Northern Territory Government

Information Booklet IB1

Sweet Potato Production Guide for the Top End

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Published 2005

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1. Introduction

Sweet potato is a crop that is very well suited to local growing conditions, especially during our prolonged Dry Season. When grown with irrigation, high yields are obtainable and root quality is good. Poor yields and quality, associated with low ambient and soil temperatures are problems for southern growers during Winter which can provide a market opportunity for locally grown crops.

The Horticulture Division of DPIFM conducted an extensive research program on sweet potato from 1983 through to 1993 covering all the major agronomic issues for crop production. This work included varietal evaluation, nutrition and irrigation requirements, pest and disease control and post-harvest studies. Since that time, new varieties have been developed in Queensland and have been assessed in a local screening trial in 2003 to provide updated varietal recommendations. This report summarises past research and provides a guide to successful sweet potato production in the Top End.

Brief summaries of individual research trials are included with detailed reports available within the Horticulture Division Technical Annual Reports which is available at www.nt.gov.au/dpifm under Vegetables – Sweet Potato or a hard copy from DPIFM – Publications, phone (08) 89992313.

2. Site Selection and Preparation

A well drained sandy loam is preferred and heavy clay soils should be avoided as they can retard root development resulting in growth cracks and poor root shape. Lighter soils are more easily washed from the roots at harvest time. Wet season green manure cropping with a sterile forage sorghum is recommended and should be thoroughly incorporated and de-composed by planting time.

Soil pH should be adjusted to about 6.0 by applying lime or dolomite. Rates of 240kg and 400kg/hectare respectively will raise the pH by 0.1 of a unit. The soil should be deep ripped and then disc or tyne cultivated to break up any large clods and provide enough loose soil for hilling of beds. A yearly soil test is recommended to assess soil properties, pH and nutrient levels before ground preparation.

3. Planting Material

Queensland Department of Primary Industries and Fisheries (QDPIF) operates a virus screening program at the Redlands Research Station. Growers can purchase a limited amount of planting material where the desired variety is guaranteed and its virus free status is assured. This material requires bulking up in a nursery bed to provide enough cuttings for a commercial planting. For current supply details call the QDPIF Call Centre on 13 25 23.

4. Bed Formation

Sweet potato is grown on raised beds or mounds. This provides the developing roots with loose friable soil to expand to their potential size and shape without restriction. It also allows adequate drainage and provides easy harvesting with a mechanical digger.

Mounds should be approximately 30cm high and 40cm wide at the base. The main consideration is that the developing roots remain under the soil within the hill. If using a mechanical digger at harvest time it is important to match the width of the mound with the width of the digger mouth. Space the mounds at 1.5- 2.0m apart (depending on the tractor width) with a roadway every 6 rows to allow for boom spray access. Mounds are formed using hilling discs and the base fertiliser can be incorporated during this operation.

5. Cutting Collection

Tip cuttings about 30-40 cm long with approximately 8 nodes are collected from the nursery bed or the last established planting. Tip cuttings should be taken from crops that are old enough to provide material without excess damage. Avoid “back cuts” as these will have variable maturity and result in significant yield reduction *(1993 Tips versus backcuts comparison – page 12)*. The lower leaves should be cut away as tearing them off may damage the nodes that will produce the roots. Cuttings can be left under moist cloth in the shade for a couple of days to promote nodal rooting before planting in the field. At the recommended plant spacing, 330 cuttings are required for 100 metres of row.

6. Seedbed Production of Cuttings

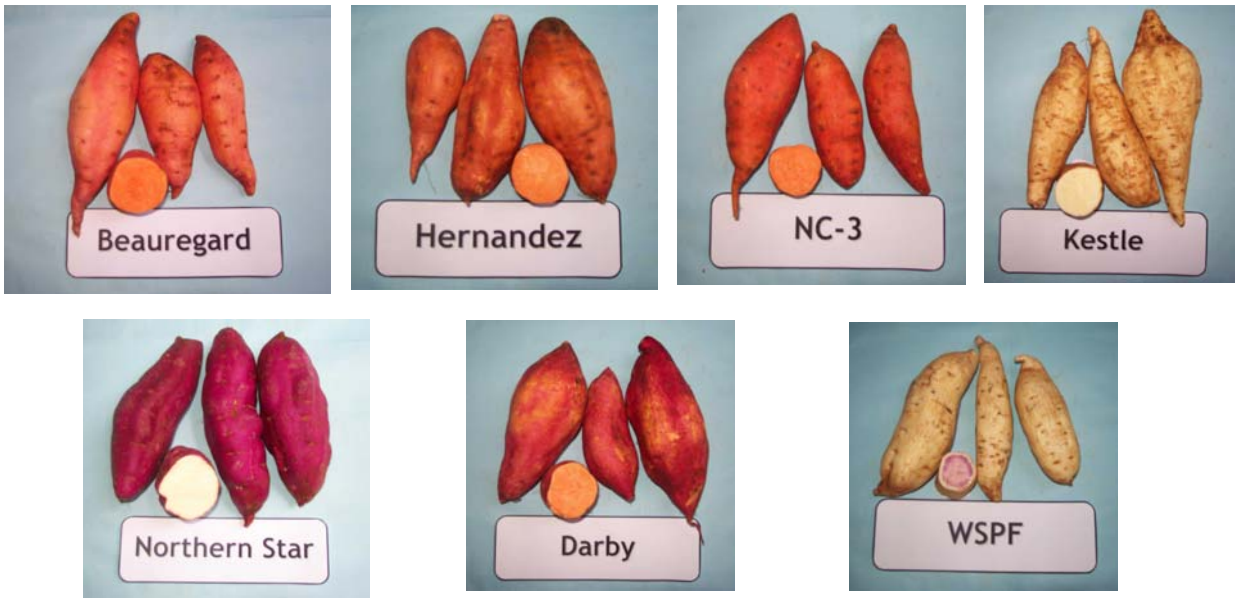
This involves the propagation of cuttings from harvested roots which are placed close together in a seedbed. This is an alternative method of producing planting material which requires less labour but does sacrifice a percentage of marketable roots. Research conducted at Coastal Plains Horticulture Research Farm (CPHRF) *(1992 Seedbed production of cuttings - page 12)* showed that it required about 25kg of roots to plant $1m^2$ of seedbed which yielded approximately 200 cuttings per cut over 4 cuts.

7. Planting Cuttings

Cuttings should be planted at about a 45º angle into the hills as this promotes good even root development. Half of the cutting or 3 to 4 nodes should be buried at a spacing of 30cm between plants. Mechanical planters are available and used on large-scale plantings but manual planting is widely practiced. This can be as simple as pushing the cutting into the hill with a forked stick. The labour requirement for hand planting is estimated at 32 hours per hectare. Cuttings need to be watered in at or immediately after planting. Plantings should be scheduled to allow for progressive fortnightly harvests over the desired production period.

8. Varieties

There are commonly three distinct types of sweet potato that are available for commercial production. Virus free planting material can be purchased from the QDPIF Redlands Research Station.



1) Orange/copper skin with orange flesh eg: Beauregard, Hernandez, Beerwah Gold, NC-3, LO-323, Centennial, Darby.

2) White/cream skin with white/cream flesh eg: Hawaii, Kestel.

3) Red/purple skin with cream/white flesh eg: Northern Star, Red Abundance, Rojo Blanco.

A fourth type with white skin and marbled pink-purple flesh (WSPF) is also becoming available.

Selection of a variety to grow should be based on market demand and the results from local screening trials conducted by the Horticulture Division. Varieties are assessed on a number of parameters including root shape and uniformity, marketable yield, skin and flesh attractiveness and plant vigour.

Research *(2003/04 Variety screening trial – page 13)* indicates that Beauregard has a greater yield potential with better quality attributes than any of the standard orange skin/orange flesh types. Although NC-3 continues to perform well in this climate, it will be replaced with Beauregard as the recommended variety for this type.

Consumer tastes have changed in recent years and there appears to be an increase in demand for the white fleshed starchy sweet potato. Several purple skin/white flesh varieties have been screened in past research but all showed poor root shape with very thin easily marked skins. A new variety called Northern Star rated highly in both of these characteristics with less long thin roots and a tough “double skin” that resists damage during harvest. This will easily replace the previously recommended variety Red Abundance.

The white skin/white fleshed Kestel performed poorly as have other varieties of this type in past varietal assessments. It appears that a good variety of this type for arid monsoonal tropics is yet to be developed.

A new selection developed as part of the Redland’s program is WSPF. It has white skin with purple marbled flesh and is developing its own specific market appeal. Although it yielded poorly when harvested at 20 weeks, its potential should not be ignored by growers.

It should be noted that the maturity times can vary significantly between varieties ranging from 18 to 24 weeks. For more detail on the latest varietal screening refer to the Horticulture Division’s Technical Annual Report for 2003/2004 which can be seen at www.nt.gov.au/dpifm under Vegetables – Sweet Potato.

9. Irrigation

Research conducted on irrigation systems compared overhead mini-sprinkler and drip tape application.

a) Mini-sprinklers:

Yields under this system are up to 15% more than the drip system which can be attributed to more vigorous growth due to rooting of the vine nodes on the wet soil between the beds. Root quality is superior to the tape system but weed growth is more of a problem.

A mini-sprinkler system needs to be correctly designed to give complete and even ground cover. The successful system used in the research consisted of Wingfield challenger sprinklers with yellow jets positioned 50cm above the crop. There was 3m between pipelines and 5m between sprinklers. With an operating pressure of 150kpa at the sprinkler this system delivered a measured precipitation rate of 8mm per hour.

b) Drip tape:

Drip tape irrigation can work well but depends on accurate irrigation monitoring and scheduling. This method produces a continuous wetted strip along the raised bed which needs to be maintained at field capacity throughout crop growth. Research *(1993 Irrigation comparison trial – page 12)* comparing one and two tapes per bed showed an 8% increase in yield with two tapes. Tape irrigation is significantly cheaper than mini-sprinklers but would need replacing with each crop.

There are some disadvantages with using tape irrigation. Keeping the tape in a set position on the hill during planting and crop growth can be difficult. Removing the tape at harvest time to prevent it tangling in the vine pulveriser or digger could also be a problem. More severe soil cracking with tape irrigation allows easier entry for sweet potato weevil resulting in significantly more damage than overhead watering. Root shape and colour was not as good as with overhead watering.

The drip system used in the research was high flow T tape with 20cm emitter spacing which delivered 6.6 litres per metre per hour at 70kpa.

c) Irrigation & Scheduling:

The best way to maintain the desired moisture content in the hills is to monitor the soil moisture with tensiometers. Tensiometers should tell you when and how long to irrigate. A shallow tube at 15–20cm into the hill will indicate the timing of irrigation and a deeper tube just below the base of the hill at 40–50cm will determine the length of irrigation. Water requirement will vary with soil type and increase as storage roots develop within the hills. It is desirable to maintain moisture content in the hills at or near field capacity. Both tensiometers should remain within the 10–20kpa range on sandy soils. This is especially important from 10 weeks onward as roots have been initiated and are starting to fill out. This is also the period of increased water use by the plants. Fluctuating soil moisture levels during this stage will reduce yield and cause cracking of roots.

10. Nutrition

The recommended fertiliser rate for sweet potato production in the Top End is based on crop removal figures. Research *(1992 Nutrition monitoring trial – page 12)* has shown that this recommendation will produce high yields when used in conjunction with yearly soil nutrient testing and petiole sap nutrient monitoring.

Estimated crop removal in kg per hectare is:

- 100kg Nitrogen (N)
- 90kg Phosphorus (P)
- 200kg Potassium (K)
- 200kg Calcium (Ca)

All the phosphorus may be applied in the basal along with 50kg of N and 50kg of K. The remaining 50kg N and 150kg K should be divided into two side-dressings at 4–6 weeks and at 10–12 weeks from planting. Some calcium will be supplied by the lime or dolomite used to adjust the soil pH and any additional calcium may be applied in the basal as gypsum. Petiole sap nutrient monitoring is advisable so the desired nutrient levels for different growth phases can be checked. Any trace element deficiency would be detected by regular petiole testing but generally two foliar applications around the time of side-dressing should maintain adequate levels. Sprays should include zinc, copper, manganese, iron and boron.

The following table shows the optimum ranges for the major nutrients in petiole sap:

	Early running (0 – 10 weeks)	Mid growth (10 – 15 weeks)	Late growth (15 – 20 weeks)
Nitrate ppm	2000 - 3000	1000 - 2000	500 - 1000
Phosphate ppm	100 - 200	100 - 200	100 - 200
Potassium ppm	3000 - 4500	3000 - 4500	2500 - 4000
Calcium ppm	300 - 700	300 - 700	300 - 700
Magnesium ppm	300 - 700	300 - 700	300 - 700

a) Fertiliser application:

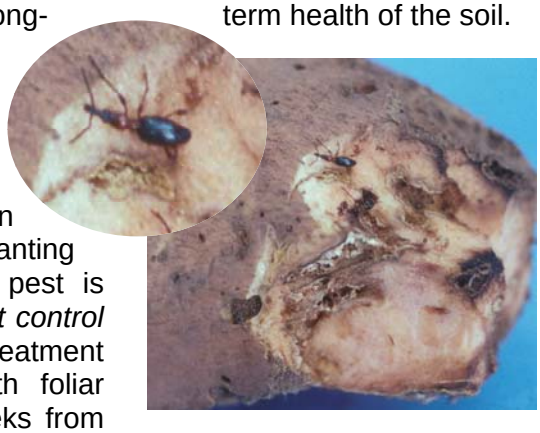
The recommended rates of side-dressing fertiliser should be calculated on the area of crop (eg: 20 rows, 50m long at 2m spacing = 2000m^2 or 0.2ha). If using drip tape this fertiliser needs to be injected through the lines. If watering with sprinklers then the fertiliser can be either injected or applied in the solid form and irrigated into the beds.

Fertiliser	Planting	4-6 weeks	10-12 weeks
Major Nutrient	Basal (at planting)	Side dressing 1	Side dressing 2
Ca	200kg/ha	-	-
N	50kg/ha	25kg/ha	25kg/ha
P	90kg/ha	-	-
K	50kg/ha	75kg/ha	75kg/ha
Trace Elements		Foliar spray 1	Foliar spray 2

11. Pest and Disease

A fallow period should follow each crop to prevent build up of soil borne pests and disease. Planting a green manure crop after harvest helps to suppress any regrowth and weeds as well as improving soil structure and is essential for the long-term health of the soil.

a) Sweet Potato Weevil:



This is the most serious pest of sweet potato. Adults are ant-like which lay eggs on stems and roots. The larvae burrow into the roots making them un-marketable. They can pupate in the stems and be transferred in planting material. Once established in a crop this pest is difficult to control. Research *(1993 Soil insect control trial – page 13)* has shown that a pre-plant treatment of cuttings with chlorpyrifos combined with foliar applications of chlorpyrifos at 5 and 10 weeks from planting provides significant control. Planting material collected from an infected crop would require insecticide dipping before planting. Destroying all crop residue after harvest and crop rotations are the best ways to keep weevil numbers down.

Current chemical registrations, contact DPIFM Chemistry on (08) 8999 2016. Current registrations AgChem chlorpyrifos 500 EC®, Conquest chlorpyrifos 500® and NuFarm chlorpyrifos 500 EC® (Infopest March 2005).

Visit: http://www.apvma.gov.au/pubcris/subpage_pubcris.shtml as at 25/8/05.

b) Giant Termite:

Termites can be a major problem especially on newly cleared ground where the activity of established colonies has not been identified. Avoiding known termite infested areas may be successful in the short term. Aggregation techniques to locate and concentrate termite activity followed by a baiting program is the best way to clear future planting areas of this pest.

c) Other Pests:

Leaf feeding caterpillars may cause problems if infestation is severe enough to cause significant leaf reduction.

At the start of the Wet Season, hungry Magpie Geese can cause serious damage by trampling crops and eating the roots.

Black-footed tree rats are also a problem in the Katherine area along the river.

d) Mycoplasma (little leaf disease):

Infected plants have small pale yellow stunted leaves and stems. The infection is spread by leafhoppers and if plants are infected while young, yields are greatly reduced. Control is by regular monitoring for symptoms and the removal and destruction of infected plants.

e) Viruses:

Feathery Mottle virus has been detected in the NT but research has shown that the infection had no significant effect on yield *(1993 Virus effect on yields – page 11).* In other major production areas of Australia, severe infection has caused yield reduction and distorted roots. Symptoms are often not visible on infected plants and laboratory testing is required to confirm any infection. The virus is spread by insect vectors and by infected planting material. If sweet potato is to be grown over an extended period then new virus free material should be obtained from the virus free program in Queensland every few years.

f) Fungal Disease:

Soil borne fungal diseases can infect the roots but are not a large problem on well drained sandy soils. Any organic matter added to the soil should be well decomposed before planting.

12. Weed Control

Weeds may be a problem early in crop growth before vigorous vine growth covers the beds as plants become established. A number of control strategies may be used:

After bed formation, irrigate to germinate any weed seed then spray with a knockdown herbicide before planting.

Pre and post emergent herbicides are registered for sweet potato in the NT but their effect under local conditions has not been tested. Information on rates and weeds controlled is available through Infopest.

Rotary finger cultivators are effective in removing small seedling weeds during early crop growth.

Encourage vigorous early vine growth to smother weeds.

Organic mulch is a good option for small planting areas especially when using a nursery area that produces cuttings for planting material.

13. Maturity and Harvesting

Root maturity can vary between varieties and root development is slower during cooler weather. Growers need to monitor the development of roots with regular checks of root size after 18 weeks. Marketable grades of roots are between 0.25 and 1 kilogram. If harvested at the correct time, around 60-70% of total roots should be within this grade. If grown during the dry season most varieties should be ready for digging at about 20 -22 weeks from planting. If left too long in the ground the roots can become oversize and unmarketable.

Harvesting sweet potato can be very labour intensive and requires suitable equipment for commercial production. Before harvest most of the top growth needs to be removed or it will become entangled in the digging machine. Vine removal is best done with a flail pulveriser where the flails are shaped to the contour of the bed. This will chop the vine into pieces and leave the hills bare. A standard slasher or pulveriser can be used but will not remove material between the rows. Avoid chopping into the top of the hill and damaging the roots. Following this any remaining vines can be cut on both sides of the hill with large sharp coulters mounted on a tool bar. This vine removal should be done a week before digging to toughen the skin of the roots.

Roots are lifted from the soil using a single row potato digger. To avoid digger damage this should be done while the hills are still moist so that some soil travels up the digger bars with the roots. The digger elevator should be moving only slightly faster than ground speed.

The dug roots are then manually collected into bulk bins and transported to the shed. Avoid lengthy exposure to the sun and skin damage will be less if the roots are kept wet during handling.

Research trials have shown that 20-40 tonnes per hectare of marketable roots is achievable depending on variety and management.

14. Post-harvest

Correct post-harvest handling is critical for any produce and sweet potato is no exception. Harvested roots should be washed, graded and cooled soon after being dug and not left in the field for an extended period. Keeping the roots wet or moist will help prevent skin damage. Washing equipment includes a water hopper or soaking trough connected by an elevator to a conveyor of soft brushes with multiple high pressure spray jets. Harvested roots are immersed in the water hopper which lessens skin rubbing damage and loosens soil adhering to the roots before entering the washing brushes. Avoid hard brushes which can damage the skin and clean brushes and conveyors regularly to avoid latex build-up.

Marketable root weight is between 0.25kg and 1.0kg with 2 grades of 0.25-0.6kg and 0.6-1.0kg. These are usually packed in 20kg boxes with one size grade per box. Top quality roots should be free of soil with smooth undamaged skins. They should have good even shape with no cracking or insect damage.

a) Storage:

Post-harvest storage rots such as Rhizopus fungi can infect damaged areas on roots and can spread to other roots on contact. The best control is preventive by avoiding skin damage and not packing damaged roots. Roots should be dry before packing.

Optimum storage conditions are at 14–16ºC in a high humidity cool store *(1990 Post-harvest storage trials – page 11).*

Storage below 10ºC may cause chilling injury and above 16ºC can lead to excess weight loss and sprouting.

b) Root curing:

This process involves the forced hot air treatment of roots at 30ºC with 90% relative humidity for between 4-6 days. This must be done immediately after harvest and results in the formation of a wound skin which heals any mechanical damage suffered during harvest. Post harvest rot infections are minimised and excessive moisture loss prevented. Curing can also improve eating quality by increasing sweetness.

Root curing is not a standard commercial practice in Australia but is worth considering if roots need to be stored for a pro-longed period.

15. Markets

Historical wholesale price information for southern markets shows lower throughputs and higher prices from August to December. Recent market reports show this window has diminished somewhat and that prices are mainly stable throughout the year. Updated sweet potato price information can be purchased from Ausmarket, go to www.ausmarket.net.au

There are under-exploited markets in Darwin and other NT centres which are currently unreliably supplied with sweet potato from interstate.

To achieve prices above average in any market the quality of the sweet potato roots is of primary importance. Intending growers should create their own estimates of gross margins of sweet potato production in the NT.

16. Summary of Sweet Potato Trials Conducted at Coastal Plains Horticulture Research Farm (CPHRF)

Full project reports can be found on the Crops, Forestry and Horticulture web at www.nt.gov.au/dpifm under Vegetables – Sweet Potato and hard copies of yearly Technical Annual Reports can be purchased from the DPIFM Publications Section at the Berrimah Farm.

a) 1983 Variety screening trial – 7 varieties:

Beerwah Gold and NC-3 produced the best quality roots with good even shape and size. LO323 had very high total yield but root quality very variable. The purple skinned white fleshed Red Abundance had poor yields and severe root cracking.

b) 1984 Variety screening trial – 7 varieties:

NC-3 rated the best of the orange flesh types. LO323 yields again very high with many over size roots and appears to be a quick maturing variety. Although Red Abundance produced average yields in this trial, the thin purple skin was easily damaged with mechanical harvesting exposing the white flesh. All varieties had moderate to severe termite damage.

c) 1985 Variety screening trial – 11 varieties:

This trial included five varieties from AVRDC in Taiwan. All had exceptionally high yields but root size and shape was extremely variable. Varieties were progressively harvested to determine optimum maturity. LO323 harvested at 18 weeks from planting reduced the number of over sized roots. NC-3 and Beerwah Gold again yielded well with a high market grade when harvested at 20 to 22 weeks. Red Abundance produced many long thin roots and marketable yield was low. The general performance of this variety has been inconsistent and a better purple skin white flesh type is required.

d) 1988 Variety screening trials – 5 varieties:

Two replicated trials were conducted on five selected varieties to determine the average marketable yield. Centennial and LO323 were the highest with 29.5 and 46.5 tonnes per hectare respectively but they had a high percentage of large roots with irregular shapes. The roots of NC-3 and Beerwah Gold were clean, uniform and medium grade yielding 27.1 and 25.4 tonnes per hectare respectively. Red Abundance yielded poorly with 12.7 tonnes and quality was poor.

e) 1990 Post-harvest storage trials:

The four recommended varieties were grown to test their response to post harvest storage treatments and the effect of hot air curing on the storage ability of roots. Both cured and non-cured roots were stored at both ambient temperature and cool storage (14–16ºC). All treatments had four replicates and assessments were conducted over four weeks storage. Over all treatments NC-3 stored the best while LO323 rated the worst. All cured roots had significantly less surface rot development and the combination of curing and cool storage was most effective in reducing weight loss and surface rots.

f) 1992 Variety screening trial – 9 varieties:

Several new varieties were introduced from Queensland and their performance was compared with the known varieties. NC-3 continued to rate as the best of the orange varieties. Resisto rated well for root quality but had a high percentage of small reject roots. Collyambally was white skinned with white flesh with a poor appearance and irregular root shape. Rojo Blanco was rated as the best of the purple skin white flesh types with root uniformity and shape superior to Red Abundance. These varieties were tested for virus by grafting them onto an indicator plant, *Ipomea setosa*. This technique indicated that NC-3 was positive to Feathery Mottle Virus.

g) 1993 Virus effect on yields:

Although NC-3 tested positive to virus in the 1992 planting, the trial yields were very good and this raised speculation on the effects of the virus on USA cultivars like NC-3. New virus free material was obtained from the virus free program in Queensland and compared with the infected NC-3 in a trial planting. There was no significant yield reduction due to the virus infection. This indicates that NC-3 may have tolerance to Feathery Mottle Virus under local growing conditions.

h) 1992 Nutrition monitoring trial:

Petiole sap nutrient levels were monitored weekly to test the current fertiliser recommendations which were based on crop removal figures. Crop Tech Laboratories analysed the samples and based their recommendations on nutrient monitoring work conducted in Queensland. Generally the Nitrogen and Potassium levels remained within the desired range with N levels steadily dropping away during the root development phase and K remaining about 4000ppm throughout. Phosphorus and calcium inputs were insufficient and should be marginally increased.

Trace element levels were good except for copper and manganese which would require supplementary foliar or injected applications. It appears that the current recommendation may require some adjustment but does produce good yields and provides an adequate guide for growers. Petiole sap nutrient monitoring is advisable for commercial production.

i) 1992 Seedbed production of cuttings:

The collection of cuttings from an established crop in the field is a very labour intensive operation. Seedbed production produces uniform, straight and easy to harvest cuttings from a comparatively small area. Seedbed cuttings can be harvested four or five times with about four weeks between cuts. Propagation from quality roots selected from harvested crops could also be beneficial in helping prevent any genetic deterioration of the variety in the long term. Selecting from high yielding plants is also selecting away from possible virus infected plants of low yield.

j) 1993 Irrigation comparison trial:

This trial compared the performance of the variety NC-3 under the following three irrigation treatments. One line of high flow T tape, two lines of high flow T tape and overhead mini sprinklers. The mean marketable yields were very high with 70, 76 and 84 tonnes/hectare respectively. Irrigation run times were based on evaporation replacement calculations with all treatments maintaining similar soil moisture tension and volumetric soil water content around the developing roots. Lower yields associated with the tape treatments due to lack of crop vigour can be attributed to the inability of the plant runners to set nodal roots in the dry soil between the hills. Weed problems were much more severe in the mini-sprinklers treatment and weevil damage was more extensive in the tape treatments due to soil cracking along the hills allowing pest entry to developing roots. Tapes could become a problem if they became entangled in the mechanical digger at harvest time. Mini-sprinklers have a significantly higher capital expenditure when installing the irrigation system but did produce larger roots with better shape and skin colour. With accurate irrigation scheduling during the critical root initiation and filling period, T tape would be an efficient irrigation method for commercial production.

k) 1993 Tips versus backcuts comparison:

Tip cuttings are used as standard commercial practice when growing sweet potato because it is believed that cuttings taken further back from the terminal cutting result in lower yields. A trial comparing the two types of cuttings of the variety NC-3 showed that backcut material consistently yielded 10 tonne/hectare less than tip cutting planting material.

l) 1993 Soil insect control trial:

The two pests that can cause severe economic damage to developing roots are the sweet potato weevil and the giant termite. The objective of this trial was to evaluate the effectiveness of the registered insecticide chlorpyrifos in controlling these pests by comparing several application methods. These included a pre plant treatment of cuttings, a pre-plant soil incorporation and foliar sprays. Dipping of planting material alone was not sufficient to prevent damage and soil incorporation was less effective than foliar sprays. The best level of control of weevils was achieved by the combination of dipping the cuttings and foliar sprays at 5-10 weeks after planting. The treatments had little effect on termite activity which appeared only in isolated areas of the trial.

m) 2003/04 Variety screening trial – 8 varieties:

The trial provided the desired comparison of new and known varieties in regard to potential yields and important root quality parameters. Although NC-3 continues to perform well in this climate, it will be replaced with Beauregard as the recommended variety for this type. Northern Star rated highly with fewer long thin roots and a tough “double skin” that resists damage during harvest. This will easily replace the previously recommended variety Red Abundance. The white skin/white fleshed Kestel performed poorly in this trial and it appears that a good variety of this type is yet to be developed. There appears to be a growing market niche for the unusual white skin/purple flesh type called WSPF and although it yielded poorly when harvested at 20 weeks in this trial its potential should not be ignored by growers. A field day for potential growers was held at CPHRF at the time of harvesting the trial. All varieties were on display along with harvesting and grading machinery.