

FERTILIZER USE IN OCEANIA: TYPES AND AMOUNTS

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Summary

Oceania is a diverse region spanning the Pacific Ocean. Agricultural production ranges from organically grown home gardens to farming and grazing in fields of thousands of hectares. Consequently fertilizer consumption ranges from zero to high amounts.

Economic conditions are a major determinant of fertilizer use in all of the countries of Oceania because agriculture receives little or no subsidies and the dominant countries in the region, Australia and New Zealand, rely heavily on exports for their incomes. In Australia and New Zealand there has been a trend away from relying on legumes to supply nitrogen to adding it in manufactured ammonium phosphate fertilizers.

Overall, inorganic fertilizer application results in positive environmental effects through better ground cover, which reduces erosion and through better soil fertility conditions which improves water infiltration and holding capacity.

Increases in soil organic matter also increase the nutrient holding capacity of the soil. Whilst the overall benefits are positive, problems resulting from nutrient pollution have occurred in several local areas.

1. The region

Country	Land area 1997/98 (x10 ³ ha)	Agricultural area 1997/98 (x10 ³ ha)	Permanent crops 1997/98 (x10 ³ ha)	% change in 10 years	Permanent pasture 1997/98 (x 10 ³ ha)	% change in 10 years
Oceania	849,137	4,902,052	2,968	25.6	431,899	-1.6
Australia	768,230	471,550	225	16.0	418,000	-1.5
Papua New Guinea	45,286	760	610	11.9	90	-1.1
New Zealand	26,799	16,580	1,725	41.2	13,300	-3.6
Solomon Islands	2,799	100	18	5.9	40	2.6
New Caledonia	1,828	229	6	-14.3	216	-8.1
Fiji Islands	1,827	460	85	6.3	175	11.1
Vanuatu	1,219	145	90	0.0	25	0.0
French Polynesia	366	48	22	0.0	20	0.0
Samoa	283	123	67	0.0	1	0.0
Kiribati	73	37	37	0.0		
Tonga	72	123	31	0.0	4	0.0
Federated States of Micronesia,	70	46	32	*	10	*
Guam	55	20	6	0.0	8	0.0
Northern Mariana Is	46	14	3	*	4	*
Palau	46	14			4	*
Niue	26	8	2	0.0	1	0.0
Cook Islands	23	7	3	-25.0		
American Samoa	20	3	2	0.0		
Wallis and Futura Is	20	5	4	0		
Marshall Islands	18	3				
Christmas Island	13	<1				
Canton and Enderbury Is	7	<1				
Norfolk Island	4	1			1	0.0
Tuvalu	3	<1				
Nauru	2	<1				
Cocos (Keeling) Islands	1	<1				
Tokelau	1	<1				
Pacific Islands Trust Territories	<1	<1	0	*	0	*

- Changes from a zero base, therefore meaningless.

Table 1. Land, agricultural, permanent crop and pasture areas in countries of Oceania in 1997/98 and percentage change in the area of crops and pastures in the 10 years prior to 1997/98.

Oceania is an extraordinarily diverse region made up of more than 3000 islands and/or continents with a total land area of 849 130 000 ha and an agricultural area of 490 052 000 ha (see **Error! Reference source not found.**). The largest land areas are in Australia, Papua New Guinea and New Zealand, which together make up 99.0% of the total land area and 99.7% of the agricultural area. In addition to these three large areas, there are 25 small island states that lie between 141°E and 157°W and 5°N and 23°S.

2. Geology and soils

2.1. Australia

Australia is the lowest, flattest and, apart from Antarctica, the driest of the continents (ABS 1998). Unlike Europe and North America, where some landscapes date back to 'only' 20 000 years ago, when great ice sheets retreated, the age of landforms in Australia is generally measured in many millions of years.

The continent can be divided into three parts: the Western Plateau; the Central Lowlands; and the Eastern Highlands.

The Western Plateau consists of very old rocks (some over 3000 million years old), and much of it has existed as a landmass for over 500 million years.

The central lowlands; Much of the center of Australia is flat, but there are numerous low mountain ranges.

The Eastern Highlands rise gently from central lowlands towards a series of high plateaus, and even the highest part around Mt. Kosciuszko in New South Wales (2228 meters) is part of a plateau.

The present topography results from a long landscape history that started in the Permian, about 290 million years ago, when much of Australia was glaciated by a huge ice cap. Throughout the Tertiary, volcanoes erupted in eastern Australia. Some individual volcanoes were the size of modern Vesuvius, and huge lava plains covered large areas. Volcanic activity continued up to a few thousand years ago in Victoria and Queensland. Australia's youngest volcano is Mt. Gambier in South Australia, about 6000 years old. Today a large part of Australia is arid or semi-arid.

Australia is a relatively flat continent, with mean elevation just exceeding 200 meters. The dominant feature of the continent is the Great Dividing Range, which spans the length of the Eastern Seaboard. There are very few naturally good soils for agriculture. Most are infertile and shallow, with deficiencies in phosphorus and/or nitrogen.

To offset these deficiencies superphosphate and nitrogenous fertilizers are widely used, particularly on pasture and cereal crops. Fragile soil structure and a susceptibility to

waterlogging are other common features of Australian soils, while large areas are naturally affected by salt or acidity. These soil characteristics restrict particular agricultural activities or rule out agricultural activity altogether.

With the exception of Antarctica, Australia is the world's driest continent. The wet northern summer is suited to beef cattle grazing inland and the growing of sugar and tropical fruits in coastal areas. The drier summer conditions of southern Australia favor wheat and other dryland cereal farming, sheep grazing and dairy cattle (in the higher rainfall areas) as well as beef cattle. Within regions there is also a high degree of rainfall variability from year to year, which is most pronounced in the arid and semi-arid regions. Rainfall variability often results in lengthy periods without rain. The seasonality and variability of rainfall in Australia require that water be stored, and 70% of the stored water resource (including ground water) is consumed by the agricultural sector. Storage ensures that there are adequate supplies all year round for those agricultural activities requiring a continuous supply. Irrigation has opened up areas of Australia to agricultural activities that otherwise would have not been suitable.

Evaporation is another important element of Australia's environment affecting agricultural production. Hot summers are accompanied by an abundance of sunlight. This combination of climatic variables leads to high rates of evaporation. Areas that have been cleared for crop and pasture production tend to coincide with five to nine months effective rainfall (where rainfall exceeds evaporation) per year. In areas of effective rainfall of more than nine months, generally only higher value crops or tropical crops and fruits are grown, while in areas with effective rainfall of less than five months, cropping is usually restricted to areas that are irrigated

Since European settlement the vegetation of Australia has altered significantly. In particular, large areas of Australia's forest and woodland vegetation systems have been cleared, predominantly for agricultural activity. The areas that have been altered most are those that have been opened up to cultivation or intensive grazing. Other areas, particularly in the semi-arid regions where extensive grazing of native grasses occurs, now show signs of returning to timber and scrub.

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Biographical Sketches

Graeme Blair is an Honorary Fellow at the University of New England having retired as Associate Professor of Plant Nutrition. His research, and that of his numerous international postgraduate students, has focussed on matching the rate of supply of nutrients from fertilizers to plant demand, with particular emphasis on sulphur and phosphorus.

Villiami Manu is Principal Scientist in the Ministry of Agriculture and Fisheries in the Kingdom of Tonga. He obtained his Ph.D. from the University of New England for research which surveyed the nutrient status of the major soils of Tonga and for studies on the effects of mulches on crop production, quality and economics. He plays a key role in Tongan agriculture across a broad range of disciplines.