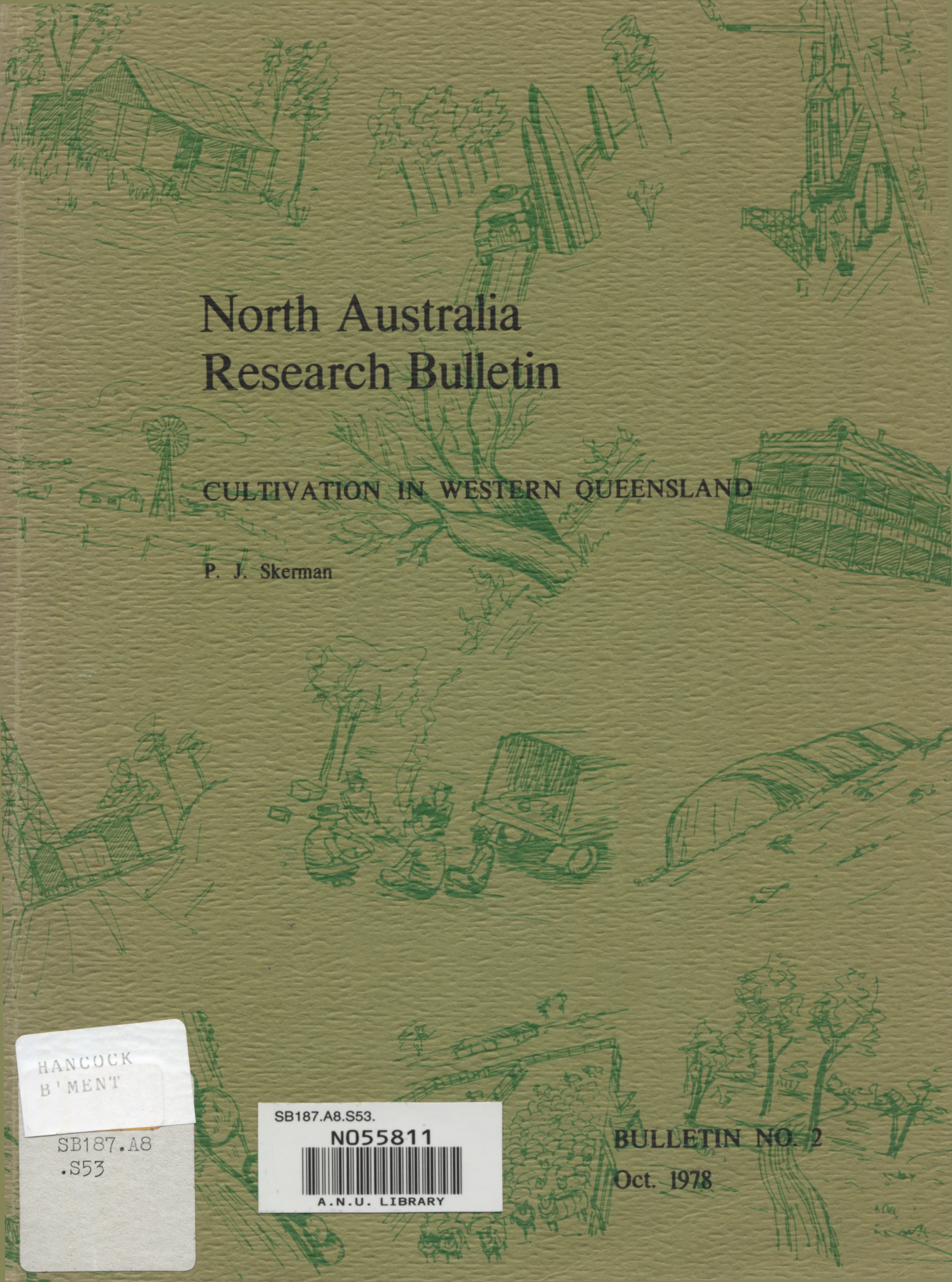

North Australia Research Bulletin

CULTIVATION IN WESTERN QUEENSLAND

P. J. Skerman

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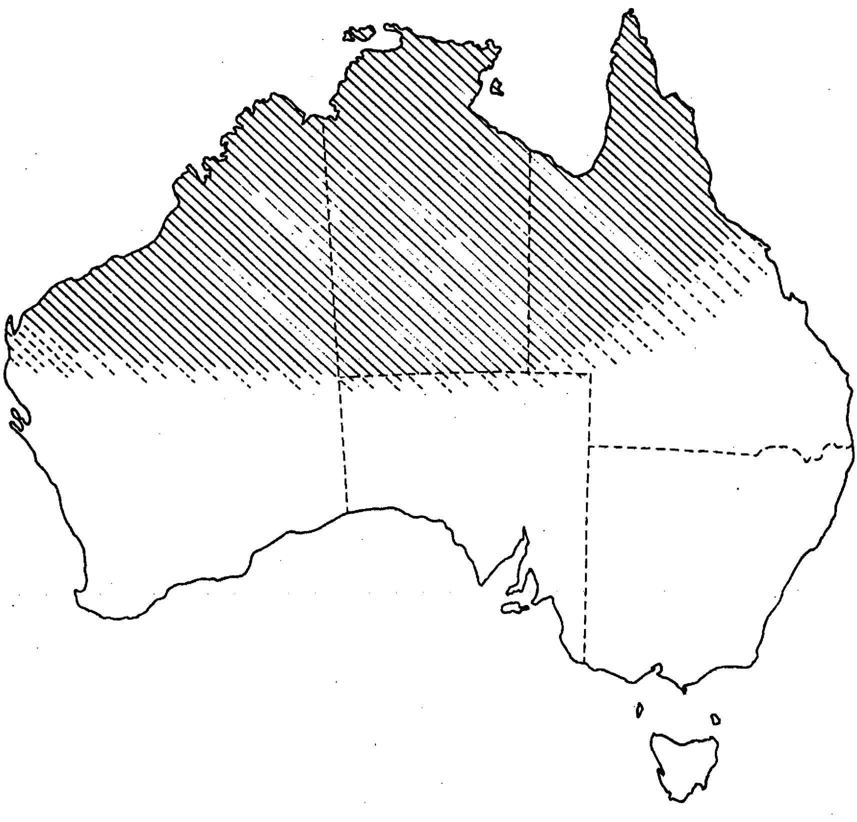
ERRATA

Page	Location	Correction
17	par 1, line 3	For devasted, read devastated
18	par 3, line 3	For twleve, read twelve
40	last line	For J. Saxelby, read J.A.B. Saxelby
88, 89		These pages are incorrectly numbered. The text should be read in this sequence of pages: 87, 89, 88, 90
116	par 3, line 8	For phosphorous, read phosphorus
134	par 4, line 2	" " " "
135	par 1, line 13	" " " "
139	par 3, line 5	" " " "
	par 4, line 6	" " " "

CULTIVATION IN WESTERN QUEENSLAND



Map of Australia showing areas in which NARU has interest

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North Australia Research Bulletin No. 2

CULTIVATION IN WESTERN QUEENSLAND

BY DR P.J. SKERMAN

The North Australia Research Unit
The Australian National University
Darwin, October, 1978

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TABLE OF CONTENTS

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Although the author was personally involved in the survey, initiation and early operations of the Queensland-British Food Corporation's activities in the Central Highlands, he is deeply indebted to Miss Penelope Rogers, of the University of Queensland staff, for permission to draw copiously on her honours thesis in history entitled "The Peak Downs Scheme", for which she researched in detail the original documents in the Queensland Departments of the Co-ordinator-General and Primary Industries (previously Department of Agriculture and Stock).

The Director-General of the Queensland Department of Primary Industries, A.A. Ross, requested his Deputy Director of Plant Industry, N.F. Fox, and his staff to make available departmental files and personal information covering cultivation in the Central Highlands. T.E. O'Sullivan, also of the Department, kindly allowed me access to, and use of, an internal report entitled "Farming in the Central Highlands", covering recent developments in that area.

Several farmers and graziers throughout the districts involved co-operated by forwarding information of their respective farming experiences.

The Librarian of the University of Queensland Central Library, the Fryer Library and the Biological Sciences Library and the Queensland State Library freely gave me access to publications.

Finally, I am indebted to Mrs Joan Holmwood for her diligence in perusing and typing the manuscript.

P.J. SKERMAN

11.11.1977

LIST OF MAPS

LIST OF TABLES

LIST OF PLATES

ABBREVIATIONS

Acronyms:

BAE	Bureau of Agricultural Economics
DPI	Queensland Department of Primary Industries
QAJ	*Queensland Agricultural Journal*
QBFC	Queensland-British Food Corporation
QBI	Queensland Bureau of Investigation
QDAS	Queensland Department of Agriculture and Stock
QPD	*Queensland Parliamentary Debates*

Units of Measurement:

a	acre
bu	bushel
cm	centimetre
ha	hectare
hl	hectolitre
kg	kilogram
lb	pound
Ml	megalitre
m	metre
mm	millimetre
oz	ounce
ppm	parts per million
t	tonne

INTRODUCTION

Queensland has a substantial history of crop raising based, for the most part, on the better watered and comparatively fertile areas which were occupied in the early years of settlement. The first farmers occupied the alluvia of the coastal streams of south Queensland. The fertile black soil downs and plains of the Darling Downs had been rapidly taken up by squatters following in the wake of John Campbell and Patrick Leslie in 1840. To cultivate in the 1860s was to be a traitor to this group.[1] It took the continued efforts of the storekeepers who wanted more intensive settlement, the selectors who craved the land for grain growing, recurrent drought and financial crises to break finally the monopoly of the "Pure Merinos" and give agriculturists access to these lands under the Land Act of 1868.[2]

Black clay soils require correct timing of cultivation operations to bring them effectively into successful production. Ploughing with horse teams in the early days was slow and heavy work and the cultivation schedule was often upset. Droughts and flooding further complicated the task. Dry farming techniques for moisture conservation from the predominantly summer rainfall had to be developed in this area of marginal rainfall for cropping, and so extensive cropping had to await the advent of mechanization in the 1925-35 era.

Meanwhile the "Unsettled Areas"[3] west of the Darling Downs were mainly locked in the grip of brigalow (*Acacia harpophylla*) scrub and the prickly pear cacti (*Opuntia* spp.), until the successful control of the prickly pear by larvae of the cactoblastis moth (*Cactoblastis cactorum*) in the late 1920s, and the wholesale destruction of the brigalow scrubs with the availability of heavy land clearing machinery after World War II.

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[1]Waterson, 1968:62

[2]*ibid.*, p.33

[3]*ibid.*, p.18

The Central Highlands had always been a predominantly pastoral region, given over to sheep raising, until the white spear grass (*Aristida leptopoda*) invasion caused gradual switching to cattle after the 1914-15 drought.[1] Agricultural activity was restricted by the marginal nature of the rainfall, opposition from pastoralists and the lack of finance from the banks for such an undertaking.

After the devastating 1946 drought by which time dry farming techniques had been established on the Darling Downs and large-scale cultivation machinery became available, good farmers, mainly from the Darling Downs, initiated successful grain-growing in the area. The access of the Queensland-British Food Corporation to previously freehold land in 1949, and the impact of its partially successful operation, increased agricultural interest. Finally, the winding up of the Corporation's activities, making both land and machinery available, together with a compulsion on lessees to cultivate a minimum area, resulted in a continuing rapid expansion of grain growing from 1952 to the present.

The Western sheep graziers, occupying fertile and treeless, though less climatically suitable, land for grain growing were casting their eyes eastwards at this agricultural expansion. Motivated by heavy sheep losses in recent droughts and high wool prices, some of those holding mitchell grass downs experimented with cropping for silage and green fodder during the 1953-63 decade. Economic conditions and poor crop performance gradually caused cessation of the venture.

Throughout all these experiences lessons have been learnt. It is the purpose of this monograph to document the history of cultivation in the Central Highlands and Western Queensland in the hope that the lessons learned might prove valuable in present and future uses of the lands. The area dealt with includes the Central Highlands, the Central West and the North West as delineated on Map 1, p.3.

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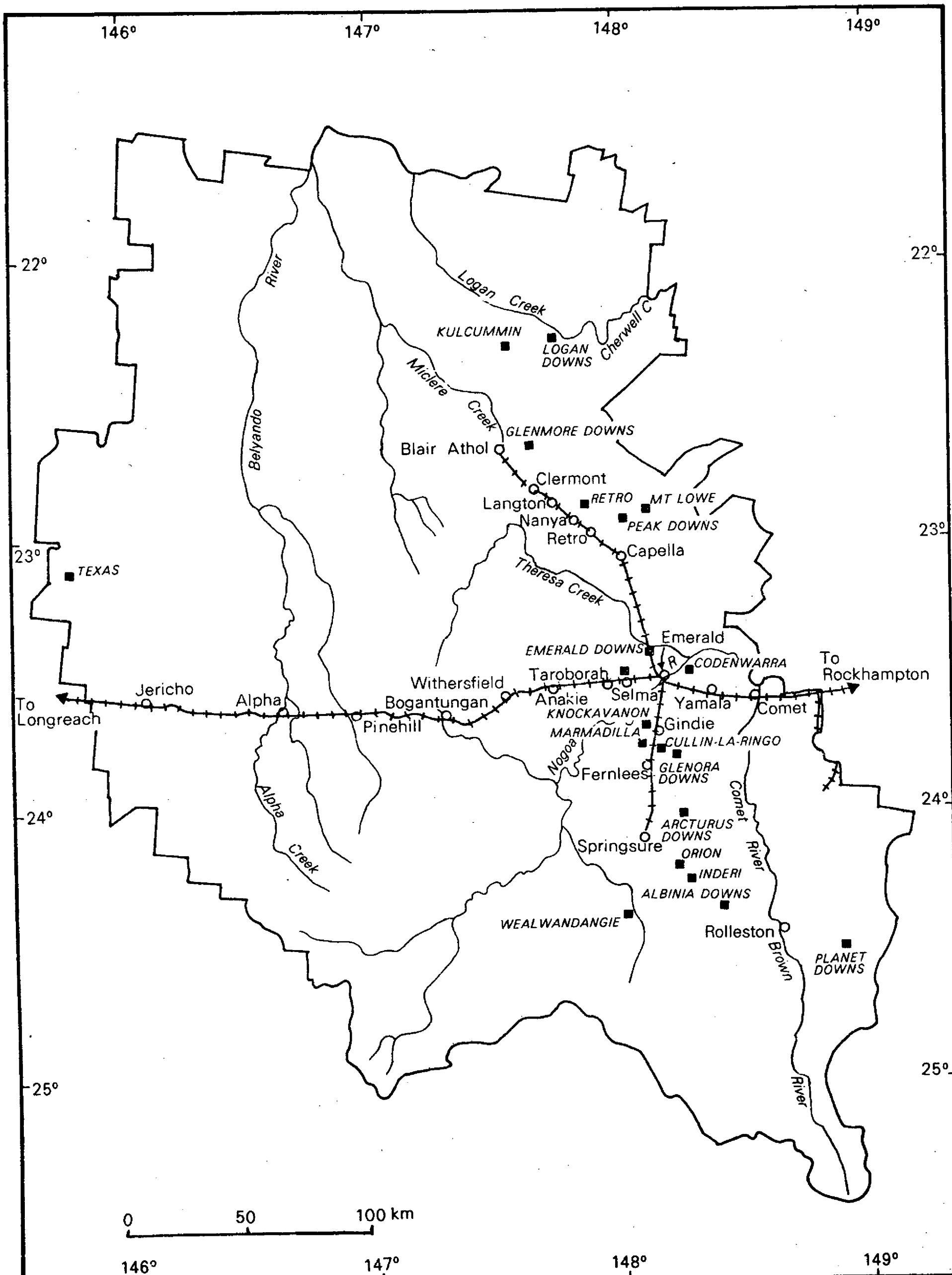
[1] Everist, 1938:4

Map 1
General Location Map

Map 2
Location Map, Central Highlands



PART I

THE CENTRAL HIGHLANDS

Physical Characteristics

The Central Highlands include the shires of Belyando, Bauhinia, Emerald, Jericho and Peak Downs (see Map 2, p.4). The area covers the northern slopes from the Buckland Tableland and includes the basins of the Belyando River in the Burdekin River system, the Nogoa and Comet Rivers in the Fitzroy system and the Alice River in the Barcoo River system. Cultivation is restricted to the alluvial soils of the rivers, open downs black earths carrying *Dichanthium* grassland, grey and brown clays of the brigalow (*Acacia harpophylla*) and yellowwood (*Terminalia oblongata*) forests, and small patches of deep sandy soils.[1]

Climatological data for the region are given in Tables 1-6, pp.4-9.

Dr L.G. Miles, of the Queensland Department of Primary Industries, whilst engaged in plant breeding at Biloela Research Station assessed that a daily maximum temperature of over 38°C for three or more days adversely affected sorghum grain production, and this effect of heat was later confirmed by Pasternak and Wilson.[2]

The number of heat waves (temperatures in excess of 38°C) for three or more consecutive days at Clermont between 1914 and 1950 was[3]

November	16	January	41
December	30	February	14
March	7		

Experience of cropping in the region has confirmed that heat waves are a cropping hazard.

It can be seen then that the Central Highlands constitutes a marginal area for cropping.

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[1]Skerman, 1953:145-6

[2]Pasternak and Wilson, 1969:636-8

[3]Skerman, 1956:195

TABLE 1

Average Monthly and Annual Rainfall Data for Central Highlands Centres

(in millimetres, to 1950)

Place	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual Average
Rolleston (62)	102	82	64	44	30	45	33	26	29	40	64	80	639
Springsure (82)	105	94	74	39	34	44	29	25	33	40	60	82	659
Emerald (68)	103	85	74	35	26	34	28	21	25	33	55	83	602
Capella (52)	97	78	65	31	22	38	22	14	20	31	56	85	559
Clermont (80)	120	106	79	41	32	42	26	17	24	32	54	94	667

Note: Figures in brackets indicate length of record in years.

Source: Skerman, 1953:139

TABLE 2

Seasonal Rainfall Distribution and Reliability for Central Highlands Centres

Place	Average distribution of seasonal rainfall (mm)		Reliability of summer rainfall		
	Summer (Oct-Mar) Total	Winter (Apr-Sept) Total	Percentage chances of receiving less than 250 mm	Percentage chances of receiving less than 375 mm	Range of summer rain-fall (mm)
Rolleston	400	200	14	42	250 - 500
Springsure	400	175	14	40	325 - 600
Emerald	400	163	20	50	200 - 500
Capella	375	138	25	50	150 - 500
Clermont	400	138	14	37	200 - 600

TABLE 3

Distribution of Planting Rains, 1942-1951

for Four Central Highlands Centres[1]

	10 year period (no.)	Sorghum planting Oct 1-Feb 14 (no.)	Wheat planting Mar-July (no.)
Planting rain at all four centres	25	12	9
Planting rain at 3 centres only	15	7	7
Planting rain at 2 centres only	18	8	6
Planting rain at 1 centre only	24	18	4

[1]Rolleston, Springsure, Emerald and Clermont.

Note: In the absence of actual soil moisture measurements a minimum of 37.5 mm of rain within a week has been taken as the maximum amount of rain needed for planting (Skerman, 1953:145-6). Only about one quarter of the scattered planting rains which fall throughout the area actually fall on any one property or in one locality.

TABLE 4

Distribution of Planting Rains
for Four Central Highlands Centres

Place	10 year period	Sorghum planting	Wheat planting
Rolleston	53	23	20
Springsure	56	31	19
Emerald	49	26	18
Clermont	50	29	16

TABLE 5

Percentage Reliability of Effective Rainfall for Three Central Highlands Centres

Place	4 wet summer months	4 consecutive wet summer months	4 wet summer plus 2 wet winter months	2 wet summer plus 2 wet winter months	2 wet summer plus 4 wet winter months
Springsure	82	77	59	68	33
Emerald	84	79	63	72	35
Clermont	79	76	62	78	34

Note: From this table it may be concluded that summer cropping should be more reliable than winter cropping, but that a summer fallow followed by wet winter months would enhance winter cropping performance.

Source: Farmer, Everist & Moule, 1947:2

TABLE 6

Average Number of Days over Month of Minimum Screen Temperature of 0°C or Less (1930-1939) for Three Central Highlands Centres

Place	May	June	July	Aug	Sept	Date of first 0°C frost on record	Av. no. of frost free days (2.2°C)
Springsure	0.2	4.1	3.0	4.0	0.4	April 27	299
Emerald	-	2.6	2.8	2.5	-	May 26	311
Clermont	-	2.2	3.0	1.9	-	May 15	319

Note: From this table it may be concluded that frost is a climatic hazard to cropping in the Central Highlands.

Source: Foley, 1945:116-7

Early History of Cropping in the Central Highlands

The Peak Downs district was discovered and traversed in 1844-1845 by Ludwig Leichhardt on his way from Jimbour, on the Darling Downs, to Port Essington. He travelled from the Comet River to its junction with the McKenzie and then via Mt Stewart, whence he saw "an undulating country of varied character, now extending in fine downs and plains, now covered with belts of thick brigalow scrub, with occasional ridges of silver-leaved ironbark forest".[1] On his journey north he found and named *Albinia Downs* and the Comet River on 29 December 1844. He also noted "...if water were plentiful, the downs of Peak Range would be inferior to no country in the world."[2] In April 1854 Charles and Colin Archer, who had applied for the *Gracemere* (Rockhampton) property, decided to inspect the area of which Leichhardt had told them, and by July 1854 had acquired what were later *Gordon Downs, Emerald Downs, Peak Downs, Retro* and *Langton*. In 1861 J.T. Allen and Ernest Davies passed through *Bauhinia Downs, Planet Downs* and *Albinia Downs* on their way to the Barcoo. The discovery of gold (1861) and copper (1862) around present day Clermont led to an increase in population. The site of present day Springsure was a camping ground on the trading route from the Barcoo to Rockhampton with wool, and the return journey with provisions.

The first statistical record of cropping in the Central Highlands was in 1864 when the Springsure police district recorded 0.4 ha (1 acre) of gardens, and in the following year 1.2 ha of maize grain, 1.2 ha of maize for green fodder and 0.2 ha of gardens. By 1873 the garden area had increased to 4.8 ha, with 0.8 ha of green maize and 0.44 ha of vines. Meanwhile the Clermont and Copperfield police district needed grain, fodder and vegetables and in 1873 there were 12 ha of maize for grain, 0.4 ha of barley for hay, 1.6 ha of oats for hay, 1.6 ha of vines and 3.6 ha of gardens. Presumably the maize and oats were for mine horses and poultry, and the gardens were cultivated by Chinese to supply vegetables and fruit to local residents and travellers.[3] In 1892 the "Colonial Expert in Agriculture" noted:

> I have seen few districts in the Colony which seem to me to promise more in the

---

[1]Leichhardt, 1847:122

[2]*ibid.*

[3]Francis, 1935:102

> production of a great variety of fruits, grains, and vegetables than this much neglected Emerald Downs district. I saw two or three gardens in the neighbourhood that were most creditable to their cultivators and to the district, but here, as elsewhere, our friend John Chinaman may be seen hobbling along from one cottage to another with his two baskets, supplying the residents with vegetables and fruit, while backyards and allotments adjoining their houses, were devoted wholly to the cultivation of weeds and goats.[1]

In 1894 only 1.6 ha were irrigated in the Clermont district and between 1.6 ha and 5.6 ha each year from 1898 to 1902. Emerald recorded between 2.8 ha and 15.2 ha from 1897 to 1903, and Springsure from 0.8 ha to 1.6 ha each year from 1895 to 1898.[2]

Maize appears to have been the most important crop in the Central Highlands from 1890 until about 1910, with the greatest area being sown around Clermont. Some 128 ha were sown in 1877 with a peak of 184 ha in 1878, then a gradual decline to 20 ha in 1910, after the big drought. Meanwhile Emerald and Springsure districts devoted only about 20 ha each to maize production. Potatoes and other vegetables were important, as well as a few vines and citrus fruits. Lucerne was cultivated at Springsure from 1866 onwards, apparently being irrigated from wells. Sorghum was represented by 3.6 ha in the Clermont district in 1873. Wheat began to create interest, and in 1873 there were 3.6 ha of wheat harvested for hay and 0.4 ha for green feed. In 1880, when the Clermont railway extension was being debated in Parliament, the Minister for Works "had every confidence that ultimately the district would produce enough cereals to supply the wants of the whole inland country."[3]

Many holdings were converted to freehold tenure and the Land Act of 1884 resumed portions of some holdings for closer settlement as selections. In 1890 there was a considerable demand for land. A number of selections were

---

[1] *Western Champion*, 26.1.1892

[2] Eklund, 1924:289-308

[3] *QPD*, 33:762

taken up by experienced farmers, many of them drawn from the southern states by the exceptionally fertile character of the soil. Many of these selectors, although intending to adopt a system of general farming, including dairying, looked to wheat as their staple crop, and at Fernlees and Anakie it was expected there would be substantial wheat-fields. The proprietors of the flour mill at Maryborough intended to erect a similar one at Rockhampton to meet the anticipated output of wheat.[1]

In reference to Emerald the "Colonial Expert in Agriculture" said, "It is not unlikely that the quicker growing and hardier wheats will do wonderfully well here. That is, when we know of a suitable variety, and the proper time to sow the seed."[2] In 1894 Professor E.M. Shelton, of the Department of Agriculture, established wheat experiments at Clermont and Springsure. In the 1896-1897 Annual Report of the Secretary for Agriculture it was noted that several Victorians had settled near Emerald and had commenced wheat growing on an extensive scale. The fairly large yield of 1896 led to increased sowing in 1897. In this year the Central Districts grew 77.6 ha of wheat (35.2 ha unproductive, 9.6 ha for hay, 0.8 ha for green feed and 32 ha for grain, which averaged 0.6 t/ha). The December 1898 issue of the *Queensland Agricultural Journal* carried an illustration of wheat grown at Emerald that season by Mr Scott of *Emerald Downs* which, the editor said, "would put to blush any southern wheats." The yield of wheat in 1898 at Emerald was 57.24 t from 38.8 ha, or 1.47 t/ha, despite some rust attack. In 1899 the area sown was 161.2 ha, of which 90 ha were harvested for grain. It must be remembered that all this cultivation was done by horse power, which was slow, and the working of these dark cracking clay soils was often extremely difficult.

The Gindie State Farm

Early in 1898 a State Farm was established at Gindie, some 21 km south of Emerald, on the Springsure branch of the Central Railway system. This was in keeping with the Government's policy to establish State Farms in the important agricultural areas of the state, and to demonstrate suitable crops and sound methods of husbandry for each district. The Farm, which is currently private property,

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[1]Weedon, 1898:282

[2]*Western Champion*, 26.1.1892

originally formed part of the resumed half of *Fernlees*. It comprised 3,445 ha of mainly open downs country, with volcanic black soil, watered by the Nogoa River, Mosquito, Gindie and other creeks and lagoons. Wells were sunk to supply the home farm with water, and the first farmer was Alex Watt, a well-known farmer and sugar planter from the Logan district.

After attending the 1898 Pastoral and Agricultural Conference at Rockhampton, the Hon. J.V. Chataway (Minister for Agriculture), P. McLean (Under-Secretary for Agriculture) and Mr Lamb, a delegate from Warwick and a prominent Darling Downs wheat farmer, inspected the Farm. All expressed the opinion that it would be demonstrated that wheat would be satisfactorily and profitably grown in the Central districts.[1] Indeed, in his Annual Report for 1897-1898 McLean noted that it would be "the aim and endeavour of the Department" to do just that.[2]

The first manager of the Farm, Robert Jarrott, was appointed on 5 August 1898. His first annual report gave a strong hint of the problems caused by weather in this marginal area. Slightly over 4 ha of maize, planted in September, 2.4 ha of panicum (Oct.) and 1.2 ha of cowpeas all failed because of lack of rain. Three later sowings of maize, however, gave a fair crop, and some of it was sold for seed. Some other crops performed well:

> Millets - nine varieties were planted in October, all of which did well. The amber cane and broom millet were exceedingly fine crops. The seeds of these millets have been saved for next season's operations.
>
> Lucerne - a trial crop of 7 acres was sown on 10th February but did not come up until 2nd March, at which time there was a sufficient fall of rain to germinate the seed. After it was well up it made remarkable growth. On 22nd April a cutting of about five tons was taken off, which I consider was very satisfactory.
>
> Wheat - I commenced to sow on 15 March, and continued to sow at intervals, as

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[1]*QAJ*, 1898:451

[2]*Annual Report*, *QDAS*, 1897-1898:2

> weather permitted, until June. There are 63 acres of wheat and barley planted. This includes 23 varieties of stud wheat. So far the wheat is looking as well as possible, especially about 300 acres of the earlier plots that were drilled in.[1]

In his second annual report, for 1888-1900, the manager could report better results. Some 1.18 t of maize grain were harvested, despite depredations of caterpillars (probably *Heliothis armigera*) at the silking stage; three good cuttings of lucerne hay were made, though on the shallow soils there was little growth in the hot months; just over 8 t of panicum hay were made; 0.2 ha of swede turnips and 5 t of pumpkins were produced and sold; over a hectare of cowpeas were made into hay, which demonstrated the drought tolerance of this crop at the time. Twenty-four hectares of wheat yielded 25.5 t of grain although some lodged in a heavy wind storm; and 1.5 ha each of malting barley and Canadian field peas did well. However, 12 ha of maize sown in December 1899 failed to germinate. Four hectares were planted to fruit trees and 3 ha were prepared for a vineyard which was planted in the following year.[2]

By the time Jarrott wrote his third report (1900-01) the hints of 1898 were a reality. Crops of wheat, oats, barley, rye and field peas failed for grain, although some was cut for hay and some grazed.[3] The next year, 1901-02, was worse; only 225 mm of rain were recorded. All crops failed, the remaining vines were transferred to the Westbrook State Farm, and the only produce consisted of beautiful vegetables irrigated from the farm homestead well.[4] The drought continued into 1903 and all the cattle and farm horses were sent to the Dee River for agistment and the sheep were sold. A few showers gave some growth to maize and setaria which were cut for fodder. Some hope for the wheat crop was entertained but the drought took its toll. Rain in September 1903 allowed some broom millet, sorghum and maize to be planted. Some broom millet brush was marketed and a small stack of silage was built from the maize. A small area of cotton did not bloom, and grasshoppers destroyed a later sowing of maize and cowpeas. Some 23 ha of new season's wheat and 0.5 ha of oats were sown on very wet land on 1 May

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[1] Jarrott, 1899:50

[2] *Annual Report, QDAS,* 1899-1900:2

[3] *QAJ,* 1900:20

[4] *Annual Report, QDAS,* 1901-02:3

1904, but because of low winter rain these were cut for hay, which proved to be a lucky event as a mouse plague in October devasted the country.[1] In late 1904 maize, cotton, castor beans, broom corn, sorghum and cowpeas were planted. The cotton germination was poor, but the plants which grew carried a heavy crop of bolls, although the boll worms played havoc with them. Dry hot weather affected the castor beans, maize, broom corn and sorghum, and another grasshopper plague annihilated the castor beans but did not touch the cowpeas![2]

Thus in its initial seven years the Gindie State Farm had suffered extreme drought, heat waves, grasshopper and mice plagues, boll worm attack on the cotton and, mentioned several times in the annual reports, weed trouble, especially with fat hen (*Chenopodium album*). There had been only one favourable season.

Summary of activities Although the Farm existed from 1898 to 1932, there is little need for a full record of cropping. While the annual reports are not very detailed in some years, the following facts emerge over the thirty-five years of its history:[3]

- wheat growing for hay was successful on well-prepared fallowed land at least two out of every three years;
- maize growing for grain was hazardous, but for ensilage was successful one in two years;
- sorghum growing, when tried, was successful twice in every three years, mostly being used for silage;
- cowpeas were useful for fodder and hay, and showed some drought tolerance;
- the performance of cotton was uneven, and boll worms affected the few crops grown;
- dryland lucerne was successful occasionally, but it was found that irrigation of a small area for stud stock feeding was well worthwhile;

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[1]Jarrott, 1905:56-8

[2]*ibid.*, 1906

[3]Skerman, 1948d:61

- barley and oats performed similarly to wheat, but oats was not successful for grain; both crops were used for green feed or hay;
- severe droughts, as well as short dry periods, seriously interfered with farm performance, and fodder conservation as hay or silage proved a sound venture;
- grasshopper plagues occurred frequently; in one period from 1903-15 attacks occurred in eight out of the twleve years, with six consecutive yearly occurrences;
- mice plagues occurred irregularly, two being recorded in the thirty-five years of records;
- corn ear worm (*Heliothis armigera*) was occasionally a problem in maize, and "ladybirds" were severe on pumpkins;
- weeds, especially fat hen (*Chenopodium album*), were often troublesome;
- heat waves severely interfered with crop establishment and the early stages of growth;
- the loose self-mulching soils of the open downs are hard to consolidate in the preparation of a seedbed.

The Gindie State Farm was closed in 1932, along with several other state enterprises, by the Moore Government. The state was in the throes of the depression of the time, and cultivation in remote areas was difficult. The farm had recently moved more towards stud livestock and there was competition from private breeders for the market.

The Gindie Farm demonstrated in a small way that given adequate rainfall, a wide variety of crops could be grown on the fertile black soils of the Central Highlands. It demonstrated the sound integration of cropping with livestock, and the need for fodder conservation as hay and silage to cope with the inevitable droughts. The physical and biological hazards of cropping were also apparent - the difficulty of seedbed preparation in the loose, self-mulching soils; the need for moisture conservation and the necessity to plant while soil moisture was sufficient to ensure germination. The problem of heat waves was highlighted; the irregular, but certain, invasions of corn ear worm, boll worm and ladybirds on susceptible crops and the devastation caused by plagues of grasshoppers and mice became all too clear. The use of horsepower limited the area handled and slowed land preparation and planting; these problems have since been largely overcome by mechanization.

Continuance of Private Farming after the 1901-03 Drought

As soon as this devastating drought was over Daniel Bros, of Gindie, planted 120 ha of wheat which was reported as doing well in June 1904, but no record of its harvest performance was recorded. In October of that year, however, the Rockhampton Milling Company announced that it was closing its flour mill at Rockhampton (where the Gindie wheat would have been sent), because the government had removed the duty on flour purchased in southern states of Australia. The owners declared that they could not compete in price with flour imported from Adelaide, which sold more cheaply in Rockhampton than locally-produced flour.

Wheat then practically disappeared from the Central Highlands' scene until in 1910 P.C. Allen, of *Retro*, at Capella started growing wheat for hay.[1] He continued whenever possible under the climatic circumstances until the property was sold to the Queensland-British Food Corporation in 1949, when there were still 55 t of wheaten hay on hand.[2] In 1915 *Retro* had an accumulation of 630 t of wheaten hay which was chaffed and fed to sheep in 1916. From 1919 to 1925 wheaten hay, harvested from 64 ha in six out of the seven years, produced 1,199 t of good quality hay at a cost of $4.66/t. From 1915 until 1939 *Retro* regularly supplied wheaten chaff to *Maneroo*, Longreach, owned by the same company.

G.B. Brooks, the Inspector of Agriculture for the Department of Agriculture for the Central District, stationed at Rockhampton, established demonstration plots on a number of farms and on the farm of A.S. Bailey, at Capella, in the 1916-17 season six varieties of fodder sorghum yielded from 3.5 to 4.81 t/ha.[3]

Hybrid cotton was tried at Gindie State Farm in the 1903-04 season, but it did badly. However, in the 1904-05 season some Russells Big Boll cotton did very well, and many of the

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[1] Carew, 1932:53-9

[2] Saclier, 1977: personal communication

[3] Brooks, 1917:194-6

plants were fairly loaded with bolls, but the boll worm played havoc with it. A small quantity of nice quality cotton was obtained. Some 33 ha of cotton were grown in Clermont in 1908, and a slightly larger area was harvested each year until the outbreak of the Great War in 1914. The *Queensland Agricultural Journal* of January 1914 mentioned "the results of records of the ginning at Ipswich this season show that cotton of excellent quality has been sent from such remote places as Capella and Gogango." In 1916 Daniel Jones, the cotton expert of the Department of Agriculture, saw a unique cotton at Capella - a very heavy cropper, and another but different, type with different fibre colour, not as prolific. At *Gordon Downs* he observed an arboraceous species which was cut down annually by frost, but bore excellent crops of one of the best staples he had seen.[1]

In 1921 an overseas cotton delegation toured Queensland and visited the Central Highlands. Apparently this visit stimulated some renewed interest in cotton, as from 1921 the crop was sown in the Springsure, Emerald and Clermont districts, rising to a peak area of 156 ha at Clermont (1922-23). Jones[2] reported that a limb of cotton grown by Stolz Bros, of Yamala, carried twenty to thirty mature bolls. The brothers planted 5.6 ha in September 1920, and were picking their own for a return of $75 to $100/ha. At Capella were five areas ranging from 1.6 ha to 6.4 ha under cotton and another farmer was planting 12 ha. Farming in the Central Highlands practically ceased at the outbreak of World War II in 1939; with the cessation of the war, however, there was a slow revival as a result of the availability, although not abundance, of improved machinery. Cotton production revived spasmodically to register 200 ha in the Belyando shire in 1951-52, 300 ha and 162 ha in Peak Downs shire in 1959-60 and 1960-61 respectively and, with better prices and irrigation, some 1,070 ha in Emerald shire in the 1970-71 season, falling to 493 ha in 1975-76.

Citrus growing had begun when the Stolz Bros had planted an orchard at Yamala in the early 1920s. This orchard, grown under natural rainfall, was still flourishing in the late 1960s.

The severe 1914-15 drought resulted in the invasion of the depleted natural pastures by white spear grass (*Aristida*

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[1]Jones, 1916:156

[2]Jones, *Capricornian*, 5.2.1921

leptopoda). From that time on it became more serious, and Everist[1] reported it to be a major menace to sheep raising, causing graziers to switch to cattle. Its spread was attributed to overstocking with sheep, burning, drought, soil erosion and wind dispersal of the inflorescence. The grass is aggressive, unpalatable to stock and the seeds dangerous to sheep, capable of penetrating the wool, skin and even the flesh and eyes. The position worsened, and on 10 July 1947 "Herdsman" wrote in the *Central Queensland Herald*, "white spear grass, a grass which in fifteen years has infested and ruined thousands of acres of the best grazing lands in the Capella, Emerald and Springsure districts, might be controlled by ploughing."

In 1936 G. Heaton of *Glenmore Downs*, Clermont, first planted lucerne and it was still producing in 1947.[2] F.R. Vellnagel, who had had cropping experience in the Maranoa, bought *Emerald Downs* in 1945 and immediately instituted a cropping programme; he was the pioneer dwarf grain sorghum grower on the Central Highlands. His first crop of 136 ha planted on 16 February 1947 yield 0.54 t/ha, while a second planting of 6 ha put in a fortnight later gave 1.9 t/ha on only 28.25 mm of rain spread over nine falls in fifteen weeks. A crop of 80 ha of unharvested self-sown sorghum fattened 1,150 aged sheep.[3] In 1948 he planted 64 ha of Kalo sorghum and 24 ha of Wheatland Milo on land which had been fallowed for twelve months. The Wheatland Milo was a failure for grain, but the Kalo yielded 0.68 t/ha on a mere 19.5 mm of rain in five falls. Some 3,200 sheep, ten horses and three head of cattle grazed the residues for seven weeks; all gained weight and were in strong condition. Some 80 ha of sudan grass sown in January experienced a heat wave and a poor strike followed, but the crop recovered with February rain and was grazed twice in March and April.

The first crop of grain sorghum in 1949 was harvested in May, when 28 ha averaged 2.45 t/ha. The later crop of 218 ha was hit by a severe frost and only half the anticipated yield was harvested. Aphis attack caused the header harvester to gum up which slowed down the operation. Seventy-two hectares of sudan grass were planted on 18 February, but a severe heat wave gave only a 20 per cent germination, although a second germination occurred in March. Three

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[1]Everist, 1938:4-5

[2]Hassell, 9.1.47: personal communication

[3]*Queensland Country Life*, 12.5.1948

thousand wethers were put in on 20 March and ten days later another 2,000 grazed the crop till the third week in May. The paddock was spelled for three weeks, then ten cows, horses and up to 1,400 sheep grazed the crop till 10 September. The paddock was then spelled for four weeks, and 1,100 sheep put in. Old wethers were sold in August and dressed 21.8 kg. Mr Vellnagel said he hoped to use sudan grass as winter and spring feed. Sheep made better use of sorghum than cattle, as they could pick up shed grain. On 19 January 1950 *Queensland Country Life* reported that 80 ha of Early Kalo would be harvested within the next fourteen days, a second planting was 30-45cm high and had held out well against a heat wave and dry spell in the previous three weeks. A third area of 82 ha was ready to plant as soon as it rained. No yields were subsequently quoted for these crops.

W.J. Rundle of *Glenora Downs*, Emerald, planted sorghum on unfallowed ground in 1946 and the crop failed. Twenty-two hectares of grain sorghum planted early 1947 yielded 0.4 t/ha and the stubble fed 25 sheep/ha. In August 1947 he planted 112 ha of Puno and CCC wheat and harvested 94.1 t or 0.84 t/ha and is still cropping. In the same month G. Heaton and Sons of *Glenmore Downs*, Clermont, planted 20 ha each of wheat and oats, but the crops were ruined by grasshoppers when 45cm high.

The McCosker family of *Codenwarra*, Emerald, had some 150 ha of alluvium on the Nogoa River frontage under cultivation in 1947, some of which was irrigated. Thirty-two hectares of CCC wheat planted after rain in August, and watered in October, yielded 0.92 t/ha. Four hectares of pumpkins, water melons and rockmelons were grown under irrigation, and some 20 ha of cotton, unirrigated, failed. Another 8 ha of sudan grass were irrigated, successfully.

W. Tweedie and Sons of *Moongoo*, Capella, who had farmed at Dalby on the Darling Downs, planted 32 ha of Kalo and 48 ha of Milo grain sorghum on 18 February 1947 and estimated it would yield 2.5 t/ha, but having no harvesting equipment, grazed the crop with 155 bullocks, seven horses and fifty sheep. They recorded that caterpillars (*Heliothis* ?) were bad. Later they dry planted 80 ha of CCC wheat in August 1947 and harvested 0.3 t grain/ha; they had 48 ha of Kalo grain sorghum coming into head early in December and 120 ha fallowed for planting more grain sorghum in January 1948.

These, then, were the main pioneer grain growers in the Central Highlands immediately prior to the entry of the

Queensland-British Food Corporation into grain farming activities in the area. They had been encouraged and helped by O.L. Hassell, Agricultural Adviser, Department of Agriculture and Stock, stationed at Rockhampton.

The Queensland-British Food Corporation

Initiation of the Corporation By mid-1947 Britain was facing a situation so serious that the Atlee Government feared the nation's very survival was at stake. The economic effects of World War II, an unfavourable balance of trade aggravated by the necessity to import foodstuffs, the dollar deficit and a crop failure in most of Europe combined to threaten a severe food shortage.[1]

The Food Minister (John Strachey) had three fundamental methods for obtaining supplies:

- increased local production;
- development plans in the colonies and elsewhere;
- persuading Dominions to provide additional supplies;[2]

and he chose the second. The policy was designed "...to promote the moral and material welfare of the colonial peoples, and [also] to develop the resources of the Colonies, not only for their own peoples, but also for all mankind."[3]

In this frame of mind the British Government accepted the Ground-nuts Scheme for Tanganyika, proposed by the African branch of the world-wide Unilever organization to the Colonial Office and the Ministry of Food. The interest of Unilever in obtaining raw materials for the processing and manufacturing of food-stuffs, soap and other products coincided with the Food Ministry's responsibility to obtain fats and animal foodstuffs for the British people. The Overseas Resources Development Bill, which set up the Overseas Food Corporation, and another corporation, the Colonial Development Corporation, was introduced in October 1947 and

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[1]Rogers, 1960:34-5

[2]Butler, 1948:24

[3]The Colonial Empire (1947-48): London, H.M.S.O. 1948 (Cmd. 7433):4

became law on 11 February 1948.[1] At about the same time the Australian Prime Minister, J.B. Chifley, announced that the Commonwealth Government had suggested that the Food Ministry send a mission of their experts to Australia to discuss a greater output of Australian food to assist Britain, and to study technical and other problems.

The composition of the Overseas Food Corporation was announced as early as May 1947. The chairman was to be Leslie Plummer, a left wing intellectual and a newspaper man, who was assistant general manager and member of the board of Lord Beaverbrook's Express Newspapers Limited; James McFadyen, the Vice-chairman, was director of the Co-operative Wholesale Society Limited, and a member of the Colonial Economic and Development Council. The executive members were Sir Charles Lockhart, economic adviser to the East African Governor's Conference; John Rosa, the wartime Treasury Representative to Syria and Lebanon, and later a member of the Colonial Office who was on the Wakefield Mission to East Africa to investigate the Ground-nuts Scheme; and A.J. Wakefield himself, former Director of Agriculture in Tanganyika and Inspector-General of Agriculture in the West Indies.

When Colin Clark, Director of the Queensland Bureau of Industry, was in England late in 1947, he interested the British Ministry of Food in Queensland's agricultural potentialities. The Queensland Government was at the same time taking great interest in exploratory discussions taking place in London between Australia and the United Kingdom, on the possibility of expanding production of beef, dairy products, ground-nuts and dried fruits. In response to Mr Chifley's invitation the Food Mission arrived in Australia in January 1948, and after discussions in Canberra with the Prime Minister and the Commonwealth Department of Agriculture, went north to Queensland on the invitation of the Premier, E.M. Hanlon. The party consisted of the Chairman-designate, L.A. Plummer, A.J. Wakefield, and

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[1]Overseas Resources Development Act 11 Geo VIc 15. The full title of this Act clearly showed its intent: "An Act to provide for the establishment of a Colonial Development Corporation charged with duties for securing development in colonial territories, and for the establishment of an Overseas Food Corporation charged with duties for securing the production or processing of food stuffs or other products in places outside the United Kingdom, and for the narketing thereof, and for matters connected therewith."

one of Mr Strachey's assistant secretaries in the Food Ministry, F. Hollins.[1] The primary purpose of the delegation was to find, if possible, additional large areas suitable for peanut production, since this crop has a very high oil content and protein yield per acre. However, the delegation was also interested in the production of fodder grains that could be used for meat and fat production.[2]

The Queensland Bureau of Investigation of Land and Water Resources (QBI) had recently conducted surveys of most of the developing areas of the State and in the Nogoa report the technical officers had stated:

> Primary production in the Emerald district is limited almost exclusively to pastoral pursuits... In years past wheat growing was undertaken to a limited degree but it has not persisted...
>
> The owner of "Codenwarra" has been growing wheat on river alluvium with varied success for some years...from an analysis of the incidence of (rain)falls it has been reckoned that eight out of fourteen years should have given a good crop of wheat, and a further two years would probably have given a crop... It is not suggested that wheat growing be the sole pursuit, but it may be worked in with mixed farming and grazing... Grain sorghum could very well fit in with wheat growing as a scheme of grain farming, as both crops could be handled with the same machinery. It is probable that this crop will find a place in mixed farming ventures in this area in the future. Both the grain and sweet sorghum would be valuable as stored fodder throughout the area...[3]

The Deputy Chairman of the QBI and Under-Secretary QDAS asked the author, as Agricultural Resources Officer of the Bureau to report on areas of Queensland which might be considered by the Food Mission for expansion of grain sorghum and peanut production in Queensland and the report was presented on 2 January 1948 (see Appendix I). Special note

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[1] Rogers, 1960:51

[2] *QBFC*, 1949:3

[3] Skerman, Kennedy and Skinner, 1945:3

should be taken of the comment on the Darling Downs (p.145-6) in view of later criticism by existing farmers of the Corporation's entry into grain growing and its favoured treatment for machinery and markets. Note should also be taken of the statement concerning the Central West (Emerald, Capella, Clermont, p.146).

The Premier, E.M. Hanlon, chartered an aircraft for the Mission to inspect some of the suggested areas for development and it was accompanied by local officers who had a knowledge of the state. In what may have been an omen for the scheme, the aircraft crashed at Condamine, fortunately with no injury to its passengers, and the inspection was continued by motor transport. Ground inspection then convinced the Mission that there were no suitable areas for the large scale production of peanuts which did not require substantial clearing, a step which, in the light of its experience and commitment with the East African Ground-nuts Scheme, the members were not prepared to undertake. The Mission therefore concentrated on selecting land to grow grain sorghum, and after inspecting sorghum crops being grown on the Darling Downs and subsequently F.R. Vellnagel's current crop on *Emerald Downs*, the members decided to undertake production in the Central Highlands.

The fact that variability of rainfall placed the Central Highlands in a marginal area for grain production with likelihood of occasional crop failures was not overlooked. Comparison with rainfall and temperature figures from the Darling Downs showed a fairly good chance of producing crops on the Central Highlands where the growing season, while not as moist as the Downs, was somewhat longer because of its extended frost-free record. Summer rainfall, however, was less reliable than on the Downs. An examination of the meteorological data gave some indication of the chances of receiving favourable seasons in the area compared with the Darling Downs and Goondiwindi (see Table 7 next page). In a later publication attention was drawn to the fact that the Central Highlands had a summer cropping potential more similar to that of Goondiwindi than the Darling Downs.[1]

Independent examination of daily rainfall figures for Capella, Clermont and Springsure in relation to previous and subsequent rainfall incidence during the forty-nine years of records (1899-1947) produced the following indication of crop performance for sorghum:

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[1]Farmer and Everist, 1948:1-2

Capella	- 31 successful,	9 doubtful,	9 failures;
Clermont	- 37 "	6 "	6 "
Springsure	- 40 "	7 "	2 "

Other considerations such as incidence of sorghum midge (*Contarinia sorghicola*) could affect the performance.[1] In a further memorandum just before the first sorghum harvest (6 May 1948) the author calculated the probable overall sorghum yield to be approximately 1.36 t/ha (20 bu/a.) over the fifty year period 1899-1948, with a reduction to about 1.02 t should midge damage occur.[2] Throughout the history of the Food Corporation's four year experience no field midge damage was reported.

TABLE 7

Percentage of Favourable Seasons in South-Eastern Queensland

District	Percentage of years with four wet summer months	Percentage of years with four wet summer and two wet winter months
Central Highlands:		
Clermont	79	62
Emerald	84	63
Springsure	82	59
Darling Downs:		
Dalby	93	87
Pittsworth	84	79
Warwick	99	96
South Qld Border:		
Goondiwindi	75	70

Source: Farmer, Everist and Moule, 1947:21-59

Discussions took place with local experts in land utilization, grain and animal production, soil erosion,

[1]Skerman, 1948b:1-2

[2]*ibid.*, 1948c:1

machinery, water facilities and allied matters, from the Department of Agriculture and Stock, the Department of Public Lands, the QBI, the Bureau of Industry and the Irrigation Commission. All available data about the area were presented to the Overseas Food Corporation officers.

On 25 February 1948, the Premier, on behalf of the Queensland Government, and the representatives of the Overseas Food Corporation signed a tentative agreement covering the following points:

- A joint authority would be formed, consisting of representatives of the Overseas Food Corporation and the Queensland Government. This authority would be created by statute with power to operate the undertaking.
- The Queensland Government would supply one-quarter of the capital required, up to a limit of $1,000,000, and the balance would be supplied by the Overseas Food Corporation.
- Representation on the new authority would be on the basis of capital supplied.
- It was proposed by L.A. Plummer, Chairman of the Overseas Food Corporation, that he should be Chairman, and that J.R. Kemp, Queensland Co-ordinator-General of Public Works, should be Vice-Chairman.
- The Queensland Government would acquire suitable land and lease it to the new authority.
- The target would be set at 100,000 ha of cultivation. An effort would be made to get at least 8,000 ha under crop for the next year.
- Immediately on authority being given, Mr Kemp would co-opt the services of officers of the state departments in order to start the work of cultivation.
- Cultivation would be done by large-scale scientific methods of agriculture.
- For the first few years sorghum would be the main crop grown, and this would be used in conjunction with green feed and other protein rations for fattening pigs in central Queensland, surplus grain production being available

TABLE 8

Properties held by the Queensland-British Food Corporation

Property	Area (ha)	Date of Acquisition	Tenure
1. For grain farming and grazing			
Wolfang	21,125	June 1949	Perpetual Country Lease (PCL)
Retro	29,041	1949	
Peak Downs	37,472	June 1948	
Bramber Downs	2,072	1949	
Mayfield Downs	2,239	1949	
Cullin-la-ringo	48,298	June 1948	
Marmadilla	10,080	June 1949	
Inderi	20,789	June 1948	
Orion Downs	22,553	Dec. 1949	
	6,010		Special Lease
sub-total	199,679		
2. For cattle breeding			
Croydon	94,274	Dec. 1950	Pastoral Development Lease
sub-total	94,274		
3. For pig breeding and fattening			
Bajool	275	June 1949	PCL
	97		Freehold
Emerald	771		PCL
Moura	238	Jan. 1949	Special Lease
sub-total	1,381		
4. For miscellaneous purposes (grain sheds, workshops, stores etc.)			
Bajool	2		Freehold
Springsure	0.4		"
"	2.4		Special Lease
Emerald	0.4		" "
Moura	0.4		Perpetual Town Lease
sub-total	5.6		
grand total	295,339.6		

Source: *QBFC Fifth Report*, p.11

for export to Britain as feeding stuff. Sunflowers would also be grown as an oilseed for export to Britain.

- Personnel to operate the scheme would come from Queensland and the United Kingdom, preferably suitable farm workers and ex-servicemen. Not less than seven years after the establishment of the undertaking a review would be made as to whether the undertaking should continue, or whether it should be converted to a co-operative undertaking, or in the case of the grain farms, into individual holdings. In the latter case preference would be given to employees of the undertaking.

Establishment of the Corporation A Bill was introduced by the Premier into the State Parliament on 24 March 1948, passed all stages on that date, and on 2 April 1948, Royal Assent was given to *The Queensland-British Food Production Act*. The Governor-in-Council, on 8 April 1948, appointed the following members of the Corporation, thus establishing the Corporation from this date:

L.A. Plummer,[1] Chairman, Overseas Food Corporation nominee

J.R. Kemp, Deputy-Chairman, Queensland Government nominee

J. Rosa,[2] Member, Overseas Food Corporation nominee

R.E. Hewat, Member, Overseas Food Corporation nominee

G.H. Rushbrook,[3] Member, Overseas Food Corporation nominee

E.A. Crosser, Member, Queensland Government nominee

Staff of the Corporation The professional staff of the Corporation appointed initially comprised:

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[1]Resigned 30.6.40, replaced by Sir Donald Perrett.

[2]Resigned 22.12.48, replaced by Sir Eric Coates, who in turn resigned 31.8.50, to be replaced by J.W. Roden.

[3]Resigned 4.8.52.

W.A. Rogers, B.Com., A.A.U.Q., A.F.I.A. Administrative Officer (previously Secretary, Department of the Co-ordinator-General)

H.W. Herbert, R.D.A. Assistant Administrative Officer (previously Agricultural Economist, Bureau of Industry)

W.J. Young,[1] A.M.I.E. (Aust.) General Field Manager (previously State Housing Commissioner)

C.J. McKeon, Q.D.A. Food Production Manager (previously Director of Agriculture, Department of Agriculture and Stock)

J.A.B. Saxelby, Q.D.A. Chief Piggery Officer (previously Piggery instructor, Queensland Agricultural College)

V.H. Wettenhall, General Stock Manager (owner of *Belmont* cattle property, Rockhampton)

In 1950 J. Hart, an agricultural adviser with the Department of Agriculture and Stock, and son of a Darling Downs farmer, was appointed District Agriculturist at Springsure to supervise the southern properties and conduct research in agronomy.

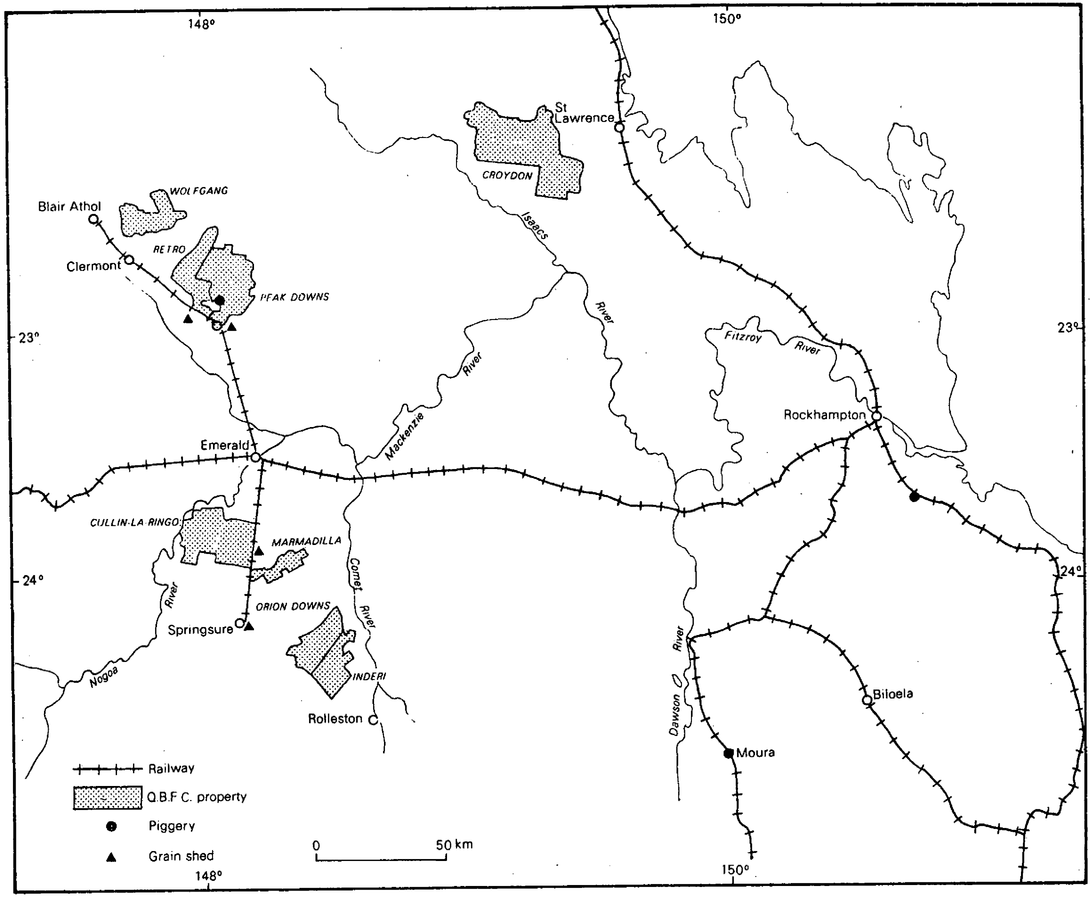
Acquisition of land At the height of its activities the QBFC owned 295,340 ha of land for grain growing and cattle finishing, cattle breeding, pig breeding and fattening, storage sheds and town houses (see Table 8, and Map 3 p.32).

Most of the properties were acquired early in the life of the scheme because it was thought that through the activities of the Corporation surrounding arable land prices would rise.[2] The land was acquired by the Co-ordinator-General acting as agent for the Corporation, and under the *State Development and Public Works Organisation Acts, 1938-40*. It was all acquired by private treaty.[3] As a matter of fact, resumption was possible and landholders would have preferred this method as it gave tax advantages over private treaty. Much controversy was brought to bear concerning the

[1]Died 5.9.49, replaced by C.M. Calder, a consulting engineer in private practice, who resigned in 1951, after which C.J. McKeon took over the role of General Field Manager.

[2]Rogers, 1960:101

[3]*ibid.*, 102



Map 3

Location Map, Queensland - British Food Corporation Activities land acquisition by the Parliamentary Opposition against the Labor Government in power. On 30 September 1951 the Corporation held 197,679 ha for grain farming, 94,274 ha for cattle breeding, 1,381 ha for pig breeding and fattening, and 5.6 ha for grain storage sheds and town houses (see Map 3).

The *Peak Downs* holding was the first to be acquired by the Corporation; at the time it was in a drought stricken condition and had been surveyed for sale as smaller blocks. The natural pastures of Queensland blue grass (*Dichanthium sericeum*), sago grass (*Paspalidium globoideum*), some Mitchell grasses (chiefly *Astrebla squarrosa* on wetter areas), *Chloris* spp., Flinders grass (*Iseilema membranaceum*) and *Digitaria* spp. were almost gone and had been largely replaced by inferior white spear grass (*Aristida leptopoda*) and Yabila grass (*Panicum queenslandicum*). Ploughing had already been shown to be effective in controlling these inferior grasses and allowing better use to be made of the land. The Peak Downs Pastoral Company, however, was glad to sell.

All the land acquired by the Corporation was held under perpetual country lease at a peppercorn or nominal rental. There were no annual rentals payable to the state but the Corporation had to pay Local Authority rates, Rabbit Board levy and so on. *Croydon* was covered by a new consolidated lease with rent payable and subject to improvement conditions such as fencing and ring-barking.[1]

Commencement of operations Main Roads Department surveyors were the first in the area, planning a road network to service the cultivations and transport depots. On Friday 21 May 1948 the author, who had previously mapped the areas for cultivation on *Peak Downs*, marked out the first areas to be ploughed. At 11am the next day ploughing began under contract by Theiss Bros Limited. No trees were removed in the process and by 29 October this firm had ploughed 12,199 ha at an overall price of 34.4¢/ha.[2] Thereafter the Corporation's own machinery took over and the land was cultivated

[1]Rogers, 1960:108

[2]Initially ploughing was done with a D8 tractor pulling four "sundercut" ploughs, but later an ingenious multiple hitch designed by Cecil Theiss allowed seven 14-disc "Shearer" ploughs to be pulled by the same tractor, cutting a swathe of 14.93 m at a single passage, while a D7 tractor could handle four ploughs and a D6, two.

twice before planting. The Corporation came in for a good deal of criticism over the machinery issue, for at this time agricultural machinery was in short supply and Queensland's grain growers were incensed that machinery was released to the Corporation when they had great difficulty in obtaining it.

As it happened, the summer of 1948-49 was one of the driest ever experienced over the sixty year period of record, and no planting rain fell until mid-January. Then twenty-nine combined seed and fertilizer drills, each sowing a strip 4.27 m wide, planted day and night for ten days to seed 8,800 ha on this first seeding rain; further rain on 3 and 4 February enabled completion of 11,714 ha. The Kalo variety of grain sorghum was sown on 7,576 ha, while 4,138 ha went to the Wheatland variety at a seeding rate of 5.5 to 6.6 kg/ha in 35cm rows. Excellent rains followed this sowing, up to 475mm falling before 31 March. C.J. McKeon, the Food Production Manager, in a broadcast on ABC radio on 8 May 1949 stated:

> Since sowing was completed, weather conditions have been very favourable and the crop has made splendid progress. Within the next three or four weeks, it is expected that harvesting will commence, and present indications are that the yield will be considerably in excess of one million bushels [27,272 t].

A report from Dr L.G. Miles, Senior Plant Breeder, Department of Agriculture and Stock, who was probably the most knowledgeable man in Queensland on grain sorghum, having bred most of the Queensland varieties at Biloela, stated that all sorghum crops were in excellent heart, and appeared capable of yields of sixty bushels per acre [4.09 t/ha], or better throughout the very extensive areas examined. He did indicate that corn ear worm (*Heliothis armigera*) and aphis (*Rhopalosiphum maidis*) were prevalent on the sorghum and rutherglen bug (*Nysius vinitor*) on the sunflowers, and that soil erosion was a problem.[1]

Prospects of a large harvest remained bright till May, when a succession of very heavy frosts severely affected the crop. Examination of temperature records subsequently made by the author indicated that the chances of getting so

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[1]Rogers, 1960:119

severe a frost between 7 and 14 May when the 1948 frosts occurred, are from nil to 3 per cent. Frosts as early as the 1948 ones had been recorded only once in the previous thirty-six years.[1]

There was also major loss of grain due to lodging as a result of which all the grain was not harvested, even though crop lifters were used.[2] The final harvest totalled 8,618 t, a disappointing harvest from a crop which showed so much promise, and the yield of 0.74 t/ha evoked much criticism from opponents of the whole venture. Cattle grazing the stubble were able to make good use of the residues from the crop. An area of 40 ha had been sown to Sunrise sunflowers, and although this crop also suffered severely from frost, the grain produced was of excellent quality and was reserved for seed for the 1949-50 season. The yield was 0.45 t/ha.

In the 1949-50 season, the second sorghum crop obtained totalled 7,126 t from 26,573 ha sown on four properties - *Peak Downs/Retro* in the north (14,657 ha), *Cullin-la-ringo* (5,660 ha) in the centre, and *Inderi* (6,256 ha) to the south of the Corporation's area.

The first plantings, made at the end of October and in the first week in November, totalled 4,000 ha. These crops were affected by a heat wave and much of the land was resown. The main plantings were extended over December, January and early February. The properties, being somewhat dispersed, received planting rains at different times. However, winter rains, totalling about 750 mm, occurred during the harvesting period, the *average* rainfall at this time being 135-200 mm. Although the rain caused some grain loss, 32,727 t were harvested for an average yield of 1.23 t/ha. The main problem caused by the rain was to increase labour costs. Tractor drivers had to be paid during the wet weather for doing practically nothing; bags in the field and grain sheds had to be restacked after a plague of mice; heavy expenditure was incurred keeping the black soil roads trafficable. Practically the whole of Queensland had almost double the average annual rainfall in 1950. The wet season extended into July, and harvesting operations, which began on 16 April, were suspended on 23 May. *Inderi* received a total of 1,165 mm of rain in the year, whereas the average annual rainfall was 549.24 mm, and *Cullin-la-ringo* 991.5 mm

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[1]Skerman, 1949:1

[2]*QBFC*, 1950:5

against an average of 547 mm. Of a total of 134 days harvesting period, seventy-one were lost at *Inderi* and thirty-nine at *Cullin-la-ringo*, where 3,000 bags of grain were ruined in the field.[1] Damage by mice was severe in the field and they also gained access to the "mouse-proof" grain sheds through some lapse in supervision, causing further losses. In addition to the sorghum, 450 t of sunflower seed were harvested. Wheat was planted during the autumn, but was destroyed in the field by mice.

In the third season (1950-51) planting was delayed awaiting rain until January-February. Of the 21,480 ha of sorghum planted, 5,120 ha failed to germinate because of lack of rain. An additional 4,480 ha were grazed off and 11,880 ha were harvested for a yield of 9,282 t; in addition 2,454 t were obtained from a ratoon crop grown on stored moisture from the 1950 wet season plus the current season's rainfall. The yield for the *whole* area sown was 0.43 t/ha. The sunflower crop of 360 ha was a total failure. The grain growing operation for the year showed a loss of $490,154.[2]

Of the 47,846 t of sorghum grain harvested from the three crops, 1948-51, 36,648 t were exported to the United Kingdom, 8,144 t were used for feed and seed, and 3,054 t were destroyed in a fire caused by ignition of fumigating chemicals in the Bajool grain shed.

In the 1950 internal report on one of the properties the District Agriculturist, J. Hart, condemned the Corporation's farming methods in no uncertain terms:

> It appears doubtful whether the present system of annual cropping of the same areas with accompanying brief cultivation period can be continued indefinitely with success. Even overlooking the desirability of some crop rotation, it is felt that a decrease in soil structure and fertility, accompanied by a great increase in weed growth, will result if our present system of land usage is continued... The only practical method of overcoming this problem is to reduce the area cropped each year, or alternatively, increase the present area of cultivation, but retain our present area of crop, and use some system of fallowing.

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[1]Rogers, 1960:122

[2]*QBFC Fourth Report*, p.6

> ...The present system of annual land cropping does not conform with the principles of good land management, and the introduction of the 1/3 fallow system should be effected immediately.
>
> Observations on last season's crop indicate that land preparation was insufficient and seedbed conditions poor; correct and necessary cultivation requirements appear to have been sacrificed for acreage. This is agriculturally and economically unsound.[1]

The fourth and final season of the Corporation's farming activities in 1951-52 achieved a sowing of 25,108 ha of sorghum, 2,000 ha of which failed to germinate due to lack of rain. Some 6,400 ha were planted in December 1951, and a further 4,000 ha in January and February, some of which had to be replanted, and in desperation 18,400 ha were sown "dry" in February. This later planted area was also hit by an earlier-than-usual frost in June and was finally grazed off. Only 10,900 ha of mainly early-sown crop were harvested. The total grain yield from the 25,108 ha sown was 8,782 t or 0.35 t/ha. However, some 2,000 ha grown on fallowed land at *Inderi* yielded quite heavily. Again the farming operations showed a loss for the year - $408,066.[2] The final average yield for the Corporation's whole farming experience was 0.73 t/ha of grain sorghum, a disappointingly low figure as compared to that hoped for.

<u>The livestock operations</u> In the preliminary submission with regard to the suitability of the Central Highlands for the Corporation's needs, the author stressed its marginal nature for grain production and the need to combine grain production with meat or wool enterprises.[3] The Darling Downs, Burnett and Callide Valley sorghum growers had previously shown the importance of sorghum stubble for dairy cattle during the winter months, and the Corporation found that the introduction of cattle to utilize its non-arable lands and the stubbles (crop residues) after harvest proved a profitable venture in the first year. However, there were

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[1]Rogers, 1960:122

[2]*QBFC*, 1952:6

[3]Skerman, 1948a:2

political objections to this practice because of the memory of the failure of the state cattle stations between 1915 and 1932, and because of its competition with private graziers in both purchasing store cattle and the sale of the finished animals to the meatworks.[1] The report of the Stock Manager, V. Wettenhall, was encouraging:

> Some 500 Hereford bullocks from 2 to 3 years were turned on to the first stubbles in open bleak downs in July 1949 under probably the hardest winter conditions for frost and cold winds that has been experienced in the country for years... Normally stock in the Central Highlands would be doing well to hold their own on the best of natural pastures in these conditions. These young bullocks on these stubbles went right ahead ...and were marketed as prime fats in Brisbane and Rockhampton during November of the same year...[2]

The cattle breeding station *Croydon*, inland from St Lawrence, of 93,184 ha was purchased in December 1950 to help supply store cattle at a cheaper price than they could be obtained on the open market. The cattle statistics over the life of the Corporation are given in Table 9.

TABLE 9

Cattle Statistics: QBFC 1949-52

year	on fattening properties	on breeding property	total	sales
1949	9,134	-	9.134	2,979
1950	16,926	-	16,926	2,654
1951	13,421	6,742	20,163	7,799
1952	14,886	7,517	22,401	8,568

Source: *QBFC Fifth Report*, p.4

By 31 March 1949 some 1,605 cattle had been purchased; a year later the Corporation held 15,000 head, and by 30

[1] Rogers, 1960:134

[2] *ibid.*, p.135

September 1950 some 6,573 had been sold to meat exporting companies.

Cattle raising was, in fact, the only part of the scheme to show a profit; in 1950-51 it turned a profit of $25,394, while the next year it was more than six times as great, $168,850.[1] It should be noted, however, that the grain project was never credited with the feed it provided for the cattle, and the sorghum stubble was, in fact, very important in this respect.

The term sorghum "stubble" needs elucidation. In a cold year a frost will eventually kill off all the vegetative material after the grain is ripe and with the removal of the grain the remaining stalk and flag (leaf) will constitute the "stubble," the feeding value of which is determined by soil fertility and rainfall interactions; it is often more nutritious in a year of low rainfall.[2] Where frosts occur after grain formation but before maturation, as happened in the first crop at *Peak Downs*, much pinched grain will remain in the field and will improve the nutritive value of the stalk and flag. In a wet year, such as occurred in 1950, voluntary growth of the legume *Glycine tomentosa* amongst the stubble greatly improved its feeding value; and in a year of no frosts or light frost and good soil moisture green regrowth from the stems will enhance the grazing. Again, if a crop lodges and stalks carrying heads of grain cannot be harvested by the machines, a greatly improved fodder is on offer to the grazing animals. In these latter cases it is more realistic to refer to the aftermath as "crop residues."

The Royal Commission of the Pastoral Industry in 1951 realized the significance of the use of crop residues for finishing beef cattle:

> We regard the beef producing section of the QBFC's activities as being of great importance to the subject under review and we recommend that the fullest advantage be taken from any opportunities for economic investigation arising therefrom.[3]

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[1] *QBFC,* 1956:6

[2] Skerman, 1953:201

[3] The Report of the Royal Commission to Investigate Certain Matters Relating to the Pastoral Industry, 1951:35

The report of the Advisory Body to the Board stated:

> It has been strongly represented to the Committee that the initiation of crop-feeding by the QBFC has stimulated interest in these areas (some of them quite remote geographically) and is considered that the successful operation of the QBFC will have a marked beneficial effect...[1]

Initially "pigs for Britain" was the main consideration of the Queensland-British Food Corporation, with grain sorghum the main feeding stuff. However, sorghum prices were too high for it to be used to finish pigs and the Corporation decided to adopt a cautious approach to pig raising development:

> The conclusion to be drawn...is that relationship between sorghum prices and pig prices is altogether out of line, in favour of sorghum. So long as these conditions obtain it will obviously not pay us to feed our sorghum to pigs.[2]

At the close of the first financial year the first piggery site had been selected at Moura, on the Dawson River, a design had been completed and preliminary work done on the site. By the end of the second year there were 1,152 pigs at Moura, and Bajool piggery was being constructed, while plans were being developed for a piggery at Emerald. In the report for the third year, the decision to develop a range breeding and fattening experiment, in which pigs would be allowed to graze directly off sorghum crops and would not be confined to pens, was announced. The report for the following year stated that pig production was still on a limited and experimental scale. The figures given below indicate the extent of the pig production enterprise at 30 September (Table 10). Pig meat produced was not sold by contract to the Ministry of Food as numbers did not warrant such an arrangement. The pigs were sold to Lakes Creek Meatworks at Rockhampton, the Corporation receiving an undertaking from the owners, the Central Queensland Meat Export Company, that pig meat would be exported to the United Kingdom to an extent equivalent to the weight of the Corporation's pigs slaughtered by the Company.[3] J. Saxelby,

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[1] Rogers, 1960:84

[2] *ibid.*, p.130

[3] *ibid.*, p.132

TABLE 10

Pig Production, QBFC 1949-52

year	Moura	Bajool	Peak Downs	total	sales
1949	500	-	-	500	-
1950	1,351	390	-	1,741	384
1951	1,634	1,141	610	3,385	739
1952	854	1,586	1,248	3,688	3,481

Source: Rogers, 1960:132

the supervisor of the pig enterprise introduced modern equipment and up-to-date feeding knowledge into the venture, and a field day at Bajool in 1951 was particularly well attended. However, because of the high cost of grain, the pig raising operations never showed a profit; during the 1950-52 period the loss was $62,800.

Research After the first sorghum crops had been planted, attention was paid to a research programme and the author was lent to the Corporation to initiate some trials as a part-time project in conjunction with a Corporation appointee, M. Davis. On the appointment of J. Hart as District Agriculturist in 1950, he undertook this research programme. The first trials were simple random block experiments to determine varieties of sorghum and sunflowers adaptable to the Central Highlands, and the best rate of seeding. As no small planters were available and technical assistance was limited, the plots were large enough to be planted by a commercial combined drill pulled by a field tractor. The first plots were planted between 6 and 8 December 1949, followed by further plantings between 21 and 24 January 1950 using certified seed of eight grain sorghum varieties. The growing season rain received was 548 mm compared with the average rainfall of 311 mm and so there was adequate moisture for the crop.

The results of these 1949-50 trials have been published in full.[1] The grain sorghum varieties yielded from a low 2.27 t/ha for Early Kalo to 4.55 t for a selection bred at the Hermitage State Farm at Warwick. The two varieties sown in bulk plantings, Kalo and Wheatland, yielded 4.29 and 3.57 t/ha respectively.

[1]Skerman, 1953:197-8

The plant population trials in this year of adequate moisture favoured the heaviest planting rate, the 10.5, 8.5 and 6.2 kg/ha plots of Kalo yielding 3.72, 3.32 and 2.40 t/ha respectively and the narrow row spacing, 17.5 cm with the heaviest planting rate, also gave the best yield with 3.50 t/ha against only 1.75 t from an 87.5 cm row spacing at a sowing rate of 4.18 kg/ha. To be fully significant such plant population studies need to be conducted over several years under a variety of seasonal conditions if dryland farmland is the practice.

A disturbingly low plant stand in relation to the amount of seed sown was revealed by counting the number of plants which survived to harvest. Although a planting rate of 8.47 kg/ha of seed was adopted, plant counts indicated that an effective stand equivalent to only 1.1 to 2.75 kg/ha remained at harvest with a tiller range per plant of 1.17 to 2.27. Laboratory germination tests prior to planting indicated a minimum of 70 per cent germination for the Wheatland variety to 84 per cent for Plainsman. A sample of seed was examined microscopically and it was found that some 66 per cent had abraded seed coats. Obviously the metal thrashing bars in the usual harvesting machines were causing damage to seed coats, which under the hot moist conditions of the seedbed led to secondary fungal and possibly insect damage. Such low emergence figures for sorghum have been recorded on the Darling Downs, even though fungicidal seed dressings are used.

Following the experimental plantings at *Peak Downs* in the 1949-50 season, Mr Hart continued the programme in the Springsure area where he was stationed as District Agriculturist. In the 1950-51 season he arrived at an optimum spacing of 30-45 cm in the rows with 35 cm between the rows. On the basis of a 25 per cent field germination in the Springsure area this is equivalent to a planting rate of 7.15 to 9.35 kg/ha.

As use was to be made of the stubble remaining after harvest for cattle grazing, an assessment of its nutritive value was obtained in co-operation with the Agricultural Chemist of the Department of Agriculture and Stock, who conducted the analyses. The crude protein content of the dried flag (leaf) from seven sorghum varieties ranged from 8.3 per cent for Plainsman to 18.1 per cent in the Kalo in the 1949-50 crop and was only 2.9 per cent in the flag of Kalo in the 1950-51 crop. Since 323.25 mm of rain fell on the 1949-50 crop, while 553.75 mm fell on the 1950-51 crop, the low protein figure was interpreted as a leaching effect in the latter year. The sunflower variety Jupiter significantly outyielded the other three varieties Polestar, Sunrise and Mennonite, and as with the sorghums, the heavier planting and closer row spacings gave significantly higher yields in this season of adequate moisture.[1]

For the 1950-51 season Mr Hart obtained a drying oven and took consecutive soil samples for moisture determination to a depth of 0.91 m on five occasions during growth. Because of good preplanting rains the soil was at field capacity at planting on 6 January 1951. Stand counts showed a 25 per cent germination, but insignificant plant loss between emergence and maturity at 139 days after planting. From 0.5 to 5.0 per cent loss from midge damage was recorded from individual plots.[2] Analysis of the soil moisture figures showed that although the soil was at field capacity at planting it had reached wilting point at the hard dough stage of plant growth. The total water requirement to grow the crop on each plot (in the 0.91 m profile) varied from 167.5 mm to 205 mm equivalent of rainfall.

From his data Hart deduced:

- a minimum of 187.5 mm of rain (absorbed by the soil) is required to produce a 1.84 t/ha crop of Kalo grain sorghum;
- 30 cm to 37.5 cm plant spacing in rows 37 cm apart (75,000 to 100,000 plants/ha) is the most desirable plant population;
- there appears to be no positive correlation between stand density and evaporation loss;
- on average figures, there is barely sufficient rainfall during any crop growing period from October to May to bring an average crop to maturity and therefore, some additional moisture must be stored prior to sowing - that is, fallowing must be introduced.

This trial was sown late in the season in January. A November sown crop would require more moisture. Further, borings were only made to 0.91 m and there was some evidence that the plants were drawing on some deeper moisture.[3]

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[1] Skerman, 1953:201

[2] Hart, 1951:12

[3] *ibid., passim*

Hart subsequently initiated trials to determine how germination percentages might be increased. His findings were:

- rolling greatly aids germination;
- "Tetroc" seed protectant may assist field germination, although there is slight evidence that it depresses the laboratory germination of seed;
- sowing speed had no significant influence on amount of seed sown per acre;
- within the limits of the normal and deep sowing depths (normal, 5 to 7.5 cm, deep, 7.5 cm plus) of this trial, there appeared to be no differences in germination; very shallow sowing is useless, even with rolling;
- there is no difference between varieties in the amount of seed sown by the combine under constant cog settings (there is, of course, a large difference in the number of seed sown due to the variation in seeds per kg);
- taking into consideration the percentage of viable seeds per kg of each variety, there is little or no difference between the field germination of Kalo and Wheatland.

Hart also undertook control experiments for the common weeds encountered in the two wet years 1949-50, *Polymeria longifolia, Teucrium integrifolium, Halorrhagis heterophylla* var. *glaucifolia* and the legume *Glycine tomentosa*. He found the hormone weedicides "Hormex" 0.2 per cent solution at 454 l/ha, and 0.1 per cent solution at the same rate, sprayed about midday on hot summer days on plants at the pre-flowering stage of growth were effective against *P. longifolia* and *H. heterophylla,* but not against *T. integrifolium* and *Glycine tomentosa*.

In addition to the above trials less intensive and observation trials were carried out at *Peak Downs* by Myles Davis, with wheat varieties, pasture grasses and linseed, and by Hart at Springsure with control of midge, but time did not permit worthwhile results to be obtained. The Corporation had tried wheat growing in 1950, but the crop was eaten off by field mice.

<u>The decision to disband</u> The East African Ground-nuts Scheme failed as a result of the difficulty of getting supplies, especially of machinery; storage problems in the

primitive conditions of Tanganyika; clearing problems and problems of tractor maintenance; the absence of proved agronomical techniques and skilled labour, as well as inefficient accounting. This failure had an unfavourable effect on the dwindling enthusiasm in Britain for the Queensland venture. On 22 November 1949 Lord Strachey, the Food Minister, dismissed J.N. Rosa, who was responsible for finance, and A.J. Wakefield, the agronomist supervising the Ground-nuts Scheme. Pressure mounted against Strachey for using Rosa and Wakefield as scapegoats, and early in 1950 Strachey was transferred to the War Office and his Food Ministry was taken over by Maurice Webb, while Sir Leslie Plummer resigned.[1]

The Conservatives in opposition were critical of the whole Overseas Food Corporation's ventures and Mr Hurd in some outspoken statements in the House of Commons gave vent to their feelings:

> I can understand the reluctance of Mr Hanlon [the Queensland Premier] to see the British Government withdraw 3/4 of the capital from this enterprise, but I do not see that we should necessarily agree with the point of view of the Labour [sic] Government in Queensland ... So far we have scored a minor success in Queensland and a major disaster in Tanganyika. Have we the sense to pause now and take stock?[2]

And again:

> I am still left with an unanswered question in my mind. What are we doing farming 700,000 acres [280,000 ha] in Queensland with the British taxpayer's money?[3]

The general elections of 1951 brought in a Conservative government which was interested in development by private enterprise. The economic position in Britain had improved since 1950, controls on cereals and feeding stuffs were abolished, and the Ministry of Food was less eager to import the Corporation's sorghum. Throughout its existence, of

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[1]Rogers, 1960:74

[2]House of Commons Debates, Vol. 485:117, 5.3.51

[3]*ibid.*, Vol. 491:1458, 1.8.51.

course, there was a British majority on the Board of the QBFC.

At the Board's meetings held in January 1952 where the Annual Report for the year ending September 1951 was received, the decision was made to appoint an Advisory Body:

> It was agreed that this Advisory Body would deal in particular with the question of whether the enterprise should continue in its present form, be replaced by a cooperative undertaking or the property used for land settlement by subdivision. An assessment was required from the Advisory Body of each alternative, with recommendations as to the course or courses which appear most practicable or desirable, together with the interim steps needed to put any change of organisation into effect.[1]

The composition of the Advisory Body was announced in Brisbane and London on 15 May 1952. The members appointed were:

Sir John Primrose, an experienced British farmer and agriculturist, and then Lord Provost of Perth, Scotland;

A.F. Bell, Under-Secretary of the Queensland Department of Agriculture and Stock;

D.N. Mathieson, Australian Manager of the Scottish Australian Co. Ltd;

A.H. Savile, Regional Director of Agriculture in Tanganyika; and

T.H. Strong, Director of the Commonwealth Bureau of Agricultural Economics in Canberra.

At the same time the Board decided to make its own internal review, and the management was requested to submit suggestions on how to make the project a commercial success, with reference to crops, methods of agriculture, balance between the different activities, organization, labour control and so on. The collective members were asked to give full estimates to the Board of the timetable, financial results, annual volume of food production and amount of working capital needed.

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[1]Rogers, 1960:78

The findings of these two bodies could be summarized as follows:

Report of the Management The members of the Management considered the benefits to be gained by greater concentration of activities, but decided that the anticipated saving in operating costs and reduction in management costs would be offset by the relative increase in cost per hectare and per tonne, of interest and depreciation. They recommended the continuation of grain production as the central part of the Corporation's activities on 20,000 to 28,000 ha annually apportioned between *Peak Downs*, *Cullin-la-ringo* and *Orion Downs*. This would enable the maximum area to be obtained from the plant held, the spread of planting risks, better use of stubbles and capital works provided and the essential crop rotation. As the most important means of reducing high costs of production they proposed measures to stabilize the labour force. They suggested starting an experiment on *Orion Downs*, which was relatively isolated, with a fixed salary scale for the men and bonuses for sorghum production above a fixed quota as an incentive system; or, alternatively, the abolition of the Industrial Agreement in operation and substitution of the normal methods used by other farmers; or the payment of a weekly salary, with or without bonuses, for unlimited hours of work. They also recommended a programme of capital expenditure on amenities for the workers, and the reduction in paper control as far as this was practicable.

The management fought hard for the continuance of the scheme, in which they still had considerable faith. They believed that the full seven year testing period was necessary before the scheme could be weighed accurately.[1]

> We claim that, since inception, the Corporation has been dogged by adverse climatic conditions spread over three, and possibly four consecutive years which has affected crop results... A succession of good seasons would, obviously, have shown quite a different financial result.
>
> Cattle...have benefitted from crops rejected from harvest, and have recently shown a profit, notwithstanding adverse seasonal conditions...

[1]Rogers, 1960:79-81

> Pig raising has been in the early developmental stages when profits could not be expected...
>
> The Central West of Queensland is worth fighting for...
>
> The battle should be beyond politics. Australia's empty spaces must be developed and what better avenue exists than rural agriculture with its concomitant development in secondary and tertiary industry.[1]

On five points they claimed that results had been achieved which were not measurable in money. The black soil downs had been opened to agriculture; information had been gained in cropping procedures which would be of value to all future settlers; other growers had come in from surrounding areas; the value of sorghum stubble had been demonstrated, and new ground had been broken by large-scale pig breeding and fattening without the use of milk urgently needed in other directions.[2]

This memorandum was rejected by the Board. Sir John Kemp was delegated to approach the Queensland Government on the question of cutting up the land for settlement. This before the Advisory Body had ever been appointed![3]

Report of the Advisory Body The Advisory Body presented its report to the Board in July 1952. It emphasized that the Corporation's activities had to be considered in a wider context, noting that by demonstration the Corporation had laid the ground work, admittedly without marked success as far as its own operations were concerned, for the agricultural development of large areas of the state where environmental conditions were as good as or better than those of the Central Highlands.[4] It was inclined to blame crop failures on the techniques used, while realizing that the defects resulted from the speed and urgency of expanding acreages, and the lack of precedent on which to work. They criticized the lack of suitable measures to control soil erosion; of summer fallowing; of co-ordination between stock and cropping sides of the venture; and under-capitalization resulting from the investment of too much capital in the land

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[1]Rogers, 1960:80-2

[2]*ibid.*, p.82

[3]*ibid.*, p.80

[4]*ibid.*, pp.84-5

initially. They indicated also that heavier implements to give deeper cultivation would have given better results. On the organizational side they disapproved of the remote control and heavy costs of administration, and the transference of a government department type of attitude to the running of the scheme.[1]

Their recommendations included nine fundamental changes in the scheme:

(1) the reconstruction of the Board so that it should include more experienced agriculturists, as well as nominees of both governments for liaison;

(2) the transference of the headquarters to Emerald or Magenta (on Corporation property), using agents for the off-the-property business;

(3) greater delegation of responsibility for decisions to the management at property level;

(4) the abolition of the Industrial Agreement with the A.W.U.;

(5) the refunding of the interest already paid, amounting to £142,000, and the abolition of any future obligations;

(6) the reduction in scale of the enterprise, more capital being made available through sale of certain properties to develop the remaining holdings;

(7) the abolition of the costly system of storing massive quantities of spare parts for machinery;

(8) a change in emphasis from immediate food production to sound developmental principles;

(9) more and more systematic liaison with scientific advisors.[2]

The Board's reply to such criticism stressed the economic factor:

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[1]Rogers, 1960:150

[2]*ibid.*, p.85-6

> While the Board fully appreciated the point which the Advisory Body had in mind, it cannot dismiss as of little consequence the economic aspect of such things as conservation or summer fallowing.[1]

In this, they were supported by the General Field Manager:

> In addition to loss of revenue for that period, the cost of maintaining the fallow would be heavy. Additional labour and machinery would be required to maintain the fallow.[2]

The Board refused to accept the practicability of the proposed modifications, and felt that the time had come to liquidate the project completely. The Memorandum of the Board stated that the Corporation had failed to demonstrate that their method of farming was economically viable, and they did not feel inclined to test the Committee's recommendations on changed techniques without experimentation on a pilot scale. Because of the legal obligation of the Board to produce food for Britain, and to operate commercially at the same time, they felt that concentration on principles of development was inappropriate to the functions of the QBFC. The Memorandum did not attempt a justification of the results in terms of difficulties encountered, but rather stressed the cold hard facts of the economic situation. However, it did stress that the primary factor in the financial failure was the original urgency in tackling the scheme.[3]

The last section of the Memorandum, entitled "The Lessons of Experience," concluded that the whole conception had been a mistake, and that large-scale projects of the nature of the Peak Downs Scheme need to proceed gradually and test their practicability on a small scale first. The final conclusion was that private enterprise, aided indirectly by Government, was the most effective agency in developing new areas.[4]

On 4 August 1952 the Board submitted its report, along with that of the Advisory Body, to the Queensland State

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[1]Rogers, 1960:126

[2]*ibid.*

[3]*ibid.*, p.86

[4]*ibid.*, p.88

Cabinet. It took six months for the two Governments to come to a decision on the future of the Scheme, the final conclusion being announced on 12 February 1953, when V.C. Gair, who had replaced E.M. Hanlon as Premier following the latter's death, made an announcement concerning the Government's intentions:

> Grain growing did not prove a commercial success, principally because of adverse seasonal conditions. Cattle breeding and fattening were successful while pig raising was mostly on an experimental scale...
>
> The Queensland Government did not intend to continue on the lines previously adopted for the Corporation.
>
> Suitable lands would be made available to closer settlement as subdivisions into blocks considered living areas, were completed.
>
> All other assets would be sold after reservations for experimental purposes and carrying on the properties pending settlement.[1]

The Board members resigned on 17 March 1953, delegating their responsibility to the Co-ordinator-General who, with a committee of representatives from the Lands Department, the Treasury and the Department of Agriculture and Stock, was to carry on the project pending the winding-up legislation. Authority was granted by Order-in-General for this transfer of control. On 17 July the Deputy Premier, J.D. Duggan, announced that the land would be cut up into sixty-nine farm settlement leases and seventeen grazing selections.

The Queensland-British Food Corporation "Winding-Up" Act of 1953 was introduced by Mr Gair and assented to on 18 December. It gave effect to the financial provisions and land redistribution outlined above, formally liquidating the QBFC and creating the Queensland Government Central Queensland Estates "to fulfill the functions of a liquidator under *The Companies Act 1931-1942*," and carry on the business to secure the most beneficial winding-up. Blocks classified as agriculture *cum* grazing blocks, to be not greater than 2,400 ha, were to be disposed of as settlement farms under the group provisions of the Lands Acts. Applicants had to prove their

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[1]*Courier Mail*, 12.2.53

eligibility and pay an annual rent, and were granted a lease for twenty-eight years, with a cultivation clause enforcing the annual cultivation of at least 120 ha on each block. The purely pastoral leases were from 2,800 ha in size, and were to be auctioned as Preferential Pastoral Leases, the tenure initially being for thirty years, with certain priority rights at the expiry of the lease.

The piggeries and cattle breeding places were excluded from this arrangement. *Croydon*, the cattle breeding property, was sold as a going concern for $310,000 with 10,000 cattle, having been purchased for $170,000 with 7,500 cattle. The Bajool piggery area of 271.6 ha was divided into three units, and sold in 1954 and 1955, two being sold by private treaty and one by negotiation following an auction. The sixty-nine Farm Settlement Leases and seventeen Grazing Selections were all disposed of by 9 November 1956. The average price received for the Grazing Selections at auction was $7.40/ha compared with the purchase price all under $2 per acre. No purchase price was received for the Settlement Farms, but whereas previously 75 per cent of the lands were freehold and paid no rents to the state, the 28,400 ha of leasehold bringing only $1,571 annually, the new rental charges brought a revenue of $34,768 annually for an initial period of twenty-eight years before revision would be carried out. Subdivision was carried out gradually to secure the most advantageous circumstances for disposal of the Corporation's assets.

While the QBFC was being wound up and the land subdivided for closer settlement, limited cropping and grazing activities were continued on properties that were retained. Accumulated trading profits of $212,780 were made to help offset the previous losses. Grain made a small profit in 1953 for the first time, and in 1954 the pig enterprise showed a profit, also for the first time. In 1953, 2,442 ha were cropped to sorghum to produce a yield of 4,626 t, or 1.28 t/ha. In 1954, 2,400 ha of sorghum averaged 1.26 t/ha, along with 1,200 ha of wheat. In 1955 the final planting of 931 ha of sorghum and 600 ha of wheat was made. All the produce was marketed locally. After 1955 agricultural operations ceased, and soon afterwards the cattle and pig production units were closed down. Probably better farming methods as a result of Hart's research, and constructive criticism from the Advisory Body, plus the lightening of the cost of extensive administrative units, played major roles in the better overall financial results after liquidation.

Why did the Queensland-British Food Corporation fail? A complex interaction of factors operated to foil the aspirations of the Food Corporation - climatic, political, administrative and technological.

1. Climatic influences

The climatic factors likely to prove limiting in the production of grain sorghum in the Central Highlands were seen to be:

- heat waves in January, combined with
- drought;
- heavy midge attack in some years;
- heavy smut infestation - controlled by seed dusting before planting;
- early frosts which occasionally damaged crops.[1]

The Corporation experienced each of these in its short existence.

It had been advised that the Central Highlands region was marginal for cropping on climatic analyses[2] and that successful production from the region would require integration with sheep or cattle.[3] Climatic hazards soon became evident after the Corporation commenced its operations in May 1948 and devastating early frosts in May 1949, coupled with some crop lodging, reduced the harvest of the first crop from an estimated 27,272 t to 8,618 t. Such early frosts have occurred in the area only once every thirty-six years since records have been assembled. This initial setback was a severe blow to the Corporation's plans.

The second crop planted in the 1949-50 season was beset by lack of adequate planting rains and one quarter of the area sown failed to germinate. The year 1950 saw practically the whole of Queensland receive more than twice its average annual rainfall. This caused harvesting difficulties, and some of the crop had to be abandoned in the field. Moreover, the heavy wet black clay soils caused considerable transport problems, and in some fields severe erosion occurred as a result of heavy rainfall in the cultivated slopes. A plague of mice caused considerable loss in both field and storage shed.

[1]Skerman, 1953:187-9

[2]Farmer, Everist and Moule, 1947:21-59

[3]Farmer and Everist, 1948:2

The 1950 early wet season was prolonged into the winter and delayed the preparation of the land for the succeeding 1950-51 crop, which was planted on hastily prepared land, and severely affected by heat waves and drought. The stored subsoil moisture remaining from the heavy 1950 wet season, however, produced a ratoon crop of 2,454 t of grain, the only cost of which was the harvest.

Planting rains were again inadequate for the 1951-52 crop and in desperation 18,400 ha were sown "dry." The later plantings were affected by an earlier than usual frost in June and these crops were grazed.

2. Political considerations

The scheme was initiated by Labour Governments in both the United Kingdom and Queensland and there was criticism by the Conservative Opposition spokesmen because they felt that it had socialistic aims. However, politics had little to do with the overall failure of the scheme unless, perhaps, it caused it to be wound up before it had been adequately tested.

The Queensland Government was anxious to open up this relatively fertile area in the Central Highlands for more intensive production, but owners were already preparing for this venture because of deterioration of the natural pastures for wool growing and cattle production. It is true that the acquisition of such large areas of land in the early years had a political flavour, in that such acquisition was meant to stop land speculation in the event of a successful outcome of the operations, and would also release previously alienated land for lease by the Crown at the cessation of the scheme. The Corporation's acquisition of land in the northern, central and southern areas of the Central Highlands was sound, insofar as it increased the chances of staggered planting rains and harvests.[1] The extent of the acquisition was defended in that the original target of 100,000 ha of cultivation in the third year had to be met. However, the acquisition of so much land in the early stages of the venture consumed so much of the allocated capital that efficiency in the later years suffered.

3. Administrative influences

The administrative arrangements did have markedly adverse effects on the Food Corporation's performance. The Board of the QBFC initially did not contain any member with actual

[1]Skerman, 1953:146

farming experience. The huge extent of the undertaking to be attained in such a relatively short time called for a very efficient organization.

The choice of the Queensland Co-ordinator-General of Public Works, John Kemp, to head the Queensland activities appeared at first glance to put an engineer where an agriculturist should have been, but Kemp was a man who had tremendous authority in the Public Service, could get things done in a hurry, and was an enthusiast. The work of development of the scheme embodied large-scale design, construction and maintenance of buildings and roads, and transport and storage facilities requiring engineering knowledge. Although he had no farming experience Kemp always sought the advice of specialists and strongly supported his staff.

The Food Production Manager was chosen because he was the top public servant in agriculture and was dedicated to the task. It is true that he had had no actual farming experience, and because of his huge responsibility was rather over-cautious in taking some risks as to planting times, something a small-scale farmer is always prepared to do. Because headquarters were established in Brisbane, remote control of field operations, particularly relating to planting of the crops, did not allow for on-the-spot decisions of those in the field who were better placed to make judgements.

The sphere of authority of the Livestock Manager, who was well qualified in this practical field, often clashed with that of the Food Production Manager. For example, on occasions the latter wanted to prepare stubble land for the next crop, while the Livestock Manager wished to retain it for further grazing. Friction arose between the two sections under their control, and such happenings as leaving gates open so that cattle gained unwanted access to unharvested crops did not help matters.

However, it was in the field of labour relations where the most serious escalation of costs occurred. The Corporation accepted an Industrial Agreement with the Australian Workers' Union for its staff. This meant, *inter alia*, that award wages had to be paid at the going rates for a normal day's work, with overtime for excessive working hours, time-and-a-half for Saturday work and double time rates for Sundays and holidays. Planting time demanded round-the-clock tractor work and harvesting pressures called for much overtime, so these operations became very costly. The wet year of 1950 often did not allow the tractor drivers to work their tractors and machinery in the sodden black soil fields, but they had to be paid the tractor drivers' award rates to do menial tasks or do nothing. It was difficult to stand them down because of the isolation of the venture, and some who were so dispensed with left the district and did not return. They had to be replaced by less experienced men. There was also a decline in dedication to the tasks, particularly after the early crop failures.[1] Worker accommodation on the site was poor and labour turnover was rapid; the average duration of service for the Corporation by a labourer was three to four months.[2] To add to the financial burden the Award for tractor drivers rose by 47 per cent between 1948 and 1951.

The costing system was designed by the Corporation and was based on their East African experience with the Groundnuts Scheme, where labour conditions and competence were different from those in Queensland. A booklet dealing with costing was printed and distributed as a guide to its officers. A large spare parts depot was established and a system of reporting break-downs, filling order forms, approval of supply and so on, typical of public service management, made this section of the administration top heavy in personnel and costly to operate. The Advisory Body recommended that the headquarters be moved to the actual crop growing area and the costing system simplified.

4. Technological factors

The greatest deficiency in the use of technology apparent in the scheme was the general non-adoption of the technique of bare fallowing for the benefit of succeeding crops. The area had a marginal rainfall so that crop frequency depended on soil moisture accumulation and retention to improve the yields and number of harvests. Hart[3] showed locally at Springsure that the normal annual rainfall was insufficient to ensure a sufficiently high yield to offset costs of production. By the time this was established and bare fallowing recommended as a necessity, the decision to abandon the Food Corporation Scheme had been made. The subsequent success which the Central Highlands farmers have achieved has been largely the result of the adoption of this practice. The non-adoption of bare fallowing was defended on the grounds of the need to reach the 100,000 ha of cultivation

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[1]Herbert, 1953:21

[2]Rogers, 1960:155

[3]Hart, 1951:12

target as soon as possible, and the cost of extra cultivations involved in bare fallowing. It has been subsequently proved by local grain growers that the extra cost involved is worthwhile.

In retrospect the initial crop of the 1948-49 season would not have benefited much from a previous bare fallow, as rainfall during the germination and growing period was adequate for a high yield. Had a sufficiently large area of land been bare fallowed for the second crop in the 1949-50 season it is likely that the sown seed would have germinated and the crop carried to maturity by the subsequent more than adequate rainfall; lodging and other harvesting difficulties may also have been accentuated. The Corporation at this time was still building up acreage towards the allotted target and deemed that there was not time to fallow. Bare fallowing for the 1950-51 crop would have been almost impossible because of rainfall interference and probable serious erosion from the heavy storms.

The lack of erosion control measures was another technological failing as was proved on some areas in the wet 1950 season. Again the Administration, although in possession of a full report on the erosion hazard and its mitigation from the Department of Agriculture and Stock,[1] decided that the cost involved was not worthwhile. In retrospect the then suggested erosion control measures may not have given full protection, as it has since been found that the growing sorghum crop does not give adequate protection to the soil, and that narrow terraces will not hold. Current practice is to utilize broad-based terraces, cultivating the whole area.

Another technological problem which still has to be resolved adequately is the low percentage of field germination in relation to the quantity of seed sown. This was demonstrated both at *Peak Downs*[2] and subsequently at Springsure.[3] Figures of 20 to 25 per cent establishment from what was considered good quality seed involved the adoption of a heavier planting rate of 6.6 to 8 kg/ha. Present sorghum growers plant at a rate as low as 1.5 to 2 kg/ha, and treat the seed to control fungal infection and seed harvesting ants.

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[1]Ladewig, 1948

[2]Skerman, 1953:198

[3]Hart, 1951:20-4

Hart showed that rolling of the seedbed as soon as the soil was trafficable without the roller picking up the wet soil gave an enhanced establishment.[1] Rolling with either home-made rollers from spare motor vehicle tyres or with press wheels built into modern planting machinery is now almost universally adopted.

Rotation of crops is a practice which integrates with the bare fallowing system. Little rotation was practised by the Corporation because of its emphasis on sorghum production. The sunflower crop was little known and less researched at the time, and the only time wheat was tried a mouse plague destroyed the immature crop. Present practice is to use as a rotation crop one which will command the highest return commensurate with season and crop requirements, the contract price for the grain generally being known before planting.

Farm Development During and Subsequent to the Winding-up of the QBFC

Some experienced farmers moved to the Central Highlands during the QBFC's era and with the new leases containing a cultivation clause, the sale of the farming machinery and finance from banks, a new impetus was given to cultivation. O.K. Benn, a Darling Downs farmer, took up *Wyoming*, Capella, in 1950 and operated it as a mixed farm of 520 ha. His sorghum yields are given in Table 11 (see next page). His highest individual paddock yield was 5.916 t/ha. Over the two seven-year periods of activity, Benn's production figures were as follows:

1950/51-1956/57 2.24 t/ha Average annual rainfall 750 mm

1956/57-1963/64 1.97 t/ha Average annual rainfall 615 mm

A Department of Agriculture Branch Office was established at Emerald in 1953, after the closure of the QBFC, and since then local research and extension services have been stepped up. The Commonwealth Development Bank of Australia organized a Land Development School at Emerald in September 1964, the Central Highlands District Council of the Queensland Grain-growers' Association organized a special sorghum symposium in December 1969 and a sorghum growing seminar in 1976. These have led to a much better informed farming community and greater farmer-scientist liaison in the Central Highlands.

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[1]Hart, 1951:24-6

TABLE 11

Grain Sorghum Yields, *Wyoming*, Capella, 1950-64

Year	Yield Average t/ha	Comment	Rainfall *Wyoming* (mm)
1950/51	1.02	severe midge and mice damage	714
1951/52	2.45		514
1952/53	2.04		504
1953/54	2.65		854
1954/55	1.63	excessive rain, obvious N shortage	1,038
1955/56	3.06	highest average ever obtained	870
1956/57	2.86	Wheatland lodged badly, Alpha good	760
1957/58	1.84	severe midge	769
1958/59	2.24		654
1959/60	1.97		613
1960/61	1.84	some nutrient deficiency expected	612
1961/62	2.24		552
1963/64	1.43	severe moisture stress	348

Source: Hart, 1975:153

By 1955 there were seventeen new settlers on ex-QBFC blocks and an overall total of about 100 growers producing grain sorghum. In 1955 open-pollinated varieties constituted all commercial sowings, and in that year the first hybrids were introduced on *Little Zealand*, Capella. Subsequent seed production work was largely developed by C.L. Brimblecombe of *Mt Lowe*, Capella.

The reliability of cropping has improved with the general introduction of fallowing, soil conservation measures and monitoring planting in relation to stored soil moisture, heat wave incidence and midge attack. The use of press wheels on planters has improved germination, along with benzene hexachloride treatment for seed harvesting, ant control and seed dressings for fungal suppression. Fertilizer application, particularly of nitrogen, phosphorus and zinc, according to soil test information, is increasing.

However, a glance at the average yield per ha since 1945-46, until 1974-75 (see Appendix II) indicates that production has not increased greatly, averaging only 1.11 t/ha. The eight years from 1955-56 gave an average yield of 1.47 t/ha, the four subsequent ones only 0.72 t/ha, indicating that rainfall is still the major factor affecting sorghum yields. An officer of the QDPI calculated that over an average ten year period the sorghum yields would be as follows:

TABLE 12

Estimated Sorghum Yields
Central Highlands

Frequency	Yield (t/ha)
1	fail
1	.61
1	.90
2	1.22
4	1.51
1	2.44
10 years	av. 1.20 t/ha

Source: Wegener, 1969:67

Hart was always intrigued by the fact that grain sorghum would yield an average of 2.04 t/ha on the Darling Downs, yet only 1.11 t/ha in the Central Highlands. He cited a potential of 8.84 t/ha on the Darling Downs, but O.K. Benn, under the best of circumstances, could obtain only 5.29 t/ha at Capella.[1] Recent evidence would suggest that there is a varietal yield block and that varieties should be bred specifically for the Central Highland regions. Some headway

[1]Hart, 1975:154

is being made in breeding for high yield, resistance to lodging, sugar-cane mosaic virus, head type, bloom and grain weight.[1] Recently invasion of some sorghum fields by shattercane, a complex involving *Sorghum verticilliflorum*, *S. almum*, *S. halepense* and *S. bicolor*, is posing a major threat to the seed retention in commercial crops, and will need the urgent and dedicated attention of plant breeders and seed producers.[2]

The impressive increase in cultivation in the Central Highlands encouraged by the QBFC's activities is indicated by the total area under crop of its four "agricultural" shires (Table 13). The figures indicate a phenomenal increase in grain growing, particularly since the recent fall in beef prices, and a marked decrease in green feed (oats and forage sorghum) from the same cause. They also indicate a choice of major crops from which to choose a rotation and there are many other minor ones such as sudan grass, safflower, rape and cotton. Many graziers like to use sorghum stubble for cattle grazing, thereby delaying the sowing of the next crop. The rotation is determined by the contract prices for grains, the needs of livestock, the handling of seasonal crop residues and especially soil moisture status.

Wheat was one of the first crops grown in the Central Highlands and has continued to find a place in the rotation because of its adaptability, its special seasonal role and its sharing of the standard farm machinery suite. It is not as reliable as summer cropping and involves a bare fallowing technique over summer which exposes the soil to erosion, particularly on the slopes. It matures earlier in this environment than on the Darling Downs and so allows a longer fallow break for a succeeding crop. The average yield over thirty years from 1945 has been 0.71 t/ha. The highest average yield was 1.42 t in 1968, while in 1946 there was no crop.

Safflower found a place in the rotation in the mid-sixties and J.C. Mayne, of *Wealwandangie*, south of Springsure, reports it has been the safest crop in that area. However, performance is varied. It was found that a young safflower crop compared favourably with oats for grazing, and was preferred in some cases because its deep rooting

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[1]Vincent, 1976:8-17

[2]W.H. Hazard, 18.7.77: personal communication

TABLE 13

Total and Principal Crop Areas (ha)* by Shires, and Total for Central Highlands 1944-76

	Year	Bauhinia	Belyando	Emerald	Peak Downs	Total
Total Crop Area	1944-45	10	9	38	2	59
	1951-52	5,086	3,992	5,174	14,792	29,044
	1964-65	24,722	17,530	18,537	36,732	97,521
	1975-76	41,193	29,851	30,510	48,074	149,628
Grain Sorghum	1944-45	-	-	-	-	-
	1951-52	5,070	3,923	4,815	14,289	28,097
	1964-65	7,415	3,698	9,939	11,817	32,869
	1975-76	20,869	8,758	13,720	20,083	63,430
Sun-flower	1944-45	-	-	-	-	-
	1951-52	-	-	-	-	-
	1964-65	162	-	-	264	426
	1975-76	9,519	11,049	3,953	8,317	32,838
Wheat	1944-45	-	-	-	-	-
	1951-52	-	20	162	36	218
	1964-65	5,542	4,699	5,251	13,285	28,777
	1975-76	4,065	5,012	7,788	3,817	20,682
Green Feed	1944-45	6	1	-	-	7
	1951-52	16	40	179	309	544
	1964-65	8,323	5,199	2,761	5,692	21,975
	1975-76	2,832	1,084	1,001	3,021	7,938

*Areas prior to 1975-76 converted at the rate of 2.47 acres to 1 hectare

Source: Australian Bureau of Statistics per P. Lloyd habit anchored the plant, whereas oats was often pulled up because of its failure to establish secondary roots.[1]

Sunflowers have been shown to be particularly well suited to the Central Highlands, and a phenomenal increase in area has occurred during recent years. Sorghum follows sunflower very well in a rotation, as it is easier to work the soil to a good tilth after sunflower than after sorghum.[2] Brimblecombe suggests this rotation, depending on soil moisture status and prices:

> [It is best to] grow sunflower in the first summer, then sorghum the second summer, and if moisture was adequate a further sorghum crop, and then a long fallow to wheat or safflower. Wheat could be double cropped back to a summer crop if moisture is available but not safflower owing to its high moisture usage.

Crop Fattening of Beef Cattle and Sheep

This was initiated in a small way before the advent of the QBFC by graziers such as Tweedie Bros of *Mongoon*, Capella, R.F. Vellnagel of *Emerald Downs*, Capella and W.R. Rundle of *Glenora Downs*, Emerald. However, the large-scale operation of the QBFC stimulated more rapid development of this practice, mainly with beef cattle. The QBFC found stubble fattening of cattle profitable. Cattle grazing natural pastures always lose weight during the winter months, from April to September or longer. This interruption of growth prevents cattle from reaching a suitable degree of finish at an early age, reduces over-all turn-off and causes fluctuations in supply of slaughter cattle.[3] Seasonal price indices for slaughter cattle for Cannon Hill meatworks from 1955-61 showed that there was an average increase of 10 to 15 per cent in prices over the winter period. Prices are usually lowest in the March to May period, and highest in the September to November period.[4] To overcome the problem of low nutrition in winter it is necessary in most of Queensland to grow crops; oats and forage sorghums are the most popular, though safflower and rape have been used.

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[1]Brauns and Rudder, 1963:583-4

[2]Brimblecombe, C.L., 1977: personal communication

[3]Sutherland, 1962:0-5

[4]*BAE*, 1964

Oats gives higher yields in the middle of winter than the sorghums, but the latter are useful to provide feed in early winter or early summer. The stubble remaining after the grain sorghum harvest is of variable quality depending on the amount of grain unharvested and the amount of green regrowth.[1]

Because of low frost incidence in the northern half of the Central Highlands, sorghum regrowth is very useful forage whenever soil moisture is adequate. Crop fattening or "finishing" has been carried out extensively in the Central Highlands with both cattle and sheep. With the present slump in beef prices the practice has significantly declined with graziers concentrating on grain production. In 1964 the Bureau of Agricultural Economics (BAE) made a survey of cattle finishing on oats; the figures for the Central Highlands compared with the Darling Downs were as follows:

TABLE 14

Crop Fattening Performances
Darling Downs and Central Highlands

	Darling Downs	Central Highlands
Area under winter grazing (ha per farm)	79.2	100
Months grazed	June-October	June-October
Duration of grazing (days)	142	97
Live wt gain, kg per beast per ha	218	153
Estimated carcase wt gain per ha	145	105
Net income per ha	45	17.5

Source: *BAE*, 1964

Performance of oats in the north of the Central Highlands is poor,[2] but at *Wealwandangie* there has been only one

[1] O'Sullivan, 1977:16

[2] *ibid.*

failure in twenty years, and the sweet sorghum cultivar "Sugardrip" is frequently used as standover forage for winter. The environment is such that a forage crop can be sown whenever rain and stored soil moisture permit it.

Feed-lot Finishing in the Central Highlands

A cattle feed-lot was operated on *Arcturus Downs*, Springsure for a few years by Ryan Estates. The manager, Derm O'Donohue, cultivated some 1,000 ha of grain sorghum and the feed-lot ration consisted of ground grain sorghum, with roughage of sorghum stubble and/or peanut shells, a little ground limestone and 56 g of urea/head/day.[1] The feed-lot operated until the relative economics of beef production and the sale of grain resulted in favour of a grain enterprise.

At *Wealwandangie*, grain sorghum has been grown since 1961 and, in spite of two years when the crop failed, it has averaged better than 3.26 t/ha. They have also made "Sugardrip" sorghum and lablab bean into silage for fourteen of the last sixteen years at 4,000-5,000 t/year. Both the sorghum grain and the silage have been used in the cattle feedlot till the beef price slump started in 1974.

Irrigation in the Central Highlands

From the time of first settlement there is evidence that the Chinese worked small fruit and vegetable gardens near centres of population and hawked their produce around the towns. These gardens were watered from streams and a few wells where a shallow aquifer occurred nearby. Jensen[2] mentions the magnificent vegetables irrigated in the homestead garden at *Wealwandangie*. In 1965 the Mayne family developed three bores which have been used to irrigate lucerne and oats for drought feeding, and one is now devoted to lucerne hay production, which since 1965 has averaged about 25 t/ha/year. Other bores used for irrigation are operating in the Cona Creek to Vandyke Creek area and one at *Nogun*, Rolleston, on the Brown River. Several people irrigate by pumping directly from the Nogoa River below the Fairbairn dam. One of the earliest was L.J.O. McCosker, who erected a small weir and irrigated sudan grass in 1947, and also grew some cotton. His son at present irrigates forage crops by contour bay irrigation.[3]

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[1] O'Sullivan, 1977:16

[2] Jensen, 1921:361

[3] O'Sullivan, 1977:23

The Emerald Irrigation Scheme, based on a proposed dam on the Nogoa, at Nogoa Gap, some 19 km above Emerald, was considered in 1945 and O.L. Hassell, Senior Agricultural Adviser, QDAS, Rockhampton, visited the area and in a memorandum dated 14 September reported on the soil types suitable for irrigation. He intimated that the alluvial soils were heavily timbered and subject to flooding, and the fertile open downs soils were from 3 to 16 km from the Nogoa and Comet Rivers. A more detailed inspection was made by Skerman, Kennedy and Skinner,[1] who reported some difficult alluvial soils carrying brigalow (*Acacia harpophylla*) and yellowwood (*Terminalia oblongata*) forest on open downs black earths to which water would have to be pumped, and some sandy-surfaced soils of low fertility within the area potentially commanded from the proposed dam.

In 1949 the Irrigation and Water Supply Commission built a weir across the Nogoa at Selma, near Emerald, for the purpose of irrigating lucerne and a pilot farm was initiated, using water from this weir. It was found that there was extreme variation in the soils on this farm and water management was difficult. A second pilot farm on cracking clays was initiated and irrigated from a channel. The Emerald Irrigation Scheme originally envisaged some 130 irrigated farms using 147,000 megalitres (Ml) annually from the 1.44 million Ml storage. This has been scaled down to eighty farms. Forty-five farms have been developed on the left bank.

O'Sullivan reported:[2]

> [Irrigation] commenced in 1972-73 with the supply of irrigation water through the new channel system to 13 farms. The largest unit of country on the left bank is open downs. Unfortunately, neither of the two pilot farms had included downs soils and there was little prior knowledge of their behaviour under irrigation. Irrigation of this type of heavy cracking clay had not been attempted previously on slopes much in excess of 0.1 per cent. Some slopes here are of the order of 2.0 per cent.
>
> Careful consideration had previously been given to contour irrigation. However,

[1]Skerman, Kennedy and Skinner, 1945:1-12

[2]O'Sullivan, 1977:24

it was found that water flow produced degradation of the furrow which, when combined with differential swelling of hill and furrow, rapidly produced a much flattened profile. Moreover, when cracking occurred across a hill, control of irrigation water was lost. Cracks linked furrows, producing an overloading effect resulting in gullying.

Engineers found themselves committed to straight-down-the-slope furrows. This solution brought further problems. Water flows were too rapid and caused scouring. Uneven terrain produced areas of scouring and areas of deposition. When water was siphoned into wheel track furrows, infiltration was cut drastically. Experimental work has shown that soil loss was within the acceptable range of 12.5 t/ha per year, both in irrigation flows and storm stimulation. However, in practice the trial conditions appeared unrepresentative of the real situation. To solve the problem planners decided to:-

1. reduce siphon diameter from 31 mm to 28 mm,
2. improve the levelling situation,
3. avoid irrigating furrows compacted by the tractor wheel.

These techniques await further assessment. If they do not work, then the situation is extremely serious.

These unique topographic problems were compounded by the lack of experience of the farmers. Recently, some highly experienced cotton growers have come to the area from the Darling Downs to escape herbicide drift problems. Their knowledge should be invaluable to Emerald.

Irrigators are now growing significant areas of specialized crops such as cotton and soy beans. Row cropping equipment has been purchased. Interest in and use of fertilisers is increasing. The cheapest input, water, is the one they are most reluctant to use. This is probably because the new irrigators were all former dryland farmers.

A third problem which cannot be ignored has been the incidence of insects in Summer crops. There has been a heavy reliance on grain Sorghum in summer, and locusts, grubs and midge have wreeked havoc. Locusts have also damaged soybeans severely. There appears to be an Ord River problem particularly with locusts, in the way they 'home in' on the wet areas.

These three factors, namely the tremendously difficult terrain, the inexperience of the farmers, and the enormous insect problem, have combined to make the early years extremely difficult.

Research Needs

The research needs for the dryland farming in the Central Highlands include:

- further research on germination problems with sorghum;
- all aspects of soil moisture storage including stubble mulching for water retention and erosion control;
- nutrition studies in depth in relation to existing known deficiencies of phosphorus, zinc and sulphur along with nitrogen in many areas;
- improved planting machinery including press wheels and weed control;[1]
- plant breeding studies to sort out the shattercane problem and environmental problems limiting maximum yields.

In the irrigation areas research is needed in:

- water management;
- soil nutrition for the varying soil types;
- type of irrigation system;
- efficiency of water use.[2]

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[1]French, A.V., 30.8.77: personal communication

[2]Hunter, M., 1977: personal communication

Plate I: A good crop of Wheatland grain sorghum on *Cullin-la-ringo*, south of Emerald, grown by the Queensland-British Food Corporation.

Conclusions

The Central Highlands are destined to play an increasingly important role in crop production in Queensland because of their present reserves of potentially arable land, particularly in the brigalow areas. The region will remain marginal for cropping under dryland farming conditions, but improving techniques resulting from agronomic research will enhance cropping performance. Extreme care will need to be taken in tillage methods and rotational cropping programmes to conserve soil on both the open downs and the brigalow areas. Soil structure and soil fertility decline are likely to be more rapid in the brigalow areas than on the open black earth downs, and this must be recognized and dealt with from the beginning of cultivation. The red earths occurring on the eastern edge of the Highlands will pose more severe soil structural and fertility problems if brought under the plough, and sound methods of organic matter accumulation will be required in the farming techniques should cropping enter this existing pastoral territory.[1] Overall, a system of mixed farming involving crop and pasture production with animal husbandry should emerge as a permanent land use measure.

Development of the Emerald Irrigation Area should proceed to its full agricultural capacity, but problems of water distribution on undulating land and its infiltration into the soil will have to be solved whilst at the same time minimizing run-off and subsequent loss of soil. However, development of cotton growing will be a major impetus to increased production. A cotton gin costing $2.5 to $2.9 million is expected to be ready to receive cotton from some 4,050 ha of irrigated land for the 1979 season. The Emerald Rural Training School is providing intensive training in irrigation farming, and for the 1977-78 season is planning irrigation of 100 ha of cotton, 140 ha of sunflowers, 100 ha of wheat, 16 ha each of soybean and navy bean and 40 ha of irrigated pasture.[2]

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[1]Keefer, McDonald and Tucker, 1977:145-7

[2]*The Queensland Graingrower*, 2.11.77

PART II

CENTRAL-WEST AND NORTH-WEST QUEENSLAND

Physical Characteristics

That portion of Queensland now to be considered contains some 554,700 sq km, 32 per cent of the total area of the State (see Map 4, p.72). Included is the whole of the Central Western Statistical Division[1] and a major part of the North-West Division.[2] Mainly because of climatic limitations cultivation in these western districts is much more marginal than in the Central Highlands, and attempts to grow crops have met even a modest degree of success only in the easternmost shires.

Climate The whole of this region lies within the Australian arid zone, which may be defined as that part of the continent where the agricultural growing season is less than twelve weeks in four years out of five.[3] The average annual rainfall ranges from under 150 mm in the far south-west to nearly 530 mm per annum in the south-eastern districts (see Table 15), with a variability of 30 to 50 per cent.[4] Rainfall is markedly seasonal; in the southern shires 70 per cent of the annual total is received between November and April, while in the northern districts the figure rises to approach 90 per cent. Practically all districts in which any cultivation has been practised lie within the zone which records two "wet" summer and no "wet" winter months in 75 per cent of the years for which records are available[5] (see Table 16). The time when pre-planting and planting rains

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[1]Comprising the shires of Aramac, Barcaldine, Tambo, Isisford, Ilfracombe, Longreach, Winton, Barcoo, Diamantina and Boulia.

[2]The shires included are Flinders, Richmond, McKinlay, Cloncurry and Mt Isa.

[3]*Arid Zone Newsletter*, 1969:7

[4]Dick, 1958:31-42

[5]Farmer, Everist and Moule, 1947:45-6

Map 4
Location Map, Central-West and North-West Queensland

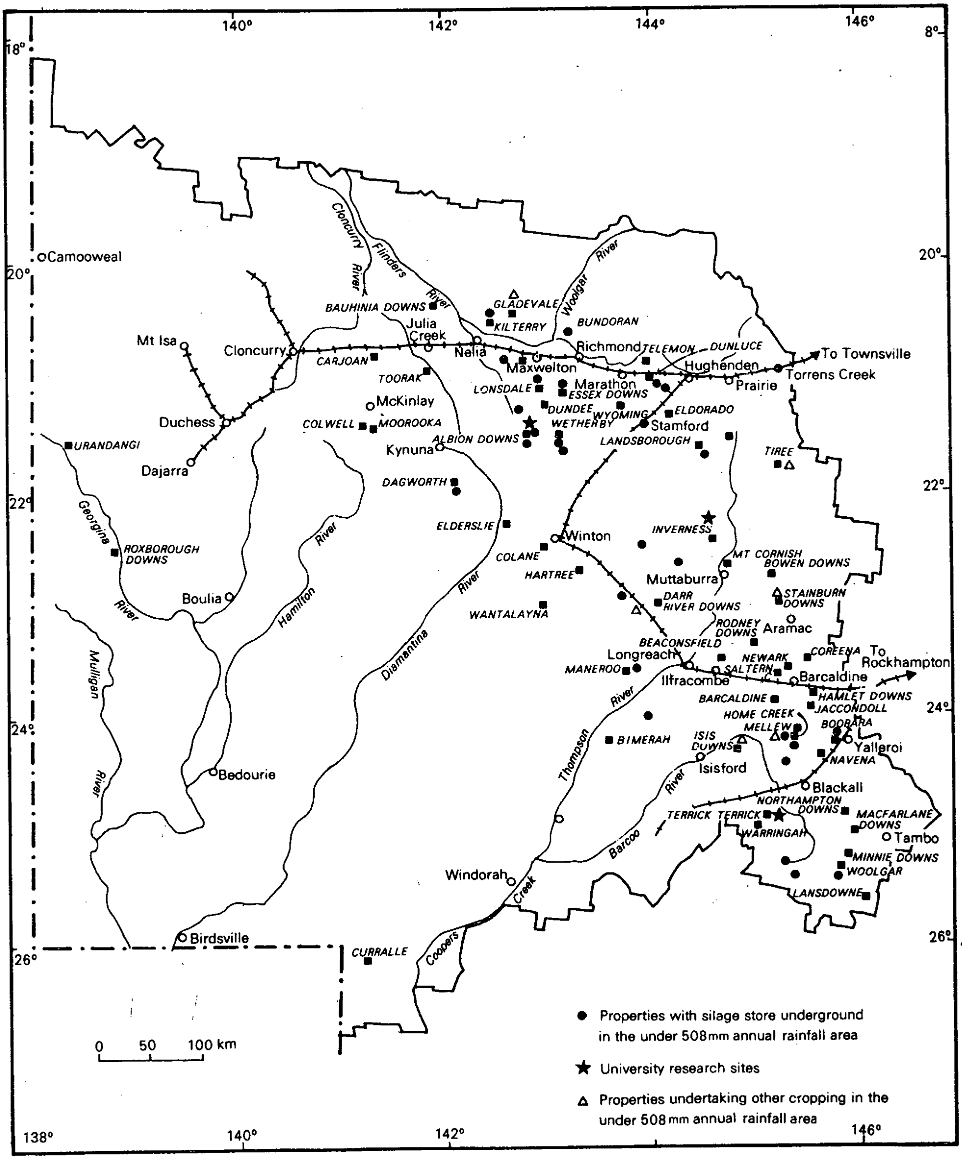

TABLE 15

Monthly and Annual Average Rainfall for Central-West and North-West Centres (in mm, to 1957)

Centre	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Tambo	80	73	77	65	36	35	32	29	19	21	34	46	67	534
Blackall	77	75	84	67	36	35	31	27	17	19	35	38	64	528
Aramac	77	76	73	56	32	24	29	21	10	16	24	35	51	447
Hughenden	73	115	95	55	26	16	23	12	7	10	21	33	71	484
Isisford	72	64	73	67	34	26	27	22	13	15	26	34	50	451
Longreach	64	58	88	61	24	22	23	19	7	14	24	32	47	419
Winton	73	82	82	55	19	16	22	15	5	10	19	32	47	404
Richmond	68	113	104	58	20	15	19	10	3	6	15	32	65	460
Windorah	70	38	42	38	22	18	20	14	9	11	17	23	33	285
Kynuna	67	84	84	52	16	14	21	11	4	8	16	31	59	400
Julia Ck	44	114	102	45	14	9	15	6	10	3	13	32	66	429
Birdsville	65	20	20	12	9	11	13	9	4	6	9	15	15	143
Boulia	71	43	50	39	15	11	13	8	7	7	13	23	33	262
Cloncurry	73	112	107	60	17	12	16	8	4	7	12	33	70	458

Source: Qld Primary Prod. Co-op. Assn, 1957

TABLE 16

Rainfall and Evaporation Figures for Queensland Stations

Station	Mean Av. Rainfall mm	Mean Summer Rainfall (Nov.-Apr. incl.)	Mean Winter Rainfall (May-Oct. incl.)	*Mean Annual Evaporation mm	Mean no. Wet Summer months	Mean no. Wet Winter months
Tambo	534	364	170	3125	2	2
Blackall	528	364	164	3225	2	0
Aramac	447	323	124	3250	2	0
Hughenden	484	395	89	3400	2	0
Isisford	451	322	129	3325	2	0
Longreach	419	310	109	3450	2	0
Winton	404	317	87	3600	2	0
Richmond	460	392	68	3600	2	0
Windorah	285	196	89	3650	0	0
Kynuna	400	326	74	3800	2	0
Julia Creek	429	373	56	3750	2	0
Birdsville	143	91	52	3975	0	0
Boulia	262	203	59	4050	0	0
Cloncurry	458	399	59	3900	2	0

*Extrapolated from Bureau of Meteorology, 1975. *Climatic Atlas of Australia*, Map Set No. 3, Evaporation. AGPS, Canberra.

Source: Farmer, Everist and Moule, 1947:25

are received is also of importance. In the northern districts (Cloncurry, Richmond and Hughenden) the mean dates for pre-planting rains are 14 to 21 December, while those for planting rains are from 18 to 31 January.[1] The pattern for the southern districts (Tambo, Blackall and Isisford) is similar, but the Longreach and Aramac districts usually do not receive pre-planting rains until January.

Droughts are an ever-present hazard in this region and while their specific effects will be noted later (cf. pp. 104-6), data indicating the frequency of droughts for those districts in which cropping has been attempted are given in Table 17.

TABLE 17

Drought Frequency for Centres within the Zone of Potential Cropping (expressed as a percentage of the 58-year period 1894-1951)

Centre	Drought duration over 4 months	Drought duration 11 months and over
Cloncurry	90	12
Richmond	90	12
Winton	85	16
Hughenden	78	7
Longreach	74	16
Isisford	72	14
Blackall	50	2
Tambo	40	2

Source: Everist and Moule, 1952:256-65

It can readily be seen that the incidence of shorter droughts increases westward from 40 per cent at Tambo to 90 per cent at Richmond and Cloncurry, but that droughts of longer duration are most likely to occur in the Longreach-Winton districts.

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[1]Slatyer, 1964:98-101

Temperature plays an equally important role. Table 18 gives the basic data but does not, perhaps, sufficiently indicate the influence of the extreme conditions, particularly the upper extremes. Most of the region records daily maximum summer temperatures in excess of 35°C for three to four months each year, while the Winton-Kynuna-Richmond districts record such temperatures for over six months annually.[1] Heat waves are also common; for example, during the 27-year period 1924-50 Winton experienced the following number of heat waves during which temperatures of 40.5°C or higher were recorded for three consecutive days:[2]

November	17
December	46
January	55
February	18
March	5

Most of the region is relatively frost-free, but an occasional frost can affect susceptible crops such as sorghum. The average frost-free period increases from 332 days at Blackall to 361 days at Winton.

Soils and vegetation Practically all the area wherein cultivation has been attempted consists of brown self-mulching cracking clays (MM5 and UG 5.32, 5.33, 5.34, 5.37, 5.38, CB_2 and UG 5.22 and 5.23 in the *Atlas of Australian Soils* and Northcote's classification,[3] respectively) developed on sedimentary material of Cretaceous age, including the Winton formation of freshwater sediments and the marine beds of the Tambo and Roma formations. The surface pH is relatively high from 7.5-8.1, sodium may be a significant percentage of exchangeable cations; and the available phosphorous generally from 75-200 ppm P_2O_5 (Bureau of Sugar Experiment Station method of analysis). Up to 1,200 ppm of available P_2O_5 may be found at the junction with the parent material at a depth of about one metre. The vegetation on these soils is mainly open Mitchell grass (*Astrebla* spp.) and Flinders grass (*Iseilema* spp.) grassland.[4]

An exception to these types of soils is the so-called "desert" country in the vicinity of Barcaldine, which has

[1] Farmer, Everist and Moule, 1947:33-6

[2] Skerman, 1958:195

[3] Northcote, 1965:112

[4] Skerman, 1958:91

TABLE 18

Temperature Figures for Western Queensland Centres

Centre	Jan-Feb mean max.	June-July mean min.	No. of Months with mean max. >35°C
Tambo	35.00	4.25	1
Blackall	36.50	6.80	4
Hughenden	35.60	8.50	4
Isisford	36.60	7.20	4
Longreach	36.70	7.20	4
Winton	37.20	8.50	6
Richmond	36.30	9.10	6
Windorah	37.40	6.60	4
Kynuna	37.05	8.00	6
Julia Creek	38.80	8.80	5
Birdsville	38.60	6.40	4
Boulia	37.85	8.10	5
Cloncurry	36.40	11.40	5

Source: Extracted from *Climatic Averages Queensland*, August 1975 deep sandy soils (AA4 and UG 5.1 soil) carrying open *Eucalyptus* forest. This soil is well drained and deep, but poor in nutrients. Nevertheless, it was upon this soil that much of the early cultivation was based.

Brief Settlement History

The first European to see any substantial portion of this region was Mitchell who, in September 1846, passed the sites of Tambo and Blackall and travelled on to near Isisford, on the Alice River, before turning back. There was little interest in settlement until after Queensland was granted self-government in 1859, but soon thereafter the first overtures were made. In 1861 J.T. Allen and Ernest Davies set off for the Barcoo country and passed through *Albinia Downs*, then the western-most settlement in Queensland, and reached new country, where Allen took up *Elizabeth Creek*, afterwards *Minnie Downs*, while Davies took up *Northampton*, which he later sold to Hordern and Manning. The Irvings obtained forfeited *Alice Downs*, and Hordern took up *Terrick*, but sold it to Goviss and Parsons.[1] Meanwhile to the north Robert Christison took up *Lammermoor*, some 3,110 sq km on Towerhill Creek in 1866, at that time the farthest out-back station in that part of North Queensland.[2] By 1870 George Fairbairn Senr owned several million ha including *Peak Downs*, *Barcaldine Downs*, *Lansdowne*, *Bimerah*, *Logan Downs*, *Stainburn Downs* and *Beaconsfield*.

The Beginnings of Cultivation

Very little cultivation is recorded in the far western areas in the early Registrar-General's Reports on the Statistical Register of Queensland. The first record is for 0.4 ha of potatoes at Blackall in 1874, which yielded 6 t; by 1878 the area had grown to 1.2 ha of market gardens plus 0.8 ha of sweet potatoes, 1.2 ha of lucerne and 3.6 ha of vegetables. Thereafter small areas of gardens were recorded for Longreach, Tambo, Boulia, Burke, Camooweal, Richmond, Jundah and Windorah, presumably conducted by Chinese gardeners until about the 1930s.

Vegetables, fruits and milk were needed, if not always provided, for the people of the far west, especially for the children and nursing mothers. The isolation and cost of

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[1]Lilley, 1973:23-6

[2]Anon., 1906:655-7

transport made it imperative that they be provided from local sources and a determined effort was made to secure them. In providing these amenities the old adage "two is company, three a crowd" usually held, so that one or two market gardeners and dairymen could provide for the needs, whereas three might mean surplus production and price cutting.

The Chinese market gardeners The discovery of gold and other minerals in the 1860s brought many people of various nationalities to Queensland. Amongst these were Chinese, some of whom tried their hands at the diggings, but most adopted their traditional gardening on an organic basis. As settlement spread a few of these moved into the growing western townships, which inevitably had to be established near a water supply; here they began to grow vegetables and fruit in a small way, always choosing sites near the water supply on the fringes of the towns, and peddle their produce to the townsfolk on foot. Their areas were small, their equipment hand tools, and watering was by watering-can or a simple pump from surface water or wells. In the far west surface water would be taken from permanent waterholes in seasonally flowing streams, and land adjoining these would be chosen for cultivation, often without title or rent.

Organic manuring was universal, using sheep, cattle and horse manure mixed with blood and offal from the local butcher's killing pen. The Chinese were industrious, worked long hours, had little overhead expenses and sold their produce directly at satisfactory prices, more cheaply if confronted with competition. Their cost of living was low. A few short references are found in the local press of the period, such as the *Western Champion*, published at Barcaldine from 1892 to 1932, from which the following passages are taken:

Barcaldine: it is stated...that some one or two miles from the [bore head] fountain, the water is successfully used by a Chinaman for vegetable growing. 26. 1.1892

[there are] dozens of fruit laden [citrus] trees at the Chinaman's garden at the Alice [River]. 22. 6.1897

Muttaburra: ...appears very quiet after the...heavy storms we have been having....the Chinaman's vegetable garden on the Thompson was completely washed away. The grapes from Blackall are no longer available as the

	vineyards were destroyed when the Chinese gardeners were removed from near the town. 9. 2.1892
Hughenden:	Professor E.M. Shelton...was impressed by the Chinese gardens where excellent potatoes and other vegetables were growing. ?. 9.1892
Longreach:	Mr. Paterson has been endeavouring to establish a vegetable garden on Black Gin Creek.... [He] pointed out that there were a number of Chinese occupying land near him who paid no rent. 28. 2.1893
Aramac:	The Chinaman gardeners on Aramac Creek are now selling lovely potatoes for which they readily get 20/- per cwt. They each grow at least ten acres and at £10 per ton a nice income, for potatoes alone. This result has been staring white men in the face for years; how is it none of them will tackle it? 24.10.1893
Location unspecified:	The wives of the working man, as well as others, were not sufficiently patriotic to pay sixpence for European cabbages while they could obtain them from Chinamen for threepence a piece. 20. 2.1894

They were successful, and as they accumulated wealth, many returned to China.[1] Others died on their holdings, where they were buried, if we can believe the bush poet Luftig of the *Bulletin* in his suggested National Anthem for the Separationists of Central Queensland:

> "Where the heathen manureth that ground that he hoeth
> By planting his bones at the end of the row!"[2]

European market gardeners and dairymen Some Europeans tried their hands at growing fruit and vegetables in competition with the Chinese, but generally complained of lack of support by the public and competition from the Chinese. Later, however, with the departure of the Chinese, a few European gardeners took their place. The problems of the venture included the difficulty of growing vegetables in

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[1]Walker, 1977:1-3

[2]*Western Champion,* 20.2.1894

the extreme heat of summer, so that the operation was mainly growing winter vegetables such as the Crucifers. The soils also presented problems; the intractable nature of the heavy soil alluvials adjacent to streams made them difficult to work and as hard to irrigate because their high bulk density reduces infiltration, and they crack widely when dry.[1] Where suitable lighter textured alluvial soils or deep sand were available, more success was achieved. On the desert country at Barcaldine most of the townspeople grew a few citrus trees and dates in their house yards, and a few local farmers grew commercial quantities of fruit and vegetables for sale.

From 1894 onwards Mr Cronin, on *Brickhill*, in the desert country, grew water melons and pumpkins under irrigation from an artesian bore, and by 1903 had a flourishing orchard of oranges, lemons, citrons, cumquats and dates. Mr Lloyd-Jones of *Woodend*, grew pumpkins and potatoes from 1897, and in 1899 Mr Hannay, of *Hamlet Downs*, Geera, some 19 km east of Barcaldine, started growing potatoes and vegetables on the sandy country as soon as he had completed an artesian bore in June of that year.

In 1896 *Isis Downs* obtained a double furrow Hornsby plough with all the latest improvements in steering gear, chilled steel shares and so on, and set about growing two potato crops a year, a practice also followed by Mr Bunning of *Darr River Downs*. In July 1897 Mr Bunning hired Mr Whiteley, a well-known orchardist from Rockhampton, to plant an orchard near the boiling down works at Longreach. It was also reported that there were excellent orchards of oranges, lemons, guavas and peaches at *Mt Cornish*, *Corona* and *Darr River Downs*. More recently Mr Hugh Paterson of *Home Creek*, Barcaldine, has been growing vegetables such as potatoes, pumpkins and melons, along with grapes and citrus on 8.5 ha of sandy soil on the Alice River, irrigating from the water stored above a small weir.[2] For several years pumpkins and melons were grown on sandy soil in the wool scour area at Blackall, irrigated with bore water.

The one or two dairymen who operated in places like Longreach generally allowed their cattle to graze freely on the town reserve during the wet season, and attempted to grow small areas of green fodder under irrigation to help their

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[1]Skerman, 1947: *passim*

[2]Paterson, 1977: personal communication

production during the dry period. Lucerne was difficult to grow under the intense heat and flooding, and so quick growing summer crops such as sudan grass were used when dairy cattle replaced the individually owned goats.

The advent of refrigerated rail transport allowed the Committee of Direction of Fruit Marketing (COD) and the coastal dairy companies to provide refrigerated fruit and vegetables and pasteurized milk, respectively, on a regular basis, and these supplies largely supplanted local production.

The station homestead garden Because of the large areas of the properties involved, the siting of station homesteads and gardens was a major consideration in western Queensland. Permanent water was needed, all-year access if possible, and a well-drained site, preferably with a view. Many are sited near permanent water holes on light textured alluvial soils which provide excellent gardening conditions. Others less fortunately situated on many Mitchell grass downs properties are dependent on water from artesian bores and on heavy cracking clays for their gardening ventures. The combination of poor quality bore water and intractable clay precludes gardening in some instances. In the Chinese era from the late 1920s to 1930, many properties employed Chinese cook-gardeners who carried on their traditional organic farming, but in this case amply supplied with an abundance of sheep manure from under the shearing sheds, and with blood and offal from the station "killers", home slaughtered for meat supply.

The fruit trees usually selected in station homesteads are dominated by citrus (oranges, lemons and mandarins) which, in the relative isolation from pests and diseases and with abundance of sunshine, water and manure, yield excellent fruit. An almost ubiquitous zinc deficiency is evident on the western citrus trees growing in the high pH soils, and occasional copper deficiency causes dieback. Citrus are seldom grown on the heavy cracking clays of the open downs because of poor drainage. Trenches have to be dug and drainage provided by a layer of stones. Other popular fruit include figs, which do quite well and, in sandy soils, grapes.

In the cooler part of the year station vegetables included lettuce, Chinese cabbage (spinach), long beans, carrots, tomatoes, cabbages and cauliflowers, and in the summer melons, cucumbers and long beans. The watering regime usually includes heavy watering at wider intervals, to build up subsoil moisture. A heavy mulch of sheep manure makes the soil receptive and reduces evaporation. Where bore water is used it is essential to have heavy watering to take the contained solids away from the root zone, ample sheep manure to provide a weak acid to counteract the alkalinity and sulphate of ammonia for the same purpose. Grasshopper and rat plagues cause havoc in the gardens. A mobile plant nutrition, entomology and plant pathology unit, making a seasonal visit to western station properties, would be a most welcome innovation, especially to the womenfolk, who usually supervise the garden.

Attempts at Commercial Agriculture

Because of the paucity and irregularity of rainfall in western Queensland, and the limitations of horse power for cultivation which precluded bare fallowing techniques for soil moisture conservation, early commercial agriculture was dependent on irrigation.

The Alice River Settlement During the serious 1891 shearing strike many men in western Queensland were out of work and a group at Barcaldine decided to try farming on a co-operative basis to earn a living by growing and selling produce. The co-operative was formed in July 1891, and consisted of seventy-two men and one woman, each with equal rights. While one portion of the community was cultivating, the other was to work on the surrounding stations for wages, which were to be paid into a common fund for the benefit of the whole.

The Government granted the settlement, under an occupation licence, 1,400 ha in the "desert" country, consisting of poor sandy soil. The members set about clearing and fencing the land, and district graziers and communities as far away as Rockhampton gave them equipment, livestock and money to assist them. The Government lent them a pump to pump water from the Alice River for the settlement. On 23 February 1892 the Premier, Sir Samuel Griffith, visited the settlement[1] and suggested the community, which now consisted of forty-three men, form itself into a joint stock company, registered under the Companies Act, and obtain a grant of land in perpetuity.

By May 1892 the settlers had enclosed 120 ha of land and cultivated 40 ha. They have thirty-four dairy cattle, two saddle horses, seventy pigs and numerous fowls, ducks, geese

[1] *Western Champion*, 23.2.1892

and turkeys. They were growing turnips, cabbages, peas, beans, sweet potatoes and pumpkins, pineapples, bananas and grapes. Water melons had been sold for 5/- to 7/6 (50¢ to 75¢) each.[1] A dairy was built of stone to a design provided by the Department of Agriculture.[2] In June 1892 they applied for a grazing area of 1,280 ha extending to portions 21V and 22V, Parish of Glenpatrick.

By June 1893, two years and two months after starting the co-operative, only eleven men remained. As each member left he took only his clothes and blankets, but no other reward for his labours.[3] The remaining men agreed to clear 4 ha of neighbouring Mr Cronin's land in return for a three year lease. Here they grew a good wheat crop, from which they fed their fowls at their camp, and 1.2 ha of maize, melons, pumpkins and beans, under irrigation from Cronin's bore.

In 1894 they grew and sold 40.7 t of oaten hay on 7.2 ha, while in January 1895, 4.07 t of Black Hamburg grapes were sold in Rockhampton for 4d (4¢) a pound.[4] In October 1896 it was reported they had 1,500 vines looking very well.[5] The cultivation was watered by pumping from the river, but the settlement was out of water at that time and intended to put down a bore if it could get finance. The vines were manured with well decayed refuse (principally bones) from the pots of the Barcaldine boiling down works (sheep), supplemented by manure from the stock yard, and stacked until required. At one stage 26,000 sheep in three mobs were confined for a night each on the vegetable garden site. The remainder of the orchard contained mainly oranges, with some peaches, apricots, plums, figs and mulberries. There were also potatoes, maize, sweet potatoes and a crop of oaten hay. The maize stalks were fed to the cows, which yielded enough milk for the settlement plus 5 kg surplus which was sold in town. Cabbages were being sold in Alpha at 2/6d (25¢) a dozen and at a slightly higher price in Clermont. Beetroot, carrots, turnips, cabbages and herbs were sold in Barcaldine, and pigs and flowers were also being raised.

The members borrowed £900 ($1,800) and put down a bore to a depth of 406 m delivering 750,000 gallons (4 Ml) a day of

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[1]*Western Champion*, 17.5.1892

[2]*ibid.*, 5.4.1892

[3]*ibid.*, 19.9.1893

[4]*ibid.*, 21.1.1895

[5]*ibid.*, 6.10.1896

excellent water at boiling point. This was distributed in 3.2 km of main ditches and thence into minor drains. So successful was their irrigation venture that they paid off the principal and interest within two years.

During the 1901-02 drought 16,000 cabbages and cauliflowers were sent to Rockhampton in crates, and realized 7d to 1/7d (5½¢ to 15½¢) a head. The main problem apart from lack of initial capital and the initially poor soil, was the susceptibility of stone fruit, and sometimes vines, to the attack of white ants. They continued growing grapes, melons and vegetables until February 1905 when they decided to raise pigs; the local *Western Champion* noted "they will find the new business a more profitable one than trying to compete against the Chow in supplying this town with vegetables."[1]

The company name was changed to the Barcaldine Irrigation Farming and Grazing Company Limited, and admitted new and younger people.[2] These caused dissension and finally the company was sold in June 1907 for £2,500 ($5,000); the remaining few originals got £500 ($1,000) each.[3] The vineyards were carried on by their new owners, Connellan and Searle. Mr A.H. Benson, the Instructor in Fruit Culture, QDAS, visited Barcaldine soon afterwards and suggested that Barcaldine should grow raisin grapes. He despatched a consignment of cuttings from the Rockhampton Botanic Gardens.[4]

Wheat growing using artesian bore water The early interest in wheat cultivation in western Queensland was undoubtedly due to the enthusiasm of Professor E.M. Shelton, who, on 15 January 1890 accepted the position of Instructor in Agriculture in the Queensland Department of Agriculture, which had been established in 1887. Professor Shelton was, prior to his appointment, for sixteen years Professor of Agriculture at the Kansas State Agricultural College, with a special interest in wheat breeding.[5] He became first Principal of the Gatton Agricultural College on 1 July 1897, resigned a year later and returned to the United States

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[1]*Western Champion*, 20.2.1905

[2]*ibid*., 17.1.1907

[3]*ibid*., 15.6.1907

[4]*ibid*., 22.6.1907

[5]McLean, 1890:1

where he died at the age of 81, still interested in Queensland's progress.

On his Queensland appointment he undertook an extensive lecturing tour of the state, including the Central Highlands, and the Barcaldine and Hughenden districts, where he found that a Mr Cox had, in 1891, grown and sold £700 ($1,400) worth of hay and chaff. At Barcaldine he visited the Alice River Settlement and was impressed by the fertility of the open black soil downs, and the artesian water supply.[1] At that time the water from the Government bore in use contained 0.033 per cent of sodium and potassium carbonates and was unsuitable for irrigation, although Shelton considered that if allowed to stand in two successive ponds for a time "...the noxious properties of the borewater might most likely be neutralised...and...the water from the second storage pond would almost certainly be found perfectly suited to grazing crops."[2]

The solution was, in fact, much simpler and more satisfactory. The Government bore drew its supply from a rather shallow mineralized aquifer, and when, in 1892, a bore was sunk through it to an aquifer below 300 m, a supply capable of furnishing 4 Ml/day was struck. Best of all the water, with a total solid content of 28.00 gr./gal. and 2° of hardness, was classed as suitable for irrigation by the Government Analyst.[3] With this success, more bores were sunk and in March 1897 the Barcaldine Progress Association, in a brochure to attract settlement, announced that within a radius of 32 km from Barcaldine a total of twenty-two bores had been sunk to this second supply, ranging in depth from 200 m to 650 m and that yields averaged from 2 to 4 Ml/day.

The editorial of the *Western Champion* of 3.5.92 noted that W. Dalzell, of *Newark* block near Barcaldine, had irrigated 800 ha of Mitchell grass during the last twelve months from a daily flow of about 3 Ml of good quality water, when the surrounding country was dry. The editor advocated that an association be formed in Barcaldine to start an irrigation scheme. As a result of this suggestion the first meeting of persons interested in the application of artesian water to irrigate the land near Barcaldine for agricultural purposes was held in the Shakespeare Hotel on 1 June 1892, with Mr Lloyd-Jones in the chair. Mr W.H. Campbell of

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[1] *Western Champion*, 26.1.1892

[2] *ibid.*

[3] *ibid.*, 28.6.1892

Jaccondoll farm, the first man to use artesian water for irrigation, addressed the meeting; he suggested they grow maize and potatoes, send wheat to Rockhampton and later have a flour mill at Rockhampton. He listed the cost of a bore of 30 cm diameter, cased, at £900 ($1,800), channels and drains £200 ($400), pumping costs nil, giving a total of £1,400 ($2,800) to irrigate 1,600 ha. Land would cost approximately 25¢/ha. A committee of four was appointed to investigate further action.

Meanwhile the Minister for Lands had instructed the District Surveyor to send samples of all artesian water in the district to Brisbane for inspection and analyses. In the budget speech Sir Thomas McIlwraith, the Colonial Treasurer, said:

> ...The Under Secretary of the Department of Agriculture, who is able to decide authoritatively on the matter...says without any reservation that the country he has seen at Barcaldine and Longreach is capable of growing wheat in any quantity, and that where the soil and water can be brought together they may be made to produce any description of cereal.[1]

Interest in acquiring land for cultivation was growing and the Government was approached to make land available in western Queensland to carriers who plied from town to town, where they could run their bullocks and grow some produce with which to support their families. In December 1892 some eighty-three such Homestead Selections on the black soil downs were thrown open in portions of 65 ha, each as conditional selections at 62¢/ha (25¢/a) with an annual rental of 14¢/ha (16¢/a) or $5.00 (£2/10/-) as full purchase price. Similar selections were opened at Tambo (1895) and Barcaldine (1896). This explains the small areas still remaining delineated on present-day maps of these regions. They were all then potential wheat land.

In October 1893 Mr Cronin of *Brickhill* sent samples of wheat he had grown to the new milling company in Rockhampton, where they received commendation. On 30 January 1894 the editorial of the *Western Champion* discussed the future of wheat growing and posed the following four questions, with answers.

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[1]*Western Champion,* 30.8.1892

in chocolate plains soil.[1] The seed germinated but no rain fell during August and September and the plants withered and died. In January 1896 Professor Shelton revisited Barcaldine and stated that the country around Barcaldine was suitable for wheat but more experiments were needed near a bore. Campbell's wheat sown in 1896 germinated well, but suffered from dry weather and as it was coming into maturity was stripped by marsupials and parrots. A similar fate befell Cronin's crop of irrigated wheat that year. It was sown on 15 April and irrigated and watered again in June. There was no rust. It was in head in early November when the galahs stripped every grain. Campbell tried again in 1897 under irrigation, and harvested 0.43 t/ha; in 1898 his wheat sown and irrigated on 8 June, after which it received 500 mm of rain, ripened in October and yielded 1.7 t/ha on the average, with the best area reaching 1.84 t. He was offered 1.65¢/kg (4/6d per bu.) delivered in Rockhampton, but commented that "farmers will expect a higher price than this for their wheat until the local demand is satisfied."[2]

During the 1901-02 drought irrigated wheat grown on Mr Cronin's *Brickhill*, on desert country, yielded 2.73 t/ha, on Mr Hannay's *Hamlet Downs*, also on desert country, 1.34 t/ha and on Mr Shave's *Woodend*, on the plain country, 1.34 t/ha. There were also splendid crops of wheat irrigated from artesian water on the black soil farms of Messrs Arthur, Campbell, Murray and on *Coreena*.[3]

In October 1904 the Rockhampton Milling Company announced that it was closing its flour mill because the removal of the duty on flour purchased in southern states meant it could not compete with flour imported from Adelaide and sold more cheaply in Rockhampton.[4] A group of local Barcaldine farmers and businessmen decided to form a company, and invited shareholders to take up 6,000 shares at $2.00 each, no one being allowed to hold more than 100 shares. The company was formed, the directors obtained quotations for a two-bag (each of 127 kg) mill from Dell and Company, London, and as sufficient money was not on hand, wrote to the Minister of Agriculture for a loan to erect a mill. In reply the Minister asked a series of questions: how many present shareholders would grow wheat for the mill; what area would

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[1]Boyd, 1898:90-1

[2]*ibid.*, 1903:161-72

[3]*Western Champion*, 3.10.1894

[4]*ibid.*, 3.10.1904

Firstly, would the western downs produce wheat? This had been answered in the affirmative by Professor Shelton and Peter McLean, of the Department of Agriculture. Would the yield be sufficiently heavy to make wheat growing pay? Yes, with an average yield of 0.6 to 1.02 t/ha at $22.80/t, with a mill built locally. Were the seasons sufficiently regular to ensure a succession of good crops? In answer to this, it was suggested that the farmer should reckon on one or two good seasons and postpone cultivation in dry seasons; further, he should combine agriculture with pastoral pursuits! Finally, could the farmer cultivate the soil at a cost low enough to leave a large margin of profit? Again, the answer was affirmative, noting that with a team of horses at least 20 ha could be grown, with six horses and a three furrow plough covering 2 ha/day. A month later it was stated that the existing rail freights from Barcaldine to Rockhampton ($3.05/t) would need to be reduced to produce wheat for export.

Meanwhile, two flour millers became interested. In October 1894 F. Kate advised he would establish a mill at Barcaldine if settlers would guarantee 4,000 ha of wheat. There was a serious shearer's strike at the time and the local editor commented:

> ...but we are sorry to say that the strike and the depression in business seems [*sic*] to have completely destroyed all energy in this direction and probably Barcaldine will have to fall into the background and let Emerald (recommended for a mill by Professor Shelton) come to the front as the Pioneer township of progress.[1]

In July 1895 C.H. Hayes, a flour miller of Roma, announced he would erect a flour mill at Emerald and, if successful, also one at Barcaldine, but in the meantime would take Barcaldine wheat.

Professor Shelton wrote to W.H. Campbell in October 1894 stating that his wheat growing experiments at Hughenden, Herberton, Clermont and Springsure were successful and he would like to extend them to Barcaldine.[2] The local people agreed and on 24 and 25 April 1895 Professor Shelton planted eighteen varieties of wheat "dry" at Campbell's *Jaccondoll*

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[1]*Western Champion*, 23.10.1894

[2]*ibid.*

each grow and when would he start; would the present water supply give each crop 25 cm (10 inches) of rain; was there sufficient water for all potential shareholders and how would it be provided?

Presumably these questions were answered, but it was not until 12 March 1906 that the Hon. D.F. Denham, Minister for Agriculture, visited Barcaldine and proposed three methods of Government finance. Firstly, if the Company could fulfil its obligations the Government would advance 50 per cent of the necessary costs. An alternative was a guarantee from the Shire Council, although it was doubtful whether this method could be used to build a mill. The third proposal was a Government loan similar to that which was granted to Central Sugar Mills. This, however, would require amending legislation, and the selectors would be required to mortgage their holdings to the Government.[1] The Minister preferred the first proposal. He thought there was sufficient consumption of flour in the district to keep a five-bag mill employed for forty weeks a year and the profit from gristing would help pay off the mill. If wheat attracted 3/6d (35¢)/bu (13¢/hl), flour £13 ($26)/ton ($26.42/t), and bran and pollard £5 ($10)/ton ($10.61/t), business would be profitable.

Apparently none of these plans was acceptable. The wheat-grain growing industry disappeared from Barcaldine and growers seemed to move for a time to oaten hay. In an address to the Third Session of the Agricultural and Pastoral Conference in Rockhampton, in May 1898, W.H. Campbell summed up the attitude of most landholders. He pointed out that the rapid growth after rain, and condition put on by stock depastured there, militated against agriculture. The selector saw the latter as requiring a great deal of hard work, with a strong risk of failure. Grazing, on the other hand, seemed a much simpler and safer process.[2]

Date Palm Cultivation in Queensland

The early history of the cultivation of date palms in Queensland is contained in a letter from the Secretary of the Queensland Acclimatisation Society to the Director of Fruit Culture in the Department of Agriculture and Stock.[3]

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[1] *Western Champion*, 12.3.1906

[2] Campbell, 1898:24-9

[3] Ewart, 19.12.34: official communication

The record from the Society's files indicated that in 1866 female suckers of date palms were making good growth at the Society's gardens and would soon be available for distribution.

In 1893 Dr Bancroft recorded a fine specimen of date palm growing on his property at the corner of Wharf and Ann Streets, Brisbane.[1] In the same year he read a paper on dates before the Acclimatisation Society and said twenty to thirty trees were growing in Brisbane; a very good bearing tree was growing behind Mr Taylor's house in Edward Street and the finest female tree in Brisbane was in Mr Marshall's house garden in Leichhardt Street. In that year the Society obtained suckers from superior plants in the Brisbane garden of William Pattison in William Street, from Marshall's tree and from Mr Roche, of Dalby. These were transferred to Bowen Park, Brisbane, for propagation.

In 1894 female suckers raised from local trees were forwarded to Cairns, Charters Towers, Rockhampton, Bowen, Mackay, Bundaberg, Charleville, Cloncurry, Stanthorpe and Mitchell. The year 1895 was an important one for the introduction and distribution of dates. Capt. Withers, of the P & O Steamship Company, obtained six date palms in Bombay, India, and donated them to the Society which in November, also received a consignment of 110 female and 20 male suckers from the Persian Gulf. Further, locally raised suckers, both male and female, were distributed throughout the State.[2] This was a dedicated effort on the part of the Acclimatisation Society to have the potential of the crop tested in various parts of the State. Unfortunately it was reported (in 1935) that the Society's records had been lost, including a map prepared in 1896 showing the distribution of date palms in the State. In 1898 the Lands Department sent about fifty young date palms to J.C. Schmidt of *Goolburra*, Offham, and they were planted on a bore drain in stony mulga

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[1]This tree was still there in 1934 but has since been removed.

[2]Places which received these suckers included Muttaburra (Mt Cornish), Longreach, Aramac, Barcaldine, Mackay, Cairns, Cardwell, Thursday Island, Croydon, Roma, Charleville, St George, *Durham Downs* (Windorah), Camboon, Hebel, Clermont, Warwick, Pittsworth, Tambo, Yeppoon, Maryborough and the Brisbane district. *Roxborough Downs*, on the Georgina River, received suckers in 1896.

soil. They grew fairly well, but only three bore good edible fruit; the fruit of the others was woody and tastless.[1]

The QDAS took some preliminary interest in date palms and in 1901 the *Queensland Agricultural Journal* noted:

> The part of Queensland which, bearing in mind the requirements of the plant...seems to be the most suitable for the cultivation of the best dates is to the West of Hughenden, Longreach, and Charleville, and from latitude 23° to the Southern border of the State.[2]

Sir William McGregor is believed to have introduced (1904) some date palms which were planted in Roma.[3] Little further was recorded of date culture in Queensland until the 1930s, when Hon. Frank W. Bulcock, MLA, the Member for the Barcoo electorate and Minister for Agriculture and Stock, attempted to establish date growing on a commercial scale throughout the Central- and North-West and especially at Barcaldine.

The Director of Fruit Culture, Harry Barnes, contacted his counterpart in the NSW Department of Agriculture, C.G. Savage, who offered to supply seeds of the Barhee, Halaway, Khalasa, Saidy, Menakler, Thoory, Maktum and Zahidi varieties of the date palms.[4] Mr A. McTaggart, of the Council for Scientific and Industrial Research, offered him eleven varieties of hybrid dates from Indio Research Station, California.[5] Some date seeds were also obtained from Dr Swingle, of the United States Department of Agriculture. These seeds were propagated and the Director of Fruit Culture, at the request of the Minister, wrote to the following individuals and organizations asking them to plant the date suckers being forwarded:

Head Teachers of the State Schools at Blackall and Tambo;
Shire Clerk, McKinlay Shire Council, Julia Creek;
Shire Clerk, Barkly Shire Council, Camooweal;
The Chairman, Barcaldine Shire Council, Barcaldine.

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[1]Ruthenberg, 6.2.35: letter to Director of Fruit Culture.

[2]*QAJ*, 8:197

[3]Schmidt, 13.2.35: letter to Director of Fruit Culture.

[4]Savage, 31.7.34: " " " " " "

[5]McTaggart, 28.9.34: " " " " " "

About eight palms, two each of the varieties Barhee, Halaway, Saidy, and Khalasa were forwarded to each of the above with instructions to plant on a 7.2 metre square sysem. The Blackall Head Teacher advised that the palms were planted in the school grounds (in 1977 only one survived). The Barkly Shire palms were planted in the nursery, and at Barcaldine the palms were distributed in the hospital grounds, the Chairman's residence, at the Shire Hall and at the residence of H. Kerwin. All the palms mentioned above were planted about mid-October 1934. Some seeds were sent to private individuals, two of whom were J.J. O'Sullivan, *Carjoan*, Bookin and James Simmons of *Tiger Scrub*, Orallo.

Early in 1935 the Director of Fruit Culture circularized his district officers throughout Queensland asking them to advise him of any date palms in their district, the general performance of the trees, and whether suckers from the trees were available for planting. The replies indicated a statewide spread of palms, probably many of them remaining from the Acclimatisation Society's earlier distribution, or from suckers derived from these sources; the replies are summarized in Appendix III, pp. 153-5. Having established where date palms were growing and where suckers could be obtained, the Director proceeded to collect planting material and keep it at the Botanic Gardens at Rockhampton and at the Callide Research Station at Biloela.

Establishment of the Date Experimental Plot, Barcaldine

In January 1935, H.J. Freeman, Horticulture Branch of the QDAS, visited Barcaldine to select a site for the establishment of a Date Experimental Plot. He chose a 200 ha site at the "Four Mile," on the Alice River, about 6.5 km from Barcaldine, on portion 107, Parish of Barcaldine. After negotiations with the Land Administration Board it was decided to offer a special lease to J. Olive, who was to supervise the date plot, on 4 ha of the land. The site was fenced and a windmill and tank set up to pump and store water from the Alice River and distribute it through a 76.2 m pipe line to the date palms. Mr G. Shave replaced Mr Olive as lessee before the palms were planted.

The first sixty-eight date offshoots from the Rockhampton Botanic Gardens were planted on 16 September 1935 by Mr Shave, and additional planting material was obtained from the garden of Mrs Ogden, of Barcaldine, who was selling a limited amount of date fruit locally. The lessee had permission to crop for his own profit between the date palms during establishment, and a seedbed of tobacco was

Plate II: The Date Experimental Plot, Department of Agriculture and Stock, Barcaldine, in 1947, after abandonment.

established for this purpose. The establishment of the dates on the experimental plot was initially successful, and at the end of 1935 eight more palms were added from Dr J. Ryan's farm at Dayboro. Dr W.A. Summerville, QDAS, undertook a world stúdy tour in 1935 and was asked to collect seed of improved date varieties for the Barcaldine plot.

In 1935 Mr Freeman wrote an illustrated article, "Date Culture in Queensland," dealing with all aspects of date culture, in which he stated:

> The first and only dates worth mentioning to be planted in Queensland were in the Rockhampton and Barcaldine districts... those planted in the Barcaldine district have provided definite proof that dates will grow successfully in that region and will, under normal conditions, return from 200-400 lb [90-180 kg] of fruit per palm, an excellent return for this fruit. It is to be regretted that the Barcaldine dates are so non-descript that the annual sales from the few palms growing there have not been sufficiently large nor has the quality of the fruit been high enough to create a steady demand, or...to create any inducement for larger areas to be established. However, we can safely say that from Barcaldine east to Alpha and south to Blackall would be country of suitable type, as also would be many thousands of acres of western country possessing similar characteristics to the districts named....[1]

Amongst the illustrations were young date palms at the Date Experimental Plot at Barcaldine, date palms forty years old at Barcaldine carrying an estimated crop of approximately 90 kg, and crops of long beans, tobacco, sweet potatoes and citrus trees interplanted between date palms on various Barcaldine properties.

There were periodic shortages of water at the Alice River site and it was decided to erect a small weir across the river to provide more water. The Minister for Agriculture and Stock agreed to share the cost equally with the Barcaldine Shire Council and the weir was built in 1939 for

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[1] *QAJ*, 45:376-96; 487-501 *passim*

£86.11.4d ($173.15). Some replacement palms were sent to Barcaldine from Biloela and Lawnton in 1940,[1] and in August 1941 the caretaker of the Experiment Plot (Mr Shave) forwarded a plan indicating the planting sites of 184 date palms representing nineteen varieties (Plate II, p.94).

A few more palms were distributed to private citizens at Charleville, Chinchilla, Condamine, Innisfail, Guluguba, and some were sent to Blair Athol State School for planting.

In March 1943 Shave sent a small case of dates to H. Barnes, the Director of Fruit Culture, QDAS, representing several varieties with varying flavours. He also advised that birds ate most of the dates at the plot. In the same year, when he was over eighty years of age, Shave resigned as caretaker of the Date Experimental Plot. His successor was not satisfied with the payment he was receiving for his part-time employment, labour was difficult to obtain, and the QDAS decided to abandon the Plot permanently on 19 October 1943. By this time the driving force behind the Barcaldine experiment, Hon. Frank W. Bulcock, was no longer Member for Barcoo, nor Minister for Agriculture and Stock, and wartime problems of labour and materials made it difficult to maintain the Experiment Plot.

Establishment of Dates at *Rayford Park*, Condamine, South-East Queensland

Meanwhile interested people at *Rayford Park*, Condamine, in south-east Queensland, had established some date palms in 1938, under the supervision of A.M. Richardson, Inspector under the Diseases in Plants Act, QDAS, Toowoomba. On 3 July 1939 he reported that seventy-eight palms were planted at *Rayford Park* and were doing well. Four more were added from the Lawnton Acclimatisation Garden in May 1940.

Eventually the palms raised from Summerville's seeds became an embarrassment at the Biloela Station, because more space was required for its normal research work. Mr G. Proud, of *Baker's Bend*, Charleville, was keen to grow dates, and after an inspection was made of his farm thirty-six date

[1]These plants came from a selection of nine California varieties obtained in 1937 by Dr W.A. Summerville, QDAS. The seeds were planted at the Callide Cotton Research Station, Biloela, and at the Queensland Acclimatisation garden at Lawnton.

palms, covering all varieties held at Biloela, were despatched to him in October 1942. However, about half the palms died, and in August 1944 he advised that he was unable to carry on. He suggested that *Dillalah*, Charleville, would take the remaining dates and they were moved to that site. The varieties transferred consisted of Halaway, Kustaway, Barhee, Zahidi, Hellah and Amary.

In the early war years the date plot at *Rayford Park*, Condamine, was in danger of destruction in order to build an aerodrome for the Air Force, but a compromise was arranged so that most of the plot was saved. The *Rayford Park* plot now constitutes the main date centre in Queensland. Palms have been distributed from this plot to a number of private citizens in south-eastern Queensland, and to the Aboriginal Welfare Board at Boggabilla, New South Wales. On 3 November 1948, A.M. Richardson presented a report to the Department of Agriculture and Stock, summarizing the ten years' work with date culture at *Rayford Park*.[1] No date research is now undertaken by the Department of Primary Industries.

Dates have rather specific environmental requirements if a high quality commercial fruit is the aim of cultivation of the date palm. To maintain maximum growth, the soil should be wet to depths of two to three metres and no part of the root zone should be allowed to dry to within the wilting range. In sandy soils palms have been found to respond to a constant supply of water. It is estimated that 12 to 24 Ml/ha are required to grow date palms. In the Barcaldine experiment water was always a limiting factor in crop performance. Furthermore, dates are susceptible to rain and high humidity during the rapid fruit growth period[2] and the rainfall pattern at Barcaldine is such that good quality fruit cannot be guaranteed. Consequently it is not anticipated that quality fruit suitable for large scale commercial production would be produced in the area, although locally produced fruit find a small market.

Agricultural Project Clubs in Queensland Primary Schools

In the preface to a textbook, *Elementary Lessons in Agriculture for the Use of Schools*, published in 1910, A.J. Boyd, Under Secretary, commented:

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[1]Richardson, 3.11.48: letter to Director of Fruit Culture

[2]Tate and Hilgeman, 1958:4

> The study of Agriculture has now become, generally, a part of education....I have endeavoured, in the elementary lessons in this book, to present to the youth of Queensland a clear path towards the higher branches of the science of Agriculture ....Especially have I aimed at placing in the hands of the pupils of the Country State schools a book which, under the guidance of the teachers, will...instil into their minds a desire to become further acquainted with the operations of Agriculture...[1]

In another publication, *Agricultural Project Clubs in Queensland*, distributed in 1949, the preface states:

> ...the Agricultural Home Project Scheme received its first mention and early impetus in connection with the Rural Schools established at Nambour on 30th January 1917, and at Boonah and Marburg in 1919 ....There were clubs...in operation before this time...but...there was no definite organisation within the school such as is now known.[2]

A Department of Public Instruction brochure of the early 1920s noted that the agricultural project idea had spread from rural schools to non-rural schools. The Agricultural Education Bill of 1922 provided for the establishment of a Board of Agricultural Education, and a report on Agricultural Education stated that manual training and school gardening were necessary and important parts of a primary school curriculum. In addition, the authors stressed the value of handwork as a mental stimulus, holding that the garden "...should be the laboratory of the country school... [and is] as essentially necessary as the classroom." Pupils were to be encouraged to till a small plot at home, on the same lines as the demonstration plot at school.[3]

In 1926 A.G. Aitchison was appointed as Project Club Organiser for the purpose of encouraging the formation of

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[1]Boyd, 1910:1

[2]Anon., 1949:1

[3]Thompson and Bosworth, 1922:9-18, *passim*

Agricultural Home Project Clubs, and he occupied this position until he retired in 1956. He directed the emphasis of the Project Clubs to the child as the centre of activity, with his complete development as the aim. In the Home Project Club the theoretical work is carried out at the school and the practical work at the homes of the members of the club. Where a class in any school is well represented in the Home Project Club membership, the teacher is permitted to treat matter contributing to project knowledge as an agricultural course complying with syllabus requirements. Participation in the Home Project Club is entirely voluntary on the part of the teacher and pupil. As the scheme progressed some schools deemed it advisable to carry out the practical work of the project at the school as well as at members' homes. Later, when such projects as Forestry were introduced, and where it was considered advisable to work the full project at the school, the work was not extended to the homes of the pupils. The number of primary schools engaged in Agricultural Project work grew from fifty-three in 1927 to 526 in 1940, reached 571 in 1958, and has receded to 348 in 1976. In that year they involved 8,861 members working on school projects and 147 on home projects.

Following Mr Aitchison's retirement the work was most ably supervised by J.P. Kahler for another sixteen years and, since his retirement, the Project Clubs are now in the hands of J.J. Althaus. Recent introductions are school bus services to take children residing within about 80 km to the schools and the distribution of school kits, including kodachromes, to add visual aid techniques to the theoretical and practical instruction. Central and North-West Queensland clubs are operating at

Alpha	Cloncurry	Longreach
Anakie	Comet	McKinlay
Aramac	Dajarra	Mary Kathleen
Barcaldine	Duchess	Maxwelton
Blackall	Hughenden	Mt Isa
Bogantungan	Isisford	Muttaburra
Boulia	Jericho	Prairie
Camooweal	Julia Creek	Richmond
Capella	Jundah	Tambo
Clermont	Kynuna	Torren's Creek

and Winton.

Of these thirty-one clubs, twenty-nine have gardening projects involving vegetables, ten have citrus orchards and three have sorghum plots. The remainder of the clubs have pasture, goats, poultry and bees. Multiple activities are common: the largest group is at Barcaldine, with five current clubs involving citrus, vegetables, sorghum, poultry and bees.

The observations made on a crop can be illustrated by the procedures suggested for handling a citrus crop. Studies include varieties (to spread the availability over a season) soils, irrigation (including water quality) mulching, fertilizers, green manures, budding, grafting, pruning, insect pests and diseases and their control, spray techniques, maturity standards, picking, grading, packing and marketing and packing shed hygiene and judging competitions. Each student keeps a record book, which is assessed, and he engages in the practical field work. Selected students spend a week and a half at a summer school at the Queensland Agricultural College and a week at the Royal National Show.

The Barcaldine State School commenced its citrus project in 1940 with twenty-two trees, with a spread of varieties including Washington Navels, Joppa and late Valencia oranges; Emperor and Beauty of Glen Retreat mandarins; Marsh Seedless grapefruit; and Lisbon, Villa Franca and Genoa lemons. The trees were irrigated from good quality artesian bore water and the soil was deep sand (Plate III). The chief diseases encountered were collar rot, mottle leaf (zinc deficiency), and exanthema, and these have been treated and controlled. Pests include grasshoppers, scale insects, fruit fly and citrus bugs, and spraying of recommended chemicals control these. The produce from the orchard is sold locally and the proceeds redirected to the purchase of equipment and chemicals; fresh fruit is sold amongst the students at a nominal charge.

On 26 June 1944 it was reported by J.P. Kahler, of the Department of Public Instruction, who inspected the club project, that all but five of the children had citrus trees at home. Fruit had been supplied to the domestic science section and fifty pints of jam were made. Some £4 ($8.00) had been obtained from the sale of fruit and seventy-two dozen fruit had been given to the children. In 1948 he reported that some home plots then had as many as fifty trees.

<u>The impact of the school project clubs</u> Apart from the training in organization, public speaking, theoretical and practical agriculture and marketing, the transfer of agricultural knowledge from the school to the home is of paramount importance, especially in isolated areas where home-grown fruit and vegetables are so important both nutritionally and economically. Although large scale production is not possible, these small projects point the way towards

<u>Plate III</u>: The Barcaldine State School Agricultural Project. View of the citrus grove 15 months after planting.
Queensland Country Life Photograph

better husbandry in preparation for larger ventures and they are available to all schools that nominate. It is felt that the school project clubs have had a significant beneficial effect on the general home garden culture in western Queensland, where the student lives close enough to partake in the scheme.

The Silage Era on the Mitchell Grass Downs in Western Queensland

Queensland's wool-growing area is contained largely within the 250 mm and 500 mm isohyets, with an extension eastwards into the 500 mm to 625 mm belt in the Central Highlands, the Western Downs and the Maranoa (see Map 5, p.103). The central and northern region of this belt is made up of the so-called "desert" country (open *Eucalyptus* forest) east of Barcaldine, Aramac and Hughenden, and the Mitchell and Flinders grass downs. Around Barcaldine the soils of the "desert" country are mainly deep sands. The soils of the Mitchell and Flinders grass downs are developed on sedimentary material of Cretaceous age, and are heavy, self-mulching clays. They usually carry a grassland vegetation, though areas, particularly near Blackall, carry thick gidyea (*Acacia cambagei*) scrubs, and others known as lightly timbered downs carry scattered trees of boree (*Acacia cana*) and whitewood (*Atalaya hemiglauca*).[1]

In normal and good seasons, these downs properties are excellent wool-growing areas. The main diet of the sheep is, however, not so much the comparatively drought-resistant Mitchell grasses (*Astrebla* spp.) but an ephemeral gramineous and herbaceous flora of Flinders grass (*Iseilema* spp.), button grass (*Dactyloctenium radulans*), spider couch (*Brachyachne convergens*), Queensland blue grass (*Dichanthium sericeum*), tar vine (*Boerhavia diffusa*), some annual Chenopods and a sparse sprinkling of legumes such as *Rhynchosia minima* and *Glycine* spp. Davidson has published a detailed account of the Mitchell grass association in the Longreach district.[2]

Davies, Scott and Kennedy, working at *Elderslie*, Winton, showed that a Mitchell grass pasture alone provides a submaintenance ration in the winter and spring and until the new season's growth occurs in the summer after rain.[3]

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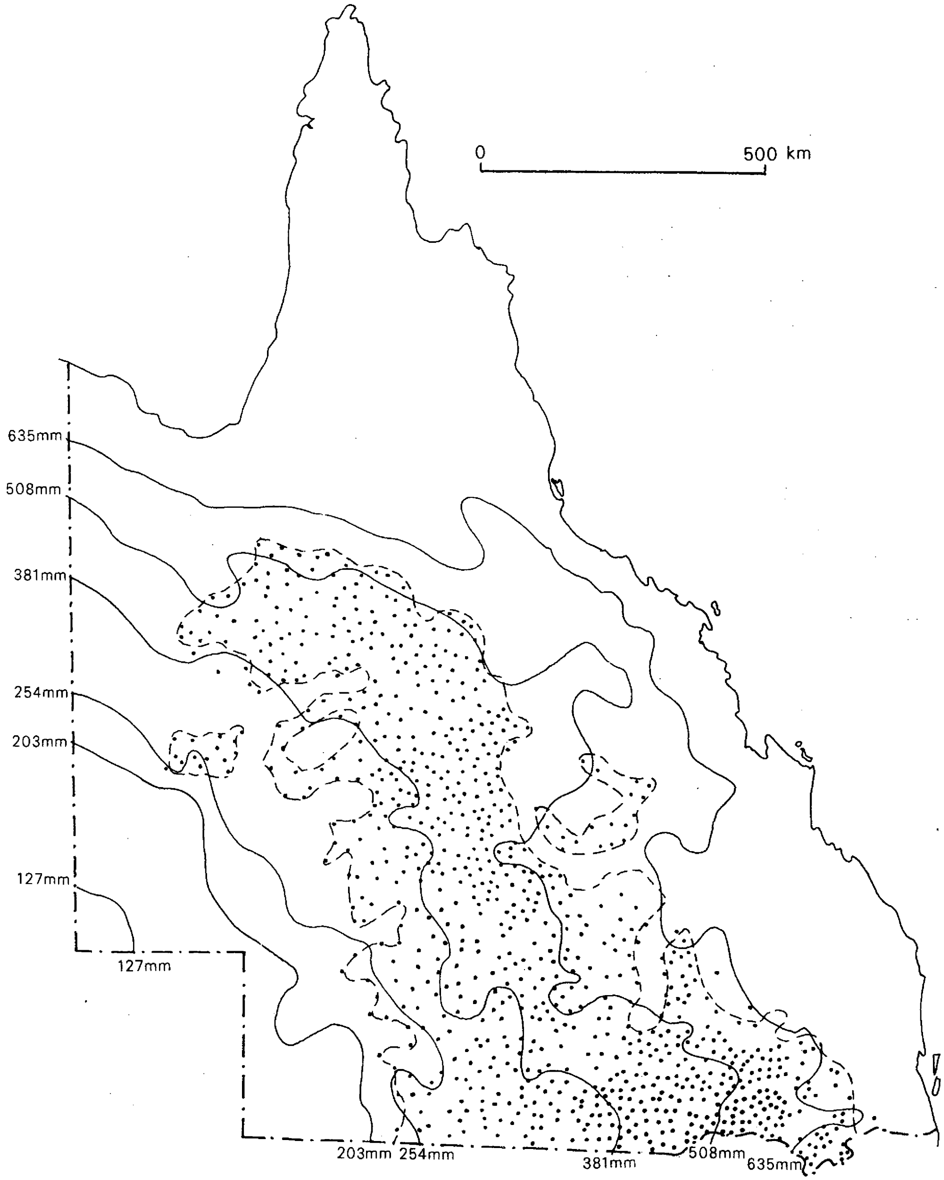
[1]Skerman, 1958:89

[2]Davidson, 1954:46-59

[3]Davies, Scott and Kennedy, 1938:127-42

Map 5
Major Sheep and Wool Raising Districts of Queensland



• One dote represents 20,000 sheep

Selective grazing by sheep probably offsets this general inadequacy to a certain extent, and it is known that Merino sheep reduce their maintenance requirements as the plane of nutrition falls, and there is thus some adaptation to the local environment. There may also be a vitamin A deficiency in old Mitchell grass pastures. Many deficiencies in a gramineous diet can be made up by browsing "top-feed," the deeper-rooted trees and shrubs having the ability to withstand dry periods much longer than ground vegetation, and they can also draw on deeper soil supplies of nutrients. Unfortunately, much of the Mitchell grass country is devoid of "top-feed" except for limited forage from the mimosa bush (*Acacia farnesiana*) along bore drains and scattered young trees of boree, whitewood or gidyea. These trees, however, along with the coolibah (*Eucalyptus microtheca*) fringing the water courses, do provide shade for rams during joining.[1]

The general picture of a Mitchell grass pasture, then, is one of an almost complete sward made up of tussocks of Mitchell grass between which annual grasses and herbs flourish in the normal summer monsoonal season. As a result of selective grazing or by effluxion of time, the annuals disappear, leaving the Mitchell grass tussocks as standing hay from about April onwards. As the drier winter and spring periods progress, the Mitchell grass is gradually grazed down, and if the dry season is prolonged, the grazing pressure increases until only the stubble of the tussocks remains, with practically no feed available. In the vicinity of watering places, the tussocks might disappear altogether. From about April the Mitchell grass provides less than a maintenance ration, and a fodder drought period is set in train. In the absence of rain, severe drought can develop quickly, particularly as the warmer spring weather approaches, followed by intense summer heat waves.[2] The effects of such droughts on the pastoral industry can scarcely be conveyed by words or statistics, but those noted below may give some indication of the scale of such disasters.

In the three months ending September 1884, 13,000 head of cattle were lost on *Mt Cornish*, *Bowen Downs* lost 65,000 sheep and Australia's total sheep loss for the year was 15 million.[3] In 1885 *Kilcummin*, at Clermont, lost 40,000, in 1889

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[1]Moule, 1950:29-37

[2]Skerman, 1956:105-8

[3]Macmillan, 1963:37

another 40,000 and in 1893 the losses were reported to be 98,000.[1] Bennett has described the situation at the turn of the century in the following terms:

> By the middle of '99 trains were running day and night transferring nearly a million sheep from the great stations beyond Winton to the eastern tablelands....
>
> The suffering and loss were the result of unprecedented drought coming after a succession of years of diminishing rainfall, and not of overstocking; indeed no *bona fide* grazier would have dared to stock up the Government's new estimate to two sheep to three acres.... '99 closed without the thunderstorms for which people looked - surely relief must come in the New Year! But January passed without rain; a rainless February was succeeded by a rainless March, and the time for the wet season had gone by....Mount Emu way, where sheep had been sent twelve months ago, thousands of skins taken from the sheep which first succumbed remained stacked by the road, for scarcity of grass and water prevented sending for them; and contrasting with these first effects of the drought, when sheep died in the wool and their skins were worth saving, were now seen the bodies of hundreds of shorn animals that had dropped in their tracks returning from relief country. Mount Cornish, that fine cattle station that had run 30-40,000 head of cattle, had lost all but a fraction of the herd, and Bowen Downs had to send to Lammermoor for fifty bullocks to eat....
>
> The country along Tower Hill creek and from Torren's Creek to Richmond was nothing but a desert (1901)...
>
> On many stations the end had come and contracts were let for plucking wool off dead sheep....

Australia-wide sheep losses from three of the most serious droughts were:

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[1]Casey, 1966:82-9
[2]Bennett, 1927:219-44

1891-1902	53 million	50 per cent of nation's total
1910-1915	25 "	25 " " " " "
1941-1946	29 "	23 " " " " "

The sequence of droughts has continued to the present day. On 2 December 1965 it was reported:

> ...a staggering Queensland drought toll of seven million sheep worth £14 million is forecast for 1965-66 by a survey just completed by the United Graziers' Association.[1]

Droughts have recently been researched in some detail by several authors in Lovett's book *The Environmental, Economic and Social Significance of Drought*.[2]

The search for a drought fodder Faced with the virtual certainty that they will experience at least one major drought in their active lifetime, it is not surprising that ever since settlement began the problem of providing fodder when natural pastures have deteriorated has exercised the minds of pastoralists. At the turn of the century a station manager in the Channel Country of Western Queensland cut and conserved the lush annual pastures from a small area after a flood, put it into a brick silo and successfully fed it to bulls the following year.

In March 1929 N.A.R. Pollock, the Northern Instructor in Agriculture in the QDAS, wrote of "...increased interest... being displayed in the matter of growing fodders in the Western Country."[3] No properties were mentioned and no further information as to whether the crops were ensiled was reported. It indicated, however, that he was interested in such development. In the November issue of the same journal, however, it was reported that Pollock, in company with Professor Prescott (Waite Institute, Adelaide), H.J.C. Hines (University of Queensland) and W.R. Winks, Chemical Laboratory, QDAS, examined the soils of the north-western rolling downs. The report stated: "At 'Colane' near Winton, sudan grass (*Sorghum sudanense*) germinating after a fall of rain in April had given excellent results, being cut for hay and grazed by sheep during several months."[4]

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[1] *Courier-Mail*, 2.12.65

[2] Lovett, 1973:318pp.

[3] *QAJ*, 31:249

[4] *ibid.*, 32:527

In June 1936 the *Journal* published photographs of sorghum and sudan grass being cut for conservation as hay on *Coreena*, Barcaldine.[1] These crops were grown under irrigation from bore water. Irrigation of small areas of sudan grass and lucerne with surface water from the Longreach water hole for feeding local livestock was reported by the author in October 1947.[2] The difficulty of getting water to soak into these heavy grey clays was stressed. Mr D.J. O'Dea purchased *Tiree*, Torrens Creek, in 1945 and started experiments with rain-fed cropping in 1947. Sorghum, sudan grass, wheat and oats were tried with some success.

The entry of the Queensland-British Food Corporation into the farming picture in the Central Highlands in 1948 apparently caused at least one north-western grazier to think of extending cropping farther west:

> The Peak Downs venture has got everyone thinking - and talking....Country under Mitchell and Flinders grass averages about half a ton per acre; under sorghum it should grow anything up to 50 tons per acre, probably averaging 20 tons. A ton of fodder would feed three sheep a year without any natural grass. A selector running 5,000 sheep could produce all the fodder necessary to feed them for 12 months by cultivating 100 acres of his land. Whatever the outlay might be, it is safe to say it would be infinitely cheaper than bought fodder, and provision against drought that way would be better than sacrificing sheep at any old price, then buying in again at probably £3 per head, and often enough it cannot be done at any figure.[3]

In 1951 Anning bought some machinery for grain sorghum growing but sold it after drought and the long growing season required for grain sorghum defeated the venture.

As wool prices climbed to record heights in the 1950s graziers in central and north-west Queensland found themselves better able financially to undertake measures to

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[1]*QAJ*, 1936:600-01

[2]Skerman, 1947

[3]Harry Anning, *Queensland Country Life*, 26.6.49

improve their basis for drought mitigation. One of these was John Kelman who, with two brothers and a cousin, moved from Moree, New South Wales, to the Richmond district, in 1938; he himself took up *Dundee*. With his background of farming experience he started ploughing his Mitchell grass downs in the 1952 drought and planted his first crop of sorghum in 1953. He grazed the crop because he did not have suitable machinery to conserve it. In 1954, 200 ha were sown to fodder crops - 7 ha to *Sorghum almum*, 10 ha to sudan grass and the remainder to saccaline and Sweet Italian fodder sorghums. Grasshoppers affected the crop, but during March he was able to ensile some 2,000 t of silage in trenches cut into the heavy clay soil of the rolling downs, at a cost estimated at $3/t. He estimated he could get a crop in three years out of five.[1] Maize grain, an alternative drought fodder, was then costing $88.13/t plus $11.56¢ cartage.

Meanwhile A.C. McClymont, of *Inverness*, Muttaburra, had grown a crop of sudan grass and ensiled it in trenches in 1953, the first grazier to conserve silage in this area. He estimated that he had 600 t in storage. Mr G.R. Moule, then Director of Sheep Husbandry in the Department of Agriculture and Stock, undertook a sheep feeding trial at *Inverness* in mid-1953, using the sudan grass silage McClymont had made. His conclusions were:

(1) the value of silage has been amply demonstrated under conditions harsher than those of normal drought feeding;

(2) feeding at a rate in excess of 1.4 kg per head per day is not warranted;

(3) the silage needed the addition of small quantities of protein-rich supplement and/or some such material as Calphos;

(4) 0.9 kg of silage plus a supplement looks a suitable level for maintenance through a drought, and lambing on the higher level of 1.4 kg silage plus supplement looks a possibility.[2]

These observations showed that silage could be successfully used for drought feeding of sheep, and indicated that it

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[1]*Queensland Country Life*, 13.5.54

[2]Moule, 1953:1-2

could probably be used also in feeding for production. A second trial to check whether the ewes could be lambed on silage showed that a better ration was needed, and 2.3 kg of silage plus 112 g of protein meal proved adequate.

Meanwhile A.R. Bird, a post-graduate student in the Faculty of Agriculture, University of Queensland, undertook a research programme to determine the causes of fluctuating sheep numbers in the Charleville district of western Queensland. He showed that recurring drought was the single most important factor in such variation.[1] In April 1953 the author was appointed to the staff of the Department of Agriculture, University of Queensland, to undertake, amongst other duties, a study of drought mitigation measures throughout western Queensland wool growing areas.

A Wool Research Advisory Committee was set up at the University under the Chairmanship of Professor T.K. Ewer,[2] the other members being Professor L.J.H. Teakle,[3] P.J. Skerman,[3] G.R. Moule,[4] V.J. Wagner[4] and E.C. Muir.[5] At a meeting on 31 July 1953 it was decided that research should be instituted:

> to determine the possibility of introducing crops and the improvement of pasture utilisation as means of minimising drought losses in sheep. It was decided that this work should include a study of summer and winter crops, moisture conservation and the use of various implements such as the basin lister, seeding practices and storage methods.[6]

It was also decided to work beyond the areas now under cultivation and to give attention chiefly to heavy textured country where moisture retention is such that reserves may be stored to meet a considerable proportion of the crop's requirements. The brigalow country was suggested as a suitable locality, but Messrs Moule and Wagner successfully moved that research should move further west, beyond the

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[1] Bird, 1953:43-85

[2] Professor of Veterinary Science, University of Queensland

[3] Department of Agriculture, University of Queensland

[4] QDAS

[5] Queensland Lands Department

[6] Wool Research Advisory Committee Minutes, 31.7.53

Plate IV: Fodder sorghum crops at *Terrick Terrick* merino sheep stud, Blackall, 1958. The crop on the left was grown on land bare fallowed for 18 months. The crop on the right was grown on land bare fallowed for 6 months to which 483 kg/ha of sulphate of ammonia was added at planting.

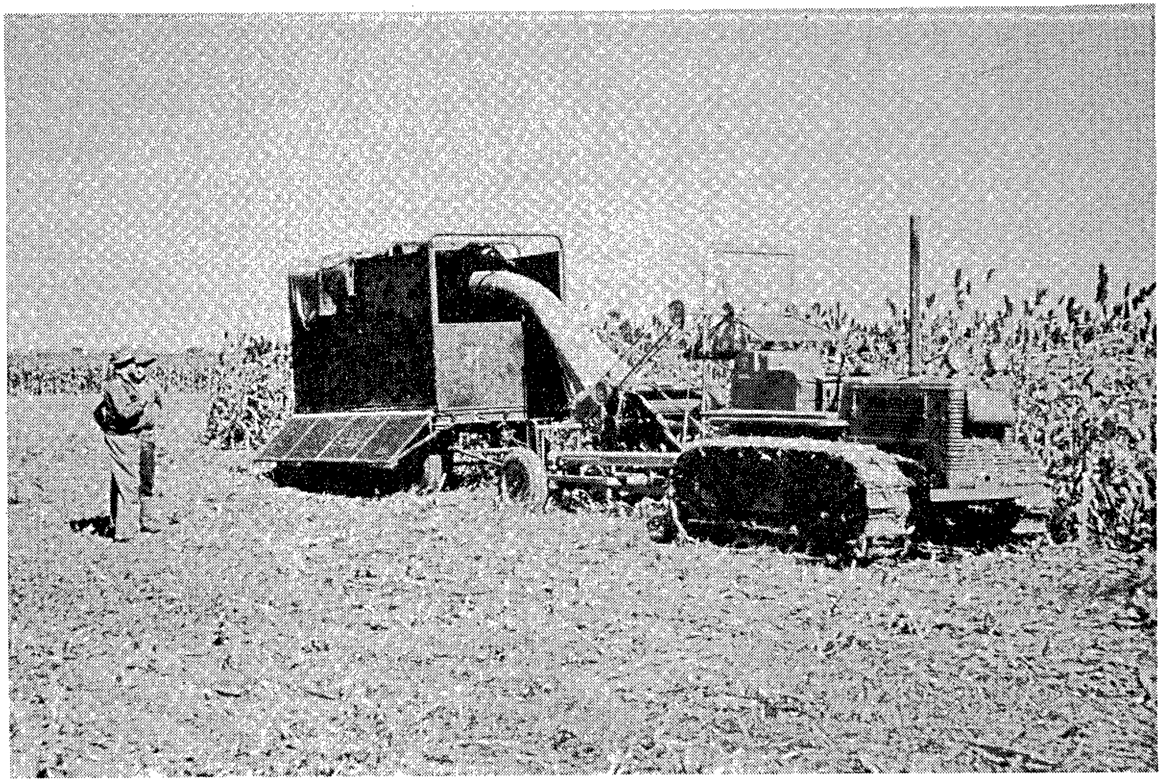
areas then being researched by QDAS. It was decided to arrange for experiments on suitable properties between Charleville and Richmond. Further, it was suggested that *Gowrie* (Charleville), *Terrick Terrick* and *Isis Downs* (Blackall), *Inverness* (Muttaburra) and *Dundee* (Richmond) should be inspected as suitable sites.

Accordingly, in September 1953, the author visited A.C. McClymont, of *Inverness*, and O.W. Smith, of *Gowrie*. Both agreed to co-operate in agronomy trials, and did so wholeheartedly for the next nine years. In 1955 trials were initiated at *Terrick Terrick*, the Australian Estates stud at Blackall, where M.G. Murdoch gave willing support, although continuously engaged in a large stud Merino breeding programme. Short term trials were conducted at John Kelman's *Dundee* in 1955, and at J. Stewart-Moore's *Telemon*, near Marathon, in 1958. The first trials at *Gowrie* were planted on 5 January 1954, and those at *Inverness* on 24 February of the same year. The planting at *Inverness* took place between 7 pm and 9 pm, using tractor headlights, to take advantage of an impending storm. Results of these trials will be discussed later.

The spread of interest in cropping for silage was rapid. Wool prices were good, there was a generous 20 per cent per annum tax rebate on the purchase of farm machinery, and with the initial success of Messrs Kelman and McClymont, others were keen to engage in cultivation. At this time there were no QDAS agricultural advisers in central Queensland west of Emerald. There was a good deal of grazier to grazier contact, to see and discuss cropping, and the author, at the request of individual graziers, or through QDAS Sheep and Wool advisers, visited many properties, often using privately-owned light aircraft supplied by graziers.

In May 1955 field days were conducted by the University, in conjunction with G.R. Moule, QDAS, at *Gowrie*, *Inverness* and *Terrick Terrick*, attracting a total of 280 graziers, wool brokers and livestock agents; at the latter property the machinery, trial plots and silage trenches were major interests (Plates IV and V). The following year two more field days were held, one at *Dundee* and the other at *Gowrie*; 180 people were attracted. Attendances of this sort indicate the interest generated in the experiments.

The distribution of cropping in western Queensland Mitchell grass downs in January 1959 is shown on Map 4 (p. 72). The extent of the impact in western Queensland can be gauged from the figures for silage production



<u>Plate V</u>: Harvesting a crop of fodder sorghum for ensilage, *Terrick* stud, Blackall 1955. Equipment consists of a crawler type tractor, forage harvester-chopper, and self-tipping trailer.

in Queensland recorded by the Government Statistician (Table 19). The height of interest and production was reached in the 1955-57 period, when the western graziers conserved half the State's total volume of silage. The interest was short-lived, extending over five years, and since then only one or two graziers have adopted the practice.

Sheep feeding with sorghum silage It was necessary to establish that sorghum silage would be a satisfactory feed for starving sheep. In addition to the feeding trials instituted at *Inverness* by G.R. Moule in 1954, Professor T.K. Ewer undertook some trials at *Terrick Terrick* Flock station at Blackall in 1958. He found the silage being made and fed to sheep in western Queensland contained 4.9 per cent crude protein of low digestibility, so that the sheep were in negative nitrogen balance. The silage was also high in silica. He fed silage in conjunction with the non-protein nitrogen compounds ammonia, ammonium sulphate, ammonium nitrate and urea, and with protein meal, using silage alone as a control. Palatability and crude protein digestibility were improved by additions of ammonium sulphate, ammonium nitrate and protein meal. Urea and ammonia solutions made the silage unpalatable. However, a complete mineral supplement resulted in a pronounced improvement in the utilization of nitrogen and of crude fibre. The control group sheep were very weak at the end of the period.[1]

In 1958 Skerman and Wynn fed four groups of *Terrick* Merino ewe weaners for twelve weeks, in paddocks of droughted Mitchell grass stubble having a crude protein content of 0.31 per cent, with a ration of 1.9 kg/head/day of sorghum silage of crude protein content of 4.5 per cent plus:

Group 1 - 56 g of poona cowpea grain (26 per cent crude protein)

Group 2 - 56 g sheep nuts (17 per cent crude protein); and

Group 3 - 28 g of lucerne hay plus 28 g sheep nuts respectively.

Group 4 - 2 kg silage plus 15 g of a bone flour-salt mixture.

All groups were in good condition when rain fell after twelve weeks and wool production from the cowpea-supplemented group significantly out-yielded that from the other

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[1]Ewer and Robins, 1958:52-8

TABLE 19

Silage Production - Queensland 1952-76*

Year	Total Queensland Tonnes	Western Divisions	
		Tonnes	Per cent of Total
1952-53	13,038	574	4.4
1953-54	18,846	3,217	17.1
1954-55	25,206	7,195	28.5
1955-56	36,333	18,763	51.9
1956-57	73,230	35,643	48.6
1957-58	42,112	12,878	30.6
1958-59	74,688	3,166	4.2
1959-60	61,211	2,523	4.1
1960-61	52,120	1,934	3.7
1961-62	75,167	2,221	2.9
1962-63	64,632	2,041	3.2
1963-64	54,117	2,778	5.1
1964-65	35,059	1,954	5.3
1965-66	43,658	-	drought
1966-67	32,469	1,293	3.9
1967-68	36,890	62	trace
1968-69	18,549	509	2.7
1969-70	58,429	438	0.75
1970-71	127,233	46	(drought) trace
1971-72	78,352	56	trace
1972-73	50,546	nil	-
1973-74	47,719	500	1.0
1974-75	36,641	450	1.2
1975-76	27,273	nil	-

*Government Statistician figures

protein-supplemented groups, and all gave better wool production than the group which received silage with only a mineral supplement.[1]

Many graziers reported on their experience with sorghum silage feeding and all expressed general satisfaction, especially with its advantages as a drought reserve (see Appendix IV, p.157).

When the sorghum crop was insufficiently grown to be converted into silage it was invariably grazed by sheep or cattle. Some areas of sudan grass were grown with the express purpose of grazing. The possession of cultivation and planting machinery led some graziers to try a winter crop of oats when seasonal conditions were suitable. Hence in addition to the silage conserved a considerable increase in the production of green fodder eventuated. The area used for green fodder for the three western divisions each year from 1951 to 1971 inclusive are given in Table 20.

TABLE 20

Area Devoted to Green Fodder in Western Queensland 1951-71

Year	Central West Division (ha)	North West Division (ha)	Far West Division (ha)
1951-52	1,369	305	nil
1954-55	3,675	1,848	646
1959-60	24,201	1,421	472
1964-65	59,294	115	344
1970-71	66,439	88	5

Source: Qld Govt Statistician

Some properties such as *Isis Downs*, Blackall, did not undertake ensilage, but concentrated on hay from oats and cowpeas. They took off some cowpea grain, and undertook grazing on sorghum and cowpeas, on which the stock did very well. During 1958 and 1959 W.H. Rich of *Boorara*, Yalleroi, grazed a mixture of sudan grass and poona cowpeas with cattle, with very good results; he also had some success with oats in winter

[1]Skerman and Wynn, 1960:59-62

The experience with grazing the sorghum crops which did not come to sufficient maturity for silage, as well as the grazing of stubble and regrowth, was generally very encouraging (see Appendix V). A further benefit from the cultivation, especially in the case of *Terrick Terrick*, was its elimination, particularly near the homestead and yards, of feathertop wire grass (*Aristida latifolia*), which was a nuisance causing grass seed trouble in the wool, especially of the stud rams which were kept handy to the homestead.

Research Each new development in agriculture should be preceded by adequate research. However, graziers had already begun cropping. The silage era in western Queensland was accompanied by a research programme initiated by the author at the University of Queensland and funded by donations from graziers, pastoral companies, the University and later by the Commonwealth Wool Research Fund. It was initiated following the work of A.R. Bird at Charleville,[1] and stimulated by the prior entry of graziers into the cropping scene in the north and central west of Queensland. Post-graduate students at the University undertook much of the research as part of their training for higher degrees. The research took many forms - studies of soils, soil moisture and fallowing, species trials with sorghum and other crops, time of cutting for silage, silage quality and feeding trials. There were also practical field trials with machinery. A brief summary of some of the findings follows.

1. Soils The main soils of the area under discussion are grey and brown soils of heavy texture[2] derived from sedimentary material, having a thickness above the parent material varying from 80-135 cm. They are self-mulching clays, with abundant soft lime in the profile to 50 cm, which gives way to crystalline gypsum below this depth. The clay content of the solum is from 45-55 per cent. The available phosphorous varies from about 75-200 ppm in the surface soil, but may reach over 1,000 ppm in the parent material. Sodium may be present in a high proportion of the exchangeable cations at a depth of 90-120 cm. Nitrogen was limiting.[3]

2. Fallowing and soil moisture use Bare fallowing of the heavy black clays of the Darling Downs increases nitrate

[1]Bird, 1953:43-85

[2]Stephens, 1953:38

[3]Skerman, 1958:10

nitrogen production and soil moisture storage. Trials at *Inverness* indicated similar behaviour in these heavy grey-brown clays. The nitrate nitrogen increased from 4 ppm on 12 February 1954 to 22 ppm in the surface 15 cm of soil on 21 September 1954 under bare fallowing,[1] and 21.25 cm of available soil moisture equivalent of rainfall was stored in the 120 cm soil profile. Sorghum roots during ten weeks growth in this soil penetrated to a depth of 125 cm with a lateral spread of 45 cm.[2]

A long bare fallow for 18 months at *Terrick Terrick* produced a crop of 45.05 t/ha of sorghum, whilst a companion plot given a short fallow and treated with 483 kg/ha of sulphate of ammonia produced a crop of 43.27 t/ha, indicating that the value of the bare fallow at that time was equivalent to the application of 493 kg/ha of sulphate of ammonia.[3]

3. Use of nitrogen fertilizers Following on the above trials a nitrogen fertilizer trial was laid out at *Dundee*. A small increase in yield from nitrogen application was shown, but in these areas of unreliable rainfall the application of nitrogen is only likely to give significant increases in yield where rainfall is plentiful, or irrigation possible.[4]

4. Sorghum varieties All the sweet sorghum varieties out-yielded sudan grass, but there was little difference between the individual varieties. Varieties with differing maturation times should rather be selected to stagger the harvesting period, to ease the pressure on machinery and labour, and for medium height and heavy yield to ensure ease of harvest with the present types of forage harvester.

5. Quality of silage The average crude protein content of the sorghum silage made on several western Queensland properties was 4.5 per cent. For production, a protein content of about 8 per cent is desirable. Trials were made to improve protein content by combining sorghum with a legume such as cowpea (*Vigna unguiculata*) in the field, cutting and ensiling the crops together. Mixing 2 ha of cowpea with 1 ha of sorghum increased the silage protein to 8.1 per cent,

[1] Skerman, 1958:110

[2] *ibid*., p.111

[3] *ibid*., p.115

[4] *ibid*., p.118

but overall per hectare yield was decreased and it presented problems in harvesting. Laboratory trials comparing sorghum cut at different ages of the crop in relation to moisture content, crude protein yield and losses in ensilage gave the following figures[1] (Table 21). The four and six weeks harvest produced silage of poor quality. Hence sorghum harvested at eight weeks would give the desired protein content at a yield loss of 34 t/ha from the twelve weeks figure.

The grazier therefore had a choice of seeking a high weight of silage and supplementing the ration with concentrates, or accepting a lower yield of better quality silage. Silage from sorghum shred-harvested by a hammer-type harvester invariably contained soil flicked from the surface mulch and was neglected by sheep.

6. Silage losses From the laboratory tests by Catchpoole it can be seen that total losses in ensiling were 14 per cent for material of ten weeks of age.[2] Field losses would be higher, but with care in excavation and trimming of the earth trench, the compaction of the material in the trench, and adequate cover of soil with the necessary rain-shedding camber, losses could normally be contained to below 20 per cent of the ensiled material.

The excavation of the material from the trench for feeding posed several problems for graziers. The topography of the downs country did not lend itself to hillside trenches where end-loaders could gouge the material out from ground level to eliminate losses by contamination with soil. Bulldozers, rear-end- and front-end-loaders were used to gather the silage, often with large losses. One mechanical continuous "Trensilage" excavator was imported a few years after the start of the silage era, but it needed a level base from which to work. Many graziers were frustrated by this loss.

The estimate of stored silage also caused some disillusionment. The author excavated a trench at *Dundee*, and weighed 0.029 m^3 (one cubic foot) of sorghum silage to record a weight of 17.3 kg. One grazier stated he had overestimated his storage by a factor of three, another that he had recovered only 60 per cent of his silage. In the former case the original trenches were only 3.66 m wide, instead of the usual 6.4 m for a 100 t trench, and proportionate losses were greater.

[1] Catchpoole, 1962:103

[2] *ibid.*

TABLE 21

Moisture and Protein Contents, Yields of Crop, and Losses During Ensilage at Different Crop Age

Age of Crop (weeks)	Moisture wet weight (%)	Crude Protein dry weight (%)	Yield of Crop t/ha (%)	Losses during Ensilage		
				Total original weight (%)	Effluent Loss original weight (%)	Crude Protein loss per cent original Crude Protein
4	80.8	17.2	7.89	63	56	43
6	82.9	12.6	36.14	57	53	21
8	82.7	9.1	56.75	42	34	16
10	80.5	6.7	87.29	14	11	10
12	78.3	4.8	91.62	4	1	7
14	73.5	5.4	77.62	-	0	-
16	71.9	5.1	79.91	4	0	4

Source: Catchpoole, 1962:103

7. The cost of conserved silage Many estimates of the cost of conserved silage were published and they all fell within the range of $3.05 to $6.10/t on the property during the 1954-64 period. This constituted quite a cheap source of roughage. One grazier sold his property in late 1957, placing a value of $8.13/t on his silage in underground trenches.

8. Other crops Some thirty-six grain legumes were tried in this environment to see if a grain legume could be grown to supplement the silage. Few were suitable, the most promising being mung bean (*Vigna radiata*) and lab-lab bean (*Lab-lab purpureus*) but the frequency of a grain crop was low. Lucerne planted at 1.1 kg/ha in rows two metres apart persisted for three years, in deep soil under rain-fed conditions when the establishment moisture was good.

9. Cessation of University agronomy research With staff problems caused by study leave commitments, additional lectures, the absence of a field research station, allied with the cut in air traffic to western Queensland when low wool prices forced graziers to make less frequent or cheaper business visits, the University Wool Research programme in agronomy ceased in 1963. The Australian Estates Company very generously donated the sum of $20,000 towards establishing a field station on Council reserve land at Blackall, and the Blackall Shire Council was agreeable. However, it was considered by University authorities to be too far removed for University surveillance and too costly to support for the likely benefits for post-graduate research, and the money was utilized for the Sir Stanley Colman Laboratory at the University's Mt Cotton farm. Meanwhile, the Department of Primary Industries had established the Charleville Pastoral Laboratory to handle south-western Queensland research, while a little agronomic research was carried out at Toorak Field Station, Julia Creek, and later at the Richmond Station Water Research Project.

Some problems encountered with the fodder conservation programme

1. Integration of cropping of sorghum for silage with station management The cropping of sorghum and its subsequent harvest for ensiling demands some skilled labour, apart from station management. However, skilled labour was often difficult to obtain and station personnel were called upon to assist with the cropping and ensilage

procedures.[1] Many properties undertake sheep shearing in February-March ahead of the ripening of native pasture seeds which detach at maturity and adhere to the wool, thus reducing its value. Again summer is a common period for fly strike by sheep blowflies and this calls for jetting or the Mules operation. Flooding is also common in later summer and sheep have to be moved to high ground or pulled out of boggy ground. Several properties reported this conflict of interests in characteristic fashion:

> Haven't done a tap of other work than sheep handling since July.[2]
>
> A man has to be grazier, farmer and shearer.[3]
>
> I really haven't got time to handle feeding trials for a while.[4]
>
> Fly strike and shifting 300 head of cattle to Charleville interfered with harvesting.[5]
>
> Cropping coincides with shearing in February.[6]
>
> Too busy with other work to look after farming.[7]
>
> We found we just could not give the time to cropping, as it required attention at the same time as other more urgently needed work.[8]

2. Increasing labour costs The Station Hand's Award for Queensland on 1 February 1954 was set at $23.00 per week. The award rose to $24.40 in April 1956; to $26.50 in February 1959; to $28.50 in January 1961; and $32.65 in March

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[1]Weston, 1971:622

[2]*Inverness*, Muttaburra, 8.10.55

[3]*Kilterry*, Nelia, 21.7.56

[4]*Inverness*, 15.12.57

[5]*Macfarlane Downs*, Tambo, 13.6.59

[6]*Maneroo*, Longreach, 28.7.61

[7]*Gladevale*, Maxwelton, 17.4.77

[8]*Navena*, Blackall, 18.4.77

1965. Many of the graziers who undertook cropping complained not only of the increasing labour costs, but also of the declining efficiency of labour. By this time most of the graziers had ceased cropping. When good seasons occurred again the wage structure had worsened, the award rising rapidly to $44.45 in February 1973; $101.42 in February 1976 and to $115.47 in April 1977. Consequently cropping has virtually ceased in western Queensland, and few graziers can afford to employ station labour.

3. Decline in wool prices Cropping in western Queensland was made possible to graziers when the high wool prices of the early 1950s enabled them to buy the necessary machinery. At the time a depreciation allowance for taxation purposes was granted at 20 per cent a year, so that machinery could be written off after five years. However, after five years of high wool prices, in 1958-59 wool declined appreciably in value (Table 22), and once the machinery initially purchased had been written off, money for replacement was hard to find. In this way declining wool prices had a major effect on the cessation of cropping.

4. Frequency of cropping It was recognized from the start that cropping frequency would be low in an area of semi-arid rainfall with 35-40 per cent variability, and that opportunity cropping in years of good rainfall or of adequate stored soil moisture would be the basis of the system. Estimates of two to three crops in five years were made and confirmed by graziers early in the period. It is interesting that at *Warringah*, Blackall, between 1961 and 1977, John Kemp had actually obtained two crops in five years on the average. Calculations made by officers of the Division of Land Research and Regional Survey, CSIRO,[1] based on models of water use and methods of estimating evaporation, gave crops grown in the Richmond area during a growing season of over eight weeks a 28 per cent chance. In addition to such crops for silage, useful grazing can be obtained from some crops which do not reach this stage. This infrequency of cropping, and especially the additional cultivation required to maintain bare fallows, which was seldom practised, caused some graziers to abandon the system.

The initial three years (1954-56) of cropping coincided with over-average rainfall and stimulated cropping, but thereafter seasons tended to be more normal until 1965, when rainfall dropped below average for from six to eight years.

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[1]Slatyer, 1964:98-9

TABLE 22

Prices of Type 72 AB Wool, Wool Statistical Areas 6 and 12 (Western Queensland) sold at Brisbane

Season	Real Price Greasy 72 AB ¢/kg	Season	Real Price Greasy 72 AB ¢/kg
1953-54	282.5	1964-65	142.2
1954-55	229.5	1965-66	130.2
1955-56	183.8	1966-67	120.4
1956-57	241.2	1967-68	103.4
1957-58	198.0	1968-69	105.8
1958-59	156.1	1969-70	102.4
1959-60	164.4	1970-71	65.2
1960-61	147.8	1971-72	71.5
1961-62	154.6	1972-73	168.8
1962-63	170.8	1973-74	143.2
1963-64	182.2		

Source: BAE

5. Crop yields The author estimated that the yields in the first year may be of the order of 7.5 to 12.75 t/ha, but should improve to 17.8 t on the average and, on well-prepared land under good conditions, 25 to 35 t should not be unusual.[1] Under the fallow experiment at Muttaburra a yield of 45 t/ha was achieved, but the field experience over many properties was a yield of 10 to 15 t/ha.

6. Land valuation In not a few cases the state Valuer-General's Department made an unpopular contribution to the cropping scene by contending that improvements made to fencing, water supply and the like proved the cropping potential of the land and hence justified an increase in valuation. Sometimes the increases were substantial and the farmers quite naturally felt that such action constituted a penalty for their pioneering efforts. No doubt this factor weighed against continued cropping, particularly when a run of poor seasons occurred.

[1]Skerman, *Queensland Country Life*, 8.4.54

7. Grasshoppers Grasshoppers caused serious damage to some crops. On 13 March 1954 *Wetherby*, Richmond, reported that 16 ha of sudan grass was badly hit by grasshoppers, but had come again. Another grasshopper plague was recorded on this property in February 1968. A similar attack occurred on *Dundee*. In February 1954 grasshoppers wiped out two successive sowings of sudan grass and were damaging a replanted crop of saccaline fodder sorghum; they were still bad in May 1954. A poona cowpea crop was eaten off at *Inverness* by grasshoppers in February-March 1954, as were all legumes at *Granada*, Cloncurry in 1960. At this time only a few graziers were growing sorghum and so crop damage was confined. The species of grasshopper involved was the plague locust *Chortoicetes terminifera*.[1]

8. Rats Rat plagues cause periodic damage to crops and pastures in central and north-west Queensland. A particularly serious one occurred in 1956. Of the several graziers who wrote of the problem, two from the Richmond district used these words:

> I much regret to state that my sorghum crop was a complete failure owing to the rats. I had 200 acres under cultivation and I estimate that I got about 20 tons off the lot. I was a little late starting to harvest owing to the fact that I was held up for machinery, and by the time that I started to harvest the rats had taken about two-thirds of the crop. You could not imagine the amount of crop that they took off in the short space of time.[2]
>
> The rats harvested most of my crop. We only filled a small pit about 100 tons. There was only 100 acres in the crop I harvested and rats must have taken at least four-fifths of it. In the beginning of May, I sowed about 70 acres more and got quite a good strike, but there is no sign of it now - they haven't left a stalk.[3]

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[1] Skerman, 1958:129

[2] G. Facer, *Albion Downs:* personal communication

[3] K. Kelman, *Essex Downs:* personal communication

Dr G.M. Dunnet of CSIRO Wildlife Section, Canberra, visited the area and identified the plague rats as *Rattus villosissimus*. In September 1956 Dr McKerras found that the rats were succumbing to a fungus, *Borellia* sp.[1]

9. Feral pigs The feral pig population has been building up over the years in western and indeed over most of Queensland. Reports of pig damage to sorghum crops were received from *Dundee*, in June 1956, and intermittently from *Wetherby*, Richmond, and *Terrick Terrick*.

10. Kangaroos Kangaroos posed a minor threat to the sorghum crops, but in 1957 they destroyed a small area of experimental plots at *Inverness*.

11. Bird attack Birds such as galah parrots (*Kakatoe roseicapilla*), corella parrots (*Kakatoe sanguinea*) and brolgas (*Grus rubicundus*) readily attack the sorghum grain in the head.[2] The sweet or fodder sorghum grain usually has high tannin which is unpalatable to birds up to the hard dough stage, at which stage the crop is cut for ensiling. Occasionally wet weather, or large areas to harvest, caused some of this grain to ripen, which lowered the tannin content and severe loss of grain occurred from bird attack.

Grain sorghums are lower in tannin and are particularly vulnerable to bird damage. This is why sorghum was grown for silage rather than grain in Queensland University trials. Where grain sorghum was grown reports of severe bird attack came from *Isis Downs*, Isisford, and *Nulgara*, McKinlay, where brolgas were a problem in 1975.

12. Weeds In wet seasons it was difficult to work machinery on the grey and brown soils of heavy texture and fallows were often overgrown with local weed and some annual grass species. This necessitated an extra cultivation or another ploughing if weeds were too far advanced. A compromise machine, a "king-seeder," with seed box mounted on a disc cultivator, allowed planting as the weeds were turned over, but germination was often uneven, and the loose surface soil quickly dried out.

The main perennial weeds to give trouble in cultivations were *Polymeria longifolia* and *Teucrium integrifolium*, both

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[1]Skerman, 1958:128-9

[2]*ibid*., p.129

rhizomatous species. They were difficult to destroy by cultivation, and where they occurred the sorghum was stunted and did not flower. At *Clarendon*, Blackall, on two occasions *Polymeria longifolia* was attacked by an epiphytotic of an unidentified rust fungus which severely affected its growth. This weed also affected crops in the Central Highlands where Hart found that Hormex sprays, at a strength of 0.2 per cent solution at 454 litres/ha, were effective when sprayed about mid-day on hot summer days, on plants at the pre-flowering stage of growth.[1]

13. Frost In general the area is relatively frost free. At *Kilterry*, Nelia, a frost in 1959 spoilt the sorghum crop, and a frost in 1956 affected a crop at *Home Creek*, Barcaldine; both were subsequently grazed. The general absence of frosts allowed the sorghum crop to recommence growth in the original crop, or from stubble, on a number of occasions when soil moisture was restored by subsequent rain. This is an important feature of the sorghum crop.[2]

Decline of Sorghum Conservation

The problems enumerated above combined to cause a cessation of sorghum as silage in western Queensland except for an occasional property. One station owner successfully operates a silage conservation programme at Blackall, in conjunction with a lucerne and grain sorghum venture at Stanthorpe; another is operated in conjunction with a Central Highlands' property. Others sold out and moved to better farming areas.

Probably the main causes of cessation of interest were:

(1) decline in wool prices after 1958;

(2) high cost and inefficiency of labour;

(3) difficulty in integrating cropping with station management;

(4) low frequency of cropping because of variable rainfall;

(5) high cost of fallowing;

(6) difficulty of excavation and feeding of silage;

(7) high losses in storage and excavation;

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[1] Hart, 1951:28-9

[2] Whiteman and Wilson, 1965:233-9

(8) low protein content of silage and low yield per hectare of sorghum.[1]

The Aftermath

The aftermath of the cropping of the Mitchell grass downs has not been specifically investigated but comments from two of the graziers are pertinent:

> *Terrick Terrick*, Blackall
> Paddocks once ploughed for sorghum are producing pastures superior to the open Mitchell grass country. Areas ploughed for sorghum in the 60's contain a wide variety of herbage and other good sheep feed.[2]
>
> *Home Creek*, Barcaldine
> [The paddocks are] now back to good grass and edible weeds.[3]

Research Needs

Long term research at a field station such as the DPI station at Toorak, Julia Creek is needed to check the long term performance of cropping under rain-fed conditions. Problems of land preparation, length and efficiency of fallowing, crop establishment, legume-sorghum mixtures, sorghum breeding to produce varieties more suited to the environment, storage and excavation of silage need to be investigated. The present economic environment does not call for urgency in this research but it is anticipated that opportunity cropping will one day creep farther west than the recognized agricultural areas of today.

The Richmond Shallow Storage Research Project

Following the general decline, in the 1950s and early 1960s in central and north-west Queensland, of dryland cropping for fodder conservation as silage as a means of drought mitigation, E.J. Weston, the agrostologist of the DPI then stationed at the Toorak Field Station, Julia Creek, gave thought to introducing irrigation of crops, in a small way for alleviation of drought losses. He had seen one or two graziers irrigating successfully from natural and artificial sources of supplies where these were available, and examined

[1]BAE, 1964:36-7

[2]*Queensland Country Life*, Merino Annual, 21.4.77:19

[3]*Queensland Country Life*, 13.4.77

the incidence of run-off from local catchments during the normal summer monsoonal period. He found that the incidence of storm rains likely to produce run-off was about 70 per cent or seven years in ten.[1] He argued that if the frequency of success of an agricultural system could be matched to the incidence of run-off, a suitable storage and irrigation system could greatly improve the chances of successful cropping.

North-western Queensland is an area experiencing high temperatures and excessive evaporation. Mean maximum temperatures remain higher than 35°C from October to March, which is also the rainy season, and the annual evaporation from a free water surface increases from 2800 mm in the east to 4000 mm in the western areas of the region. Consequently there is an immediate and continuing loss of stored water from the open surface and no satisfactory anti-evaporants have been developed. Sites for the storage of large bodies of water in the north-western open downs country are practically non-existent, and stream gradients are so low that creeks consist mainly of a series of interlocking channels rather than as a well defined water course. Under such conditions siltation and re-direction of channels usually accompanies attempts to build large-scale storage.

Shallow water storage Weston therefore decided to survey the possibilities of using the water soon after storage to minimize losses by evaporation, and to construct shallow and thus cheap storage dams to collect local run-off. He felt that sufficient suitable sites would be found to make a significant contribution of irrigated fodder for drought amelioration.[2]

Choosing a stream with a gradient of 1:1,000 located about 2 km from the Richmond railway station, he constructed a storage dam with a capacity of 400 Ml (340 ac ft or 100 million gallons). The earth wall, built from 12,000 m^3 of clay, is 600 m long and has a maximum height of 3.3 m. The ponded area is 70 ha and has a maximum depth of 2.1 m. The cost in 1967 was $3,000 (Plate VI).

The volume of water lost by evaporation is extremely high. Loss of the top 0.69 m (2 ft) of water to evaporation and seepage amounts to approximately 285 Ml. The remaining 163 Ml of useable water still represents a storage ratio of 15:1,

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[1]Weston, 1972:115-6

[2]*ibid.*, p.116

Plate VI: The Richmond Shallow Water Research Project dam near O'Connell Creek with adjacent cultivation irrigated from it.
DPI Photograph

which is highly favourable. The average daily evaporation (mms) from a free water surface for Toorak Field Station, at Julia Creek (the nearest records) are as follows:

January	120	July	62
February	110	August	72
March	92	September	90
April	92	October	115
May	70	November	125
June	60	December	117

Thus it is important to use the stored water as soon after storage as it is needed by the crops to be irrigated. For the same reason short season summer crops will fit into the scheme better than winter crops, as run-off from summer storms will fill the storage. As a further bonus the saturated soil zone beneath the ponded water can provide additional "irrigated" land as the water level recedes. This system has been used for years by cultivators along the banks of the Nile in Egypt. Weston adopted this practice to provide a succession of crops extending well into the winter.[1]

Research A capacity curve, determined after surveying the ponded area of the dam, was used to calculate the quantity of water in the dam at different depths. For the Richmond Shallow Storage dam the figures were:

Storage volume		440 Ml
Evaporation losses (0.69 m depth)	285 Ml leaving	155 Ml
Evaporation loss during irrigatioon and barrow pit water	31 Ml leaving	124 Ml

One irrigation at the rate of 1.7 Ml per hectare handles 73 ha.[2]

In 1968 the dam at the Shallow Storage Research Project at Richmond, filled and by-washed for three days following a storm of 75 mm in four hours over the catchment, which was already wet from a previous rain. Since when full the dam contains sufficient water for one irrigation only over the 70 ha area, its use should take place when it can achieve maximum benefit. Brinsmead and others have shown that an

[1]Weston, 1972:118-9

[2]*ibid.*, p.116

irrigation at flowering has a major effect in increasing grain yield if moisture is deficient.[1] Brolga grain sorghum was planted five to ten days after the rain which filled the dam. Furrow irrigation of the crop was begun two weeks before its theoretical flowering date, which was fifty-two days after germination. At this stage the plants were beginning to show moisture stress because no follow-up rain fell. Good grain heads developed and grain yield estimates were from 2.5 to 5.0 t/ha. Storage characteristics of the dam were as predicted.

1. Moisture for germination Soil moisture determinations, carried out daily on the brown soil of heavy texture in the Richmond area at depths of 2.5, 5.0, 7.5 and 10 cm following planting rains, revealed that wilting point was reached in the surface 2.5 cms three days after rain. That at 5.0, 7.5 and 10 cm reached wilting point after thirteen, twenty-one and twenty-three days after rain respectively. During this period surface soil temperatures of 50°C were not uncommon.[2] Following 157.25 mm of planting rain, only 60.75 mm (39 per cent) was stored as available soil moisture for cropping in rough-ploughed soil. The remainder was lost through evaporation and run-off. The 250 mm held in the upper 10 cm of soil is not included in the above, since within six days of planting this depth of surface soil had dried out below wilting point.

Germination percentages of Brolga grain sorghum declined rapidly from 39 per cent for the first day of planting to 0.9 per cent for the fourth and final day of planting. Planting commenced five days after rain, as soon as it was possible for machinery to work the land. However, by the fourth day of planting (ninth day after rain) soil moisture in the surface 5 cm had reached wilting point.

Clewett deduced three conclusions from these investigations:

(a) planting must proceed rapidly as soon as possible after rain;

(b) an improvement in equipment is necessary which ensures moist soil is pressed firmly around the seed;

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[1]Brinsmead, 1966:7.58-7.60

[2]Weston, 1969:80

(c) the efficiency of storing soil moisture for crop growth from planting rains is very low due to high evaporation rates in this semi-arid environment and slow infiltration rates into these grey and brown soils of heavy texture.[1]

2. Run-off Run-off from a catchment depends on the catchment condition and antecedent rainfall, as well as the nature of the current rainfall initiating the run-off. The grey and brown soils of heavy texture in the open downs country in central and north-west Queensland crack extensively when dry, and these cracks must be sealed before run-off commences. The vegetation varies over the years from bare ground, through tussock grassland of Mitchell grass (*Astrebla* spp.), to almost a complete sward, for in a good rainfall year annual grasses and forbs will occupy the ground between the Mitchell grass tussocks. Consequently the variation in run-off is extreme.

In five of the six years to 1973 the average run-off from the catchment of the Richmond Shallow Storage Research Project dam was 41 mm.[2] Nine years run-off data and long term rainfall records led Clewett to suggest the following run-off frequencies over a period of fifty-seven years:

no run-off	26% or 15 years
1-10 mm	14% or 8 years
10-20 mm	21% or 12 years
20-40 mm	18% or 10 years
more than 40 mm	21% or 12 years

(Source: Clewett, 1975a:3)

A series of rainfall sequences in 1971 produced run-off equal to four times the volume of the dam and removed 5,000 m^3 of soil by erosion from the by-wash return slope. Subsequently the by-wash was resited and a drop inlet constructed, the top of which was sited 30 cm below the by-wash level. The function of the drop inlet is to hold a large volume of flood water in temporary storage.[3] Extreme run-off in 1974 totalled fifteen times the storage capacity, which caused the dam to collapse. The January run-off alone

[1]Clewett, 1970a:98

[2]Clewett and Rickman, 1973:74

[3]Anon., 1975:2

was 381 mm resulting from 636 mm of rainfall, which was six times the January average. The dam was rebuilt at a cost of $6,000.

The run-off data suggest that the project's 400 Ml dam is generally the right size for its 1,660 ha Mitchell grass catchment. To fill the dam 25 mm run-off is required. Clewett suggests the best economic philosophy is to construct cheap dams and rebuild them when broken.[1]

3. Water-use efficiency In the situation at Richmond, where land is not a limiting factor, water use efficiency is measured in terms of yield per unit of water originally harvested, rather than yield per hectare or yield per unit of water applied. In the 1970 trial irrigation of grain sorghum at both head emergence and at the grain filling stage gave the highest yield (1.20 t/ha), but a single irrigation at head emergence gave the highest water use efficiency (0.48 t/Ml of water harvested).[2] In 1972 the most efficient water use resulted from a single irrigation, just prior to flowering, with hybrid De Kalb E57 at a population of 150,000 plants/ha.[3]

The 1973 trials showed that the most efficient water use was a single irrigation at seed filling, and that the dam was potentially capable of irrigating over 100 ha and producing 356 t of grain using this irrigation strategy. The December 1974 to April 1975 cropping season received the abnormally high rainfall of 714 mm, and summer crops could be grown without irrigation. When wheat was tested for water use efficiency in 1971 it gave the best figure when irrigated to germinate and at forty days to promote secondary root development, producing 0.316 kg grain per m^3 of water. A similar result was obtained in 1972 with a single irrigation forty-two days after planting. Although multiple irrigations gave higher yields, the lower yield from the single irrigation was more than compensated for by the increased area of land irrigated.[4]

In April 1975 Gamut wheat returned the highest water use efficiency when irrigated once twenty-eight days after planting but the yield was not significantly affected by delaying

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[1]Clewett, 1974:71

[2]*ibid.*, 1970b:99

[3]Clewett and Rickman, 1972a:76

[4]*ibid.*, 1972b:77

this single irrigation till forty-five and sixty-three days after planting.[1]

4. Grain sorghum varieties and yields Several grain sorghum varieties were tested covering those with different growing periods. The early flowering varieties, which require less water, allow a greater area to be irrigated than those which mature late. Mini Milo, flowering at thirty days, Pacific 007 at fifty days and De Kalb E57 proved the best in their respective maturity groups. E57 has proved to be the best all round variety at the Richmond Shallow Storage Research Project. The highest grain yield obtained during the research period was 3,653 kg/ha.

5. Grain sorghum establishment and nutrition Difficulty was experienced in getting an adequate plant stand in the field. Harrowing with planting doubled the germination. Germination decreased from 75 per cent when planted on the first day possible after rain to 26 per cent on day eleven. Rolling after planting increased germination by only 5.6 per cent. Neither water injection down the planting shoe nor a "moisture-seeker" boot increased establishment. It is obvious that plant establishment in these heavy self-mulching soils is a major problem requiring further research. Other problems included losses from lodging, birds, rats, feral pigs and grasshoppers.

Grain sorghum has not responded to nitrogen up to 200 kg N/ha nor phosphorous up to 48 kg P/ha, even on land cropped for four years.

There was no evidence of a reduction in yield as plant population increased from 114,000 to 150,000 plants per hectare.[2]

6. Cropping on the ponded area Cropping on the area provided by the initial filling of the dam, and subsequently exposed as the water receded, was carried out for the duration of the project. In the Richmond area such cropping would normally take place by planting in the months of March to June, later than normal planting times for summer crops, but satisfactory for winter crops for establishment. The almost complete absence of follow-up rain in the winter months prevented secondary root development in the winter cereals.

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[1]Clewett, 1975b:56

[2]*ibid.*, 1975c:9

Experiments were conducted on the ponded area from 1968 until 1975. Forage sorghums have proved to be the most productive crops (Plate VII) and yields reached 12,000 kg/ha of dry matter from early planting in 1968. These sorghums also proved quite successful when sown in May, producing up to 3,500 kg/ha dry matter, but production decreased as the planting dates progressed. The major problem was declining yields in successive years on the ponded area. Additions of nitrogen fertilizer produced only a slight increase in yield and there was no response to sulphur or zinc.[1] In pot tests at the University of Queensland responses in barley grown in soils from the ponded area were shown to applications of nitrogen and phosphorous, with marginal effects from sulphur and manganese.[2] Tests with physical characteristics of the soil revealed adverse effects from flooding and the passage of machinery during planting, which produced compaction of the soil. More research is needed to solve this problem.

The enforced winter planting for the grain sorghums sown resulted in stunting, very late flowering, small heads and few grains, as a result of the cool growing conditions, and later plantings were affected by heat waves. Wheat, oats, barley, safflower, sunflower, rape, turnips and lab-lab bean performed well on occasions and helped diversify the cropping.

7. <u>Utilization of the fodder grown in shallow storage systems</u> The fodder grown in these systems in the Mitchell grass downs areas could only be used for the feeding of special classes of livestock, as the volume produced would never be sufficient to handle a whole livestock enterprise. However, the feeding of selected livestock is of special importance in the continuity of breeding systems, ensuring the survival of rams and bulls and the female breeders which can be the nucleus for a renewed flock following drought.

In the local sheep industry such fodder could be used for rams and young ewes. An area of 32 ha of grain sorghum yielding 2,000 kg/ha of grain could carry 4,000 sheep through a two month period. The feeding of grain from late in the gestation period until maximum lactation has been established, three to five weeks after lambing, would appear to give maximum efficiency of use. The water could also be

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[1]Clewett, 1975d:13

[2]*ibid.*

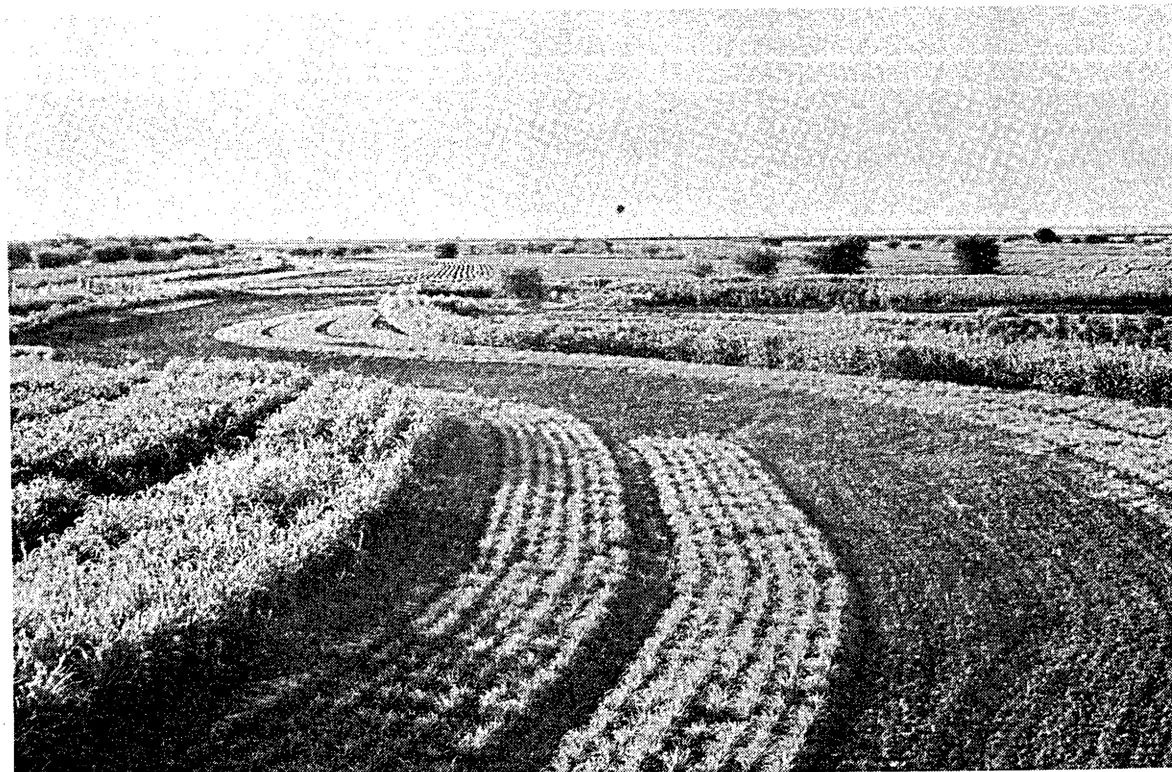

Plate VII: Successive crops of sorghum growing on the receding waters of the ponded area, Richmond Shallow Storage Research Project.
DPI Photograph

used to grow shade (and fodder) trees which could improve lamb marking percentages some 10 to 15 per cent on these shadeless and exceedingly hot open downs.[1]

The local beef cattle industry could also benefit from such fodder for saving the nucleus of a herd. The forage produced from the pondage area becomes available during July to October, and this is a period of feed stress and of higher beef cattle prices, because of scarcity of killing quality cattle. Small mobs of forward store cattle could be finished on such grazing. Daily live weight gains of 0.42 to 0.56 kg/day have been recorded on such grazing. Baling of suitable material for hay or conversion to silage could make this fodder available at other times of the year.[2]

8. The economics of irrigation from shallow water storage in north-west Queensland This aspect of production has been studied by Wegener and Weston.[3] Their conclusions were:

- the possibility for irrigated grain sorghum production in north-western Queensland pastoral areas has been evaluated for sheep production;
- for an initial investment of $18,550, even under the poorest yield and crop production assumptions, production of 1,000 t of grain in ten years is possible;
- the cost of producing this grain in 1973 ranged from $12.84/t, when eight crops in ten years are expected, and yields average 5.0 t/ha, to $26.84/t when only five crops in ten years are grown and the yield from the irrigated area averages 2.5 t/ha. Yield from the ponded areas in each instance has been assumed to be 2.5 t/ha;
- the break-even cost of grain sorghum used to enable a change from spring to autumn joining, and promote an increase in the lambing percentage, has been assessed at $17.84/t if a 10 per cent improvement (from 40 per cent

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[1]Hopkins, 1975:15-6

[2]Smith, 1975:17-9

[3]Wegener and Weston, 1973:199

to 50 per cent) in the lambing rate is assumed, along with a change in autumn joining;

- the cost of grain sorghum produced under irrigation from a shallow water storage project would, under the yield and cost assumptions made, be much less than the alternative method of purchasing grain at approximately $40/t from traditional producing areas and freighting this to north-western Queensland.

The future The future of such shallow water storage schemes depends mainly on the economics of the venture. Within this economic curtain will be the willingness of graziers to undertake the construction and maintenance of the dam, as well as to grow the crops suitable for the particular area. The availability and skill of the labour force, the cost of necessary machinery and the liability of losing the crops to pests such as feral pigs, grasshoppers, rats, galahs, corellas and brolgas will all need consideration. Tax deductions for such developmental improvements will also play a part, as will the availability and cost of agistment. The future will really be determined by its adoption or rejection by the grazing community. In the present economic climate little response can be expected.

Revegetation of Mine Tailings at Mt Isa Mines, Queensland

The processing of lead, zinc and copper ores by Mt Isa Mines Limited produces large quantities of concentrator tailings waste which is pumped as a slurry to special dams where the solids are allowed to settle and dry out. These areas are unattractive and show no signs of encroachment by plant life, even though the surfaces of some dams have remained undisturbed for more than a decade.[1] In the late 1960s Mt Isa Mines Limited decided to investigate the possibilities of artificially revegetating these waste areas. The staff dug holes throughout the denuded areas, filled them with river loam and planted a random selection of grasses, shrubs and trees. All these plants died, even though they were watered and well cared for.

The company then approached the Department of Agriculture, University of Queensland, for help and the Senior Lecturer in Agriculture, Dr P.C. Whiteman, undertook a preliminary

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[1] Ruschena, Stacey, Hunter and Whiteman, 1974:16

research programme as a research training exercise with post-graduate students. In 1969 they established a species trial for planting in the summer of 1969-70. The plot was disc ploughed to a depth of 150 mm and a basal fertilizer mixture applied to overcome normal nutrient deficiencies. A range of plant species selected for high dry matter production were planted and the area flood irrigated. Although the species germinated successfully, they soon died. Sorghum (*Sorghum bicolor*), pea bush (*Sesbania benthamiana*) and vetch (*Vicia sativa*) survived for three months. Lucerne (*Medicago sativa*) succumbed early.

It was obvious that the tailings environment was an extremely inhospitable medium for plant growth, and detailed research was needed to isolate the factors inhibiting plant establishment and growth. Commencing in March 1970, the company entered into a three year research programme with the University of Queensland, to modify the environment so that selected species of plants might be found to adapt to these rigorous conditions. The objectives of the investigation were to stabilize the surface, reducing the dust movement, and to improve the aesthetic environment.

The composition of tailings from No. 3 dam, and of fly ash, are given in Table 23. These analyses showed that the processed rock materials which constituted the tailings were high in soluble and insoluble salts, high in copper, lead and zinc, extremely deficient in nitrogen and phosphorous, had high bulk density and surface compaction. The problem of growing plants in such a substratum, in areas where high summer temperatures prevailed and with an average annual rainfall of only 350 mm, was a major one.

Laboratory tests showed that power station fly ash greatly improved the physical condition of the tailings material when incorporated into the surface, reducing bulk density and surface compaction and allowing improved leaching of soluble salts.[1] Pot trials showed a response to the application of phosphorous up to 130 kg/ha, and of nitrogen up to 216 kg/ha. Evaluation of the tailings materials showed that copper and lead smelter slags were toxic to plant growth, but that fly ash was highly beneficial.

The first field trial based on the results of the pot trials was commenced in May 1971, to evaluate two organic mulch materials, bagasse refuse from sugar cane mills, and

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[1]Whiteman and Hunter, 1972:36

TABLE 23

Composition of Tailings from No. 3 Dam, Mt Isa Mines

	Tailings No. 3 Dam	Fly Ash
Phosphoric acid (ppm P)	4.42	99.00
Phosphorous bicarbonate (ppm P)	5.50	32.50
Organic carbon (% C)	1.69	1.38
Nitrate nitrogen (ppm N)	7.25	0.60
pH (1:5 water)	7.57	7.96
Conductivity (m mhos/cm)	5.25	1.95
Chloride (ppm Cl)	397.00	4.00
Sodium (ppm Na)	363.00	10.00
Potassium (ppm K)	156.00	10.00
Calcium (ppm Ca)	12,000.00	360.00
Magnesium (ppm Mg)	4,800.00	40.00
Iron (ppm Fe)	35.50	75.00
Copper (ppm Cu)	74.50	1.95
Manganese (ppm Mn)	46.17	5.00
Zinc (ppm Zn)	80.83	2.25
Boron soluble (ppm B)	-	2.40

Source: Ruschena, Stacey, Hunter and Whiteman, 1974

oaten straw. Basal fertilizer applied consisted of superphosphate at 2,000 kg and ammonium nitrate at 400 kg/ha. The trial area was irrigated when the necessity was indicated by tensiometer readings. The plant species used for the winter sowing in July were oats (*Avena sativa*) and vetch (*Vicia sativa*). Vetch grew well under the winter conditions and outyielded the oats. Growth was better in the pots mulched with organic materials than on the bare tailings. Sorghum (*Sorghum bicolor* var. Texas 610) was sown as the summer species in September. Growth of the sorghum was also greatly improved by mulching, especially in the straw mulch, but it was obvious that major limitations to plant growth still existed.

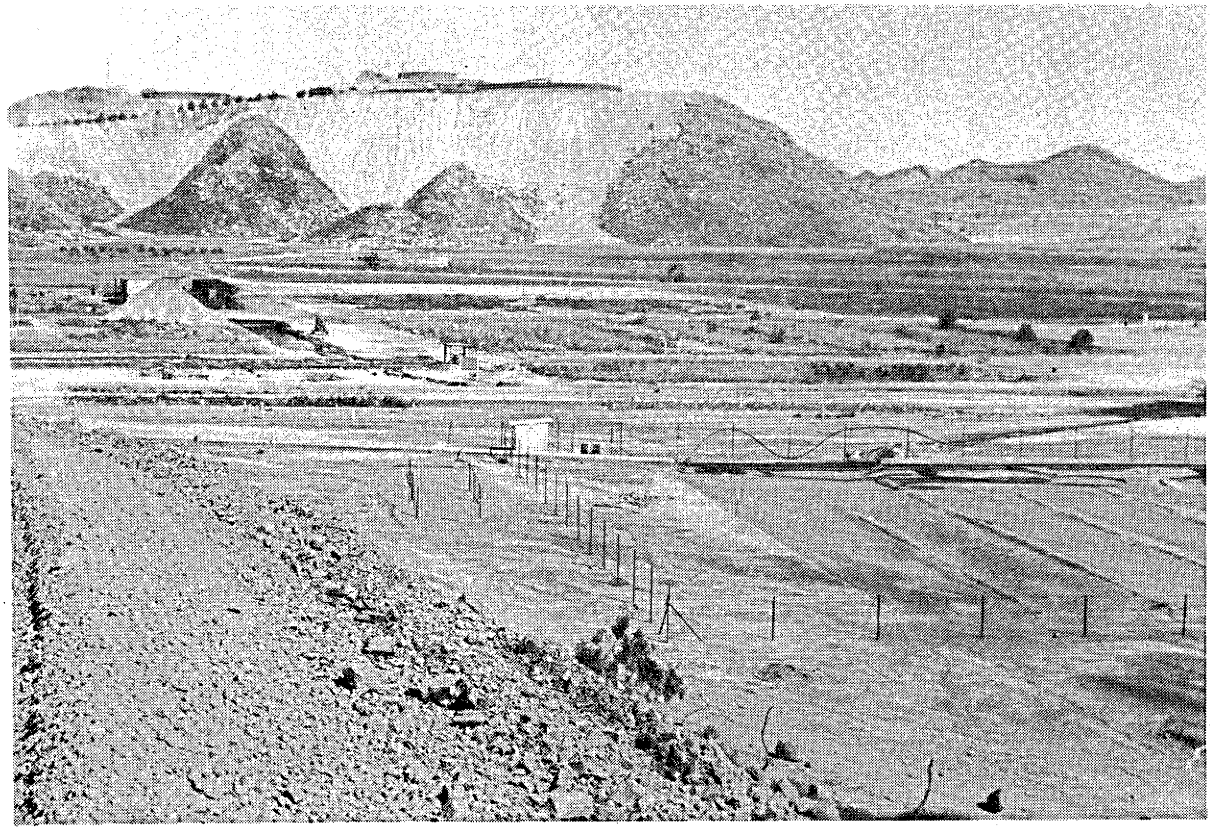

Plate VIII: General view of field trials in progress on No. 3 Tailings Dam.
Mt Isa Mines Photograph

In the last quarter of 1971 small scale field trials with amendments including reverberating furnace slag, organic residue from sewerage works, straw mulch and fly ash were sown to several species of plants and irrigated by orchard spray (Plate VIII). The results confirmed the beneficial effect of incorporating fly ash into the surface of the tailings material, and indicated that rhodes grass (*Chloris gayana*), buffel grass (*Cenchrus ciliaris*), river couch (*Cynodon dactylon*) and pea bush (*Sesbania benthamiana*) were the most promising species, while siratro (*Macroptilium atropurpureum*) had survived and made some growth.

In 1972 a field trial was laid down to evaluate further the straw and fly ash amendments in the presence of different fertilizers. Of the winter species cereal rye (*Secale cereale*) gave the highest yields and the ameliorating effect of fly ash was clearly shown. Other species used were vetch and wimmera rye grass (*Lolium rigidum*).

During 1973 an extensive native species seed collection was made around Mt Isa and these were sown. Promising species included *Sesbania benthamiana*, *Salsola kali*, *Polycarpea glabra*, *Amaranthus interruptus*, *Gomphrena brownii*, *Chrysopogon fallax*, and *Clitoria ternatea*. At present, however, rhodes grass (*Chloris gayana*) appears to be the best prospect, and research is continuing.

General Conclusions

The Central Highlands region is marginal for cropping under dry farming conditions, but agronomic research and the results from growers' experience and their dissemination by extension methods are gradually improving cropping performance. The open downs country farther west must be regarded at best only as an area for opportunity cropping, using dry farming techniques when soil moisture reserves from a succession of good seasons are such that a useful forage or fodder crop will result from planting; and when the economic condition of the current land use practice warrants the venture. Such situations will be few, and only those graziers with sufficient cultivation machinery already on their properties are likely to engage in it.

New cultivation areas will continue to be opened up in the Central Highlands, especially in the brigalow lands, as the demand for world food increases and farming bears an economic advantage either in association with, or apart from, stock raising. Urbanization and soil erosion are gradually diminishing existing world cultivation areas. It is important that adequate resource surveys and farm planning should precede the plough, to ensure that topographic and soil conditions can be modified to conserve the soil whilst at the same time bringing the land into production. Recognition of the part that existing forests play in soil protection, wildlife conservation, timber resources and recreation must play an integral part in land use decisions.

Irrigation of the suitable soils of both the Central Highlands and the central and western Queensland regions is physically and agronomically feasible, provided the economics of the venture are satisfactory, and water of suitable quality is available. High evaporation from the water surface is a major loss in above-ground open storages, and research should continue into ways of mitigating this loss in such areas of uncertain rainfall. Where State and Federal finance is limited, it is likely that irrigation projects in areas of better cropping potential will receive precedence.

It is reasonable that the Irrigation Commission could relax regulations concerning the use of artesian water of suitable quality for *temporary* irrigation in times of severe drought, to save at least the nucleus of breeding stock, especially in the stud herds. Perhaps a seasonal licence to irrigate would best serve this end, with sponsorship from the local agricultural and animal husbandry officers of the State Department of Primary Industries, acting in conjunction with an Irrigation Department Officer. It would mean extra staffing for the Irrigation Department.

Continuing long-term research into all aspects of soil and water use, water supplies, soil-water relations, adaptability of crop, pasture and plant species for soil conservation, browse and timber, animal breeding and nutrition and mechanization must be funded at a level which will give satisfactory answers within a time schedule to meet likely expansion of cultivation into these more arid environments. It will need to include studies on the environmental impact of such developments, and its social consequences. The major research effort, however, will still be needed to focus on higher productivity from existing areas of crop production.

APPENDIX I

BUREAU OF INVESTIGATION

Report on the Possibilities of Expansion of Grain Sorghum and Peanut Growing

In accordance with a direction from the Deputy Chairman the following notes are submitted with regard to possible areas for expanding production of grain sorghum and peanuts in Queensland.

GRAIN SORGHUM

Climatic requirements:

Warm, moist conditions for germination and growth, with cool relatively dry conditions for ripening and harvesting.

Soil requirements:

Fertile soil with sufficient water-holding capacity to grow the crop under rainfall alone.

Likely limiting factors in Queensland:

(a) heat wave in January, combined with (b);
(b) drought;
(c) heavy midge attack in some years;
(d) heavy smut infestation - controlled by seed dusting before planting;
(e) early frosts may occasionally damage crops.

Suitable areas:

(1) Darling Downs - Given assurance of an adequate and profitable market expansion of production will be automatic in this area. This will be possible because -

(a) wheat machinery will handle the sorghum crop and hence no extra capital overhead;

(b) soldier settlement land around Dalby, Bowenville, Jondaryan and Wandoan-Taroom, when thrown open will be planted to the crop;

(c) with an assured market maize, and millet and sudan grass areas will probably decrease in favour of grain sorghum.

(2) Burnett - Here the expansion will not be so extensive, as peanuts will probably tend to increase at the expense of other crops.

(3) Dawson Valley and Callide - Some expansion will take place here especially on the open black soil downs which will not require clearing. A January heatwave will often reduce yields in this area.

(4) Central West - (Emerald, Capella, Clermont) - Some expansion will take place here on the open downs where clearing is not necessary and where sorghum is one of the few crops which could be grown. Expansion here will depend on either share farming or graziers producing sorghum along with meat or wool. The district is in the marginal area for crop production and dependence on grain sorghum alone will be inadvisable. Brigalow areas cannot be brought into production throughout the Taroom, Springsure, Emerald, Theodore areas until clearing takes place and the recognised practice is to ring and allow the trees to stand for five years before burning. Hence production from the brigalow areas is not likely to expand suddenly. Quicker means of destruction of brigalow will inevitably lead to heavy suckering unless experiments reveal more satisfactory methods of treatment than are available at present.

(5) Southern Border - (Inglewood, Texas, Goondiwindi) - Brigalow scrub areas and the flood plains of the Dumaresq and Macintyre rivers will yield satisfactory crops in most years and some expansion is possible here unless ousted by tobacco and other irrigated crops.

(6) Maranoa - Some westward expansion from the Darling Downs is probable where the heavy soils of good fertility are encountered.

Other areas:

(7) The Gulf Country - The report of Whitehouse, Atherton and Johnson indicated that grain sorghum production would be worth a trial on the downs country in the wet belt. The trouble with this country is that

the onset of the wet season is often sudden with little preliminary rain to allow for land preparation. Hence land may not be ready for the crop and in some years rainfall is so continuous that the crop could not be planted because machinery could not be driven on the land.

(8) South-west - (Dirranbandi, St George) - Some crops could be grown here in most years on the heavy flood plains of the Balonne although the summer rainfall in this belt is not excessive and a below average rainfall would be detrimental to the crop. Attack by birds, especially galahs, may be serious.

PEANUTS

Climatic requirements:

Warm, moist conditions for germination and growth, with relatively cool and moderately dry conditions for ripening and harvesting. Queensland rainfall type is generally suitable for peanut production.

Soil requirements:

A fertile, friable, well drained soil is necessary for the best growth of nuts. Sandy soils will generally require fertiliser treatment and may dry out excessively. Heavier soils tend towards root rots and poor penetration of nuts. Where the heavy rainfalls are encountered during the growing period it is absolutely essential to have good drainage.

Likely limitations under Queensland conditions:

(a) labour for harvesting;
(b) drought;
(c) wet harvesting conditions;
(d) depletion of soil productivity by continuous cropping;
(e) relatively infertile soils in some areas.

Suitable areas:

(1) Burnett - This area at present produces over ninety per cent of the State's peanut crop. Some expansion is indicated here at the expense of maize and dairying, but rotational cropping will have to be introduced and extended to protect soil structure and productivity.

(2) Atherton Tableland - Considerable expansion has already taken place this year and more can be expected in the future at the expense of maize production and dairying.

(3) Mareeba-Dimbulah - Expansion in these areas is not likely to be extensive as the amount of suitable land is limited and present crops utilise residual fertiliser from tobacco crops. Without this practice fertiliser application would appear necessary and may be uneconomical.

(4) Gayndah - (Binjour Plateau) - There is room for some expansion on the Binjour-Gurgeena plateaux beyond Gayndah where red volcanic soil of suitable quality is already producing crops.

(5) Mt Larcom - Expansion of the crop is under way in this area. The soils here, although red, are not the true red volcanic and are less fertile than the volcanic soils of Kingaroy.

(6) Yarraman - Expansion is taking place here on red volcanic soil and should continue. Erosion will have to be watched.

(7) Barmoya and Rossmoya at Rockhampton - Some expansion is possible here.

Suggested new areas:

(8) The sugar district especially -
(a) Burdekin delta;
(b) Bundaberg red volcanics;
(c) Childers red volcanics;
(d) Kolan and Elliott Rivers alluvials.
Production in these areas would be dependent upon harvesting the crop in May and June prior to the sugar crushing in July-December. This would provide early seasonal work for the cane cutters, but an arrangement regarding harvesting awards would probably be required. In the Burdekin area the growing season for peanuts may be prolonged and this would require checking.

(9) Areas adjacent to Kingaroy -
(a) Blackbutt;
(b) Cooyar;
(c) Crow's Nest to Toowoomba;
(d) Oakey, Peranga, Acland, Quinalow, Moola;
(e) Nanango.

There are areas of suitable red forest soils and softwood scrub soils in these regions which would be suitable for nut production.

(10) The sandy alluvials of Buaraba Creek in the Northern Section of the Lockyer Valley and perhaps some of the Blenheim scrub soils.

(11) The tomato areas at Bowen where alternate crops are sought.

(12) The McIvor and Endeavour River areas at Cooktown.

(13) The alluvial soils of the Dumaresq at Texas.

(14) The sandy alluvials at St George fronting the Balonne.

(15) The red volcanic pockets of Biggenden-Coalstoun Lakes.

(16) Buderim, Maroochy River, Redland Bay - other crops generally more remunerative.

Other areas which have been mentioned -

(17) Charters Towers - The soil here is a red granitic undulating type. It is not considered very favourable due to fertiliser requirement and liability to erosion.

(18) Coastal tea-tree plains - too infertile to warrant cultivation.

Expansion of both crops is dependent upon an assured market for the products at better than Australian cost of production.

(sgd) P.J. SKERMAN.

Agricultural Resources Officer
2nd January, 1948.

APPENDIX II

Average Yields per Hectare for Grain Sorghum and Wheat
Central Highlands 1945-46 to 1974-75 inclusive

GRAIN SORGHUM Season	t/ha	WHEAT Season	t/ha
1945-46	0.05	1945	0.47
1946-47	1.00	1946	nil
1947-48	0.67	1947	0.56
1948-49	1.65	1948	0.05
1949-50	1.22	1949	0.01
1950-51	0.45	1950	0.50
1951-52	0.38	1951	nil
1952-53	1.17	1952	0.84
1953-54	1.20	1953	0.24
1954-55	0.87	1954	1.26
1955-56	1.30	1955	0.82
1956-57	1.36	1956	1.33
1957-58	1.59	1957	1.05
1958-59	1.48	1958	0.95
1959-60	1.44	1959	1.23
1960-61	1.99	1960	0.63
1961-62	1.44	1961	0.44
1962-63	1.22	1962	0.95
1963-64	0.75	1963	0.77
1964-65	0.56	1964	0.50
1965-66	0.97	1965	0.67
1966-67	0.60	1966	1.14
1967-68	1.61	1967	0.95
1968-69	0.45	1968	1.42
1969-70	0.97	1969	0.19
1970-71	1.84	1970	0.05
1971-72	1.82	1971	0.78
1972-73	0.87	1972	0.54
1973-74	1.02	1973	1.53
1974-75	1.35	1974	1.44
	av. 1.11 t/ha or 19.52 bus./ac.		av. 0.71 t/ha or 10.40 bus./ac.

Source: Department of Primary Industries (from data supplied by Australian Bureau of Statistics)

APPENDIX III

Survey of Date Palms in Queensland, 1935

Summary of replies to a request by the Director of Fruit Culture that he be informed of the existence and character of date palms in the whole of Queensland. All data came from letters addressed to the Director and are direct quotations.

Barcaldine — Mrs Ogden is the only person in Barcaldine who is able to sell a few dates each year, and has harvested from one palm as much as four cwt of dates in one year.[1]

Bedourie — There are several trees in the Bedourie hotel grounds, one tree has been bearing for twenty years. The Afghans say it is a "Turkish sugar date" - a small, very sweet and fine flavoured round fruit. There is also a large "Douglet [*sic*] Noir" date on the bore drain which has many suckers.[2] [In May 1978 there were still suckers in the bore drain and one tree in the hotel grounds.[3]]

Bowen — There are several date trees in the town in the gardens of J. Payne Senr - two very old trees, bearing fruit, said to be good bearers, suckers are available;
Bowen Gardens - three old trees, not too vigorous, no suckers;
Allen Field - one very old tree, a consistent bearer.
There are also seedling trees in the gardens of
Mrs Palkinhorne - very good bearer of nice fruit, no suckers;
Mrs Cloes - a very good tree, no suckers;
Mrs O'Keefe - a good bearer of nice fruit, suckers available;
G. Bauer - a good bearer of nice fruit, no suckers.[4]

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[1]Freeman, 23.1.35

[2]Gaffney, 15.2.35

[3]Bauer, F.H., personal communication

[4]Duffy, 30.1.35

Chinchilla	A large date palm bearing fruit is growing behind the Commercial Hotel.[1]
Clermont	...some trees in good condition and bearing well. W. Madge, of "Bathampton" Clermont has several trees and can supply 12 suckers.[2]
Croydon	Mrs Bell, three miles from Croydon has only one date palm bearing fruit.[3]
Eulo	...seedling dates at Mooning Station, Eulo.[4]
Gracemere	There are about eighteen palms in Mr C. Thorsen's property, nine at Miss Tait's property, the former home of Mr Burns of Burns and Twigg, some on Mr Barnes' property, and several on Mr Duncan's property.[5]
Leyburn	...some palms on Mr Victor Rauchle's property and at
Millmerran	...palms on Mr W. Simmon's property.[6]
Muttaburra	The Queensland Acclimatisation Society sent palms to Mount Cornish Station, Muttaburra earlier. There are several trees producing fruit and it would be possible to obtain suckers.[7]
Offham	Mr J.C. Schmidt of "Goolburra" station has dates; there are also good dates growing on "Yarmouth" and "Horton Vale" stations. The dates growing on sandy soil at Offham have a very good flavour and ripened fairly well together. Some were dried in the sun and they kept a long time. These trees are growing near a bore drain and the sandy soil around them is nearly always damp.[8]

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[1] Leslie, 8.3.35

[2] Ross, 11.2.35

[3] Allan, 15.3.35

[4] Leslie, 6.2.35

[5] Ross, 5.2.35

[6] Coleman, 2.2.35

[7] Ruthenberg, 6.2.35

[8] Schmidt, 13.2.35

Rockhampton	Mr Geddes has a very good variety - a packet of dates was sent to Hon. F.W. Bulcock, the Minister for Agriculture and Stock on 13th February 1935.[1]
Roma	...some dates at the Roma State Farm and at "Romavilla" vineyards.[2]
St George	A palm is growing in Mr Wippell's allotment.
Wallumbilla	A date palm is growing on the property of Mr Robert Hornick.[3]
Windorah	There are beautiful date palms growing at Curralle Station 117 mi from Windorah.[4]
Withcott	...eight palms are growing at Withcott of which only two are females.[5]

[1] Ross, 5.2.35; 13.2.35

[2] Leslie, 29.1.35

[3] *ibid.*, 5.2.35

[4] Beale, 4.3.35

[5] Leslie, 6.2.35

APPENDIX IV

Extracts from Graziers' Reports on Use of Sorghum Silage

Wetherby, Richmond

We fed 4,000 sheep in a very small paddock and 1,600 in a yard at the rate of 4lb 3oz/head/day. They all did well and improved on silage alone. (12.1.58)

We fed 2,000 ewes for 12 weeks with very good results. (8.1.62)

We are now using silage put down in 1955. We have been feeding weaners for 5 weeks and they are doing well - they use dry feed (pasture) better in conjunction with silage. We are feeding 17,000 sheep plus lambs on silage and there is very little silage wasted. (15.8.63)

We are feeding now in a drought. We sold 5,000 young sheep in N.S.Wales and wethers at Cannon Hill and are now feeding ewes and young lambs on silage and molasses. Mr Anning began feeding in small quantities to initiate the sheep into silage feeding. Once they were eating it they left very little. (8.11.69)

Gowan stud, Blackall

All this silage was fed out in the 1965 drought and was reasonably successful while the stocks lasted. (15.5.?7)

Terrick stud, Blackall

The rams continue to relish the silage. (14.3.58)

Silage pits put down in 1955/6 have been successfully fed to the sale rams - it is by far the most economical fodder to the grazier. (24.4.58)

Results of this feeding trial to date have been most encouraging. There now remains no doubt that sorghum silage as a drought reserve is here to stay. (16.8.58)

Sorghum silage stored in pits in good years had proved invaluable in the 1965 drought. It had been fed hammer-milled with hay, maize and meat meal and had kept the sheep in strong condition. Our experience this year has certainly proved the value of silage as a drought reserve. (1965)

Landsborough, Hughenden

I am happy with the feeding of silage when adding maize at the rate of 4 bags per day when feeding 9,000 sheep. There is not much wastage. (7.1.59)

Mellew, Barcaldine

In July 1958 we commenced teaching sheep to eat silage. Ewes with lambs were fed in open paddocks but they didn't take to the silage readily. When confined they began to eat silage supplemented with sheep nuts and later maize. We fed in cut down bitumen drums. We fed twice weekly at 4lb 3oz of silage with a small amount of maize added. The maize was eagerly taken, but the sheep kept nibbling away at the silage and actual eating was spread over much of the week so that all sheep got something. The young sheep took to the silage better. They ate well. 100% came for feeding. Of 1,393 weaners marked at the end of March and fed on silage and maize, 1,250 turned up for shearing. There are better fodders than silage but it cost me £2 per ton on the place while lucerne hay costs £23 per ton delivered. With silage there is no market fluctuation in droughts, nor loss from fire. Silage commends itself as drought fodder and no doubt its disadvantages such as low protein can be overcome. (14.3.58)

Hartree, Morella

We opened a trench put down in 1956 - the silage was of good colour with very little waste. We are feeding 1,250 classed 16 month old ewes and they are eating and looking well and indications are that it is a very satisfactory feed. (29.10.62)

Fed 8,000 ewes at watering points at about 6lb 10oz/head/day, satisfactorily. Small showers of rain made excavation and transport difficult. Fed daily to prevent loss from trampling or blowing away. (1.11.68)

Essex Downs, Richmond

Have 1,800 tons of silage on hand. We fed out

200 tons in December 1958 and sheep ate it readily. (23.6.59)

We have fed a lot of silage out and are very pleased with the result. We fed a lot of ewes through lambing for three months and have marked 30% of lambs from them. (19.3.60)

Warringah, Blackall

In 1965 we had a general drought. We fed out 500 tons of silage. We lost most of our lambs but were able to save most of our ewes. (14.5.77)

Kilterry, Nelia

In 1958 we fed 800 sheep on silage for 6-7 weeks to educate them into silage and they did well. (19.6.59)

We fed 3,500 sheep and 100 head of cattle starting 7th November 1959. The waste was considerable in the old crop. My conclusion is that cattle and 'dry' sheep can be picked up quickly. It is a costly way of saving sheep but is useful for short periods. (30.5.60)

Inverness, Muttaburra

Very pleased with the lambing ewes performance in pens when fed on silage. The ewes fell away after two months on 5lb 5oz of silage and 2oz protein meal per head per day in the pens, but picked up when put into bigger yards. (13.12.54)

Started feeding silage on March 23rd at 9-10 tons daily plus 1oz meat meal per head per day. I have over-estimated my silage store by 3 times. I don't think I will crop for fodder from now on, but occasionally for a green crop to feed off. (17.6.60) (He had bought an additional property in 1957 and was looking after both.)

Moorooka, McKinlay

I had 175 tons underground. I fed it to old ewe breeders at the end of 1958. It was fed with meat meal and readily eaten. The overall performance was satisfactory. (4.7.59)

I opened my last silage pit just before Xmas 1966 and fed 600 lambs weaned from their mothers on silage plus maize and meat meal very successfully. (5.4.67)

Bundoran, Maxwelton

We ensiled 600 tons in 1957 and twelve years later it was all fed to our ewes in the 1969-70 drought. The sorghum came out of the pits in perfect condition and it was wonderful fodder fed with a ration of wheat or maize. (18.5.77)

Lonsdale, Richmond

We fed 4lb 3oz/day per head to lambing ewes for 2½ months. The results were satisfactory though ewes lost weight but remained strong. The lambs were fair. (4.12.58)

Fed 1,400 lambing ewes from 15.9.58 to 12.12.58. The lambs were dropped early October. I have no doubts that I would have lost a lot of ewes and lambs only for the silage. (19.8.59)

Home Creek, Barcaldine

We opened two silage pits put down in 1959. We fed 6 cwt silage plus 5 gal. of weak molasses (2 gal. of molasses) and it was all cleaned up by the cattle. (27.9.64)

Telemon and *Dunluce*, Hughenden

In 1961 fed 3,100 sheep, the sheep cut 10½lb per head, and the lambs 6lb. He has 10,000 tons of sorghum silage stored underground. (20.6.63)

Toorak, Julia Creek

In 1963 some 450 tons of sorghum silage was made and some of this was fed in the late 1960s with good results.

APPENDIX V

Extracts from Graziers' Reports on Grazing Sorghum

Maneroo, Longreach

Our short crop withered and we decided to feed it off with cattle and the results were remarkable. They only left the crop to walk half a mile to water and returned immediately. They ate every straw and we sold the bullocks for £49.17.6 at Cannon Hill - crop fattening, if you please at Longreach, and a payable proposition it was. (10.10.57)

Wetherby, Richmond

We had 200 a. of sorghum and 20a. of *Sorghum almum* on which we fed 2,200 ewes for 12 weeks with very good results. (8.1.62)

Dagworth, Kynuna

The sorghum is wilting and the stock are grazing it. (28.2.59)

The grazed area is growing again. (31.3.59)

We harvested this crop and the stubble is being grazed. (31.10.59)

Gowan, Blackall

Three hundred acres of sorghum on *Gowan* this year has provided useful grazing. (24.4.58)

This area provided fair regrowth from last year for grazing. (21.1.59)

Warringah, Blackall

We planted sugar drip sorghum in January but there was insufficient moisture to mature the crop and we topped off some cattle in it. The 1970-71 and 1974-75 crops were fed off under similar conditions by cattle. (17.11.68)

Kilterry, Nelia

I planted some grain sorghum and sheep ate this first when turned into mixed grain and sweet sorghum. (22.7.57)

I planted 90 a. which was a light crop and was frosted. I grazed it with cattle which did well and I sold them as fats. (19.6.59)

All crops this year are poor and will be fed off. (30.5.60)

Inverness, Muttaburra
Our crop was a big disappointment this year, however, there was quite a lot of feeding value - we fed 2,400 ewes and 2,200 lambs for 3 weeks in May on 50 acres, then 120 rams in June-July for joining, and grazed again in August when 6" high for shearing. Then we fattened rams again in October when there was no other green feed on the place. (15.12.57)

Moorooka, McKinlay
Planted 200 a. in 1959 but failed due to lack of summer follow-up rain but later winter rain produced secondary growth which was grazed. (4.7.59)

Lonsdale, Richmond
The sorghum is certainly good stock feed and they live on the plots. (1.8.56)

Home Creek, Barcaldine
in 1956 early frost on 25th May after the sorghum crop but it produced very good grazing. *Sorghum almum* lasted about two years giving useful grazing. (13.4.77)

Rodney Downs, Ilfracombe
We had 150 a. of oats planted on a two year fallow in early April and grazed 1,000 ewes in lamb for 3 months (at one hour per day) and later harvested 350 bags from 50 a. and grazed the rest. (5.7.59)

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