

Paper 1

HISTORY AND PRESENT STATUS OF MAIZE PRODUCTION IN NEW ZEALAND

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INTRODUCTION

Maize ranks third in production among the world's major cereal crops, following closely behind wheat and rice. In the period 1978-80, an average of 380 million tonnes was produced annually on 120 million hectares of land, representing nearly a quarter of world cereal production (CIMMYT, 1981). By comparison, 440 million tonnes of wheat, the most important cereal crop, were produced on 240 million hectares.

More than 70 countries currently have over 100,000 hectares sown to maize, making it the world's most widely distributed crop (CIMMYT, 1981). In developing countries, particularly in tropical and sub-tropical regions, maize is a staple food. In developed countries, such as New Zealand, it is used primarily for stock feed.

The domesticated maize plant belongs to the grass family, Gramineae, tribe Maydeae, and has been classified as *Zea mays* ssp. *mays* (Doebley and Iltis, 1980). It is further sub-divided into races by morphological characteristics, especially those of the ear. A second method of sub-division is on the basis of endosperm characteristics, i.e. dent, flint, flour, sweet and pop. Dent maize of the Corn Belt Dent race is the primary type grown in New Zealand for stock feed and industrial use, while sweetcorn is grown as a vegetable crop. A small area is grown annually for popcorn production.

MAIZE IN AMERICA

The genetic origin of maize is uncertain, but there is general agreement that geographically, the crop originated in either the North or South American continent (Mangelsdorf, 1974). The crop was domesticated in Mexico as early as 3400 B.C. (Mangelsdorf, 1974) and possibly much earlier (Galinat, 1977). Evidence from Peru indicates that cultivated maize was grown on the South American continent as early as 2000 B.C. (Grobman and Bonavia, 1978). By the time of the European conquests, maize growing extended from North Dakota, in the present day

United States, southward on the mainland and through the West Indies to modern Argentina and Chile (Weatherwax and Randolph, 1955).

Maize was the most important food plant for the ancient civilizations of Mexico and was an important food plant for the ancient civilizations of Peru (Mangelsdorf, 1974; Culbert, 1978; Moseley, 1978). By 1532, when the Spanish had conquered both the Aztec and Inca Empires, a diverse range of maize varieties had been developed for climatic conditions varying from coastal regions to high altitude valleys (Weatherwax and Randolph, 1955; Mangelsdorf, 1974).

EARLY HISTORY OF MAIZE IN NEW ZEALAND

The earliest recorded introduction of maize into New Zealand was in 1772 (Yen, 1959; Rhodes and Eagles, 1984). By the middle of the nineteenth century, maize constituted an integral part of Maori agriculture and was grown alongside potatoes and squash. According to historical accounts, Maoris ate maize in raw form and carried dry grains when travelling. In time, they adopted European cooking procedures such as boiling, roasting and popping, and also modified these methods and invented new ways to use the grain; for example, a unique process referred to as Kaanga-Kopuwai in Northland, Kaanga-Pirau in the central North Island and Kaanga-Wai in the Bay of Plenty. Essentially these all meant fermented maize or maize soaked in water: the process basically involved soaking unhusked maize ears in water, then scraping off the soft, slimy kernels and preparing various dishes (Bansal, 1983).

The Maoris selected and maintained open-pollinated varieties in different regions. In Gisborne, Marigold and Prairie Queen were popular. Motiti was developed on Motiti Island and later became popular elsewhere (Chamberlain, 1956). Early Butler was the main variety for Opotiki, and together with Excelsior, dominated the Whakatane region. Other types included a black sweetcorn and a large-grained variety called Horsetooth, which is

markedly similar to the Hickory King complex from the southern United States (Rhodes and Eagles, 1984).

HYBRID CULTIVARS

In the early 1940's, the first hybrid seed of the cultivar Pfister 360 was imported into New Zealand from the U.S.A. by a Ruatoria farmer. The greater yield potential did not escape the attention of the Department of Agriculture, who in turn embarked on importation and testing of a large number of hybrids from the United States.

The first double-cross hybrid seed of Pfister 360 was produced in 1948/49, in Gisborne, by the Department of Agriculture. The Department introduced and tested hybrids in different maize growing areas, concentrating mainly on hybrids produced by the College of Agriculture, University of Wisconsin, U.S.A. Until the 1960's Wisconsin hybrids dominated the maize scene in New Zealand.

Since the 1960's, the regional testing, production and marketing of new hybrid cultivars has come under the control of New Zealand companies which have negotiated franchises with seed companies in the United States. Currently, Dalgety Crown Ltd. produces De Kalb hybrids, Corson Seeds International Ltd. produces Northrup King hybrids and Arthur Yates & Co. produces Pioneer hybrids. Each company produces a range of hybrids (Table 1). The popularity of hybrids changes rapidly; in the United States the average lifetime of a successful hybrid is 7 years (Duvick, 1984) and hybrids in New Zealand will probably have a similar lifetime.

Table 1: Commercial cultivars of maize available in New Zealand in 1984.

Hybrid	Year of release	N.Z. seed company	Maturity
XL35	1981	Dalgety Crown	Early
XL54	1984	Dalgety Crown	Mid-season
XL72aa	1981	Dalgety Crown	Late
PX442	1968	Corson Seeds	Early
PX15	1979	Corson Seeds	Early
PX49	1980	Corson Seeds	Mid-season
PX74	1976	Corson Seeds	Late
PX75	1980	Corson Seeds	Late
Pioneer brand 3901	1981	Yates	Early
Pioneer brand 3709	1979	Yates	Mid-season
Pioneer brand 3591	1979	Yates	Late

Early maturing hybrids provide full-season crops in cooler areas, such as the Manawatu, or in areas with shorter growing seasons. Late maturing hybrids provide full-season crops in warmer areas or areas with longer growing seasons, such as Gisborne and the Bay of Plenty, while mid-season hybrids provide full-season crops for areas of intermediate temperature or growing season length, such as the Waikato. In most seasons the maximum yield will be obtained by growing a hybrid which occupies the full growing season.

Mid-season hybrids are sometimes grown in cooler regions but must be sown early in the spring if they are to mature before the onset of cool weather in the autumn. In the Manawatu, mid-season hybrids have yielded less than early hybrids in cooler or shorter than average seasons (Eagles, unpublished). Furthermore, in such seasons harvesting of mid-season hybrids is delayed by slow grain drying until July or even August.

MAIZE DISTRIBUTION IN NEW ZEALAND

Between 1900 and 1960, the maize crop in New Zealand occupied between 2000 and 5000 hectares, and grain yields fluctuated between 2.8 and 3.9 tonnes/hectare (Fig. 1). During this period most maize was grown in the warmer Hawkes Bay and Poverty Bay areas (Claridge, 1972). During the 1960's and 1970's there was a rapid increase in both the area harvested and the yield obtained until by the 1976-77 season 29,000 hectares were harvested for grain with an average yield of 7.4 tonnes/hectare (Anon, 1983). By the 1981-82 season the area harvested for grain had declined to 18,750 hectares, but the average yield that season was 9.1 tonnes/hectare (Table 2).

Table 2: Distribution of maize harvested for grain in the 1981-82 season.

Region	Area ha	Production tonnes	Yield tonnes/ha
North Island			
Northland	344	1846	5.4
Central Auckland	201	1686	8.4
Waikato-Bay of Plenty	12086	110397	9.1
East Coast	2650	26348	9.9
Hawkes Bay	1319	11677	8.9
Taranaki	383	3713	9.7
Wellington	1614	13344	8.3
South Island			
Marlborough	77	494	6.4
Nelson	76	566	7.4
Total or average	18750	170071	9.1

Source: Anon (1983).

The change in area between 1966 and 1976 was largely due to an increase in maize growing in the Waikato. From a small area of 120 hectares in 1966, it rose to 22,500 hectares in 1976 surpassing all other areas combined (Buxton, 1976). Although agronomic factors, such as the availability of earlier maturing, higher yielding hybrid cultivars and the introduction of effective herbicides, undoubtedly contributed to the rise in popularity of maize in the Waikato, economic factors, such as falling prices for meat, wool and dairy products and a more assured market for maize were very important (Anon, 1979).

The three seasons 1975-77 were cooler than usual (McCormick, 1979) and yields were reduced compared to

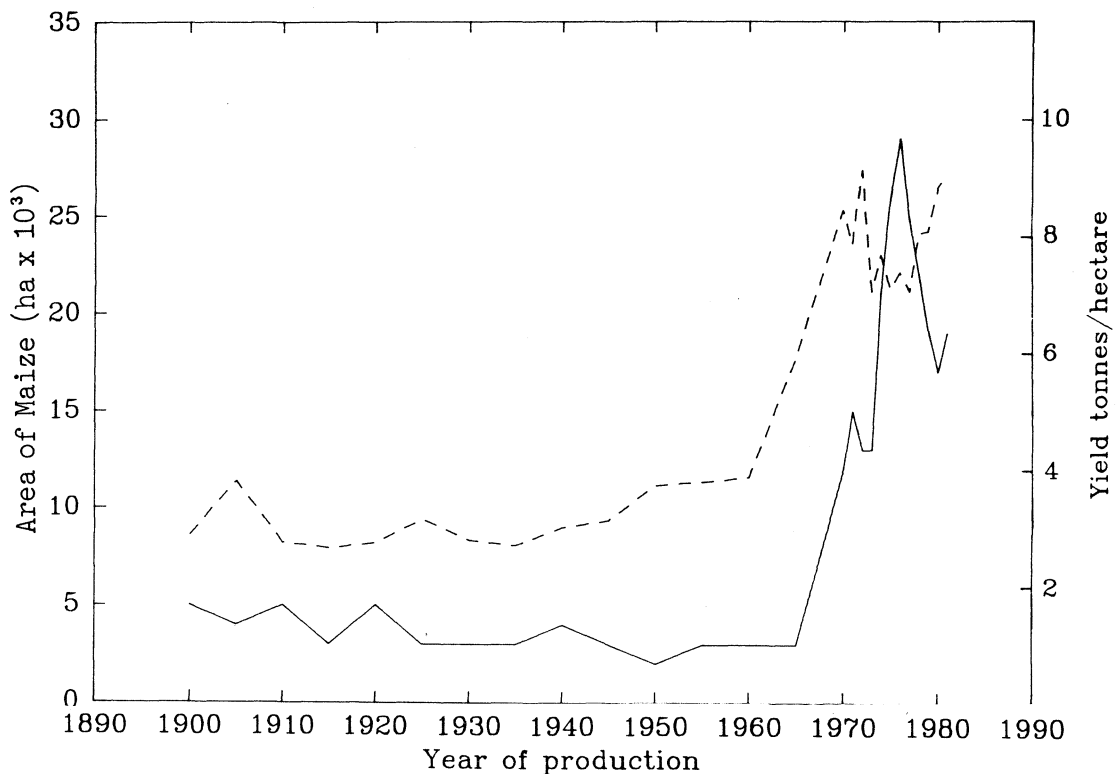


Figure 1. Area and yield of maize grown for grain for the period from 1901 to 1982 (five yearly intervals to 1970, yearly thereafter). Area, solid line; yield broken line. Source: Anon (1983).

those obtained between 1970 and 1973. This undoubtedly contributed to the decline in popularity of maize after 1976, but again economic factors, such as rising costs of maize production and more favourable prices for alternative products, were probably important.

The Waikato-Bay of Plenty region was still the major production area for maize in the 1981-82 season (Table 2). The East Coast, which includes Poverty Bay and Hawkes Bay regions were also important production areas. Maize has also made an impact in cooler areas, such as the Wellington statistical region, where 1600 ha were harvested for grain in the 1981-82 season. The small area harvested for grain in the South Island was located in the Marlborough and Nelson areas. Maize is also grown as a fodder crop — 3800 ha in the 1981-82 season (Anon, 1983), mainly in the North Island.

The average grain yield of 9.1 tonnes/ha for the 1981-82 season (Table 2) compares favourably with the average of 6.3 tonnes/ha for the U.S.A. for the 1978-80 seasons (CIMMYT, 1981). In fact, the average grain yield for New Zealand exceeded 8 tonnes/ha in every season between 1978 and 1982, making New Zealand yields among the highest in the world.

Since this paper was presented to the 1984 conference, information has become available for the 1982-83 and 1983-84 seasons. Maize grain production was reduced during 1982-83, but increased during 1983-84. Total production was estimated to approach 200,000 tonnes for the 1983-84 season, making maize the third most important cereal crop in New Zealand after barley and wheat.

REFERENCES

- Anon. 1979. The maize grain industry in New Zealand. *N.Z. Agricultural Science* 13: 63-70.
- Anon. 1983. *Agricultural Statistics 1981-82*. Department of Statistics, Wellington.
- Bansal, R.K. 1983. Maize. In: *Plant Breeding in New Zealand*, Eds. G.S. Wratt and H.C. Smith. Butterworths of NZ and DSIR, Wellington: 35-40.
- Buxton, D.A.L. 1976. Swing to maize in the Waikato. *N.Z. Journal of Agriculture* 133 (6): 2-4.
- Centro Internacional de Mejoramiento de Maize y Trigo (CIMMYT). 1981. *World maize facts and trends, report one: An analysis of changes in production, consumption, trade and prices over the last two*

- decades. El Batan, Mexico.
- Chamberlain, H. de O. 1956. *Maize growing for grain*. New Zealand Government Printer, Wellington.
- Claridge, J.H. 1972. *Arable Farm Crops of New Zealand*. DSIR and A.H. & A.W. Reed, Wellington: 117-135.
- Culbert, T.P. 1978. Mesoamerica. In: *Ancient Native Americans*, Ed. J.D. Jennings. Freeman, San Francisco: 403-453.
- Doebley, J.F., Iltis, H.H. 1980. Taxonomy of *Zea* (*Gramineae*). I. A subgeneric classification with key to taxa. *American Journal of Botany* 67: 982-993.
- Duvick, D.N. 1984. Genetic diversity in major farm crops on the farm and in reserve. *Economic Botany* 38: 161-178.
- Galinat, W.C. 1977. The origin of corn. In: *Corn and Corn Improvement*, Ed. G.F. Sprague. American Society of Agronomy, Madison: 1-47.
- Grobman, A., Bonavia, D. 1978. Pre-ceramic maize on the north-central coast of Peru. *Nature* 276: 386-387.
- McCormick, S.J. 1979. The effect of seasonal variation in temperature on the yield of maize in the Waikato and Gisborne regions. *Proceedings Agronomy Society of N.Z.* 9: 93-96.
- Mangelsdorf, P.C. 1974. *Corn. Its Origin, Evolution and Improvement*, Harvard University Press, Cambridge.
- Moseley, M.E. 1978. The evolution of Andean civilization. In: *Ancient Native Americans*, Ed. J.D. Jennings. Freeman, San Francisco: 491-541.
- Rhodes, L.L., Eagles, H.A. 1984. Origins of maize in New Zealand. *N.Z. Journal of Agricultural Research* 27: 151-156.
- Weatherwax, P., Randolph, L.F. 1955. History and origin of corn. In: *Corn and Corn Improvement*, Ed. G.F. Sprague, Academic Press, New York: 48-61.
- Yen, D.E. 1959. The use of maize by New Zealand Maoris. *Economic Botany* 13: 319-327.