Potential for introduced sweet potato cultivars in New Zealand

S.L. Lewthwaite

DSIR Crop Research, Private Bag, Christchurch

Abstract

Sweet potato (*Ipomoea batatas* (L.) Lam.) growing has a long tradition in New Zealand, going back to pre-European times. The present industry is largely reliant on Owairaka Red, a selection from an early 1850's introduction.

In this paper recently imported cultivars were compared with sweet potato clones currently being grown in New Zealand, to assess their potential under New Zealand conditions.

Imported varieties had widely diverse characteristics. The cultivar Jewel showed commercial potential with competitive yields and uniform root shape. Jewel's orange flesh colour, and sweeter, flavour, were distinctively different to Owairaka Red.

It is proposed that further cultivars should be imported for evaluation in New Zealand, to improve and diversify the sweet potato crop.

Additional key words: *kumara, imported cultivars, Owairaka Red*

Introduction

The sweet potato (*Ipomoea batatas* (L.) Lam.) or kumara was the major vegetable crop grown in New Zealand until surpassed by potatoes and maize which were introduced in 1769 and 1772 respectively.

In the 1850's an American whaling ship introduced a sweet potato variety, which became known as Waina by the Maori. Through mutation, which is a common occurrence in sweet potatoes, a number of variants of this introduction were developed. In the early 1950's H. Mouatt and J. Hunter, Department of Scientific and Industrial Research, selected one of these mutations and named it Owairaka Red (Coleman, 1972).

By the late 1960's B. Coleman had introduced several new varieties, one of which was grown by I. McKinley, and named Toka Toka Gold by W. Stacy, Ministry of Agriculture and Fisheries (I. McKinley, pers. comm.).

Today, the name Owairaka Red is more accurately used to describe an associated group of sweet potatoes, as many commercial growers have selected their own variants from the original mutation. Owairaka Red is estimated to comprise 80 to 90 % of the total crop, with the remainder mainly Toka Toka Gold and a few minor selections (T. Casey, pers. comm.).

In the 1988/89 season, the sweet potato industry produced 16,000 tonnes of roots from 640 hectares. About 90% of the crop was grown in Northland, with most of the remainder grown on the North Island's East Coast (Anon., 1991).

The sweet potato crop has a strong traditional base in New Zealand, as it has in many Pacific rim countries (Wood, 1976), but owing to lack of research into management and new cultivars the crop has developed little from its subsistence nature. Present lifestyles, associated with urbanisation, require a crop with an improved storage life, attractive appearance, and good culinary qualities including suitability for processing (Horton *et al.*, 1989).

This paper reports on sweet potato cultivar trials sited at Pukekohe in the 1988/89 and 1989/90 seasons. The aim of these trials was to evaluate a range of imported clones, and assess their sprout production, yield, and quality under New Zealand conditions.

Materials and Methods

Sprout production trial

New Zealand commercial sweet potato crops are planted using sprouts. The sprouts are produced on roots stored from the previous season's harvest, by burying

them in propagation beds of soil or sand. When the sprouts reach about 15cm in height, they are pulled from the seed root, and transplanted into the field. The number of sprouts produced per seed root determines how many roots must be kept back from the market for the following season's crop.

In the 1988/89 season a sprout production trial was conducted, to compare differences in number and vigour of plants generated for propagation by fourteen cultivars, including five Owairaka Red clones (Table 1).

Sweet potato roots harvested from multiplication plots at Pukekohe (Lat 36°57'S) on 6 April 1988, were stored in multiwalled paper sacks. Sprout initiation was not modified by heating the roots, either to cure them following harvest or to promote sprouting prior to planting.

Healthy roots with an average weight of 124 grams were selected and planted in a cold frame on 18 August 1988, by covering to a depth of one centimetre with river sand.

The trial layout consisted of a randomised complete block design with three replications of two roots per plot.

Sprouts were harvested on five occasions between 50 and 150 days after planting when they reached field planting size (approximately 15 cm). The number and fresh weight of sprouts produced were recorded for individual roots.

Evaluation and yield trials

Sweet potato cultivars were evaluated over two seasons in replicated trials at Pukekohe in Patumahoe clay loam, with an early and a late harvested trial in each season. The 1988/89 season produced good sweet potato growth. Only the three highest yielding imported cultivars were evaluated against the two New Zealand cultivars in the second season. As the 1989/90 season was dry, plant growth was slow.

The two evaluation trials conducted in the 1988/89 season were planted on the 15 November 1988. The early trial was harvested after 106 days, while the late trial was harvested after 134 days. In the 1989/90 season the two trials were planted on 3 November 1989, with the early trial harvested after 144 days, and the late trial harvested after 171 days.

Plots comprised two rows 3.0 metres long, by 0.75 m wide, with 30 plants per plot. Rooted cuttings were used for all plantings to give uniform plant size. Experimental design was a randomised complete block with three replications. Base fertiliser was 15% potash superphosphate broadcast at 2 t/ha.

During plant growth, vigour and maturity were scored, indicated by ground cover and leaf chlorosis respectively. The roots were lifted with a potato digger, and graded according to U.S.A. standards with marketable roots being greater than 2.5 cm diameter, and of marketable quality (Sterrett, 1987). For the purposes of these trials marketable quality was defined as those roots not deformed or showing disease symptoms. Harvested roots were stored and assessed for dry matter content, weight loss, and sprouting.

Results and Discussion

Sprout production trial

The number of sprouts produced for transplanting into the field is an important economic consideration, so production rates were compared with the commercially important cultivars Owairaka Red and Toka Toka Gold.

While some variation was observed amongst Owairaka Red clones, they all tended to produce high sprout numbers. The Owairaka Red control clone (D4) produced significantly more sprouts than the all introduced clones (Fig. 1).

Table 1. Sweetpotato cultivars evaluated.

Cultivars	Origin of Selection	Reference
Abundance	Australia	(Brooks, 1923)
Caromex	USA - North Carolina	(Collins *et al.*, 1979)
Eureka	USA - Louisiana	(Scheurman *et al.*, 1981)
Jasper	USA - Louisiana	(Hernandez *et al.*, 1975)
Jewel	USA - North Carolina	(Pope *et al.*, 1971)
L8-10	USA - Louisiana	L. Rolston, pers. comm.)
Toka Toka Gold	New Zealand	(I. Mckinley, pers. comm.)
Travis	USA - Louisiana	(Hernandez *et al.*, 1981)
White Maltese	Australia	(Brooks, 1923)
Owairaka Red	New Zealand	(Coleman, 1972)

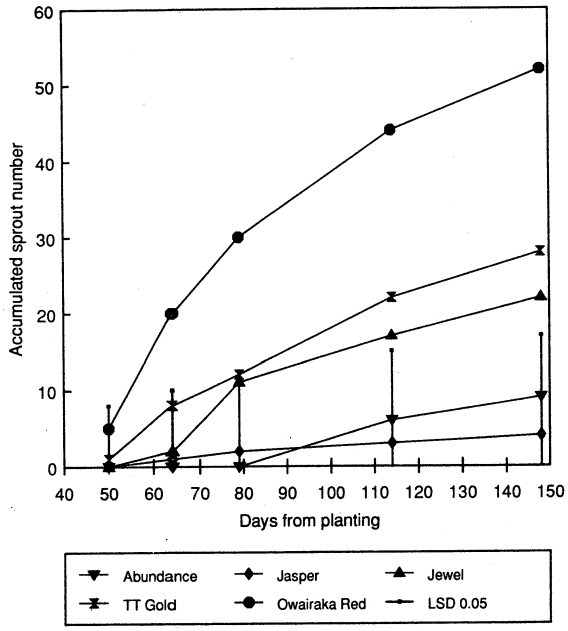

Figure 1. Accumulated production of transplant-sized sprouts over five harvests from five sweetpotato cultivars.

Abundance and Jasper produced few plants, but the remainder of the imported clones did not significantly differ from Toka Toka Gold. The present commercial use of Toka Toka Gold and Jewell indicates that heat treatment could increase sprout numbers to an acceptable level for all cultivars, except Abundance and Jasper. All cultivars produced plants that were similar in fresh weight, and equally robust when transplanted into the field.

Evaluation and yield trials

Comparable yields were obtained between the differen seasons because the second season's trials were harvested later. Travis had a high yield in the 1988/89 season (Table 2) so was included in the 1989/90 season trials (Table 3), but was not considered of commercial value as it had poor eating quality due to fibre in its roots, and rotting in storage. The clone L8-10 yielded well in both seasons, however the roots produced were long and twisted, with a tendency to growth cracks.

Owairaka Red's main commercial strengths are its traditional image, high sprout production, acceptable yield, and early maturity. Its main weaknesses include poor storage due to rotting and shrinkage, as well as production of irregular root shapes. The other New Zealand cultivar, Toka Toka Gold, had a low marketable yield due to its typical production of many small

Table 2. Yields of sweetpotato cultivars in evaluation trials 1988/89. Trials were planted 15 November 1988 and harvested after 106 and 134 growing days.

	Early harvest		Late harvest	
Cultivar	Total Yield (t/ha)	Marketable Yield (t/ha)	Total Yield (t/ha)	Marketable Yield (t/ha)
L8-10	28.0	12.7	44.1	35.7
Travis	24.2	14.9	43.5	31.0
Owairaka Red (D4)	20.3	17.7	34.0	31.0
Jewel	21.0	14.7	35.5	29.2
Caromex	22.5	15.1	31.1	23.8
Eureka	16.2	7.1	31.8	22.9
Jasper	16.2	10.1	26.0	20.7
Abundance	18.3	11.8	27.8	20.4
White Maltese	12.6	8.7	25.1	20.1
Toka Toka Gold	15.4	10.0	36.6	19.7
$LSD_{(0.05)}$	4.0	4.2	4.2	5.7
CV%	11.8	20.0	7.3	13.2

Table 3. Yields of sweetpotato cultivars in evaluation trials 1989/90. Trials were planted 3 November 1989 and harvested after 144 and 171 growing days.

	Early harvest		Late harvest	
Cultivar	Total Yield (t/ha)	Marketable Yield (t/ha)	Total Yield (t/ha)	Marketable Yield (t/ha)
L8-10	29.9	18.9	37.0	30.2
Owairaka Red (D4)	22.5	21.0	30.5	28.7
Jewel	21.4	18.7	27.0	22.3
Travis	18.6	15.0	17.1	13.3
Toka Toka Gold	16.4	10.7	27.1	14.6
$LSD_{(0.05)}$	6.6	6.3	6.7	6.0
CV%	16.8	18.5	12.0	14.6

unmarketable roots (Table 4), although the large roots did exhibit good storage characteristics.

The cultivar Jewel produced yields comparable to Owairaka Red (Table 5). Jewel roots were distinctive in colour and flavour, as well as being more evenly shaped than Owairaka Red. In a sensory evaluation of steamed sweet potato material, Jewel was preferred overall to a number of Owairaka Red clones (Kay *et al.*, 1988).

The diversity of sweet potato root types is represented by two broad preferences as can be seen in the cultivars examined in this paper. In Southern U.S.A., the preferred root characteristics include an intense orange colour, a moist mouthfeel, and very sweet taste (Martin *et al.*, 1986). In Asia and the Pacific, red skin colour is preferred, with white or yellow flesh, dry to moderately dry texture, and sweet to moderately sweet taste (Lin *et al.*, 1985).

Skin and flesh colour varied markedly between cultivars (Table 5). Abundance was of no commercial value due to late production of long, thin roots. Caromex was similar to Jewel but with a tendency to develop storage rots and susceptibility to chilling damage (Collins *et al.*, 1979). The cultivar Eureka frequently rotted in storage and produced roots with many side branches. Jasper was late maturing, and generally lacking vigour. White Maltese produced large roots with a dry matter content only 68% of Owairaka Red, and much fibre. However the imported cultivars tended to have roots of a more uniform size and shape than Owairaka Red.

The sweet potato crop may be further improved in yield, quality, and diversity, by importing and evaluating cultivars similar to Owairaka Red, as well as novel types such as Jewel. Evaluation of two recent introductions is planned. Rojo Blanco (Whatley *et al.*, 1977) is a red skinned, white fleshed cultivar, released by the Tuskegee Institute in Alabama, bred for Latin American preferences. Beauregard (Rolston *et al.*, 1987) is similar in type to Jewel, but may have higher yields, and an earlier maturity. It was released in Louisiana in 1987 and now comprises 90% of that state's sweet potato crop.

Table 4. Mean yield of three cultivars over four harvests.

Cultivar	Total yield (t/ha)	Marketable yield (t/ha)
Jewel	26.2	21.2
Owairaka Red	26.4	24.2
Toka Toka Gold	21.4	12.2
$LSD_{(0.05)}$	6.0	6.1
CV %	13.6	17.4

Table 5. Sweetpotato cultivar evaluation summary.

Cultivar	Sprout Production	Plant Vigour	Maturity	Root Colour		Root Shape	Root Storage	Commercial Potential
				Skin	Flesh			
Abundance	poor	good	late	red	white	long & thin	poor	poor
Caromex	medium	medium	medium	orange	orange	uniform, fusiform	medium	medium
Eureka	medium	good	medium	orange	deep orange	branched	poor	poor
Jasper	poor	poor	late	light red/ orange	deep orange	thin	poor	poor
Jewel	medium	medium	medium	orange	orange	uniform, fusiform	good	good
L8-10	medium	medium	late	cream/ orange	orange	thin, twisted	medium	poor
Toka Toka Gold	medium	good	early	cream	light orange	variable	good	medium
Travis	medium	medium	early	red/ orange	deep orange	uniform, fupiform	poor	medium
White Maltese	medium	good	medium	white	white	variable	poor	poor
Owairaka Red (D4)	excellent	good	early	deep red/ purple	cream	irregular	poor	good

Of the newly introduced cultivars evaluated here, Jewel appears to have the greatest overall potential, and is now being grown commercially in New Zealand.

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