles in which the horizons merge into one another gradually; the clay content normally increases gradually with depth, and the structure is massive with many fine pores. They are moderately acid to neutral in reaction, and the clays are mainly kaolinite. Soil colours range according to drainage status from red to yellow-red, yellow-brown, brown, and light greyish brown; the last three normally have marked reddish mottling. Varying amounts of ferruginous concretions are common. In field experiments, responses have been obtained

¹Speck *et al.*, 1965.

only to phosphorus in legumes and phosphorus and nitrogen in non-legumes.¹

In his more detailed account of the soils van de Graaff² noted the manifold effects of climate on these soils and their arable potential. Leaching of soluble materials from the soil profile is probable because rainfall in the wet season exceeds soil moisture storage ability and evapotranspiration rates; high temperatures increase the rate of weathering; rainfall intensity can cause rapid erosion which in turn is responsible for the shallowness of soils on slopes greater than five per cent and soils dry out completely in most areas during the dry season, which enables precipitation of dissolved materials and oxidation in these soils. He then classified the soils and estimated their arable potential; those soil groups which occur on Tipperary Station and in the Tipperary Land System are shown in Map 2. Descriptions of the major soil families on which cultivation later took place are given in Appendix II.

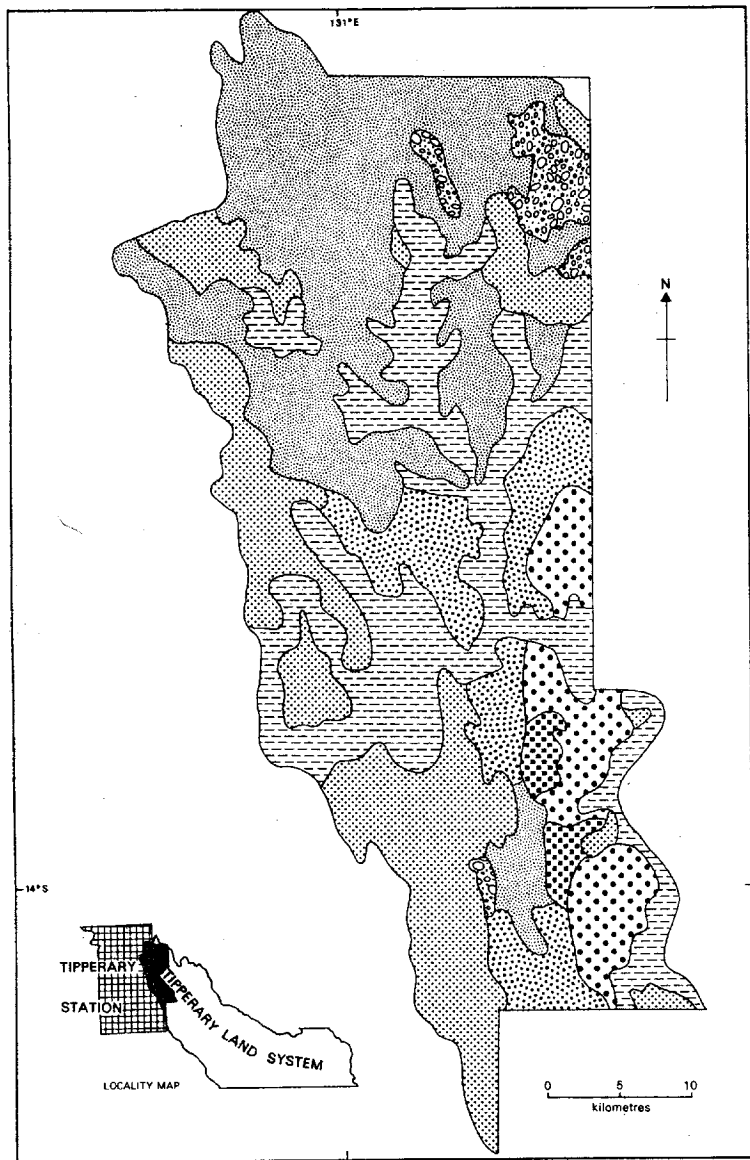
Tipperary Station (Map 3)

The area which constitutes Tipperary Station had been settled by Europeans long before the grain sorghum development. During the short life of South Australia's first settlement,³ B.T. Finnis, F. Litchfield and John McKinlay, in separate expeditions in 1865, discovered and explored the Daly River, naming it after the then Governor of South Australia. The flood plain of the lower Daly was touted as a

¹Speck, 1965:13.

²van de Graaff, 1965:68.

³Escape Cliffs, 1864-66.



**Map 2 THE SOILS OF THE TIPPERARY LAND SYSTEM OCCURRING ON
TIPPERARY STATION**



loamy red and yellow earths and skeletal soils, estimated 10-15% potentially arable



loamy red and yellow earths and sandy brown earths, estimated 20-40% potentially arable



loamy red and yellow earths, estimated 30-60% potentially arable



grey-brown cracking clays, estimated 20% potentially arable



skeletal soils and sandy brown earths, non-arable



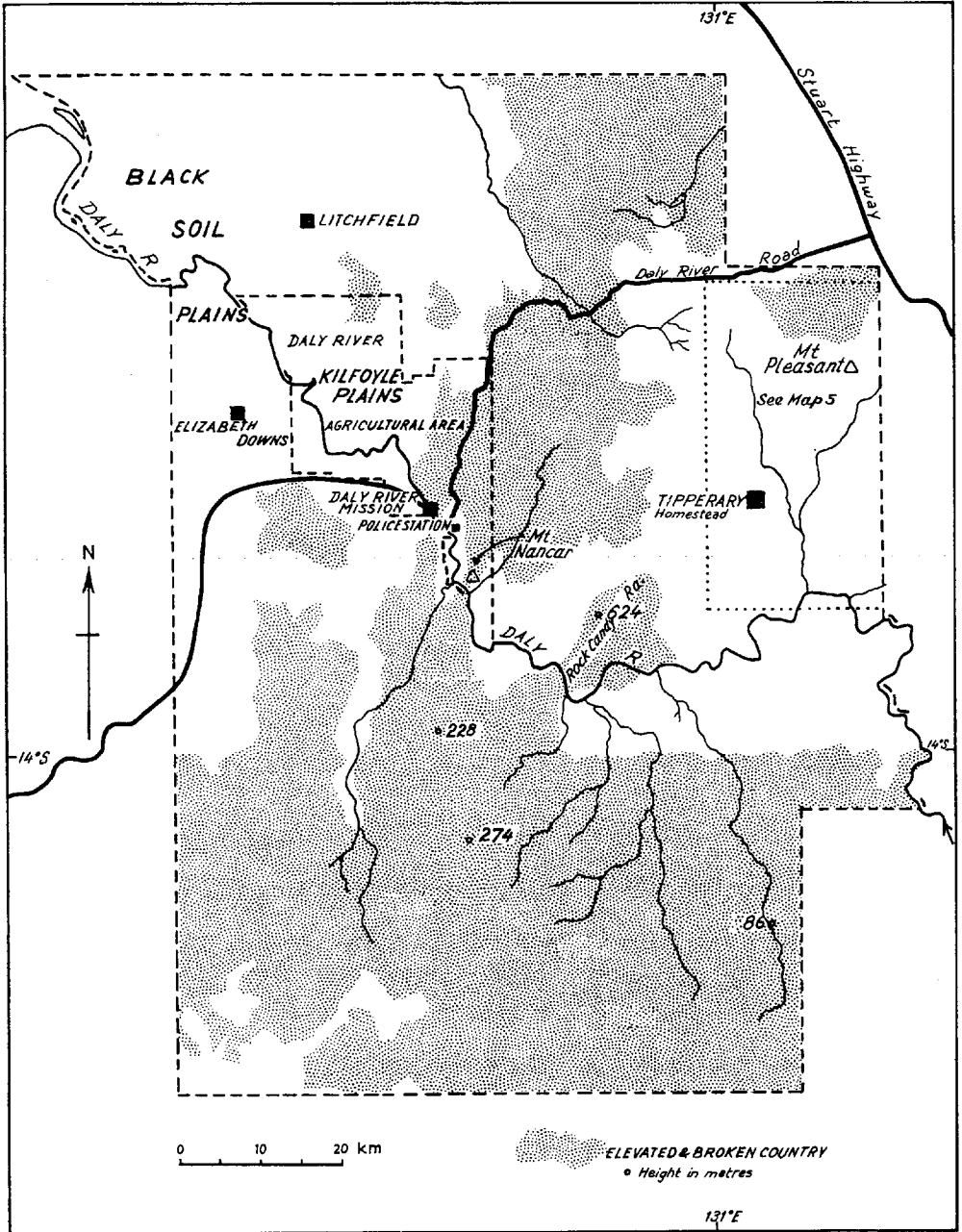
mainly sandy brown earths and sandy red and yellow earths, estimated 20-30% potentially arable



sandy red and yellow earths, estimated 50-70% potentially arable

The inset shows the relation between the land system
(17,610 sq km) and the station (9,220 sq km).

Source: van de Graaff in CSIRO, 1965.



MAP 3: Tipperary Station.

sugar-cane growing area in the early 1880s, but no real development took place. The discovery of gold and tin in the district in the 1860s and copper in the 1880s led to some activity in the district, and although various pioneers used the area around the Daly to scratch out a meagre living, no permanent industry resulted.

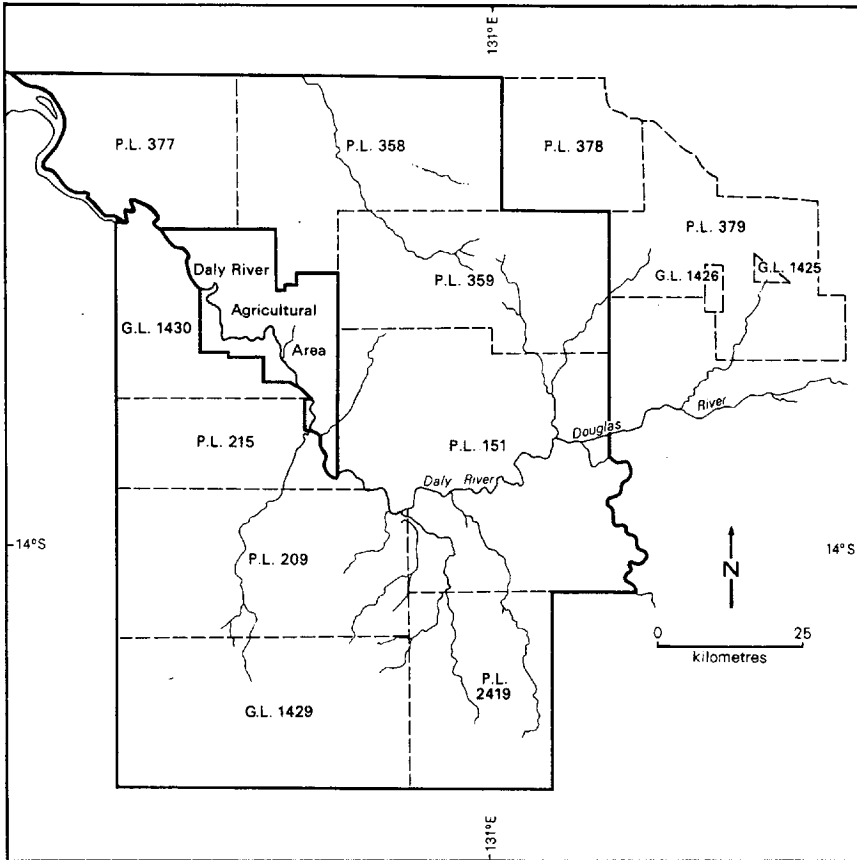
In 1886 William Joseph Byrne came to the Kimberleys with the Duracks.¹ Detailed records of his early activities in the North are lacking, but it is known that he ran cattle in the Daly district to supply meat to the miners on the gold diggings at Brocks Creek. In 1899 Byrne officially took up pastoral leases 1968 (181 sq km) and 1974 (194 sq km), each for the standard tenure of 42 years. These leases laid the foundations of Tipperary Station. Table 5 shows the expansion and modification of the family holdings over the years by the acquisition of other pastoral leases, pastoral permits and grazing licences. Because beef-cattle production was their sole means of support they were entirely dependent on the fluctuations of the beef markets. Survival during the 1920s and 1930s was difficult for the family, and it appears that the only time they prospered was during the Second World War and for brief periods during the following 12 years, when cattle were exported to the Philippines.

In 1960 Byrne's sons, Leo and Stan, took advantage of contemporary government policy and surrendered their various pastoral leases; in return they were granted pastoral lease number 562 over Tipperary Station as it is now constituted, an area of 9,220 sq km (Table 5 and Map 4).

¹Durack, 1959:85.

TABLE 5
The Growth of Tipperary
History of the Pastoral Leases Held by the Byrne Family

<u>BURNSIDE</u>		
P.L. 2230 (1914)		
122 sq km	} (excluded from P.L. 562)	
P.L. 2249 (1914)		
12 sq km		
P.L. 2274 (1916)		P.L. 378 (1941)
497 sq km		518 sq km
P.L. 2278 (1916)		
520 sq km		P.L. 379 (1941)
P.L. 2483 (1921)		912 sq km
1290 sq km		
P.L. 2484 (1921)		P.L. 358 (1941)
1005 sq km		1259 sq km
P.L. 1968 (1899)		
181 sq km		P.L. 359 (1941)
P.L. 1974 (1899)		1093 sq km
194 sq km		
P.L. 2156 (1901)		P.L. 377 (1941)
522 sq km		797 sq km
P.L. 2188 (1901)		
254 sq km		
P.L. 2209 (1902)		
518 sq km		
<u>TIPPERARY</u>		
P.L. 2419 (1916)		
836 sq km		
P.L. 151 (1931)		
1758 sq km		
P.L. 209 (1922)		
1243 sq km		
P.L. 215 (1931)		
543 sq km		
<u>TIPPERARY STATION</u>		
P.L. 562 (1960)		
9220 sq km		
<u>Notes:</u>		
(a) The years given are those in which each pastoral lease commenced.		
(b) With each change in lease, variations in area have occurred as a result of additions, subtractions and excisions of areas of land. Differences in total areas shown are accounted for by areas granted under Grazing Licences which permitted use of the land by the licensee but did not grant long term control of that land.		
(c) For some years the name Burnside Station applied to most of the land extending north and north-east of the Daly River. Tipperary Station covered the areas to the south of the river.		



MAP 4: The Consolidation of Pastoral Lease 562
from Byrne Family Holdings in 1959.

Excised from within the outer boundaries of Tipperary is the Daly River Agricultural Area (940 sq km) which includes the Daly River Mission.

The new lease became effective for a period of 50 years from 1 July 1960. Rental was set at 23¢/sq km for the first 10 years and thereafter was subject to review every decade. Specific covenants written into the lease required the stocking-rate to be increased to, and then maintained at, two beasts per square kilometre (five beasts per square mile) and, for each of the first 10 years of the lease, the construction of an additional 16 km of internal or boundary fencing was required. Basically the Tipperary Station consists of three types of country: the even coastal plains of the Litchfield and Elizabeth Downs parts of the station, the rugged relatively elevated areas of the north-eastern and southern parts and the undulating country on which the agricultural development took place.

Granting the new lease meant that the Byrne brothers had a station with a long lease available in an area which was believed to have potential for development.

Summary

By mid-1960 Tipperary Station had become a single, consolidated pastoral lease. Broad scale scientific surveys had drawn attention to the potential some of the property might have for cropping. Experiments at Katherine not far to the south had shown that peanuts and grain sorghum were agronomically suited to the district, while export market conditions strongly favoured sorghum. No pilot farms had

been established to test the economic feasibility of sorghum growing, and it is doubtful if any but a few scientists and old Territory hands recognized the importance of the variations to which the physical environment was subject.

This then was the stage upon which, after a brief interlude, an entirely new cast entered confident that by applying American know-how, boldness of action and several million dollars they could revolutionize agricultural development in the Australian savannah lands--and make a profit in the process.

The Entry of Foreign Capital

The Tipperary Pastoral Company

There is no evidence to indicate that the Byrne brothers had any intention of selling Tipperary while they were negotiating the consolidated pastoral lease, but in December 1961 sell they did, to the Tipperary Pastoral Company; the selling price was \$700,000. Directors of this company were a group of South-East Asian business men and Sir William Gunn, an experienced Queensland pastoralist, company director and former president of the United Graziers Association. Through upgrading the quality of the herd, making greater use of improved pastures and providing better watering facilities and fencing, the new owners anticipated that carrying capacity could easily be lifted to comply with the conditions of the lease and that the venture would be profitable. Unfortunately, it was not.

Capital expenditure between August 1961 and 31 January 1966 totalled over \$360,000. This was more than the company felt desirable and, although a small trading profit was

realized each year, by 30 June 1965 the company had accumulated losses of \$181,724, and by the same time the following year this had increased to \$308,747.¹ It had become obvious that the company did not have the resources to develop the property fully and a decision was made to find a buyer. An initial attempt to sell the station to a Sydney-based company was unsuccessful and an approach was then made to a group of American investors with whom Gunn was involved in Queensland.

The Texans Take Over--The Tipperary Land Corporation

The leader of the group which was to make Tipperary a household word in much of Australia was Robert M. Leibrock a petroleum engineer from Midland, Texas, who originally came to Australia in a search for oil. In the course of his travels in Cape York Peninsula he was much impressed with the pastoral potential of that region, which at the time seemed bright as a result of the introduction of Townsville stylo (*Stylosanthes humilis*) and work done by CSIRO on pasture improvement. In company with several other Americans, most of them Texas oil men, three stations in the Coen-Laura district (Lakefield, Laura and Silver Plains) totalling 8,153 sq km, were purchased. The sale was negotiated by Gunn Rural Management, a Brisbane-based consulting firm founded by Sir William Gunn.² The Lakefield Company

¹Records of Companies Office, Darwin.

²Kelly, 1971:80-81; 172. Sir William Gunn comes through as the common demoninator in what was to be the Tipperary story. He had been interested in the latter stages of the ill-fated Territory Rice scheme and in addition to his interest in the Tipperary Pastoral Company, had purchased a property of some 1,981 sq km adjoining it. Through his

was formed in 1965 to operate the stations; principals in the venture were Leibrock, F.H. Callaway, G.H. Landreth, R.E. Campbell and J.G. McMillian. Their investment totalled \$1,350,000, of which \$680,000 was for the initial purchase. Management of the stations, under direction from the owners, was conducted by Gunn Rural Management.

For a number of reasons, by October 1966 the opportunity to invest in Tipperary appealed to the Americans. An attempt to obtain greatly improved land tenure conditions over their Peninsula holdings from the Queensland Government failed, forcing curtailment of some of their plans for those properties.¹ Another factor undoubtedly was the first stages of the Ord River Scheme, which promised a revolution in cropping for much of the North,² and the Texans were infected with the enthusiasm for development then pervading the North. Both short and long-term prospects for the cattle industry were promising, for there were world-wide beef shortages, increased consumer demand and limitations to

consulting company and other activities he had wide interests and influence in Australian pastoral matters. My research has not revealed precisely when or how Gunn and the Lakefield principals came together, but since all were in the development business, it is not surprising they did so.

¹Kelly, 1971:80-81; 172-4.

²Work on a diversion dam at Kununurra was begun in 1960, a pilot farm of 970 ha was established, and the first farms allocated in 1962 from which the first commercial crops were harvested in 1964. An appraisal of the scheme led to the decision by the Commonwealth Government, in November 1967, to proceed with the construction of the main dam to hold back a lake with a capacity of 5,674 million cubic metres and an expansion of the cultivated area. These were indeed heady days for the proponents of northern development. (Kerr, 1975:169).

production in other parts of the world. In Australia, increased government awareness of the role of the beef industry in the economy led to substantial tax concession to encourage investment. Widespread popular interest in northern pastoral areas had resulted in the possibility of capital gains which would be difficult to match in other sectors. Finally, opening of the Katherine and Darwin meatworks in 1963 greatly improved returns to beef producers in the Top End, and Tipperary was ideally situated to market cattle at either abattoir.

The Texans did not go into the development of Tipperary blindly. They considered the available research data and the existing infrastructure, made market investigations and initiated feasibility studies both in the United States and Australia. After their Queensland experience, the long term of the Tipperary lease was undoubtedly a significant factor. What they learned and calculated impressed them favourably. As Liebrock told an employee of Gunn's, he considered the Top End to be 20 years further advanced than Cape York Peninsula.¹

Arrangements were therefore made to buy the station and an invitation to participate in the venture was accepted by William Neely, a lawyer from Midland, Texas, who was part-owner of Kalpower Station adjoining the Lakefield properties on Cape York, and who played a prominent role in the development. A major company re-organization was necessary, and the Tipperary Land Corporation was registered in Texas on 30 January 1967. Leibrock became President of the new corporation, Neely was made Vice-President and Sir William

¹Syd Parker, personal communication.

Gunn held the post of Managing Director. Transfer of the ownership of the assets of the Lakefield Company to Tipperary Land Corporation became effective in March 1967. Through the assumption of a vendor's debt of \$31,000 and the payment of \$1,072,000 in cash, Tipperary Station, its cattle and improvements were purchased in April 1967.

Preliminary Moves

To transform Tipperary from a languid cattle station into a large-scale cropping venture required action in several spheres, some of them outside the direct control of the Corporation. Important land tenure matters had to be settled, specific plans for development made and finance arranged. While in the sections which follow a particular progression of events is evident, it should be remembered that they were, in fact, proceeding simultaneously, and were often dependant upon one another for ultimate success.

Land Tenure

A potentially serious stumbling block lay in the provisions of the Northern Territory Land Ordinance then pertaining which forbade cultivated agriculture on pastoral leases. In addition, to undertake a venture of the proposed magnitude the Americans wished to be assured of a more secure tenure than the 50 year lease under which Tipperary was held, a lease which expired in 2010. Clearly if the scheme was to go ahead changes to the Ordinance were necessary, and this responsibility lay with the Northern Territory Legislative Council, although all legislation dealing with crown lands had to be reserved for review by the Federal

Government.¹

Early in February Leibrock wrote to the Australian Government outlining the proposed scheme and indicating the changes considered necessary.² Negotiations with several departments followed with the result that on 9 March the Minister for Territories (Hon. C.E. Barnes) distributed to the House of Representatives a statement made by the Administrator of the Northern Territory which gave notice of proposals to amend the Ordinances.³

Two days after this statement was released Dr Rex Patterson, Opposition spokesman on northern development, raised the matter in terms of foreign interests gaining exclusive rights and eventual freehold title to approximately 400,000 ha of the best agricultural land in the Territory before Australian farmers or companies had a chance to develop it.⁴ This reflected a widespread feeling in Australia that too many of the resources of the country were under foreign control. On 16 March Patterson said he felt that the Corporation had been given access to the alterations to the Ordinances before the Parliament was aware of them.⁵ The

¹At that time Legislative Council consisted of 17 members, six of whom held their posts by virtue of being government officials, three others were appointed by the government but were non-official, while the remaining eight were elected by the Territory voters. It was therefore possible for the elected members to defeat government proposals by gaining the support of one or more non-official members. (Heatley, 1979:31, 34.)

²Leibrock to McEwan, Minister for Trade and Industry, 9.2.1967. Unpublished TLC files.

³CPD(R), 1967, 54:382.

⁴*ibid.*, p.502.

⁵*ibid.*, pp.810-23.

necessary legislation was introduced into the Legislative Council and during the second reading debate on 18 May the Director of Lands (A.W. Richardson) said the changes were intended to encourage development of the North by making provision for cropping on pastoral leases and for extension of the term of the leases to more than 50 years.¹ 'Roll-over' provisions in the bill meant application could be made between the twentieth and fortieth years of a pastoral lease to have a new 50 year lease granted upon surrender of the existing lease. While this provision fell short of freehold title, it did grant leaseholders the opportunity to extend their period of tenure. In the same legislation residential requirements on agricultural leases were removed and the maximum area that could be held under these leases was increased to 81,000 ha.

The elected member for Arnhem, R.J. Withnall, analysed in detail the proposed changes and the structure of the Bill, and repeated concern that the contents were known to 'private persons' before they were known to the Council.² These allegations were denied by A.V. Atkins, Assistant Administrator, when he replied that the principles of the changes had been under consideration for some time and that no commitment had been given to the Corporation. As a result of dissatisfaction with some sections of the Bill it was not passed during the May sittings of the Council. After further amendments and what was often a lively debate, the bill was passed on 17 August 1967 and received assent on 8 September. Relevant changes effected by the legislation are shown in Table 6.

¹NTLCD 1967, 9:302-314.

²*ibid.*

TABLE 6
Changes in Pastoral Leases in Northern Territory resultant from Crown Lands Ordinance (No 2) 1967

Previously	Under 1967 Ordinances
<p>1. Development conditions specified for first 15 years - no incentive to continue improvements thereafter.</p> <p>2. Arable lands except for pasture improvements and seed production, remained uncultivated.</p> <p>3. Pastoral lessees could apply to subdivide their leases into two or more pastoral leases.</p> <p>4. At expiry of lease current lessee had priority.</p>	<p>"Roll over" provisions. Retained maximum term of 50 years and enabled lessees to apply to convert to a new 50 year lease between 20th and 40th year of their lease. This allowed:</p> <ul style="list-style-type: none"> (i) secure tenure sufficient to encourage development over full period of lease; (ii) Crown more frequent opportunities to regain land alienated under pastoral leases; (iii) more frequent reviews of lease conditions and therefore closer settlement; and (iv) compensation to be paid for any improvements on land surrendered to Crown. <p>Agricultural activities permitted on pastoral leases:</p> <ul style="list-style-type: none"> (i) lessee to notify annually extent of agricultural production; and (ii) rent to be reappraised on next due date on basis of agricultural land. <p>Subdivision of developed agricultural land into economically viable agricultural farms permitted. Administrator's and Minister's approval necessary after agriculture proved viable on proposed subdivision.</p> <p>Because of "roll over" provisions, no priority at expiry of lease.</p>

Source: Northern Territory of Australia, Crown Lands Ordinance 1931-72:48-64.

On 6 September the Administrator granted approval for the official transfer of the title to Tipperary Station to Tipperary Land Corporation. Issue of debentures to the American public commenced on 12 September. Originally this issue had been planned for May, but was delayed pending the alterations to the Crown Lands Ordinance. The delay "did not seriously...impede the achievement of corporate goals."¹ Indeed, it may even have helped, for between the May and the September sittings of the Legislative Council the Corporation was able to make public its quite startling plans. The fact that operations actually began at the station well before the enabling legislation was enacted indicates how confident was the Corporation that the Northern Territory would be more amenable than had been Queensland.

Plans for Development

The principals in the TLC intended to establish a diversified and integrated resource development operation, and while the land tenure and financial matters were being sorted out, they developed their plans--no one could accuse them of thinking small.¹ On Cape York development was to proceed toward more efficient production of beef, but for Tipperary, in response to the indicated potential of the district, wider-reaching plans were forged in pursuit of the four main themes of cropping, improved cattle production, fishing and mining.

¹Unless otherwise indicated, the proposals for development noted below are those contained in the *Prospectus*, Tipperary Land Corporation Debenture and Common Stock Issue, 12 September 1967, published by F. Eberstadt & Co., New York.

Cropping

The cropping operations proposed were confidently expected to revolutionize the rural sector for much of North Australia. Application of American 'know-how' would produce immense amounts of grain sorghum¹ needed to feed an increasingly hungry world, and the *Prospectus* made it sound a moral duty to do so. Traditional ideas of "small agricultural lots developed by individuals using old back-breaking methods and small equipment" were anathema to the concept of this development.² Because vast areas of land were available huge cultivations were to be prepared to make maximum use of mechanization, and hence allow more efficient production.

A pair of D9 Caterpillar tractors dragging an anchor chain and cable between them were to pull the virgin, open eucalypt woodland. Follow-up operations of clearing timber into windrows were to be done by another D9 equipped with especially designed rakes. On completion of clearing, the areas to be cultivated would be deep ploughed to 25 cm with cultivators imported from the United States. Losses in operating efficiency would be minimized by avoiding turning such large equipment in small areas. Visions were held of more than 570 ha being ploughed in a day and of "...16-row cultivation equipment with drivers like ships' captains

¹No other main crop seems to have been seriously considered, at least in the early stages of the scheme. This may have been due to the fact that a good deal of experimentation with sorghum had been carried out at Katherine with reasonably good results, and there was a ready world market for the grain. Perhaps the recollections some of the Texans had of thousands of hectares of the crop at home played a role.

²W. Neely, quoted in *N.T. News*, 24.7.1967:1.

putting down rows of crops two miles long...."¹ It was a captivating and inspiring scenario.

In the first season a total of 4,850 ha would be planted to grain sorghum and, subject to results, this area would be doubled for each of the next four years until approximately 78,000 ha were under the plough.² In accordance with research findings 90 kg/ha of nitrogen would be applied. This would require over 1,000 t of urea for the first crop and, in addition, more than 2,400 t of superphosphate would be used. Maintaining these rates of application would require in excess of 40,000 t of superphosphate and 16,000 t of urea in the fifth year.

A contract signed with Mitsui and Company for an initial period of two years guaranteed a market for the grain. Provided no less than 5,000 t was available for export each year, the Japanese would pay \$44.50/t for the first crop and for the second crop the price paid would be based on that quoted on the Gulf Coast of the United States. Transport of the sorghum to Darwin would be by either the Stuart Highway or the North Australia Railway, each of which was close to the station, and in Darwin existing facilities for the bulk handling of iron ore could be used to load the grain for export. Provision of relatively minor support facilities would be necessary and the company would supply these. It was believed that an annual production of 5,000 t

¹*N.T. News*, 24.7.1967:1.

²With respect to this goal Leibrock commented: "There was really no scientific basis for the decision to cultivate 4,850 ha for the first year and to double this figure in each successive year." (Leibrock to Bauer, 2.11.1979. Personal communication.)

would be easily attained, because expert consultants in Texas felt that, at the suggested levels of fertilizer application, a conservative estimate of yields would be 3,360 kg/ha and, given sound management, 4,480 kg/ha would be possible.¹ The figure of 3,360 kg/ha, which exceeded all yields obtained at KEF (Table 1, p.76), was used in all economic forecasts and is used in Table 7 to show the amounts of sorghum it was hoped to produce. In addition, the contract price for the first crop is used to give estimates of possible returns to the Corporation.

TABLE 7

Proposed Levels of Sorghum Production and Returns
for the First Five Years of Cropping

Season	Area (ha) ¹	Production (tonnes) ²	Income (\$) ³
1967-68	4,856	16,316	726,062
1968-69	9,712	32,632	1,452,124
1969-70	19,425	65,268	2,904,426
1970-71	38,850	130,536	5,808,852
1971-72	77,700	261,072	11,617,704

¹All calculations are based on 4,856 ha being cultivated in the first year.

²Based on one crop each year with a yield of 3,360 kg/ha.

³Based on a price of \$44.50/t.

Research undertaken at the International Rice Research Institute in the Philippines had explored the ratooning capabilities of sorghum and showed that three crops could be harvested from the one planting.² Introducing such a

¹Bloodworth, M.E. *et al.*, 1967:74.

²*The IRRI Reporter*, 1969:5(2):3-4.

program at Tipperary would effectively expand the area cropped each year, introduce economies of scale and increase the annual production to much higher levels than those shown in Table 6, which are based on one harvest per year. To allow multiple cropping, irrigation would be used, based initially upon use of underground water supplies and then, at a later stage, water pumped directly from the Daly River. While the flow of the river was sufficient to irrigate at least 8,000 ha at all times during the dry season, the first trial area grown with water from this source would be about 1,200 ha. Following the example of the Ord Scheme, construction of a dam on the Daly, probably at Mt Nancar (Map 2), would permit considerable expansion of the irrigation scheme in the long term.

At Tipperary the use of irrigation would help sorghum growth during periods of water stress in the wet season, and thus ensure production levels well in excess of the 5,000 t required to meet the terms of the export contract. Although grain sorghum production was the main thrust of the cropping program, the possibility of crop diversification was recognized. Peanuts, a leguminous crop, would be introduced into a crop rotation program within a couple of years, and growing rice on suitable parts of the coastal plains around the lower reaches of the Daly was considered.

Once cropping had been proved viable, the involvement of the Australian workforce would be increased by encouraging the workers to purchase equipment for share farming and then their own blocks of land. Appropriate farm size for this subdivision was thought to be 4,800 ha, and as proven farming areas were sold the main areas of cultivation would be expanded accordingly, until the suitable arable land,

estimated to be in excess of 300,000 ha, was cropped. Corporation finance would be available to help employees start their own farms. This program would be instrumental in supporting the population of 15,000 it was hoped would be established as a result of the corporation's activities.¹ A population of this size would have an enormous impact on the Territory's economy, as the 1966 census showed the population of the Daly River district to be 551 out of a Territory total of 21,540.²

Cattle Production

At the time of the takeover by the Americans the cattle on Tipperary, basically Shorthorn stock, were estimated to number 25,000 head. Under open range conditions weight gains followed the seasonal patterns mentioned above (p.77). Fences were few and other facilities limited to holding yards used during the spasmodic musterings. Proposals for improvements followed two main lines: better bloodlines were to be introduced to breed higher quality cattle and concurrently, management and nutritional standards raised. Two distinct and separate stud herds would be maintained, one each of Shorthorn and Brahman stock. The desirable feature of Shorthorns was their adaptation through natural selection to local climatic stresses, and the Brahmans possessed better foraging abilities and tick resistance. Native cattle, selected on the basis of rate of growth, rate of reproduction and length of reproductive life would be crossed with Brahmans and the resultant crossbred cattle, having

¹*N.T. News*, 18.8.1967:3.

²Commonwealth Bureau of Census and Statistics (1968).
Northern Territory Statistical Summary 1968:20-21.

hybrid vigour, would form the basis of the commercial herd.

High prices for Brahmans in Australia, caused by a shortage of suitable animals, influenced the decision to develop Tipperary's own stud herds. For this reason many cattle reaching marketable age would be retained and this in turn would limit current income and defer realization of profits from the cattle operation.

Expansion of cattle numbers would be accelerated by increasing the reproductive rate in existing stock and reducing cattle losses. Improved management and nutrition would raise calving and survival rates and reduce the time required for cattle to reach slaughtering condition. Measures to be implemented in this direction were listed as:

- (1) the provision of better fences to control and segregate the cattle;
- (2) better forage;
- (3) more watering facilities;
- (4) construction of dips and yards in which to work the cattle and suppress and eradicate parasites such as cattle ticks; and
- (5) fertility testing bulls and culling barren cows.¹

Internal fencing would divide the property into 4,000 ha paddocks to enable better management, while more bores and dams would increase availability of water.

Townsville stylo had been introduced to the station previously on a small scale. More extensive sowings among

¹*Prospectus*, 12.9.1967:21.

native grasses would greatly improve pasture quality and provision of mineral and protein supplements would also contribute to better levels of stock nutrition. The use of supplements was not new to some of the Americans. From 1965 two of the partners in Tipperary, Neely and Faudree, had made efforts to improve nutritional levels at Kalpower, their station on Cape York. Despite opposition from the Australian management on the grounds of cost, the two Texans insisted, in October 1967, that bone meal, molasses and other supplements be fed to cattle. Their use was amongst the proposals for Tipperary. Through the prompt introduction of these methods of breeding, feeding and controlling stock long term benefits were hoped for at Tipperary.

Fishing

Coastal waters to the west of the station awaited appraisal of their commercial fishing potential. A sum of approximately \$10,000 was allocated for the initial survey commissioned by the Corporation to assess the prawning potential of the Joseph Bonapart Gulf (Map 1). If survey results were favourable and prawning operations were developed successfully, it was hoped to establish, ultimately, a home port for the fleet at the mouth of the Daly. Long-term hopes envisaged this port handling all goods and produce passing to and from the station instead of through Darwin, the closest existing port.

Mining

All senior American investors in Tipperary had backgrounds in investment in oil and mineral exploration and development. Logically activities of this kind were

included in the Corporation's goal of becoming a diversified resource development company.¹ Investment in the search for minerals was regarded as speculative but the possibility of a major find justified the expenditure. This arm of the company's activity was easily accepted in Australia, for in the late 1960s the continent was blanketed by searches for minerals, and public attention focussed on the stock exchanges where fortunes were rapidly made and lost.

Authorities to prospect were issued in the Territory by the Mines Branch of the Department of Territories. These granted the rights to search specified areas for a specific period after which they could be renewed, relinquished, or in the event of a successful find, replaced by a mining licence. Using previous discoveries in Australia as a guide, the Corporation decided to concentrate on the quest for hard rock minerals such as copper, lead, zinc, iron, nickel, gold, uranium and phosphate rock.

Finance

For so far-reaching and innovative a project to stand a chance of success very substantial amounts of money were required and this part of the operation focussed mainly in the United States.

Estimated costs, excluding operating expenses, for the farming and cattle schemes for the first five years totalled US\$15,794,000. Proposed expenditure for the first and for "a substantial portion of the second crop years," as listed in the *Prospectus* is shown in Table 8. The necessary capital was to come from private loans and from a public issue

¹*Review of Special Meeting of Shareholders*, 2.4.1968, TLC.

of debentures and shares in the United States.

TABLE 8
Proposed Expenditure for the Early Stages
of the Development

(1) Acquisition Costs of Tipperary Station	\$1,503,000
(2) Land Clearing and Land Preparation Costs (Capitalized)	176,000
(3) Farming Equipment	720,000
(4) Land Clearing Equipment	382,000
(5) Expenditures for Upgrading Herd	660,000
(6) Bulk Loading Facilities	50,000
(7) Payment of Secured Bank Notes of Lakefield Stations	401,000
(8) Working Capital	895,000
Total	<u>\$4,787,000</u>

The remaining funds received by this offering will be used to finance in part the remainder of the first five year program.

Source: *Prospectus* TLC Debenture and Common Stock
Issue, 12.9.1967:5.

The Corporation issued secured senior notes for US\$1,500,000 bearing 7 per cent interest to private American investors in September 1967. In the same way a further US\$1,000,000 was raised by 14 March 1968. Holders of these notes were guaranteed first claim on assets in the event of dissolution or liquidation of the company and other conditions of the loans made provision for annual principal repayments of US\$500,000 to commence in 1972. Warrants issued in association with the notes allowed for purchase of an aggregate 250,000 shares of common stock (see below) at US\$3.00 per share upon maturity of the notes on 15 August 1976. An agreement with the Bank of New South Wales allowed approximately US\$900,000 to be borrowed between October 1968

and September 1969, at 7 per cent interest for seven years with principal repayments beginning after the second year. This loan was secured equally with the secured senior notes. Investment in the Corporation was made more attractive by a ruling from the Australian Taxation Office that the company would be regarded as a public company in Australia. Applicable taxation rates were 37.5 per cent on the first \$10,000 of taxable income plus 42.5 per cent on amounts exceeding this base total.¹ Higher rates of taxation were payable by private companies, but in all cases liberal deductions were allowed from assessable income to calculate taxable income. Interest on company debentures payable outside Australia to foreign nationals would not be subject to tax in Australia. No capital gains tax applied in Australia and incomes taxed there would not be subject to taxation again in the United States.

Under articles of incorporation authorized share capital consisted of 5,000,000 shares of common stock and 1,000,000 shares of class A stock, all of a par value of US\$0.50 per share and with equal voting rights. These two classes of stock were, in effect, preference and ordinary shares respectively. Common stock carried entitlement to dividend payments and had priority claims over class A stock on assets if the company failed. Except for bonus share issues, class A stock did not participate in dividends, but could be converted to common stock on a share-for-share basis in any year in which cumulative net earnings reached US\$1,500,000. It was anticipated that profitability would be achieved in 1970 and in order to attain this, financial goals aimed for a 20 per cent annual rate of return with

Prospectus, 12.9.1967:36.

17 per cent as an absolute minimum. Although par value for the shares was US\$0.50, initial subscription was at a premium of US\$1.00.

In September 1967, 35,000 investment units consisting of a US\$100 debenture and 15 common stock shares were offered to the American public. From this issue it was hoped to raise US\$3,500,000 and provision was made for allocation of a further 5,000 units if required by demand. The debentures offered 6 per cent interest, matured on 1 August 1977 and were subordinated to the secured senior notes. Shares included in these investment units could not be traded separately before 12 March 1968. As response to the issue warranted sale of the extra 5,000 units a total of US\$4,000,000 was raised.

Table 9 (p.117) shows receipts at 30 September 1967 to be US\$7,019,584. With this capital base the Corporation was ready to implement its developmental programs. Some of these funds and cash generated from operations would be needed to meet interest payments before profitability was achieved. Further backing would be needed for the continuation of the program after the initial phases and this was discussed in the *Prospectus*:

Arrangements have not yet been made to complete the financing of the programs for the full five years. There is no assurance that such arrangements can be made; however, it is anticipated that the largest expenditures will be for the purchase of additional agricultural equipment which, it is expected, can be purchased under credit arrangements with the equipment dealers or financial institutions and the remainder of the required funds may be obtained from the Company's operations. If such funds should for any reasons not be available, the Company would

TABLE 9
Statement of Cash Receipts and Disbursements
For the Period 15 March 1967 to 30 September 1967
(in US\$)

Cash Balance at 15 March 1967		\$ 122,470
<u>Receipts:</u>		
Sales to the public of units, consisting of -		
Par value of 600,000 shares of common stock	\$ 300,000	
Capital paid-in over par value	300,000	
6% Subordinated Debentures due August 1977	4,000,000	4,600,000
Sale of 7% Secured Senior Notes due August 1976, together with Stock Purchase Warrants		1,530,000
Less: Discount and expenses of sale -		\$6,130,000
Common stock	50,756	
Debentures and Senior Notes	945,870	996,626
		\$5,133,374
Sale of common stock -		
Par value of 215,000 shares	\$ 107,500	
Capital paid-in over par value	107,500	215,000
Installment notes issued for heavy equipment	\$ 247,246	
Less: Interest included therein	31,493	215,753
Interim financing -		
By banks	\$ 950,000	
By others	300,000	1,250,000
Sale of cattle		197,651
Decrease in accounts receivable		7,806
Total receipts		\$7,019,584
<u>Disbursements:</u>		
Unrecovered development costs, per schedule	\$ 740,272	
Less: Depreciation and amortization included therein	153,812	\$ 586,460
Purchase of certificates of deposit		1,650,000
Payment of interim financing		1,400,000
Balance on purchase contract for Tipperary Station		1,086,400
Payment of secured bank notes		929,600
Additions to property, plant and equipment, net		1,176,816
Supplies and other prepayments and deferred charges		103,990
(Increase) in accounts payable and accruals		(340,292)
Total disbursements		\$6,592,974
Cash Balance at 30 September 1967		\$ 549,080

Source: First Progress Report, TLC, December 1967.

be required to reduce its planned operations accordingly.¹

Capital backing was adequate for the first year's crop but, with a shortage of funds for later development, success with the first crop became vital, as it would provide cash flow and act as incentive for future investment. This was to become the reef upon which the whole scheme foundered.

The Performance

Any commercial agricultural enterprise consists of two facets operating consecutively: the growing of a product and its disposal in the market place. For the enterprise to be successful each facet must be completed satisfactorily within the limits imposed by the time and finance available, as well as by the environment. In the case of Tipperary major cropping efforts were made in three seasons, and although small areas of crop yielded well, the overall performance fell well short of projections made in the original plans, and the fishing and mining operations were similarly disappointing. The effects were expressed in the balance sheets. While production and finance are treated separately in the following sections, it must be remembered that during the life of the program they were inextricably linked.

The Fateful First Season

Work began before all the legal aspects of the change of ownership and changes in Crown Lands Ordinances were completed. Sir William Gunn spoke to the men employed at

¹*Prospectus*, 12.9.1967:6.

Tipperary on 1 April 1967, outlined the program and stressed the pioneering nature of the venture to them. For at least the first twelve months the men were asked to tolerate less than ideal living conditions, as the aim of the developers was to concentrate initial investment in farming and other productive aspects of the scheme. Management policy was that the planting of 4,800 ha of grain sorghum in the first season was of paramount importance. Sir William noted, however, that upon subdivision of proven farming lands, employees of the Corporation would be given preference in allocation of the farming units.

Gathering of equipment necessary for the project began on 18 April 1967 when three D9 tractors left Brisbane and, despite delays resulting from poor road conditions, arrived at the station in time for clearing to begin on 30 April. Although no detailed surveys were carried out to determine areas for cultivation, the information supplied by the CSIRO land systems was used as a guide. Advice given by the Land Resources Section of the Northern Territory Administration was not always heeded, with the result that some unsuitable areas were cleared and cropped.

Pulling operations began along the road into Tipperary homestead and were expanded into each of the 'farm' areas to be cultivated (see Plates 1-3, pp.120-122). Map 5 indicates the parts of the station which were cleared and the area which was cropped at some time during the development. Advice received from CSIRO recommended clearing the woodland between 1 January and mid-April as soil moisture during this period would facilitate pulling of the trees. On this basis the company believed that the pair of D9s would be able to pull 180 ha in a working day of 10 hours. Ideally, the

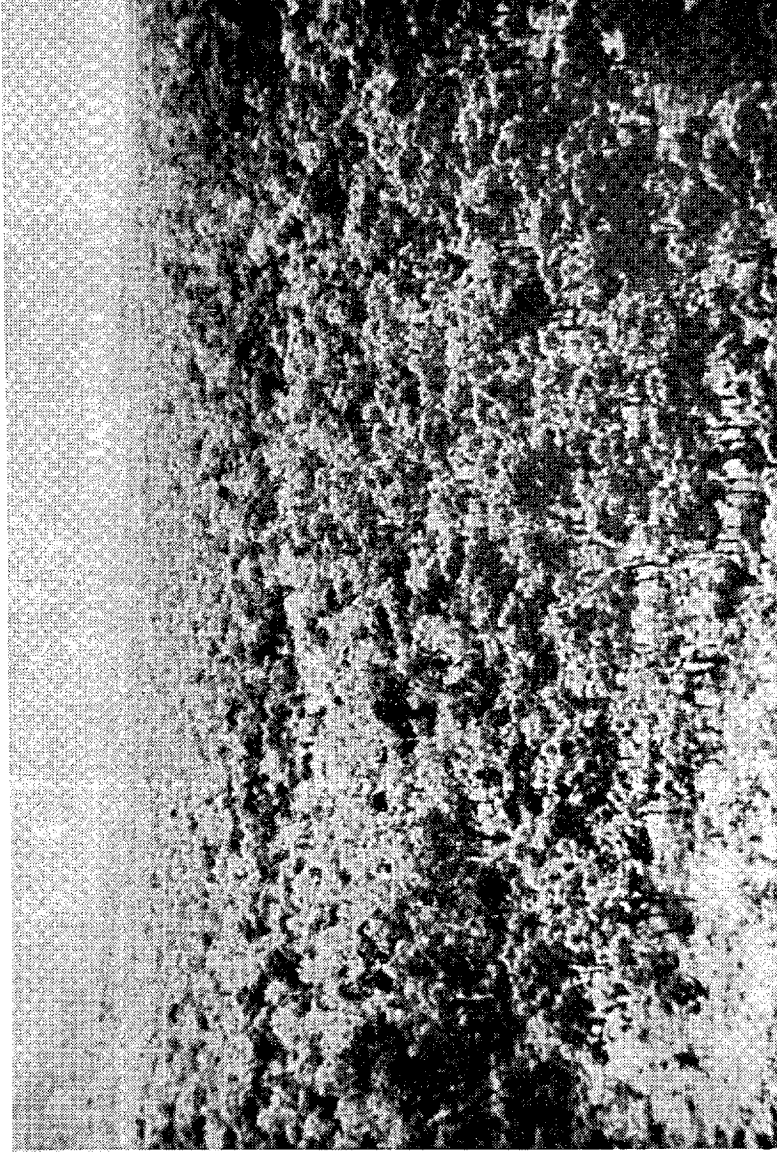


PLATE 1: Virgin savannah woodland on the area which became Farm 1 of the croppings. To the left is Mt Pleasant.

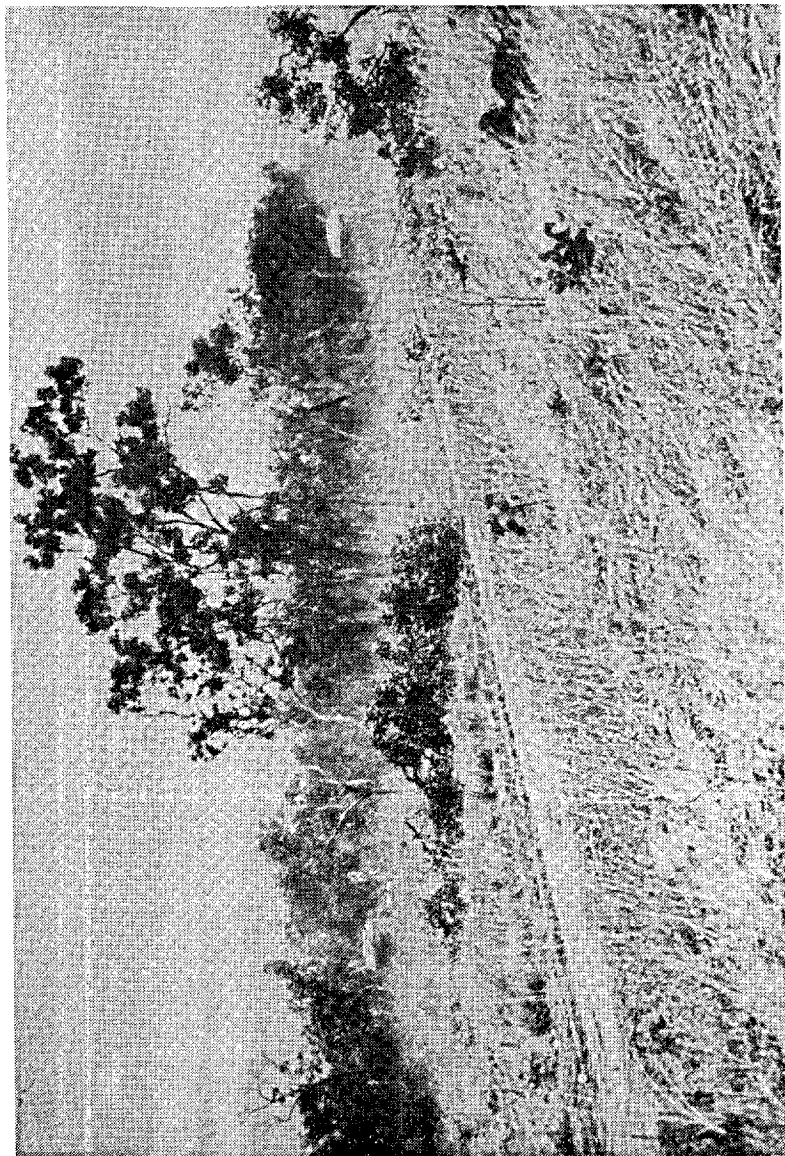


PLATE 2: Two D9 Caterpillars in action in the pulling process which was the first stage in transforming the country shown in Plate 1 to that shown in Plate 3.

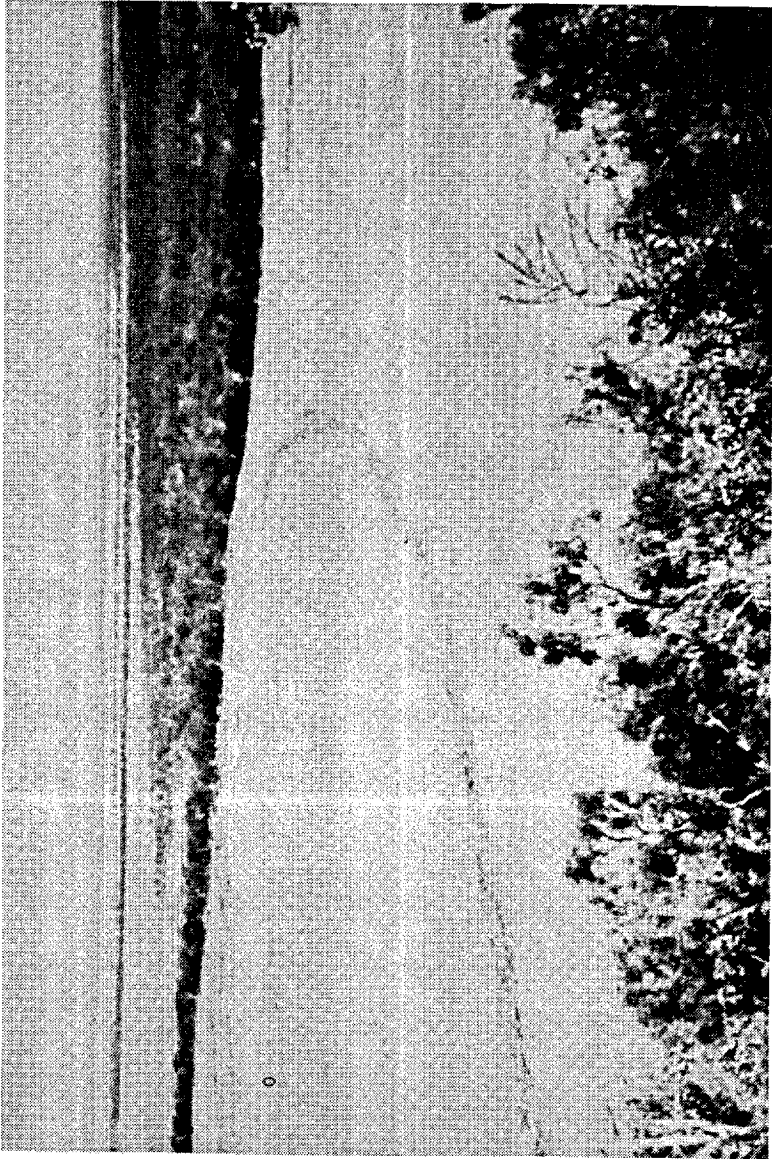
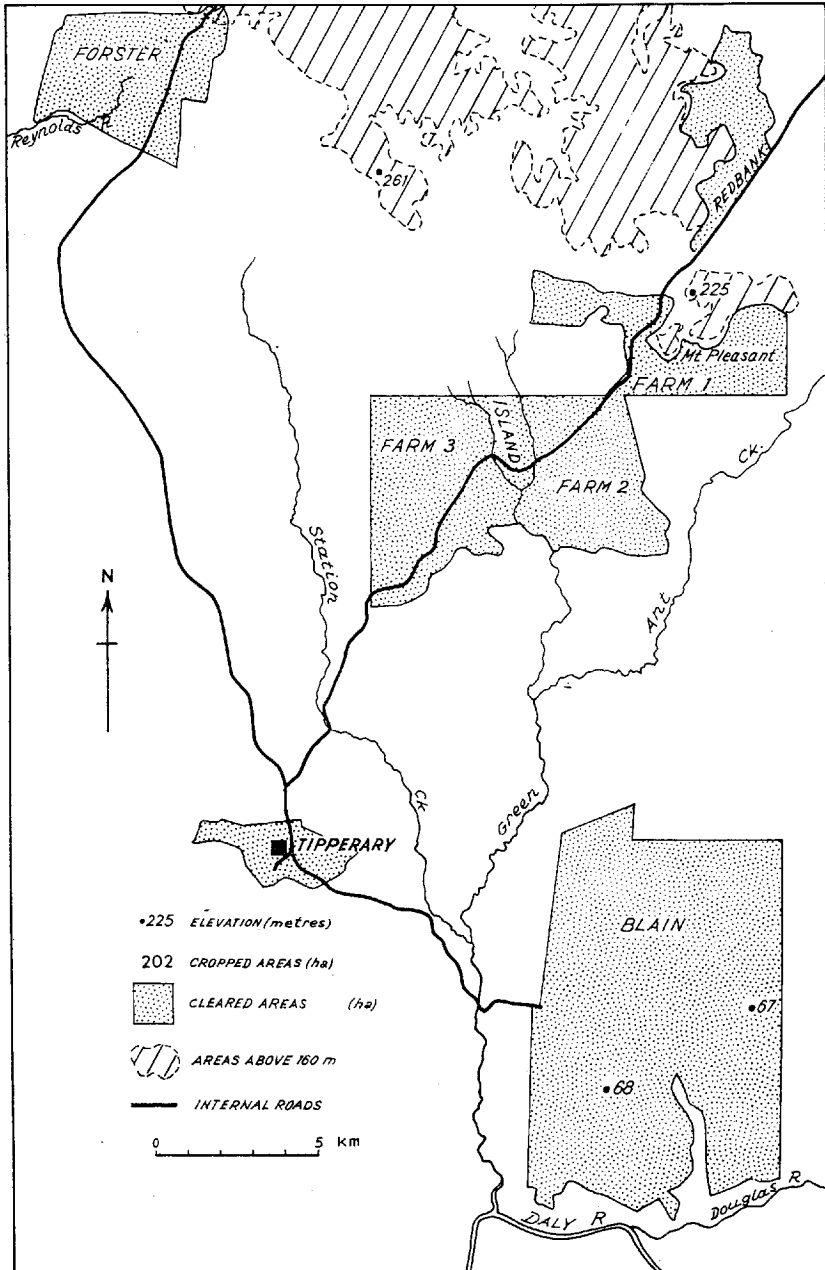


PLATE 3: Farm 1 after completion of the clearing process. Retention of the windrows would have reduced the eroding effects of runoff during the wet season. Against AIAB and CSIRO advice the windrows were burnt.



MAP 5: Tipperary areas cleared for cultivation.

pulling of the area for the first crop, 4,800 ha, would take 27 days, after which a further 9,000 ha would be pulled. The weekly report to Midland, Texas, on 14 May showed that progress was not as rapid as expected. At that stage an average of 80 ha/day was being pulled and a total of 600 ha had been cleared for cultivation.

Contributing to the failure to make anticipated progress were inexperience under the operating conditions at Tipperary, the usual teething troubles with new machinery and minor difficulties with staff. Arrival of additional machinery speeded the clearing. An extra D9 allowed two pulling teams to operate, while raking of fallen timber into windrows for burning was done by D7 Caterpillars. In the early stages, when soil moisture was adequate, pulling was satisfactory, but with the onset of drier conditions trees snapped off to leave stumps which were time consuming to remove or, if left, interfered with later operations such as ploughing and planting. On the sandier soils of the Blain the heavy machinery often buried debris which later disrupted the smooth operation of ploughs and planters.

When clearing operations began it was hoped that the first deep ploughing would also be finished quickly, to allow the soils to pass through the dry season in a roughly cultivated condition. This would reduce the number of operations to be done at the start of the wet, when time would be so precious, if the final ploughing and planting was to be done when weather conditions were most favourable. Because of the delay with clearing, ploughing did not start until September. 'Rome' ploughs had been shipped from New Orleans on 25 April especially for this job (see Plate 4, p.125). A brief trial with these new implements showed them

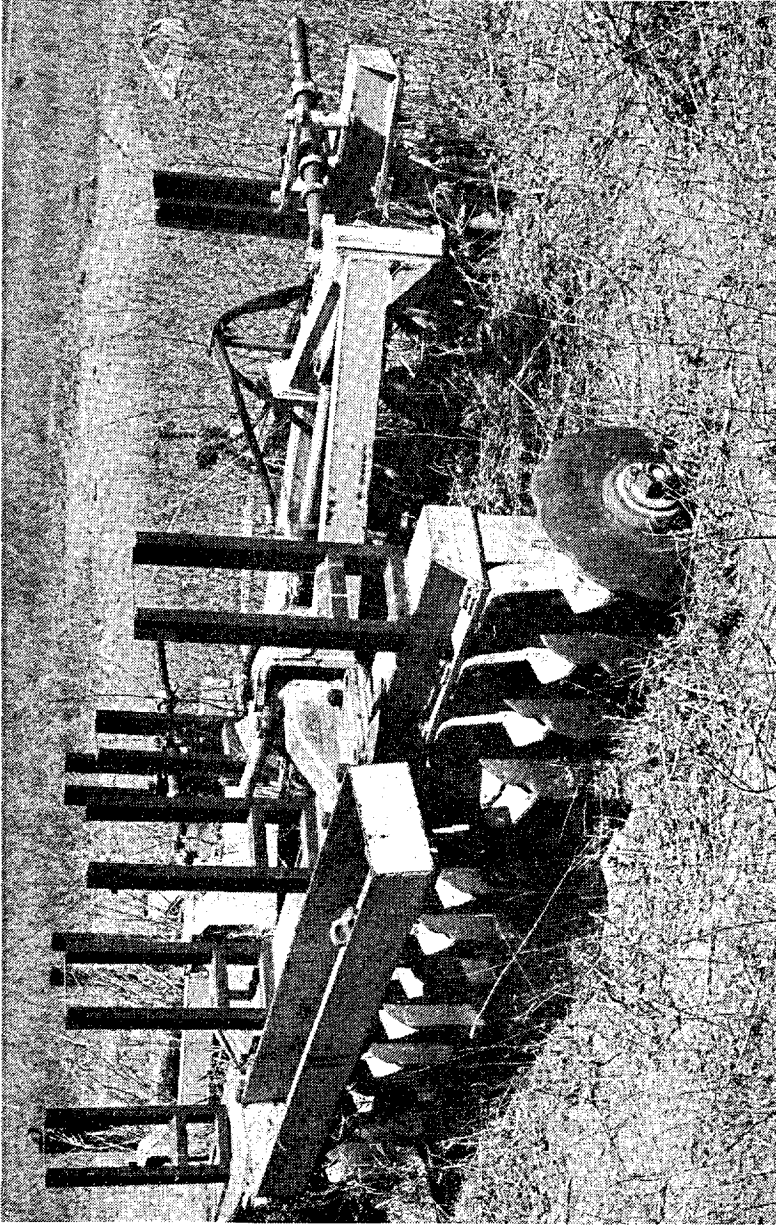


PLATE 4: One of the 'Rome' ploughs imported from the United States. It still lies adjacent to the Farm 1 area. The upright structures are disused railway lines welded to the plough for frames which carried other railway lines all of which were to add sufficient weight to enable ploughing to an adequate depth of 25 cm, but without success.

to be entirely unsuited to the conditions; they barely scratched the surface of the soil and one unit, even when weighted with five tonnes of railway line, was unable to plough to satisfactory depths. The budgeted cost for the two 8 m 'Rome' ploughs was \$39,000 and a 15 m 'Rome' harrow cost \$13,900, exclusive of freight charges from the United States. Shearer 'Majestic' ploughs were then bought and used for the initial ploughing, and for the second cultivation 'Sovereign' ploughs were employed (see Plates 5 and 6, pp. 127 and 129).

A story often related, with variations in detail, illustrates the Americans' approach to the project. After the imported ploughs had failed to penetrate the soil an Australian-made Shearer 'Majestic' plough, borrowed for the occasion, proved its ability to function satisfactorily in the Tipperary soils. On the spot Neely ordered ten such ploughs from the Shearer representative who just happened to be in attendance. After discussion about the relative merits of various ploughs and the conditions in which they would operate had continued for some hours, Neely dismayed the Shearer salesman by saying: "About that order for those Majestic ploughs, cancel it." He then astonished all present by continuing, "Make it for 20!"

Throughout the pioneering 1967-68 season a continuous stream of plant and equipment arrived at the station, tangible proof of the enthusiasm, vigour and resources of the Corporation. An inventory of machinery at Tipperary in April 1968 reflected the commitment to a large mechanized program and served as ample testimony to the size of the investment (Table 10, p.128).

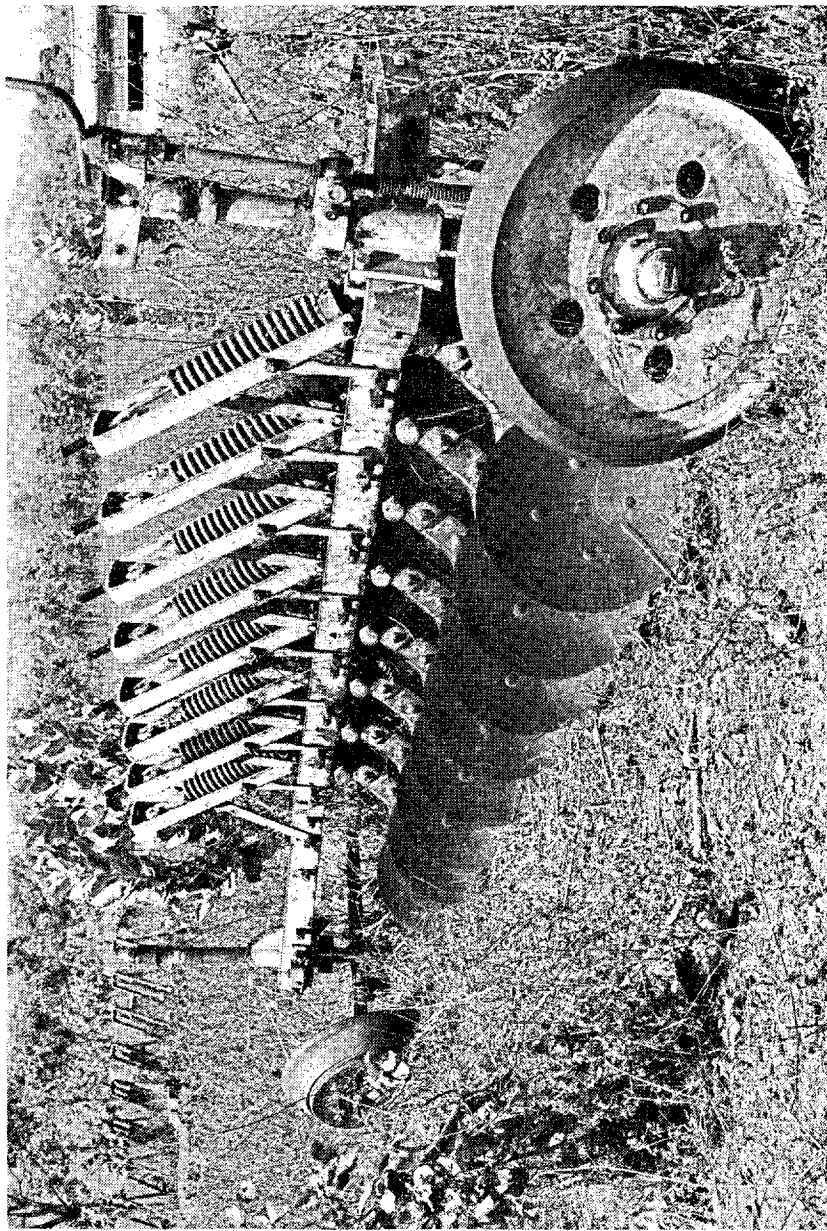


PLATE 5: Another reminder of sorghum production still remaining at Tipperary. This is a John Shearer 'Majestic' plough which was used successfully for the first cultivation.

TABLE 10

Inventory of Machinery on Tipperary Station in April 1968

<i>Tractors</i>	<i>Supply Plant and Equipment</i>
4 D9 crawlers with fittings	4 farm trailers
4 D7 crawlers with fittings	1 100 C.F.M. Compressor
1 D6C crawler with fittings	1 450 amp. welder
8 John Deere 4020 wheel tractors	4 5 ton capacity farm trailers
1 John Deere 3020 wheel tractors	3 front loaders fitted to 4020 tractors
	3 dump rakes
<i>Graders</i>	2 Wade Side rakes (heavy duty)
1 Caterpillar 12 motor grader	
<i>Ploughs</i>	<i>Harvest Equipment</i>
2 26' Rome tandem disc ploughs	4 230 bag bulk bins with P.T.O. attach
1 48' Rome tandem disc plough	4 grain/fertilizer bins
18 8 disc 'Majestic' ploughs	2 bag elevators
16 24 disc 'Sovereign' ploughs	8 augers, or equivalent yet to be purchased
<i>Harrows</i>	<i>Trucks</i>
7 sets John Deere Trashporter harrows	5 7 ton Toyota tray body trucks
	3 7 ton Toyota tip trucks
<i>Disc Drills</i>	1 Toyota service unit
8 John Deere disc drills	1 International C 1600 service unit
	1 Ford Blitz workshop unit
<i>Harvesters</i>	<i>Utilities</i>
7 John Deere 105 Auto-headers	7 Toyota land cruisers
1 John Deere Model 42 P.T.O. Header	
	<i>Slashers</i>
	4 14' slashers (on order)

Source: Unpublished TLC Files.

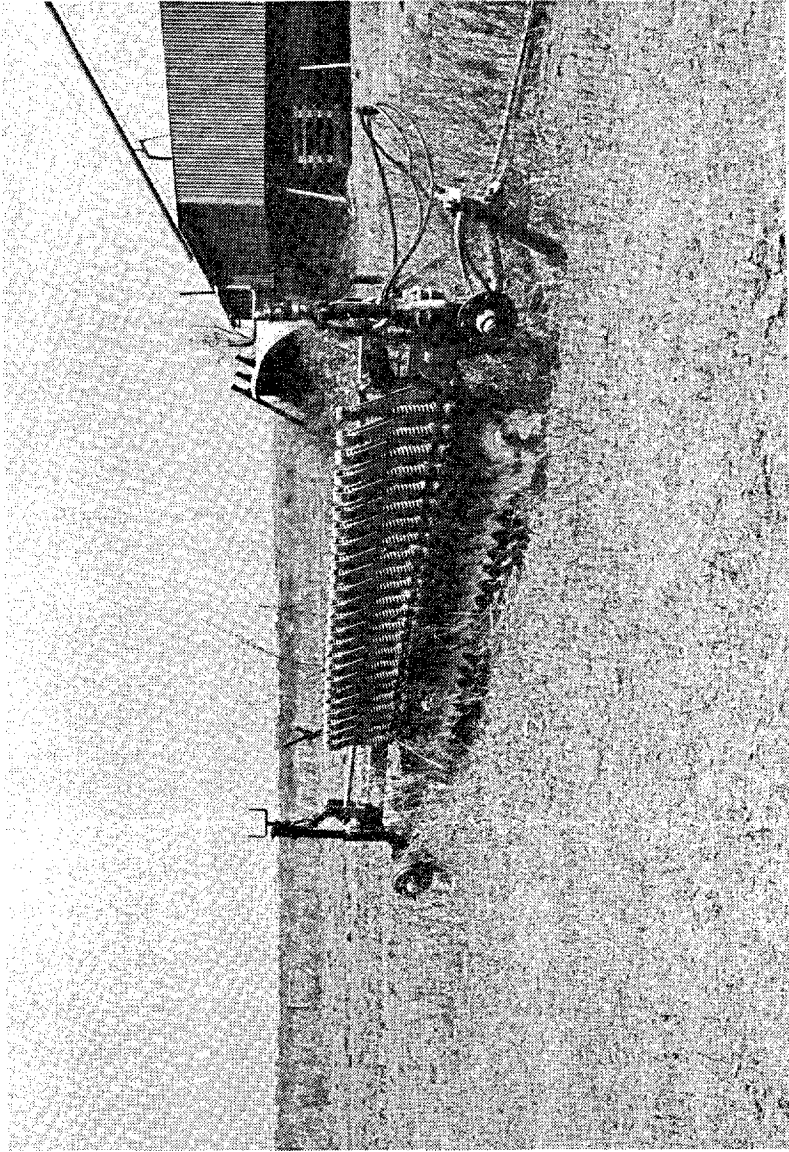


PLATE 6: Standing in front of the grain storage shed at Farm 2 is a John Shearer 'Sovereign' plough which performed the second cultivation.

F.J. (Jim) Kelly, who had farmed on the Darling Downs and had worked on Cape York, was appointed manager for all cropping operations, and each of the designated farms had its own manager. Under Kelly's supervision maximum effort was called for before the start of the rains; machinery was operated for two, 10-hour shifts a day, and serviced outside normal operational time. On 24 October the report to head office stated that of the total 7,500 ha pulled, 4,250 ha had been raked and 2,360 ha ploughed once.

While ploughing was being completed on some areas, planting began on 27 December, and on 13 January 1968 advice was sent from the station that 5,670 to 6,070 ha had been sown. To complete the planting in this time the eight John Deere disc drills were operated around-the-clock. Twelve different sorghums were sown, all at a rate of 9 kg/ha; of these the principal ones were the hybrids Texas 610, Texas 671 and Pacific 846. Variability in the crop establishment achieved was due to the range of soil types and their differing moisture content, interference from trash remaining from the clearing operations and operator fatigue.

Instead of applying fertilizer with the seed, aerial application after planting was preferred to allow the workforce to concentrate on sowing. The heavy rains of early January hampered this operation; airstrips at each of the farms were often too wet for aircraft, high winds interfered when flying was possible and because of high moisture content the fertilizer became too lumpy for even application. At the end of the month fertilizer had been applied to 2,000 ha, but it is doubtful that the desired rate of 220 kg/ha was achieved on any substantial areas, and much of the crop received no fertilizer at any stage.

Despite delays, interruptions and problems with the planting, good stands were grown in some areas. As the crop approached maturity in April, yield estimates ranged from 1,680 kg/ha to 7,500 kg/ha where fertilizer application was heaviest, as compared with the projected average of 3,360 kg/ha. It was now estimated that 4,850 ha were to be harvested, the area set in the original development proposals. The January estimates of areas planted, 5,670 to 6,070 ha, reported to head office, were obviously too optimistic.

Although much of the grain was mature in April, the John Deere 105 auto-headers did not begin harvesting until the first week in May. Various reasons have been given by different people to account for this delay. The first of the two most likely reasons is that the workforce had been diverted from the preparation of harvesting machinery and facilities to other tasks, such as working on the irrigation scheme (see p.137) and on a feedlot (see p.141). It has also been argued that because there were no artificial grain drying facilities, the sorghum was allowed to stand in the field to enable it to dry to levels set by the terms of the export contract. These standards were those of U.S. Grade 2, which allow a maximum moisture content of 14 per cent. Whatever the reason for the decision to delay the harvest, it was a fatal one for the outcome of the first crop.

In many years no May rain had been recorded at Tipperary and the maximum fall had been the 4 mm in 1964 (Table 2, p.82). Therefore, adverse weather was not anticipated. However, in May 1968 72 mm fell (Table 3, p.83). During the time that the harvesters were denied access to the crop by the wet conditions, secondary tillers were produced by the sorghum plants, and weeds grew up through the

crop. Adjustment of the harvesters to handle both ripe heads of grain and green material was extremely difficult; mature sorghum seed was cracked by the machinery and much foreign matter incorporated with the grain despite the use of special grain cleaning equipment; the result was the lowering of grain quality. The unprecedented rainfall effectively wrecked the crop on which so much depended.

Early announcements from the station stated that the unseasonal rains had merely darkened the grain and further delayed the harvest by about three weeks.¹ The full impact of the rain was realized later and announced on the front page of *The Northern Territory News* of 20 June. Only 5,000 t were suitable for marketing instead of the anticipated 16,000 t which would have been worth in excess of \$700,000 to the Corporation. The sorghum was transported to Darwin where it was stored in the open. Nature then added insult to injury in the form of 6 mm of rain in August, which increased the moisture content of the grain, encouraged mould growth and discoloured the sorghum, reducing it below the accepted international standards and making export impossible.

Disposal of the grain then became a problem which was never satisfactorily solved. Some was sold to local feed merchants and grain consumers at \$25/t, some carried back to Tipperary and the remainder dumped in Darwin. Expectations for this crop as the first stage in a long, successful program to export agricultural produce from the Top End had not been fulfilled.

¹*The Territorian*, 1.6.1968:1.

Later Crops

The setback caused by the May rains did not deter the Corporation from continuing their development program, for Neely at once announced that the area to be planted for the next season would be increased to 9,700 ha as planned.¹ However, lessons had been learnt and the 1968-69 crop would be planted earlier in December; large, covered storage facilities would be built for grain, and fertilizer would be applied with the seed at sowing. This attitude was applauded by the paper's editorial writer, who commended the Corporation for its courage to continue the program to "make the Top End one of the world's greatest agricultural producers."

Improvements were necessary at other places besides Tipperary. Experience had highlighted the need for suitable storage and bulk handling facilities at Darwin wharf. No grain had been exported from the first crop, but adequate suitable equipment was obviously needed if large quantities were to be shipped in the future. Provision of these facilities was not controlled by the company and would probably take some years. For example, the railway authorities had advised that appropriate rolling stock and bulk handling equipment, if required, could not be supplied for at least two years.

The sorghum crop was not the only casualty of events during the first season. Sir William Gunn's resignation became effective from 30 June 1968. Differences had arisen with some of the American principals over aspects of the developments, with the result that Sir William left to concentrate on other interests. He was replaced by an American, Mr Arlen Edgar, who took up residence in Brisbane.

¹*N.T. News*, 20.6.1968:1.

Confident that mistakes made with the original crop would not be repeated, the Corporation embarked upon its course of expanded cropping areas for the second season. Once again the head office in Texas issued occasional policy statements and instructions on objectives and procedures which were to be complied with in the field. Reconsideration of the program at ploughing reduced the area to be sown from 9,700 ha to 6,900 ha, and company reports to Texas stated that 6,000 ha were already planted. Areas of the Blain soils were included for the first time. This program was less hurried than the preceding one and soil preparation was of a higher standard. Soil moisture was adequate in December and sowing began on the 22nd. Numerous problems, however, plagued the planting, including breakdown of machinery; at night malfunctions were often not noticed, with the result that the overall standard of sowing was lower than for the first crop.

Attempts to apply up to 560 kg/ha of fertilizer at sowing proved difficult, and only 1,400 ha received fertilizer by this method. Aerial applications did not commence until 19 January 1969 and were finished by the end of the month, but the delay reduced the efficacy of the fertilizer. Plant populations varied from zero germination to an estimated 220,000 plants per hectare. Problems with insects, rats and weeds (especially *Pennisetum pedicellatum*) occurred in this crop, but were not of major significance. Crop production was favoured by an even rainfall distribution until the end of March.

The harvest began in April; estimates of final yield were not proclaimed as they had been for the previous crop, but hopes were held for an 18,000 t harvest. On 2 July

1969 *The Northern Territory News* (p.3) reported that the harvest was taken from 4,900 ha, and that another 1,100 ha would be cultivated and irrigated later in the year. This meant that grain was harvested from an area 1,100 ha smaller than was reported to have been planted. Large, covered pits were built for storage of the crop near Farm 1, and smaller sheds with drying facilities stored grain at Farms 2 and 3.

In fact, the harvest produced only 9,000 t and this was found to be below export standards when tested by Northern Territory authorities. Confirmation of low grain weight and excessive foreign matter content came from further standards testing at the University of Queensland. Ironically, the only grain exported from Tipperary came from this crop when, in November 1969, 3,000 t of sorghum were loaded onto the *Ta Tzong* for export to Japan. Most of the grain was loaded in bulk using facilities intended for iron ore exports, but 300 t were bagged to balance and stabilize the load in the ship's holds. In the loading operations the grain sorghum was contaminated by iron ore residues in the bulk handling equipment.¹ The Japanese then hesitated to accept the grain and finally paid \$136,917 for the shipment, a return that was disappointingly short of budget estimates. The Corporation had failed to supply the quantity and quality of sorghum required under contract terms with Mitsui and Company Limited. The contract was not renewed for future crops.

During the 1968-69 season significant changes occurred in the top levels of management. Expansion of the

¹Stolz to Bauer, 21.6.1979. Personal Communication.

Corporation occurred in January 1969 when oil exploration companies were acquired from Deane H. Stoltz, another Texan, in exchange for 990,000 shares in Tipperary Land Corporation's common stock. From April a new name, Tipperary Land and Exploration Corporation (TLEC) was used. Neely, who had resided in Darwin to help with the supervision of the Australian arm of the operations, resigned in June 1969 and was succeeded by Stoltz as president and John G. McMillian became head of Australian operations in place of Arlen Edgar, who also resigned.

This new management set about rationalization of the operations, but was unable to compensate for the setbacks experienced in the early, crucial years of the cropping development. The general formula was to 'get back to the basics' of agriculture, with local scientists to conduct experiments and trials into a wide range of agronomic matters in order to identify and overcome the problems of growing commercial crops of grain sorghum.¹ Implementation of any grand plans would come only after their practicability had been proven on a smaller scale. In accordance with this policy there was to be a reduction in the area planted, and in December 1,600 ha were sown and excellent establishment was achieved in some areas.

The 1968 crop, however, earned a certain notoriety in Top End agriculture, for in it the sorghum midge (*Contarinia sorghicola*) appeared for the first time in Territory grain sorghum. From this infestation it spread to be confirmed in crops at Katherine in 1972 and at Willeroo in

¹N.T. News, 9.12.1969:4.

1973-74.¹ Fortunately, its effect on the Tipperary crop was not serious, and the harvest totalled 2,000 t, while a yield of 3,360 kg/ha was achieved in some areas.

Smaller areas were planted to grain sorghum in subsequent years; in 1970-71, 400 ha were planted, and in 1971-72 this area was halved. Other crops were planted on limited areas, on a trial basis, and included maize, peanuts, guar, cowpea, bulrush millet and soybeans. However, areas of grain sorghum stretching as far as the eye could see remained unrealized visions.

Irrigation

Little was achieved with irrigation and no commercial crop was ever grown with it. For the 1968 dry season 1,200 ha were to be irrigated as the first stage towards growing three crops of sorghum per year. Preparations began in October 1967, when an order worth \$154,000 was placed in Brisbane for six "Targetmaster" self-contained irrigators, each of which consisted of a large nozzle, similar to that of a fire hose, mounted on a turret and powered by a diesel engine (see Plate 7, p.138). These units would suck water up from ditches especially dug for the purpose and spray

¹Doughton, 1974:52. Of the insect pests which attack sorghum this is the most serious (Anon., 1973:620). Damage is caused by larvae feeding on developing ovaries of sorghum florets which prevents the setting of grain. Under good growing conditions midge infestation will normally reduce yields by 10 to 25 per cent, but losses may range from a low of 1 or 2 per cent to as high as 95 per cent (Doughton, 1974:54). Depredations of this pest are especially serious in districts of year round cropping, such as those where crops are produced under irrigation. Its importance at Tipperary lay in the fact that future budgets for large crops would have to include costs of control measures consisting of aerial spraying with an appropriate insecticide.

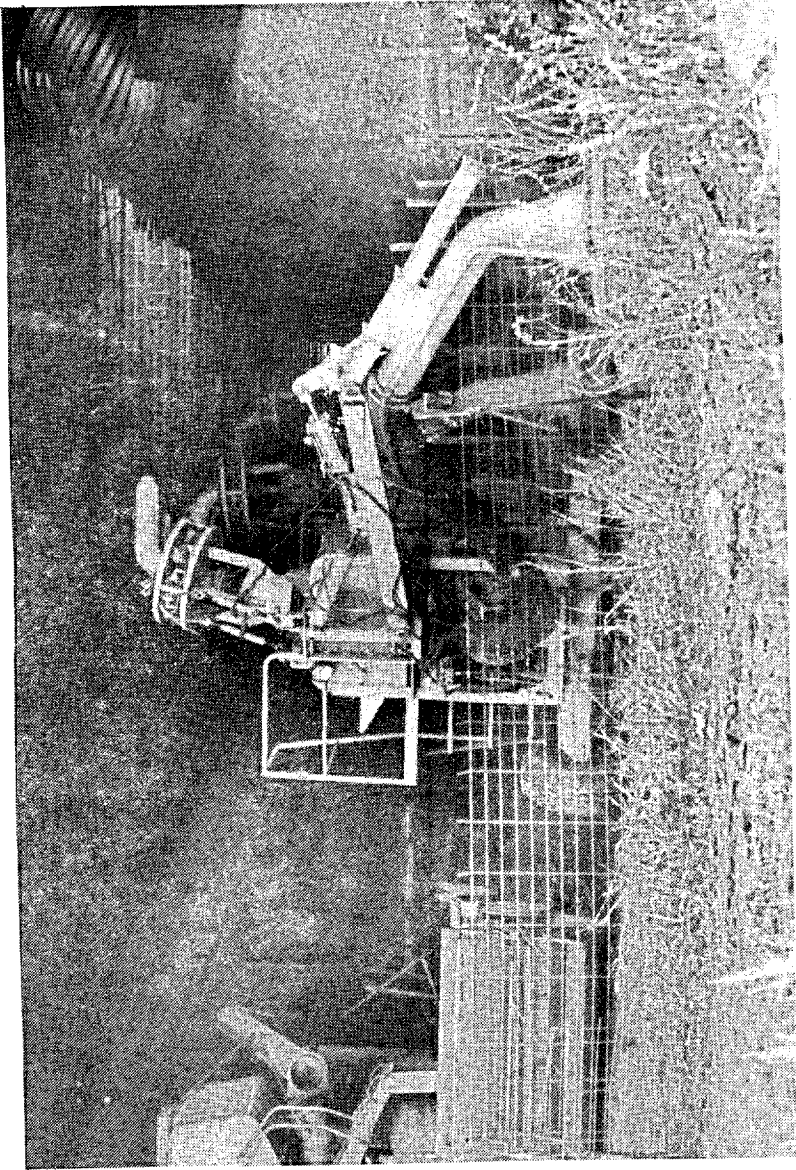


PLATE 7: Targetmaster stands in front of two of its fellow irrigation units in a covered pit used for grain storage from the second cropping season. In the right foreground rests the water intake tube and the spray turret tops the machine.

approximately 1 ha on each revolution of the turret. Calculations showed that if operated on a twenty-four hour basis, these machines could apply 75 mm of water to 220 ha daily. They were bought because, as their name implies, they could deliver water in the desired amounts to the target area without interference from wind, an important consideration for conditions at Tipperary.

In January 1968 work began on preparations for their use on the Blain. The weather which impeded fertilizer application also delayed surveys for the concrete irrigation channels and hence the construction of these and allied facilities. It was also found by the surveys that the proposed irrigation areas were too high above the Daly for water to be pumped to them economically. Selection of another area to be irrigated that dry season was not thought worthwhile, and the scheme was deferred until the following year. Employment of personnel on this irrigation work is one reason given for the preparations for the first harvest being late.

An announcement was made in the press¹ in July 1969 that dry season trials with irrigation were to commence. The target area had been revised and blocks of 160 ha would be sown until 700-800 ha had been planted to 12 different sorghums. Emphasis was given in the statement, made by McMillian, to the trial nature of the program: bores would be sunk and their operating capacity gauged, mechanical and technical problems would be identified and solved and the varieties most suitable to dry season irrigation would be sought.

Self-propelled mobile spray lines were bought for these

¹*N.T. News*, 12.7.1969:6.

trials; thirty 450 m lengths of "Grassland" equipment were supplied in Australia and Wade Rain sprays were imported from the United States (see Plate 8, p.142). From bores sunk at Farm 2 and in the Island Block a network of 35 cm pipes was laid with hydrants placed every 100 m to which the spray lines were connected in sequence as they progressed across the fields. Problems were not long in coming. Because of the length of the "Grassland" lines, undulating terrain and variable soil conditions, the spray lines tended to form S-shapes rather than move in straight lines across the cultivation. Much time and effort was required to rearrange them each time they were connected to a different hydrant.

Only half the spray lines were put into use, but the Wade Rain equipment proved more successful on Farm 2 than did the "Grassland" lines on the Island Block (see Plate 9, p.143). With rationalization of the entire program in the third season little further work was done with irrigation. Brief use was made of one "Targetmaster" on pasture and crop trials on the Island Block where it was connected to a bore; the engine from another was later used to run a generator for a domestic power plant; the remaining four units were never used.

Cattle

Improvement of the overall quality of cattle on Tipperary by the infusion of new bloodlines was one phase of the development which was successfully conducted. The stud program which used Tipperary's own bulls was augmented by the artificial insemination of selected Brahman cows with imported semen from Charolais and Chianina bulls. Despite

calving problems, the Charolais crosses produced well-muscled beasts, and although the Chianina cross calves were no bigger than Brahman calves at birth, they grew quickly into large-framed animals of good conformation and temperament. These early stages were successful ones in the proposed long-term systematic crossbreeding program designed to produce an improved beast suited to conditions at Tipperary. Better cattle management and control were facilitated by the extension of fenced areas and the provision of more watering points. In addition to other introduced grasses and legumes, Townsville stylo areas were increased to 2,500 ha and some of these plantings still persist, especially on the Elizabeth Downs parts of the station.

As indicated above (p.112) the supplementary feeding of cattle was a practice well-known to the Americans. After operations had begun at Tipperary this idea was developed further, once it was realized how much sorghum stubble and grain would be available to feed cattle. In combination with molasses and supplements of urea, phosphorus, calcium and other trace minerals, sorghum would prove valuable in maintaining stock during the dry season. On 3 February 1968 a meeting of directors in Texas decided to build a feedlot at Tipperary. The concept involved wet season grazing of cattle on legume/native grass pastures adjacent to the grain growing areas of Farms 1 and 2, and lot feeding of breeders after pasture quality declined in the dry. Pens capable of holding 500 head each would be built and ensiled sorghum stubble stored in excavated pits. The hope was to be able to feed 10,000 head after five years with 14 kg of silage per day for up to 200 days per year. Calving rates from breeding cattle maintained in this way were expected to

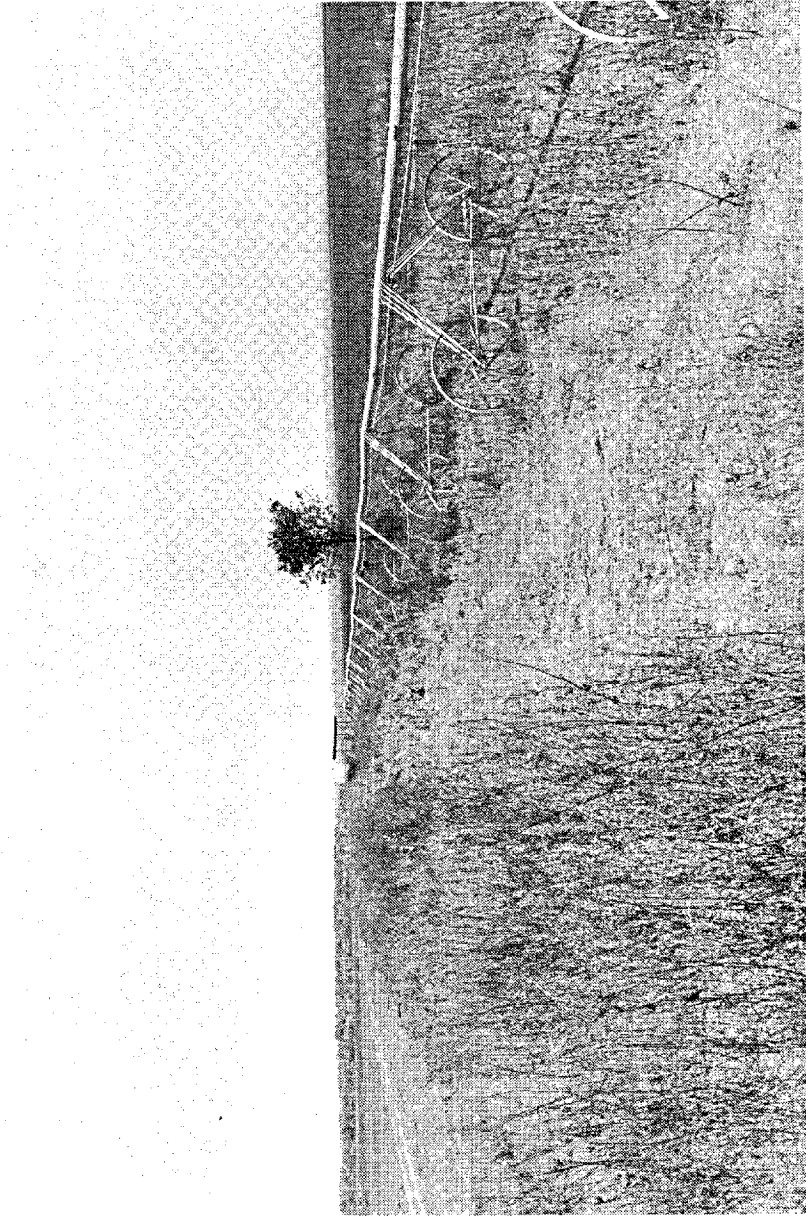


PLATE 8: A section of the Grassland irrigation equipment standing on Farm 2. In the background is the bore and pump which were to supply water for this unit. The tree has grown since the days of cultivation.

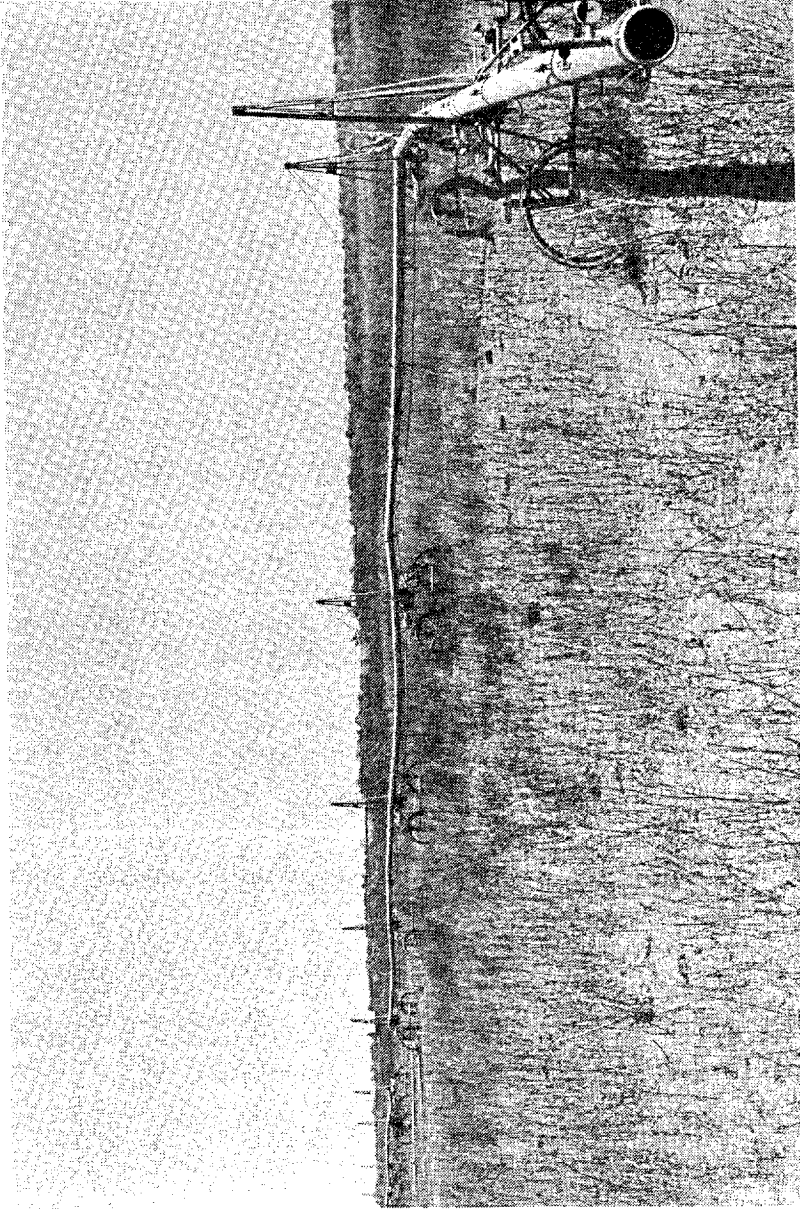


PLATE 9: 'Wade Rain' irrigation equipment although out of alignment in this photograph was more successful than the Grassland sprays in traversing the undulating areas to be cultivated.

reach 75 per cent.

An independent report on this proposal finalized by Australian consultants on 13 March cautioned that as this was to be the first such attempt in Australia several problems would be encountered.¹ The nutritive quality of the stubble was questioned, because if sorghum were allowed to stand in the paddocks until grain moisture content fell to acceptable levels, the stubble which remained would have limited value as stock feed. Therefore responses from cattle fed this stubble would be reduced. No bulk handling facilities for molasses were available at Darwin and the cost landed at Tipperary would be \$60/t. A budget drawn up by Tipperary staff in Australia estimated establishment costs for the feedlot at approximately \$500,000 and annual operating expenses at \$132,000. However, with successful experience in the United States as a guide, the decision was made to begin the feedlot at once to enable utilization of stubble from the first grain crop.

Work began on 25 March. Eight men built 14 pens from disused railway lines and steel cables, each pen covering 9 ha. After the grain harvest, sorghum stubble was cut and stored in deep trenches until required for feeding (see Plate 10, p.145). Watering of the silage by tanker was necessary to keep it cool and to prevent spontaneous combustion. The silage became tightly compacted by the weight of the tanker and other machinery moving over it, and later removal from the pits proved to be very difficult.

In the first year more than 2,000 cattle, unaccustomed to regular handling, were brought from the Litchfield and

¹Moore, Guerasimoff & Edey, 13.3.1968. Unpublished.

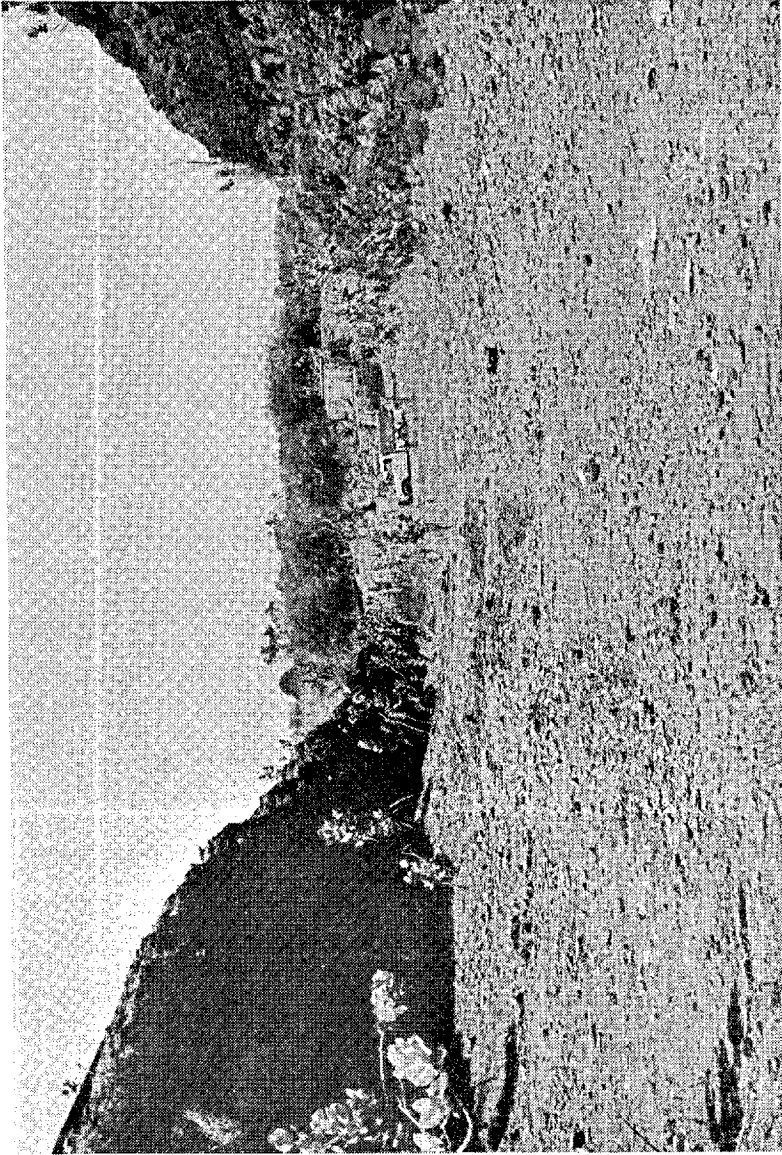


PLATE 10: This pit was one excavated through the top of a hill for storage of silage. The tank in the background supplied water to moisten the sorghum stubble as it was being packed. The photograph was taken from one end of the pit and the Toyota stands at the other end, 100 m away.

Elizabeth Downs parts of the station. Molasses was not provided, as the cost quoted to the company, \$81/t landed in Darwin (in drums), was prohibitively high. Many cattle died as they failed to respond to the stubble and others had to be released from the pens. Another attempt was made to use the feedlot during the second dry season, but this, too, was unsuccessful for similar reasons and the project was then abandoned.

Prawning

In accordance with stated goals, exploratory surveys to find prawning areas with commercial potential were conducted in the Joseph Bonaparte Gulf in September and October 1967. Results from these surveys justified commencement of operations and an experienced manager, John Nelson, was appointed on the basis of his impressive background in similar fishing ventures in Nigeria and Brazil. Initially the fleet consisted of three trawlers and a mothership, with provision made for future expansion to a maximum of 16 trawlers if warranted by experience. Within one month of its christening in October 1968, the first trawler, the *Melville T*, returned to Darwin with an estimated eight tonnes of prawns. Its sister boats, the *Bathurst T*, and the *Coburg T*, returned shortly afterwards with similar catches, to give the venture an encouraging start. Catches fluctuated widely, however, and much of the prawning was conducted in the Gulf of Carpentaria instead of to the south-west of Darwin, where catches were often disappointing.

Although the marine division did not run profitably, its operations continued to expand. In 1970 four new 20 m and two 24 m trawlers were acquired, to bring the total

fishing fleet to nine. As with all new equipment, teething problems were experienced in the running of these trawlers and it was not until Easter 1971 that the entire fleet was operating smoothly. Purchase of 30 per cent of the stock of a Darwin based barge company, Perkins Shipping and Mining Pty Ltd, gained the Corporation interests in local shipping capacity and valuable harbour front property. This investment brought the valuation of equipment and holdings of the marine operation to \$1,300,000.¹

Prawns were frozen from the time they were transferred to the mothership until they reached the consumer, a practice adopted to preserve flavour and texture. In January 1969 the company opened Darwin's first prawn processing plant, which employed 25 workers. Catches from both company and independent trawlers were processed in the factory and marketed under the brand name "Teeco". In 1969 sales were restricted to the Australian market because an application to export to Japan was rejected by Australian fishing authorities for administrative reasons. The following year shipments were permitted to Japan, and the success there of "Teeco" brand prawns brought hopes of tapping the growing market in the United States, particularly on the west coast.

Because the equipment was functioning well, and domestic and export market potential was good, by mid-1971 future prospects for prawning appeared bright. An operating profit had not been achieved, however, and in October 1971 the assets of the marine division were realized by selling to a Panamanian, Fernandes, for \$3.5 million. This sale resulted in an overall loss from prawning of \$141,000, but provided the company with much needed funds (see Finance, p.113).

¹*Annual Report 1971*, TLEC, 30.12.1971.

Mining

In September 1967 three authorities to prospect were held for 3,318 sq km of Tipperary Station and another one applied to 2,423 sq km south-west of Katherine. Purchase of these cost \$2,290 and a further \$45,000 was allocated to conduct surveys.¹ In the assessment of the mineral composition of areas standard procedures were followed, commencing with the selection of an area on the basis of a literature search and preliminary surface inspection and appraisal. Then followed exploration of specific areas by surface mapping, collection of soil and rock samples and laboratory assays of these samples. If these assays indicated that an area might be of potential commercial interest, core holes were drilled to determine the depth, volume and quality of the ore body.

In June 1968 core holes had been drilled in three areas.² Another five authorities to prospect were acquired over areas in the Northern Territory and Queensland which gave the company rights to a total area of 12,430 sq km. An additional \$100,000 was approved to continue work until the end of September 1968. A substantial deposit of bauxite was discovered at Aurukun on Cape York in 1969 and these bauxite reserves were subsequently estimated to be approximately 600 million tonnes.³ Two other companies, Billiton Aluminium Australia and Pechiney Ugine Kuhlmann, would partner Tipperary in the feasibility study into all aspects of construction of a mine, alumina plant and

¹*Review of Special Meeting of Shareholders*, TLC, 2.4.1968.

²*Third Progress Report*, TLC, July 1968.

³*Annual Report 1970*, TLEC, 5.1.1971.

associated infrastructure.¹ If results from the study were favourable it was hoped to commence operations in 1976 with facilities which would cost \$250 million. No other areas produced promising results, and in 1971 the company discontinued its hard rock mineral exploration in Australia.² Involvement in the bauxite deposits was continued as exploration work was concentrated on the North American continent.

Finance and Sale

The current financial position was reported to a meeting of shareholders in Texas on 2 April 1968 (Table 11), and emphasized the economic importance of the proceeds from the first crop by showing a net balance at 31 March of US\$157,196. It was recognized from the start of the program that funds were not adequate to carry the development through the second season. Success with the first crop would, however, realize an anticipated \$725,000 (Table 7, p.108), which would provide vital cash flow and encourage further investment from the United States.

For a short time after completion of sowing this dependence was heightened by an announcement, in January 1968, by President Johnson: in response to economic pressures in the United States foreign investment by Americans was restricted. For countries such as Australia, future investment by any company was not to exceed 65 per cent per year of the direct investors' average investments in all countries in the same economic classification as Australia during the 1965-66 based period.³ It was fortunate that as a

¹Howitt, 1978:3.

²*Annual Report 1972*, TLEC, 12.1.1973.

³Ahrens & Connor, 1968.

TABLE 11
Tipperary Land Corporation
Statement of Cash Receipts and Disbursements
For the Period 1 October 1967 to 31 March 1968
(Unaudited)
(in US\$)

Cash Balance at 30 September 1967		\$ 549,080
<u>Receipts:</u>		
Proceeds from 7% Secured Senior Notes		\$1,000,000
Proceeds from certificates of deposit		1,650,000
Miscellaneous income		16,244
Decrease in accounts receivable		1,466
Decrease in deferred charges		58,611
Total receipts		<u>\$2,726,321</u>
<u>Disbursements:</u>		
Operating expenses and costs of cattle sold	\$ 483,753	
Land development costs	236,682	
Leasehold improvements	197,518	
Unrecovered development costs	341,160	
Deferred agricultural expenses	442,686	
	<u>\$1,701,799</u>	
Less: Depreciation and amortization, included therein	(463,774)	\$1,238,025
Machinery and equipment		580,148
Livestock		10,586
Exploration, research and development		47,118
Supplies and other prepayments		83,645
Reduction of long-term debt		46,059
Decrease in accounts payable and accruals		128,024
Short-term investments		984,600
Total disbursements		<u>\$3,118,205</u>
Cash Balance at 31 March 1968		<u><u>\$ 157,196</u></u>

Source: Review of Special Meeting of Shareholders, TLC, 2.4.67.

result of a special application to Washington authorities the TLC was permitted to transfer a total US\$1,000,000 to Australia in 1968.¹

Although failure of the 1968 crop produced no returns to the company, it did not deter investment in the venture. In October investment of an additional US\$2,600,000 by American backers was announced.² To raise this amount 120,377 shares were sold at between US\$15 and US\$16 per share, and 250,000 shares were issued at US\$3 per share under outstanding warrants.

However, this initial crop failure established the pattern for all financial results obtained in Australia by the Tipperary Land Corporation. In the absence of a marked improvement in performance of the second crop, development plans were carefully reconsidered by Stoltz, whose background was in oil exploration and who had not seen the vision of vast areas of sorghum. As a relative outsider he viewed Tipperary as but a part of a larger corporate operation. His leadership and policies had two effects on the company. Losses were gradually reduced in the Australian operations (Table 12, p.152) and a larger percentage of the company's interests were concentrated in oil and mineral exploration in North America. Sale of the marine division and Silver Plains stations and closure of the Sydney office were the results of a serious cash flow problem, continuing unprofitable operations, a negative working capital position and heavy debt service requirements.³

¹*Review of Special Meeting of Shareholders*, TLC, 2.4.1968.

²*N.T. News*, 4.10.1968:6.

³*Annual Report 1971*, TLEC, 30.12.1971.

TABLE 12
Financial Results for Tipperary Land Corporation 1968-73
(in US\$)

	1968	1969	1970	1971	1972	1973
<u>Australian Operations</u>						
Income						
Ranching and Farming	319,573	425,546	542,519	479,480	383,010	507,188
Fishing	-	225,866	293,826	-	-	-
	<u>319,573</u>	<u>651,412</u>	<u>836,345</u>	<u>479,480</u>	<u>383,010</u>	<u>507,188</u>
Costs and Expenses						
Ranching and Farming	815,877	1,750,525	1,199,079*	609,339	465,461	661,901
Fishing	-	233,273	737,886	-	-	-
Depreciation and Amortization	852,297	1,191,508	995,135	438,629	372,010	159,795
	<u>1,668,174</u>	<u>3,175,306</u>	<u>2,932,100</u>	<u>1,047,968</u>	<u>837,471</u>	<u>821,696</u>
Result for year (loss)	(1,348,601)	(2,523,894)	(2,095,755)	(568,488)	(454,461)	(314,508)
<u>Total Operations</u>						
Result for year (loss)	(1,334,315)	(1,668,237)	(326,717)	(334,445)	1,577,983	1,195,520

*includes \$38,418 for mineral exploration costs

Source: Annual Reports, TLC, 1968-73.

An initial net profit of US\$1,577,983 was achieved in 1972 in the United States, where more attractive investment opportunities led to the sale of Tipperary Station in November 1973. The Suttons Motors group of companies, based in Sydney, paid \$4,500,000 for the property. An initial payment of \$2,600,000 was made, with the balance payable in ten equal annual instalments bearing 10 per cent interest.¹ Tipperary joined the Territory Rice project as a failed attempt to introduce large-scale mechanized cropping to the Territory.

Analysis of the Project

A visionary approach lay behind the conception of the whole wide-ranging program, and optimism and confidence were essential for its implementation. Once the proposals had taken a substantive form, comments were invited from agricultural scientists in Texas. Examination of the published scientific data on the Tipperary region by these agricultural consultants resulted in a report which favoured the cropping development.² The following excerpts illustrate the theme of the advice given to the promoters:

With the present world food shortage and the likelihood that it will become worse, such operations as proposed therein are highly desirable and should be encouraged. This is a sure way of getting American "know-how" into those countries where production can be greatly accelerated in a short period of time.

...large scale, mechanized production must be

¹*Australian Financial Review*, 29.8.1973:22.

²Bloodworth, M.E. *et al.*, 1967.

pushed and financed in cases where the physical and climatic resources are available and lend themselves to such extensive and highly intensified agricultural operations...the Tipperary Region appears to be one of these locations...only waiting to be developed by American "know-how" and capital.

The approach taken by Tipperary Land Corporation is sound scientifically and financially.

There is no greater good we can do than to help the earth produce as we know it can produce.¹

Sympathetic comments such as these from respected experts were tremendously encouraging. They added the dimensions of moral justification for the program and moral obligations to revolutionize the production of vast quantities of grain. This philosophy lay behind what was termed the Green Revolution,² widely popular in 1967, which tried to transform third world agriculture by advanced technologies developed in the United States, Mexico and the Philippines. The proposed efforts by the TLC were not an isolated case, but represented an extension of this principle by attempting to apply sophisticated technology to an underdeveloped and neglected region of Australia. In addition to the four main aspects of the program, other ambitious ideas, considered but never attempted, attest to the breadth of vision and enthusiasm of the American promoters. These included obtaining Australian or Northern Territory franchise rights for farm machinery, fertilizers and a motel chain; establishment and development of dairy and pig herds and an Appalouosa horse stud; ownership of their own construction

¹Bloodworth, M.E. *et al.*, 1967:i-iii.

²Brown, 1970; George, 1976:113-36.

company and cement works and investment in commercial real estate properties in Darwin.

Plans for the integrated development proposal were presented as an attractive investment package to potential backers in the United States. Irrigated cropping, scientific cattle production and exploration for minerals, individually and in combination, were popular fields of investment at that time. The diversity of the activities proposed showed that the promoters were alert to the potential of the resources available, and that they had spread any risks widely. Several other factors favoured investment in the scheme; Australia's system of government was a stable one, production costs were lower than in the United States (although in the Northern Territory they were higher than in the rest of Australia), and the principals of TLC, who had previously succeeded in a number of mineral and oil exploration ventures in the United States, had themselves invested heavily in the scheme.

Nevertheless, success was not guaranteed as was clearly stated in the *Prospectus*:

Because of the untried nature of the Company's plans and the inherent uncertainties in any agricultural program, this project, together with the securities offered by this Prospectus, must be considered to be speculative.¹

The uncertainties mentioned had been anticipated by a cautionary note in the report by Bloodworth and his associates which was apparently overlooked later in the enthusiasm to get the scheme started without delay. This comment stated:

¹*Prospectus*, 12.9.1967:5.

They [American scientists] must become familiar with local conditions before they can adapt the knowledge they have to the new environment....¹

Despite this warning and the disclaimer in the *Prospectus*, the principals were not only certain that their plans were viable, they were confident that they could carry them through to fruition. On 30 October 1967 Neely and Faudree wrote to Gunn Rural Management:

We also feel it is safe to assume that there is combined in the two of us more knowledge of the situation and environment in Australia than in any other group of non-Australians you will find.²

Pioneering developments in the North had no room for those who doubted their own ability but, from the outcome at Tipperary, it is equally clear that confidence is no substitute for knowledge and experience.

As development of Tipperary Station progressed it became obvious that the cropping environment was not completely understood. Total annual rainfall during the wet season is relatively reliable, but the timing of its commencement, its duration and distribution throughout the season can all vary markedly. The result is that no one wet season is an exact duplicate of any other, and ploughing, planting and harvesting operations all have to be adapted according to the conditions of each season. It is doubtful if this was ever really understood by the American management. After the rains of May 1968 had disastrously affected the first key crop, an announcement was made that lessons had been

¹Bloodworth, M.E. *et al.*, 1967:7.

²W. Neely and W. Faudree to Gunn Rural Management, 30.10.1967. Unpublished TLC files.

learned from bitter experience and that future crops would be planted earlier in December, presumably to avoid late rains at harvest.¹ So readily was the concept of multiple cropping of grain sorghum embraced by the Tipperary owners that three, four or five irrigated crops from the one area were believed possible.² Plans to proceed with such intensive crop production involved planting in October for harvest in late December or early January when rains usually favoured planting! These ideas were incompatible with rainfall distribution patterns through the wet.

As early as February 1967 advice was given to the Tipperary Land Corporation by Dr L. Woods of the Animal Industry Branch concerning the selection of areas for cropping.³ The land systems units of CSIRO were used as the basis for planning the areas to be cropped. Dr Woods pointed out that by definition, a land system unit indicated recurring patterns of soils, vegetation and topography.

They indicate land potential to some degree and indicate areas that are, or are not, worth further study, but they do not indicate the presence or absence of arable soils. A particular soil type may be present in several land systems, while a land system may contain a number of soils, some arable, others not.⁴

The cultivation at Tipperary was inconsistent with a clear understanding of the full meaning of land systems. As a result all subsequent phases of the operation became more complex and problems with erosion arose.

¹*N.T. News*, 20.6.1968:1.

²*Sydney Morning Herald*, 5.6.1968:16.

³Unpublished data, AIAB files.

⁴Dr L.E. Woods to TLC, 3.2.1967. Unpublished letter, AIAB files.

In May 1967 officers of the Land Resources Section, AIAB, inspected areas planned for cultivation. From this preliminary inspection it was evident that much of the cleared land was unsuitable for cropping and under the intense rainfall conditions of the region the remainder would require careful management if erosion problems were to be avoided or minimized. On further inspection in August some areas were found to be too steep for cultivation and others would be subject to major problems with run-off from adjacent hills.

Between 17 October and 6 November 1967 structural control measures were established along the base of Mt Pleasant to reduce run-off onto adjoining cultivated areas (see Plates 11 and 12). Diversion banks 3,000 m long and 1.5 m high were built and sown with a "shotgun" grass-legume mixture. A small earth dam was also constructed, but it was of insufficient capacity to hold run-off from Mt Pleasant in an average wet. This was breached in 1969 and concentrated run-off discharged onto a roadway to cause erosion.

From a monitoring program conducted throughout the development soil conservation officers were able to recommend appropriate measures to prevent or reduce further erosion. Although management had expressed its desire to implement necessary soil conservation measures, these were of lower priority than major Corporation goals and sometimes incompatible with them. As a result, conservation work was often ineffective, incomplete or destroyed by later operations. Conservation work is still continued on Tipperary and erosion there has not reached the massive and spectacular proportions of other areas of the North.

The estimated yield figure used in all budget calculations was of major importance in the formulation of the original proposals. While other values were altered in the budget predictions, the yield was consistently estimated at 3,360 kg/ha, a figure in excess of the average of trial findings at Katherine.¹ The Corporation *Prospectus* contains the following statement:

...the results of such trials are not necessarily reliable indicators of the average yields which the Company will obtain because of the small scale on which the trials were conducted.²

Ample evidence existed to show that, in fact, commercial yields are *less* than those obtained in trials.³ This does not mean that a yield of 3,360 kg/ha was unattainable. Indeed, such a yield was produced during the cropping on various parts of the station, but its use as the average figure in the first season of a pioneering venture set expectations for all crops at an excessively high level.

Implementation of the plans generated by the directors depended upon the ability of the workforce. Little difficulty was experienced in hiring men because the attractiveness of the proposals induced more than 1,000 to apply for jobs.⁴ The majority of these were farmers from drought-stricken Victoria, to whom the development represented a chance to make a fresh start. Most of the 55 actually employed in the first season brought with them experience in

¹Phillips & Norman, 1964:8; Richardson *et al.*, 1967:3.

²*Prospectus*, 12.9.1967:16-17.

³Davidson, 1962:458-59, 1966:78-80; Richardson *et al.*, 1967:3.

⁴*N.T. News*, 9.11.1967:3.

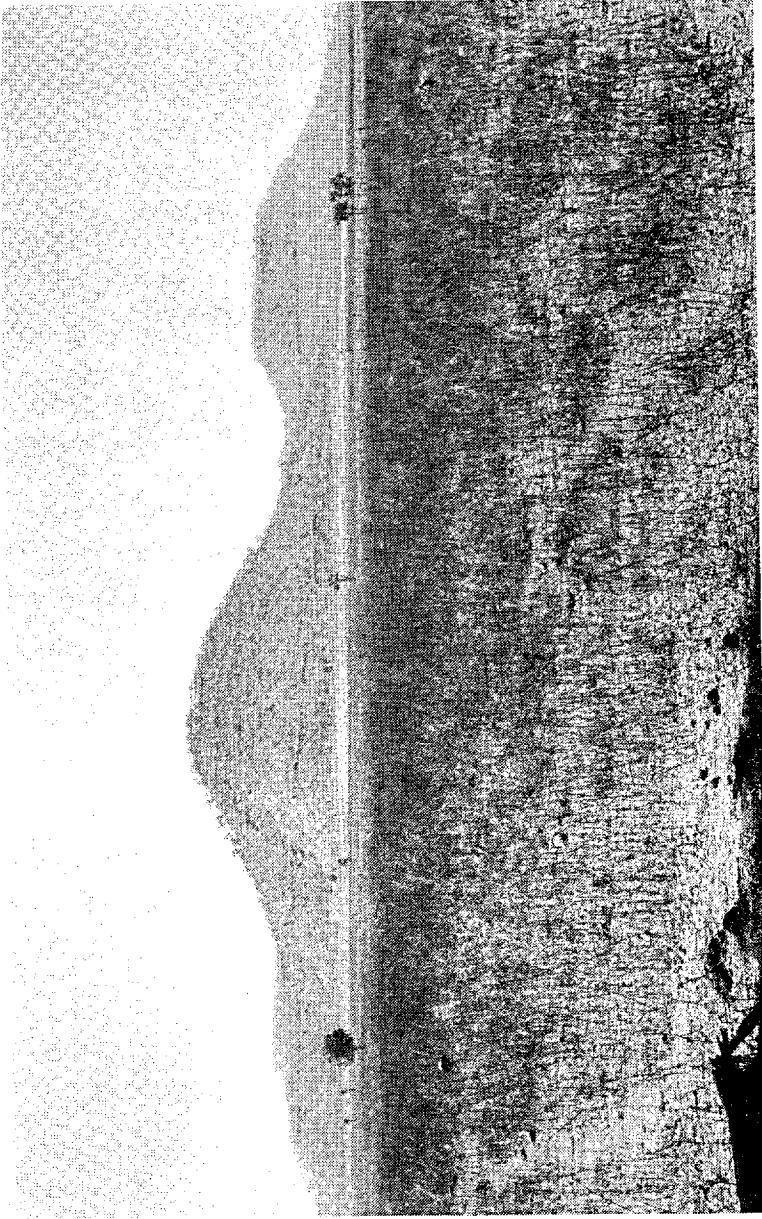


PLATE 11: Looking towards Mt Pleasant from the original campsite at Farm 1. These hills acted as effective catchments to discharge water across the cultivated area. So much did Mt Pleasant dominate the work and the efforts of the employees that it was once described as Mt --- Horrible!

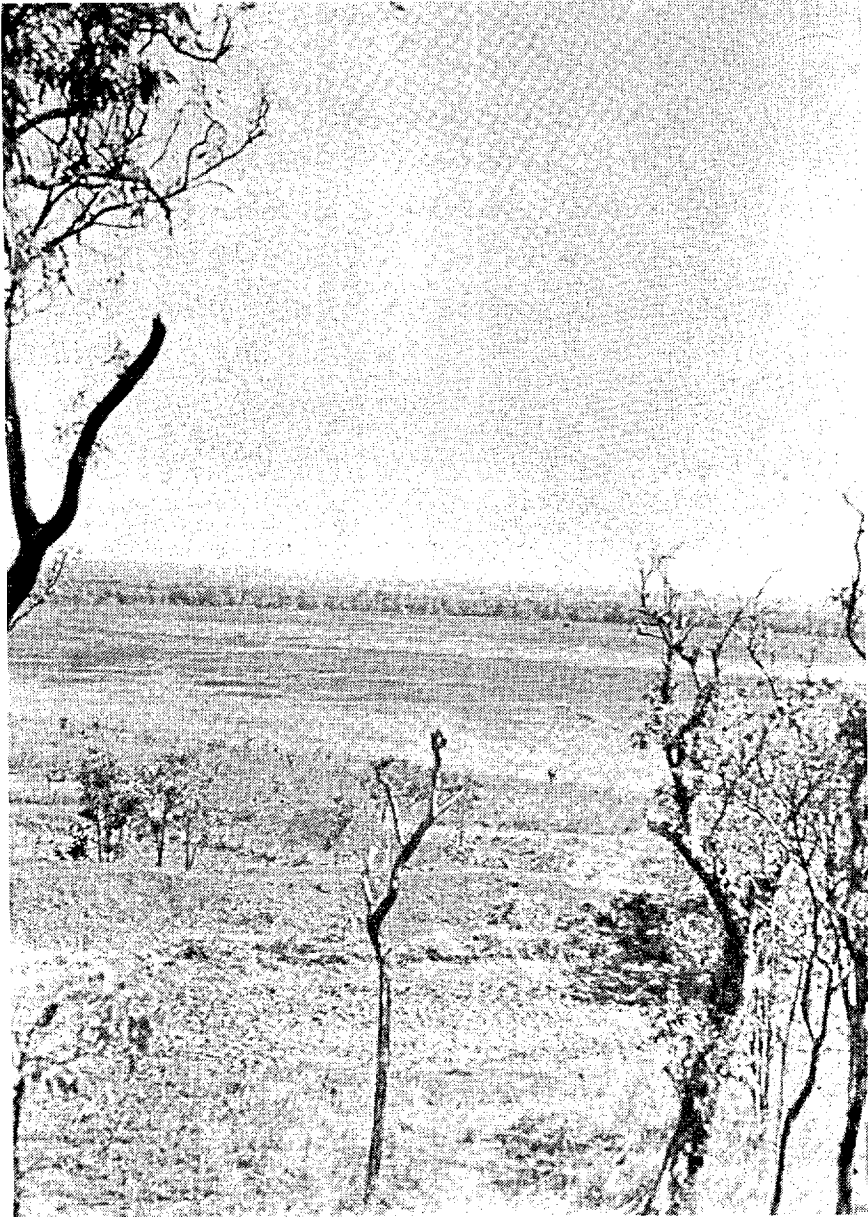


PLATE 12: The view from Mt Pleasant across Farm 1 to the original campsite. In the centre stands the remains of a shed which was part of the original living facilities. Further in the background stands the grain storage shed for Farm 2. In the foreground are the remains of the dam built to prevent runoff from Mt. Pleasant discharging onto the cultivation.

handling farm machinery but few, if any, were familiar with the environment of the Top End. To plant the first crop within the time constraints imposed by the weather required all operations to be performed with speed as the paramount consideration. As an incentive to achieving planting targets attractive hourly rates were paid: \$2.00 for tractor drivers and \$1.50 for general hands, plus keep. This compares very favourably with male wages under Commonwealth and State industrial awards which averaged \$45.00 per week. Managers of each of the farm areas and the head mechanic received an annual salary of \$4,500, and the general manager was paid \$7,000. In addition, inspiration was derived from the nature of the work, for transformation of virgin savannah woodland into an extensive mosaic of ploughed soils was both spectacular and exciting. The completion of sowing in January 1968 meant that the management and workers had accomplished a great deal in a short time, but such an achievement was not without its setbacks.

The long hours of work in the field, coupled with the austere living conditions, induced fatigue which hampered operations. Incorrect or inadequate supply of materials and equipment from other organizations further frustrated the urgency of the operations. Under such conditions breakdowns occurred and mistakes were made. Countless examples exist of particular errors of judgement, commission or omission which were time consuming or expensive to remedy. Every person associated with the program has his own stories, some apocryphal, illustrating mistakes and wastage that occurred. Alf McConnell, administrative officer at the site, relates how field workers would complain to him that they were not being paid and this was often because he was unaware that

they should be on the payroll.¹ This resulted from concentration on work in the field, which minimized the employment of personnel on administrative duties at the station, with a consequent strain on the efficient running of the operation.

These examples are symptomatic of deeper causes for the failure of the Tipperary Land Corporation to achieve its stated goals. Misinterpretation of the environmental data available led to the formulation of excessively optimistic objectives. Once the proposals for development were stated in the prospectus, failure to follow them could have left the Corporation subject to possible legal action by disgruntled shareholders in the United States. Through the need to diversify, the heavy involvement in irrigation and feedlot programs taxed all resources to the limit. Emphasis was given to the diverse nature of the corporate activities but, at the end of the first season, it was solely dependent on the outcome of the first harvest. Income was not expected from cattle operations for some years, and the marine and mineral divisions were also in the establishment and development phase. Success of the first sorghum crop would prove the viability of the proposals for development and would enable more capital to be raised easily for continuation into the second and subsequent years. Its failure was a blow from which the organization did not recover.

Consideration of these factors has led to the belief in the Territory that the Tipperary development started 'too big too soon.' This commonplace implies that a more cautious beginning, similar to that proposed by Stoltz and McMillian in 1969, would have been effective for successful

¹A. McConnell, personal communication.

cropping on such a large scale. However, the original dream and basic inspiration was for a grand scheme involving large amounts of capital. A cautious beginning would not attract suitably large investment, was contrary to the envisaged nature of the whole venture, and therefore was not considered.

Lamentation about what might have been serves no useful purpose, but worthwhile consideration can be given to the trends in the Australian grain sorghum industry from 1968 to 1972, the five year period in which Tipperary was to establish itself. Table 13 gives the average yield and total production levels in Australia, exports to Japan and average prices for that period with the values for 1967 included for comparison. In general this was a time of expansion. Increased exports to Japan attracted prices in excess of those guaranteed in the original contract TLC held with Mitsui and Company (\$44.50/t). The favourable nature of the contemporary market trends deepen the disappointment felt for the failure at Tipperary.

Why Did Tipperary Fail?

The previous section mentioned numerous interrelated factors that contributed to the scheme's downfall. No one of these can be isolated as *the* cause of failure, as it was the interaction of them all that led to the final outcome. However, this section aims to emphasize some of the reasons for failure.

Two factors of major importance were:

- through ignorance or misinterpretation of available data excessively ambitious goals

TABLE 13

Trends in the Australian Grain Sorghum Industry 1967-72

	Harvest Year					
	1967	1968	1969	1970	1971	1972
Total Australian production ('000 tonnes)	319	288	294	547	1,297	1,228
Average Australian yield (kg/ha)	1,560	1,540	1,400	1,520	2,350	1,920
Exports to Japan from Australia ('000 tonnes)	18.8	66.0	0.70	262.60	1011.90	716.60
Average price per tonne paid in Japan for Australian sorghum (\$A)	na	na	51.46	59.87	55.89	52.53

Note: Prices quoted are for sorghum of U.S. grade II quality.
na = not available

Source: Bureau of Agricultural Economics, 1975.

were originally set;

- adequate finance was never available to carry the project beyond the first planting.

To consider the first of these it is necessary to place it in the general context of farming. Every cropping program is exposed to the risks of crop failure as a result of unfavourable seasonal conditions and to the possibility of poor prices at the time of sale. In addition to these unknowns, the Tipperary Land Corporation tried to bring large areas into production using mechanized methods not previously associated with grain sorghum in the Territory. The task was made especially difficult because the decision-makers of the Corporation did not properly assess the various environmental factors. At the start, inappropriate use of the land system concept led to the clearing of ambitiously large areas, some of which were unsuitable for cultivation or were inadequately managed. Overly optimistic yields were predicted and expected from these areas. It is always a moot point whether simple bad luck can be properly assessed as a cause of failure. If it can, the unseasonal rain in May 1968 is a classic example, for it denied the Corporation its first crop which had serious repercussions for the finances of the company.

Financially, the first crop was vitally important for two reasons. Firstly, its sale would provide a cash flow to help continue the operation and secondly it would serve as tangible proof of the feasibility of the program and thus attract public investment for the planned expansion. When neither of these two benefits was realized the management saw no alternative but to carry the burden of the initial

setback and to try to make amends in the second season. In all seasons other difficulties added to the Corporation's problems: distance and all it implied in terms of supply and transport; inadequate or inappropriate storage and handling facilities; problems with machinery and staff and control from afar were some of the more telling.

Finally, there is the matter of the attitude of management. Optimism and enthusiasm were shown by the total commitment to the entire program--rainfed grain sorghum in the wet season, irrigated cropping in the dry season, feedlotting, fishing and mining--which spread the supervisory capabilities of the directors and the limited finances. Success with only one of these would have been a splendid achievement and a boon for the Territory. What was needed was a staged expansion of the project with no new phase of development undertaken until the preceding stage was established. The Corporation had a vigorous management and if it had been able to apply its energy to transforming Tipperary over a much longer period this story may well have been one of success.

The Legacy of Tipperary

Failure, like success, is relative, and no experiment such as Tipperary can be accounted a complete failure. Some benefits did accrue to the Territory and the North generally, and while they may have been meagre in comparison with those which would have resulted from its success, they were real and hence valuable.

Investment at Tipperary directed nationwide interest to the Territory and boosted its economy. Little, if any,

Australian capital was lost and even at the cessation of activities no legacy of indebtedness was left to the local business community, in contrast to the failure of some other schemes.

Valuable experience was gained from the project by employees, scientists and government personnel at all levels. Many plant operators learned their skills with farm machinery at Tipperary and were on hand when the Northern Agricultural Development Corporation project began at Willeroo in 1971. During the first cropping season experimental work was conducted on soybeans, mung beans, cowpea, forage sorghums and pasture species under supervision from the University of Queensland. For the Administration's agricultural scientists it was the first opportunity to work with a commercial enterprise in broadacre upland cropping and a greatly increased knowledge of many aspects of practical agriculture followed. Officers of the AIAB also conducted basic agronomic trials over the years at Tipperary and these were especially encouraged by the Corporation after 1969. Table 14 shows the practical nature of the experimental work with sorghum. In an attempt to diversify from a monoculture as the commercial performance of sorghum faltered, investigations were conducted into other crops such as maize, soybeans and peanuts. Results from all trials produced information on types of fertilizers, methods and rates of application, agronomic practices for sorghum growing, varieties of sorghum and a wide range of other crops and pastures which added to the fund of knowledge available for dissemination throughout the Top End. A separate technical bulletin was later published containing these results.¹

¹AIAB, 1971.

TABLE 14
Outline of Experiments on Sorghum Conducted at Tipperary
by AIAB Officers 1969-71

S O R G H U M	
Experimental Short Title	Result Summary
N x P factorial Tippera Clay loam	<i>1968-69 Wet Season</i> P required at 35 kg/ha first year followed by maintenance dressings. N responded up to 20 kg/ha. Later results showed that 40 kg/ha would be a suitable fertilizer recommendation.
K x S factorial Tippera Clay loam	Neither element is limiting in the second year of cropping.
Trace Element Trial Tippera Clay loam	Cu Zn Mn Mg and Ca were tested. None was found to be deficient.
Carriers of N fertilizer	Urea, Di-ammonium phosphate, Anhydrous ammonia, Calcium Ammonium Nitrate and Sulphate of Ammonia were tested. Sulphate of Ammonia proved worse than Urea as a carrier, otherwise no differences were measured.
Effect of Deep Ripping on Grain Sorghum production.	<i>1969-70 Wet Season</i> The aim was to break through a hard pan layer and allow improved water relations for the crop. Despite visual vegetative responses no grain yield increase was measured.
Row Space x Population trial.	Narrow row spacings were as satisfactory as wide ones. No population information obtained.
N x P factorial - Blain	Trial abandoned due to establishment problems and unevenness.
N Top dressing trial	No yield response was seen due to the dry year, but a response to protein % in the grain was noted.
N placement and split N application-Tipperera	<i>1970-71 Wet Season</i> Splitting again gave no response, except in protein % in grain.
N rate and split N trial-Tipperera	Trial largely abandoned due to bird damage.
Aerial sowing and seed presoaking trial.	Although aerial sowing sorghum is feasible the conditions of sowing are probably quite demanding for adequate populations to emerge. Presoaking was not considered useful.
Variety trials	Trials performed at Tipperary and elsewhere showed out a number of excellent performers including E57, F64 (since discontinued), Pioneer 846 and C42Y.
Plant Breeding	A plant breeding programme with a view to developing a hybrid adapted to the N.T. Top End was undertaken for some years. Tipperary was one of four regional testing sites.

Source: Airey, 1977.

The cadetship scheme, recommended by the Forster Report of 1960, had sponsored several of the recent graduates through university and Tipperary provided a valuable baptism for them.

Development of new sorghum hybrids was seen as a major research goal with long-term benefits for Territory farming. The Corporation readily sponsored collection of new gene material from Thailand as an early step towards that end. An economic analysis of land development in the Tipperary region, based on cattle production on improved pastures, was released in 1972 by the Bureau of Agricultural Economics. Fencing and watering facilities, pastures and the standard of the herd were all improved substantially during the time of the American ownership.

One further benefit for the Territory derived in part from the program at Tipperary where administrative and legislative weaknesses in the control of soil erosion were exposed. Before 1969 the prevention of soil erosion was no more than touched upon by the *Control of Waters Ordinance* and the *Crown Lands Ordinance* and little could be done officially to prevent the degradation of land. The *Soil Conservation and Control Ordinance 1969* changed this by giving the government tighter control over all development projects that could lead to destruction of land. A Commissioner for Soil Conservation was empowered to provide information and advice on soil conservation matters to landholders and in some cases to construct associated works. As a precaution against further soil degradation he was able to issue Soil Conservation Orders to prevent clearing, cultivation or overstocking of tracts of land at risk. Landholders could also be required to implement rehabilitation or prevention

measures on their properties and loans could be made available by the government to cover up to 90 per cent of the costs incurred. To give the Ordinance teeth to ensure that Commissioner's directions were carried out provision was made for fines to be imposed or caveats to be served over properties where soil conservation work was not done. This legislation brought the Territory into line with the States and has played an important part in subsequent agricultural, pastoral and mining developments.

Although it was proven that sorghum could be grown under certain conditions, the major aim of the scheme, the establishment of an enormous grain sorghum program, was not achieved. A successful export grain sorghum industry would have required a greatly improved regional infrastructure with benefits to the whole community. Proposals to sell proven farming areas to suitable men was an idea from which the men, the region and the Americans would have gained. Failure at Tipperary did not deter Australians from attempting large-scale grain sorghum projects at Willeroo and at Lakeland Downs in north Queensland. In each case cropping goals were not attained and the schemes failed.

As a result of the spectacular nature of the failures at Humpty Doo, Tipperary and Willeroo faith in the agricultural potential of the Northern Territory has been severely shaken. Although courage is needed to attempt such schemes, the experience at Tipperary shows that this must be tempered by a thoughtful approach, fully cognizant of the limitations of the environment and of man's interaction with it. The following statement, made in 1962, would appear to show the way:

...agricultural development without the high risk to capital or human endeavour (which has characterised all past attempts) will be accomplished, provided that large commercial development is preceded by land resources surveys, appropriate field research and small scale commercial development.¹

This statement and the results obtained in the North from agriculture on a grand scale suggest that a thorough reassessment of the role of this type of cropping is essential before any similar program is again attempted.

¹Stewart, 1962:169.

*APPENDIX I*LANDS OF THE TIPPERARY AREA

(From Speck, Wright & van de Graaff 1965)

Description of land system units which occur on
Tipperary Station

Mullaman

Extensive high plateaux on deeply weathered sandstone and siltstone, relief up to 122 metres. Plateau surfaces and rocky hill slopes; brownish sandy soils with concretions; tall open forests with spinifex-tall grass. Restricted valley floors; brownish and reddish sandy soils with outcrop, in valley margins, and darker, finer-textured, mottled soils in central parts; mixed tall and low open forests mainly with tropical tall grass.

Yungman

Undulating terrain on deeply weathered sandstone, siltstone, and limestone, relief mainly less than 12 metres. Upper slopes; outcrop and skeletal soils with brownish and reddish sandy soils with concretions; tall open forest with spinifex-tall grass. Lower slopes and valley floors; reddish sandy and loamy soils; mixed open forest and tall open forest with mainly tropical tall grass.

Jindara

Undulating terrain on deeply weathered and relatively unweathered sandstone, siltstone, and limestone, relief up to 30 metres. Crest surfaces; mainly brownish sandy soils with concretions; tall open forest with spinifex-tall grass.

Lower slopes; mainly reddish clay loam soils; savannah woodlands with tropical tall grass.

Claravale

Gently undulating terrain on deeply weathered sandstone, siltstone, and limestone, relief mainly less than 9 metres. Upper slopes; brownish sandy soils with concretions, some outcrop; tall open forest with spinifex-tall grass. Lower slopes and valley floors; reddish sandy or loamy soils; mainly mixed open forest with mixed tropical grass.

Wriggley

Plains on limestone, sandstone, and siltstone, relief mainly less than 3 metres; mainly reddish clay loam soils, savannah woodlands with tropical tall grass. Drainage floors; dark grey and reddish clay loam soils; open savannah woodland with tropical tall grass, local grassland.

Blain

Plains on deeply weathered and silicified sandstone, siltstone, and limestone, with extensive colluvial-alluvial mantles, relief less than 3 metres; reddish sandy or loamy soils; mixed open forests with mixed tropical grass and tropical tall grass.

Tagoman

Undulating terrain on sandstone, siltstone, and limestone, relief up to 15 metres. Crests, upper slopes, and rocky surfaces; reddish sandy or loamy soils with outcrop, locally brownish sandy soils with concretions; savannah woodlands with tropical tall grass. Lower slopes and

drainage floors; mainly reddish loamy soils, some dark or grey clayey soils in drainage floors; savannah woodland with tropical tall grass.

Kimbyan

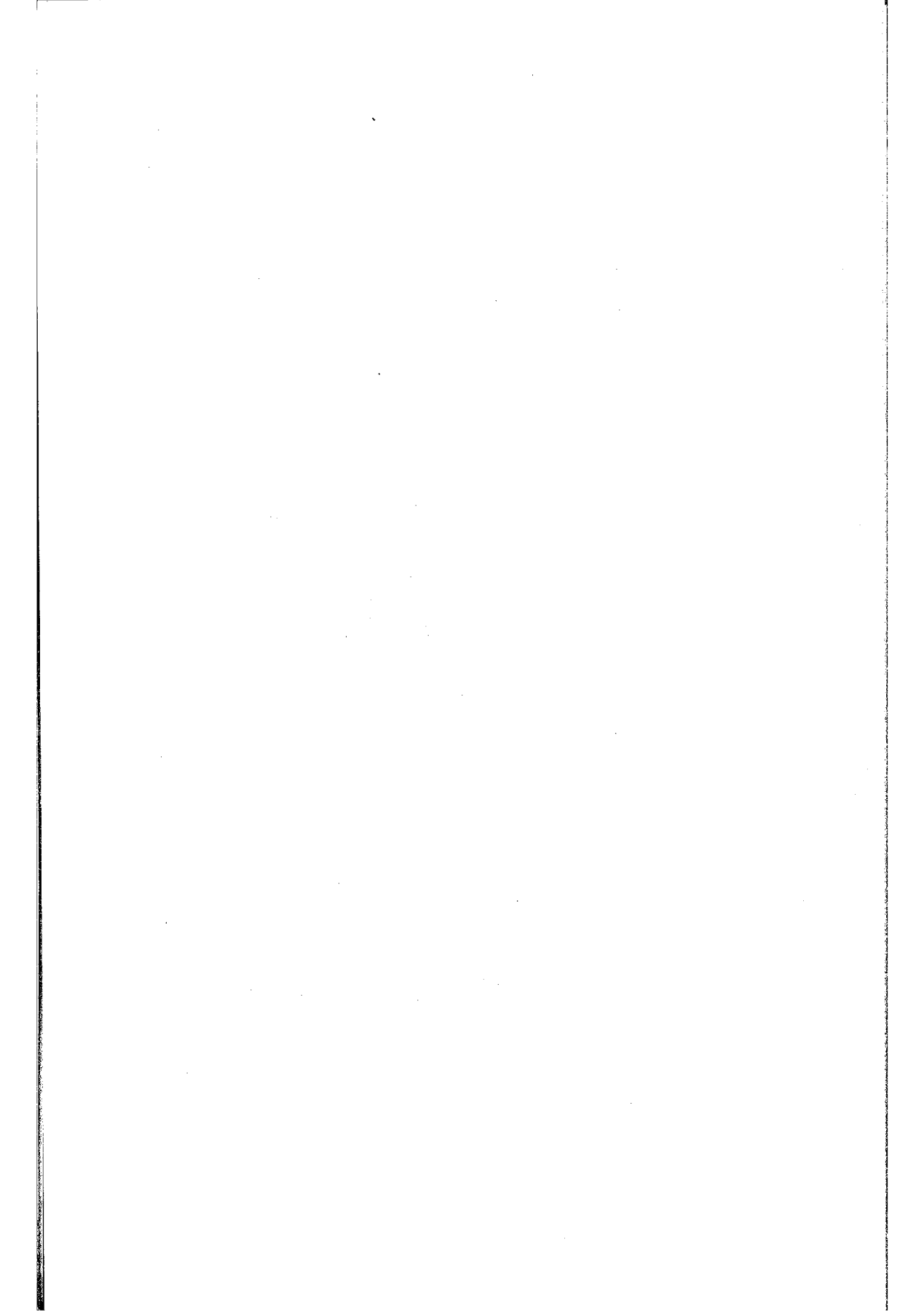
Plains on limestone, sandstone, and siltstone, relief mainly less than 3 metres; mainly reddish loamy soils with scattered outcrop; savannah woodland with tropical tall grass.

Green Ant

Tributary plains, gradients below 1 in 300. Drainage floors; dark cracking clay soils, some dark or grey calcareous soils; open savannah woodland with tropical tall grass, some grasslands. Plains; mainly brownish sandy soils with concretions; mixed open forests and savannah woodlands with tropical tall grass.

Banyan

Flood-plains, gradients mainly below 1 in 1000. Levee zones; mainly reddish or brownish sandy or loamy soils; savannah woodland with tropical tall grass, some frontage grass. Black plains; mainly dark crackling clay soils, some dark mottled clay loam soils; open savannah woodland with tropical tall grass, some grassland.



APPENDIX II

SOILS OF THE TIPPERARY AREA

(From van de Graaff 1965)

Descriptions of the major soil types which were cultivated on Tipperary Station

Tippera family characteristically has gradational texture profiles with dark reddish brown sandy loam to clay loam surface horizons which merge before or at 30 cm depth into dark red, dark reddish brown, or red clay. The surface horizon when dry is soft to hard, depending on texture and organic matter content, but the subsoils are typically hard when dry. Ferruginous concretions occur in many profiles but only in low amounts or a few individual nodules. In sites receiving considerable run-on the surface horizon is commonly darker and less reddish. This is probably due to higher organic matter content. Less red but browner subsoil colours were sometimes found in sites such as filled-in sinkholes and valley floors. The soils of this family are rarely shallow and stony. Where stones occur in the profile and as a surface cover, they consist of chert or weathered sandstone, siltstone, or limestone.

Blain family consists of gradational texture profiles typically having dark reddish brown or dark brown sand to sandy loam surface horizons which merge between 30 and 91 cm depth into dark red clay. In addition a few individual ferruginous concretions or rarely low amounts of these may be present at any depth in the subsoil. The soil surface is sometimes covered with a thin veneer of uncoated quartz sand. Shallow soils have rarely been observed in this family.

Elliott family characteristically has gradational texture profiles with a very dark grey-brown to brown sandy loam to sandy clay loam surface horizon which merges before or at 45 cm depth into yellow brown, usually red mottled clay subsoils. However, some soils with surface textures finer or coarser than is characteristic, such as clays and sands, were included in this family when they conformed in other properties. In most profiles mottling commenced above 76 cm.

Florina family has greyish brown, dark greyish brown, yellowish brown, or dark yellowish brown surface horizons of sand to sandy loam texture, single-grain or massive, loose to slightly hard, up to high amounts of ferruginous concretions. There is a gradual transition to the subsoil which is a light shade of brown or yellowish brown and is strongly mottled with red. Texture may range from sand to clay, structure is massive, and consistence is soft to hard. The subsoils are reputed (Stewart 1956) to be waterlogged and boggy for appreciable periods during the wet season.

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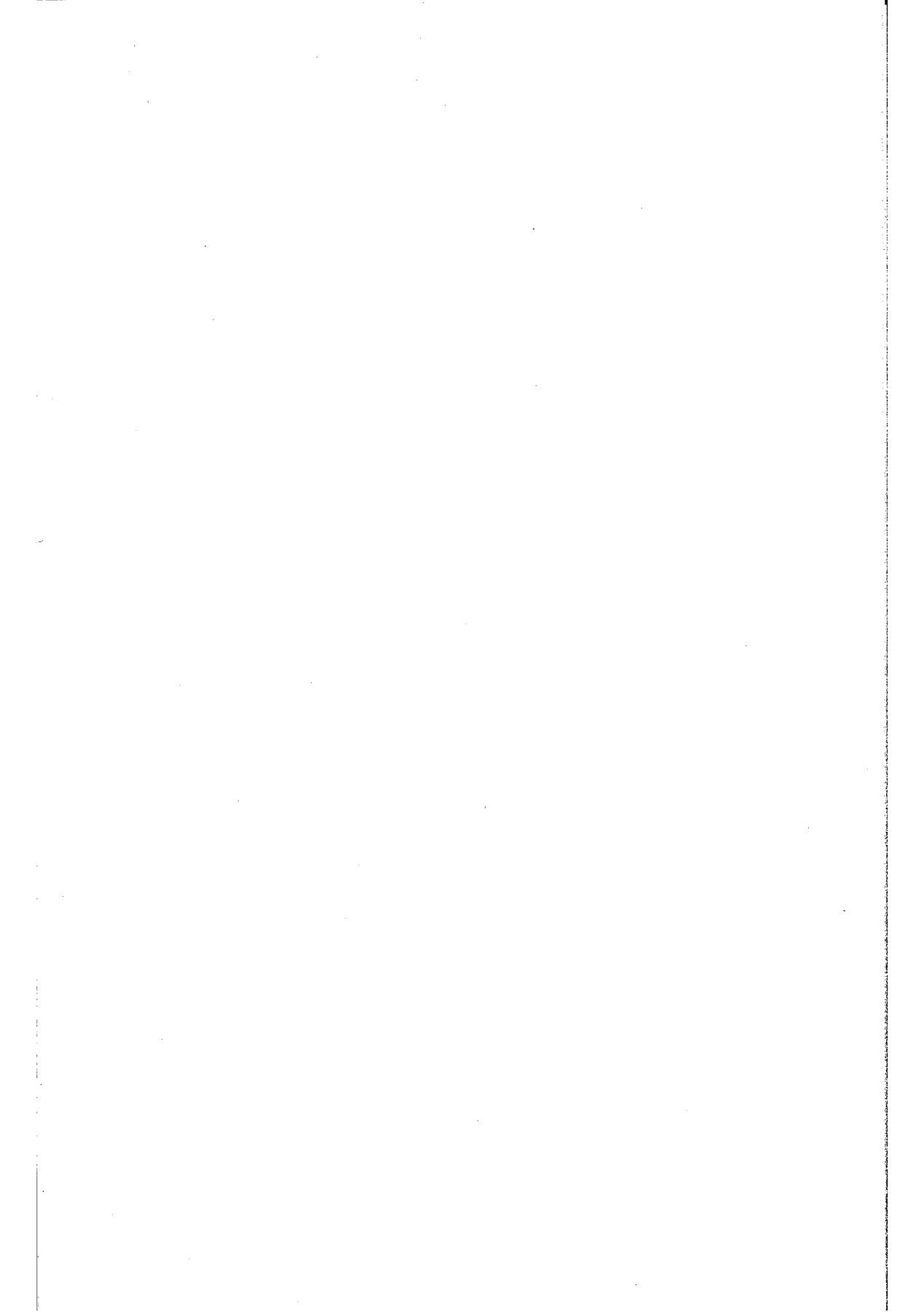
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REVIEW

Letts, G.A., Bassingthwaighte, A. and de Vos, W.E.L., *Feral Animals in the Northern Territory: Report of the Board of Inquiry, 1979*. Government Printer of the Northern Territory, 1979. xv + 234pp.

The members and staff of the Board of Inquiry into Feral Animals in the Northern Territory have produced a splendid document. This 234-page report is not the longest, or the best-written, or the most comprehensive assessment ever produced by an Australian board of inquiry; however, in considering the complexity of the assignment, the breadth of the investigation that was carried out, the depth of the analysis that was undertaken, and the speed and efficiency with which the report was consummated, it must be considered as a magnificent piece of work. The Northern Territory Legislative Assembly commissioned the investigation in June of 1978, and the finished document was off the presses only nine months later. This is a remarkable achievement.

Australia is the home of more feral animals than any other country, and the Northern Territory contains a greater variety of feral species than any of the states. Moreover, some of the animals occur in notable concentrations and their influence on both the Territory's environment and its pastoral industry is considerable. Although some attention has been paid to buffaloes and pigs in the past, a more comprehensive assessment of feral animals was long overdue, and the Board of Inquiry was established in recognition of this fact. The redoubtable Dr G.A. Letts, a man of eminence in Territory affairs as well as a scholar with a long-standing interest in feral animals, was named as Chairman of the

Board. Other members were Arthur Bassingthwaighte, Chairman of Swift Aust. Co. and William de Vos, Executive Secretary of the Northern Territory Pastoral Lessees' Association. Bruce Chapman, then an officer in the Department of Primary Industry, was Secretary to the Board.

The charge given to the Board was daunting in its breadth and complexity, specifying seven terms of reference for exhaustive inquiry and recommendations. The main points to be covered included environmental effects, disease problems and potentialities, impact on primary industries, costs/benefits of control measures, present and potential economic value, research needs, and policies/legislation/resources/facilities necessary to implement recommendations.

The Board approached its task with verve and energy, operating from Darwin, but holding formal sittings in four other localities, as well as entertaining numerous informal discussions and carrying out field inspections widely in the Territory. Some seven dozen witnesses testified before the Board and approximately the same number of written submissions was received.

The first problem faced by the Board was to decide which animals were to be the objects of study. The assignment specified only "feral animals", and nowhere is there a completely satisfactory definition of what is meant by ferality. The Board eventually decided to include nine recognized species of feral live-stock--buffalo, pigs, cattle, Bali cattle, brumbies (including Timor ponies), donkeys, camels, goats and cats--as well as rabbits, deer, foxes, sparrows, mosquito fish and dingoes. In other words, they fell back on the old Australian habit of selecting all the

species that might cause problems to the pastoralist (plus the curious addition of sparrows and mosquito fish) to be included within the purview of the study. This reiteration of the "vermin syndrome" is not worth quibbling about, as it is probably what the Legislative Assembly had in mind all along.

The report is organized into seven parts, one for each term of reference, with the section devoted to environmental effects occupying about one-third of the volume. In addition there are ten appendices as well as a summary of recommendations and conclusions that occupies seven pages.

The background, distribution, behaviour and managerial problems of each animal is discussed in greater or lesser detail, and various management recommendations are made for each. It is to the credit of the Board that it did not merely fall back on the simplistic and cliched recommendations (more research - more money - more bullets - more poison) that have bedevilled Australian wildlife management so much in the past. Although some of their suggestions read like history repeating itself (e.g., construction of barrier fences) others clearly signal a new approach (such as the enlightened statement that the Dingo Destruction Ordinance is not serving any useful purpose in the Territory, and thus should be repealed).

For summary purposes, the animals discussed can be divided into three groups:

- (1) Eight of them are of such minimal significance in the Territory, because of small numbers, limited distribution, or lack of problems, that they are only discussed briefly. These include Bali cattle,

Timor ponies, deer, goats, camels, foxes, sparrows and exotic fish.

- (2) A second group of five species is discussed in considerable detail, but the magnitude of problems caused is either limited or localized or unrecognized, and specific recommendations are unremarkable. Donkeys are noted as creating only minor problems except in the Victoria River District, where overconcentrations have been common for decades; better organized shooting and more research are recommended. Rabbits are largely restricted to the southern third of the Territory; coordinated control efforts are recommended. Brumbies are thought to number between 20,000 and 50,000 and are widespread in the Territory; their total elimination is recommended. Dingoes are recognized as a normal component of the ecosystem; no special management efforts are recommended. Cats are acknowledged as being widespread but with an environmental impact that is almost totally unknown; research is recommended, but (alas!) with a low order of priority.
- (3) The three remaining animals--buffaloes, pigs, cattle--are discussed in much greater detail, and are rightly considered as being the principal problem species. Buffaloes receive the most thoroughgoing treatment, including a full airing of the buffalo vs. cattle controversy in the Top End. A complicated set of recommendations is produced, predicated upon a division of the area west of Arnhem Land into six types of buffalo zones, with

total eradication suggested for more than half of the total area. The primary solution is to emphasize more efficient utilization of the buffalo as a resource, while encouraging the cattle industry and protecting the environment. Feral pigs are everybody's favourite enemies; their environmental damage and potential as disease reservoir cause the Board to recommend stringent and coordinated control, tempered only by the recognition that total elimination is regrettably beyond feasibility. The magnitude of the feral cattle population is considered to be greater than previous estimates have indicated--perhaps 250,000 head, which amounts to about 15 per cent of all cattle in the Territory. The stated desire to eliminate or bring these animals under effective control is pinpointed as one of the greatest challenges for rural industry. Several pertinent recommendations are made, but it is tacitly recognized that this goal is unlikely to be approached unless there are much greater economic stimuli.

The extra-textual material of the volume is a mixed bag, but on balance it must be commended because of the magnificent use of photographs. Both colour and black-and-white photos are numerous and integrated appropriately throughout the text in an exceedingly effective manner. Although the colour resolution is often unsatisfactory, the photos are so well chosen and suitable that they give an extra dimension to the book. There is also a welcome reliance on pertinent maps, fourteen in all. The over-all value of the volume is

somewhat weakened by a poor bibliography (all citations are incomplete) and an inadequate index.

The virtues of this volume are numerous, and its obvious shortcomings are few. This reviewer was particularly enchanted by three of the former:

- (1) The Board did not confine itself to noting suspected environmental changes due to feral animals, but delved deeply into historical reports and records to see what the environment was like before the "vermin" appeared on the scene, thus being able to assess the changes with much greater objectivity. This is but one example of several which could be cited to highlight the research value of this report.
- (2) Among several thoughtful recommendations, the Board suggests the establishment of a permanent Feral Animals Council in the Territory to oversee the management of the recognized problems, as well as a Feral Animals Field Force for survey and control work. If these recommendations were implemented, it might be a breakthrough of unprecedented proportions--coordination and continuity at last!
- (3) The Board recognizes the difficulties involved in devising practical solutions to these complex problems. Tucked away on page 67 is perhaps the most compelling sentence of the book, "If there were easy answers, they would already be in practice." Still and all, the Board has made a

valiant effort to ask the right questions, and perhaps come up with some of the right answers.

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OTHER NARU PUBLICATIONS

NORTH AUSTRALIA RESEARCH DIRECTORY (F.H. Bauer, ed.): this publication was inaugurated in 1975 to serve as a vehicle for the exchange of information among individuals and agencies conducting research in North Australia. Three volumes are available covering the years 1974 (204pp.), 1975 (279pp.) and 1976-77 (292pp.); \$5 per copy.

NORTH AUSTRALIA RESEARCH BULLETIN: published on a serial basis; subscription, \$20.00 for four consecutive numbers, single copies \$6.00 (Nos 1 - 4 \$5 only).

No. 1 (Sept. 1977, F.H. Bauer, ed. 125pp.):

Heatley, A.J. *Labor's Love Lost: An Appraisal of the Labor Administration of the Northern Territory 1972-75.*

Aschmann, H. *Views and Concerns Relating to Northern Development.*

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No. 2 (Nov. 1978, F.H. Bauer, ed. 171pp.):

Skerman, P.J. *North Australian Cropping Studies I: Cultivation in Western Queensland.*

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Pickup, G. and Minor, J.E. *Assessment of Research and Practice in Australian Natural Hazards Management.*

MAJOR SEMINAR PROCEEDINGS:

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Natural Hazards Management in North Australia. Proceedings of the Second NARU Seminar (1978) G. Pickup, ed., 493pp.; \$9.50 per copy.

