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UTILIZATION OF FERTILIZER RAW MATERIALS IN AUSTRALIA

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INTRODUCTION

The outstanding feature of Australian fertilizers is the very high consumption of superphosphate, which stems from the special characteristics of Australian soils. Other major elements added to the soil are nitrogen in the form of sulphate of ammonia, urea, anhydrous and aqua ammonia and potassium in the form of potassium sulphate and chloride.

Australia produces all its superphosphate requirements from imported phosphate rock. An appreciable part of its nitrogen needs is produced locally. All requirements of potassium salts are imported.

International practice is to express fertilizer consumption in plant food units of N for nitrogen, P_2O_5 for phosphorus and K_2O for potassium. Details of Australia's estimated annual consumption of main plant food nutrients in recent years are shown in Table 1.

Table 1

Australian Consumption (Estimated) of Main Plant Nutrients (tons)

	1963/64	1964/65	1965/66
Nitrogen - N Content	72,700	69,000	77,000
Phosphorous - P_2O_5 Content	750,000	846,000	952,000
Potassium - K_2O Content	52,000	61,000	64,000
N:P:K Ratio	1:10.3:0.7	1:12.3:1.1	1:12.4:1.2

Limestone, dolomite and gypsum are used both as soil conditioners and as fertilizers.

It has been recognised that minute quantities of other elements notably boron, manganese, copper, zinc, cobalt, molybdenum and perhaps other elements may also play a part in plant nutrition. These elements are referred to as trace elements, and are applied usually in conjunction with the main plant nutrients.

SULPHUR AND SULPHIDE ORES

Sulphuric acid is one of the two essential materials required for the manufacture of superphosphate, the other being phosphate rock.

There are no known deposits of elemental sulphur in Australia and imports are substantial. However, there are two oil refiners which possess sulphur recovery units. It is reported that the combined output capacity of the units is 120 tons of elemental sulphur per day.

Sulphuric acid is made in Australia from imported elemental sulphur and indigenous sulphide minerals. Details of sulphuric acid production and consumption of raw materials are shown in Table 2.

Table 2

Production of Sulphuric Acid

	Quantity of raw material (a) (tons)			Acid produced (mono-tons)		
	1964	1965	1966	1964	1965	1966
Elemental sulphur	292,309	366,626	412,663	871,084	1,002,575	1,208,983
Pyrite	242,411	229,351	237,477	305,935	283,097	278,190
Zinc cons	381,422	398,566	394,375	261,686	289,420	289,628
Lead cons	301,341	305,120	289,919	83,365	77,431	81,326
Other materials	27,089	20,301	23,165	20,536	23,972	19,492
Total acid				1,542,606	1,676,495	1,877,619

(a) Includes material wasted to air.

The chief sources of indigenous sulphide minerals for acid manufacture are pyrite concentrates, lead and zinc concentrates.

Pyrite concentrates are mined either specifically as a source of sulphur, as at Nairne, South Australia, and Norseman, Western Australia, or are recovered as a by product of base metal mining as at Mt. Morgan, Queensland, and Mt. Lyell, Tasmania. Some auriferous pyrite concentrate from Kalgoorlie is also utilized as a source of sulphur. Details of pyrite production are given in Table 3.

Table 3

Production of Pyrite Concentrates ('000 tons)

	1965		1966	
	Concentrates	Sulphur content	Concentrates	Sulphur content
Mount Morgan (Qld)	4,135	2,021	7,815	3,845
Mount Lyell (Tas)	46,912	22,893	61,006	29,344
Mairne (S.A.)	93,326	38,917	101,041	40,770
Kalgoorlie (W.A.)	22,275	7,268	22,110	7,586
Norseman (W.A.) (a)	36,905	17,597	54,026	25,612
Total	203,553	88,696	245,998	107,157

(a) Actual tonnages used in sulphuric acid production.

The bulk of lead concentrates from Broken Hill, New South Wales, is roasted at Port Pirie, South Australia, and Cockle Creek, New South Wales, and sulphuric acid is recovered from the sinter gases. The sulphur content of lead smelter gases at Mt. Isa, Queensland, is not utilized.

The whole of the zinc concentrate production from Read-Rosebery, Tasmania, and a portion of Broken Hill zinc concentrate, are roasted at Risdon, Tasmania; some zinc concentrate from Broken Hill is also roasted at Cockle Creek; sulphuric acid is recovered from sinter gases. All the zinc concentrates from Mt. Isa and the remaining zinc concentrates from Broken Hill are exported.

Alkylation sludges and hydrogen sulphide from some oil refineries and spent oxide from some gas works are used as a source of sulphur for acid production.

Details of sulphuric acid consumption in recent years are given in Table 4.

Table 4

Consumption of Sulphuric Acid (mono-tons)

	1963	1964	1965	1966
Superphosphate	1,040,753	1,207,121	1,302,490	1,512,941
Ammonium Sulphate	53,667	76,826	82,786	81,203
General Chemicals	216,453	215,495	242,291	230,638
Mining & Metallurgy		47,668	41,024	37,738
Total	1,310,873	1,547,110	1,668,591	1,862,520

PHOSPHORITE

Australian production of phosphate rock is negligible compared with domestic requirements.

Phosphate rock requirements for the superphosphate industry are imported through the agency of the British Phosophate Commissioners from Nauru, Ocean Island in the Pacific Ocean, and from Christmas Island in the Indian Ocean. Supplies of rock phosphate have recently been supplemented by imports from other sources such as the United States, Senegal and Togo. Details of imports of phosphate rock, recorded by the Commonwealth Bureau of Census and Statistics in recent years are shown in Table 5.

Table 5

Imports of Phosphate Rock
(tons)

	1963	1964	1965	1966
Christmas Island	371,514	621,293	681,865	781,353
Nauru	1,082,017	921,763	796,181	1,229,743
Ocean Island	282,568	533,627	352,333	205,469
Senegal	--	37,322	--	74,050
Togo	--	100,961	118,405	206,577
U.S.A.	26,363	134,104	561,845	755,208
Others	--	5,710	16,151	33,267
Total	1,762,462	2,354,780	2,526,780	3,285,667
Value f.o.b. ($'000)	10,708	16,236	17,505	27,479

The domestic demand for phosphate rock is directly related to the production of superphosphate, which accounts for approximately 98 percent of total consumption.

Production of superphosphate follows a seasonal pattern of demand. As a result, the industry works at a particularly high level of activity for the first half of the year; from July onwards, output is at a reduced level.

Production of superphosphate in recent years is shown in Table 6.

Table 6

Production of Superphosphate
(tons)

1962	2,778,337
1963	3,055,988
1964	3,667,501
1965	3,725,436
1966	4,356,958

It has to be noted that superphosphate production is expressed in terms of 22% P_2O_5. Production data of concentrated superphosphate (containing between 38% and 46% P_2O_5) are not available for publication.

NITRATE

Although superphosphate will continue to be the major product in the fertilizer industry, a significant growth of trend is evident in the use of nitrate as a fertilizer.

Until recent years ammonium sulphate has been virtually the only chemical nitrogenous fertilizer used in Australia. However, the usage of urea, anhydrous and aqua ammonia, NPK fertilizers and other types, has risen in the last few years.

In addition to ammonium sulphate domestic manufacturers produce fertilizer grade ammonia (anhydrous and aqua), urea and NPK fertilizers. A substantial expansion of the existing level of production is projected and plans have been made for the manufacture of fertilizer grade ammonium nitrate and ammonium phosphate, total requirements of which are at present imported.

Australian production of nitrates, recorded by the Commonwealth Bureau of Census and Statistics and available for publication, is shown in Table 7.

Table 7

Production of Nitrates
(tons)

	1963/64	1964/65	1965/66
Ammonia -			
Anhydrous	7,759	n.a.	28,731
Aqua	2,710	1,637	6,871
Ammonium sulphate	85,488	108,275	122,358
Ammoniacal liquor (in value)	$118,000	$93,000	$70,000
Urea and melanines	9,304	11,632	13,783

These nitrates are used as fertilizers and also have many industrial applications.

Total nitrogen usage for fertilizer has increased steadily from an estimated 18,400 tons in 1959/60 to a total of 42,100 tons in 1962/63 and to a total of 77,000 tons in 1965/66.

POTASH MINERALS

Australia's fertilizer requirements of potash are all imported, mainly in potassium chloride (muriate) and to a lesser degree as potassium sulphate. These are the soluble forms of potash.

Potassium chloride is the cheaper and is being used increasingly in coarse rather than fine grades. About four-fifths of the potash fertilizers used in Australia are applied as mixtures with other fertilizers.

In terms of potassium oxide - K_2O - which is the form in which the potassium nutrient element is available to plants, total consumption increased from 4870 tons in 1950 to 15,700 tons in 1955, to 30,200 tons in 1960, and to 61,200 tons in 1966.

OTHER FERTILIZER AND AGRICULTURAL MATERIALS

Limestone, dolomite and gypsum are used in Australia as both soil conditioners and fertilizers.

Limestone is produced in all States, but statistics relating to production for agricultural purposes is still incomplete. The limestone is ground to varying size limits and may also be kiln-dried or burned. Approximate production for agricultural usage is estimated as around 180,000 tons per year.

Relatively small quantities of dolomite and gypsum are ground for agricultural use, mainly in southern States. Consumption of dolomite for this purpose is estimated as around 15,000 tons per year, and of gypsum not less than 5,000 tons per year.

General usage of trace elements is increasing, although the demar is somewhat variable. These elements are mainly applied in conjunction with major fertilizers. Statistics on trace elements used in fertilizers in recent years are shown in Table 8.

Table 8

Trace Elements used in Agriculture
(tons)

Element	Compound	1962/63	1963/64	1964/65	1965/66
Copper	Sulphate	4,807	4,252	4,964	4,336
	Carbonate ore	2,597	3,974	2,154	935
	Oxide	--	38	27	168
Zinc	Sulphate	562	199	218	149
	Oxide	1,522	1,975	1,995	1,373
	Dross	7	23	31	98
	Carbonate ore	110	121	222	--
Cobalt	Sulphate	60	70	59	52
	Oxide	½	4	½	4
Molybdenum	Sodium molybdate	21	33	50	81
	Oxide	23	23	41	51
	Trioxide	22	30	18	27
	Calcium Molybdate	7	6	1	3
Manganese	Sulphate	574	594	731	768
Magnesium	Sulphate	104	50	123	252
	Oxide	33	59	214	201
Iron	Sulphate	337	415	313	274
Boron	Borax	52	57	64	78