

2012

SRDC Research Project final report

Improved methods of compost generation

Walker, B

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SRDC Research Project Final Report

Cover Page:

Title of the Project: **Improved Methods of Compost Generation**

Project Reference Number: **GGP 062**

Name(s) of the Research Organisation(s): **Advanced Nutrient Solutions Pty Ltd**

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The project participant/s wish to acknowledge receipt of project funding from the Australian Government and the Australian Sugarcane Industry as provided by the Sugar Research and Development Corporation.



Australian Government
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The Research Organisation is not a partner, joint venturer, employee or agent of SRDC and has no authority to legally bind SRDC, in any publication of substantive details or results of this Project.

COMMENDATION:

The members of the ANS P/L team have found our three SRDC Projects extremely educational.

We wish to express our sincere appreciation for the encouragement and funding support from SRDC over our 3 projects.

The experiences would not have been available to us if there had been no Grower Group Innovation Projects

From our composting experiences it is clear that farmers of tomorrow can rebuild soil fertility, produce nutritional crops and feed an expanding world population.

Thank you SRDC, we are pleased to be able to communicate the results to all farmers and the wider community.

INTRODUCTION:

The following report may well be our last in this project of nearly seven years of research, education and field practice with compost in GGP034, GGP044 and GGP062.

Compost is as necessary for a farm's long term sustainability, continuing productivity and crop nutrition as synthetic fertilisers since they were developed by German chemist, Justus von Liebig in 1840. Every farm's soil fertility will be different, but when compost is used in conjunction with artificial fertilisers, this combination will maintain and improve soil health, productivity and nutrition in crops, this century and forever. Human and animal health is dependant on nutritional crops.

Body of the Report:

Executive Summary:

This report explores different techniques and management principles and the results of compost production specifically for sugar-cane in tropical agriculture. Our earlier research using the Lubke Methodology developed in Austria for temperate and cold climates and reported on in GGP034 provides a background of basic compost production principles using community and sugar industry organic wastes, tractor drawn turning equipment and Lubke monitoring tools and principles.

The Lubke system turns compost once weekly, more often in the first month, when CO₂ content of the pile reaches 16%, but many composters claim loss of carbon and nitrogen as high as 50%, with constant turning.

Some major USA composters use Static Pile composting principles to reduce turning costs and conserve nutrient losses from turning. The Ecology Action Group in the USA use 40% fresh green feed stocks to improve nutrient content because plants remobilise nutrients before foliage dies and weather continues to reduce minerals in organic matter materials. Dr Fiona Robertson in a CRC research found cane trash left on the surface loses much of its nutrition to the atmosphere as it decomposes. Hawaiian research found losses, through plant nutrient remobilisation of 30 – 50% of N, P, K and B in sugar cane leaf blade before its death.

GGP062 reports on our experiences with static pile composting, our first experience of composting sugar-cane bagasse, using selected green feed stocks and a change in brix levels, i.e. greater nutritional content of vegetables grown with compost and liquid calcium, also, trials with producing the nitrogen component on-farm.

A brief overview of world population trends at the end of this report implies a need for a change in agricultural practices and results, if we are to feed our population by 2100 AD.

AIMS:

A key objective of the static pile trials was to determine if we can reduce cost of production without lowering nutritional content of the final product. Reduced turning will lower cost of production and conserve carbon and nitrogen, perhaps other elements, but increases CO₂ content with less aerobic activity but greater anaerobic activity producing alcohols and sulphides, substances detrimental to plant growth.

The second key objective was to evaluate the hypothesis that ALL compost feed stocks could be produced on the farm, negating any expenditure on importing off-farm inputs. Our experience has been that freight costs for off-farm feed stocks, if carted over 50km one way, can double the cash cost of compost production.

BULKING UP:

By incorporating bulky components in the compost pile, e.g. cane billets, wood chips, branches, pockets of air are trapped inside the pile and this also allows easier access of air during decomposition. Up to 40% wood chip is recommended by the Ecology Action Group, providing enough oxygen for aerobic production for up to four weeks. This would save seven or eight turns in the first month and saves two or three turns every other month.

Whilst this compost never smelled sour, hydrogen level in one pile finished at 1.6%H compared to our past average of 0.1%H . The laboratories 30 random analysis has average H @ 0.2% and highest H @ 2.2%.

Our two bulked-up static piles were left curing for fifteen months, (because of high C : N ratio, it takes longer) after which time the bulking agents had mostly decomposed, thus being easily spread. In the USA wood chip is often screened out and can be used in up to three batches of compost manufacture. Our wood-chip was probably smaller or perhaps our tropical climate assisted decomposition.



Photo 1: Mycelium Growth

Strong mycelium growth was evident in all wood-chip areas, after rain events. This compost was used in garden trials where all grew numerous miniature brownish mushrooms about 25mm tall with a top less than the size of a small pea. Mushrooms are the fruiting bodies of an active mycelium colony. They are an indication of a healthy soil and necessary for good row crop or forest growth. – Dr Elaine Ingham.

SUGAR CANE BAGASSE:

Bagasse as a compost feed stock was never available due to the huge demand by sugar factories for its use as a furnace fuel for steam and electricity production in sugar mills.

Mackay Sugar is now producing, in 2013, 30% of the local communities electricity demand, while also providing energy to the Racecourse Mill and adjacent Racecourse Refinery, through its new green energy plant, thus consuming all available bagasse.

In the 2010 – 2011 wet sason some 3000mm of rain over 6 months saturated thousands of tonnes of start-up furnace bagasse at Mackay Sugar Mills. Because this wet bagasse extinguished the mills fires at start of the next crush, it was rejected as furnace fuel and dumped on several local farms.

This saturated 2010 bagasse was used as the carbon feed stock in all three of our bagasse compost experiments as it would be our only opportunity to produce compost with bagasse.

SAMPLE 1 – WALKER:



Photo 2: Turning static pile at Walker's farm

Construction of the static pile at Walker's began on 8 March 2012. It consisted of Bagasse, chip bark, old sugar cane billets, mowed grass from headlands, mill mud/ash and old compost. The static pile was turned using an excavator relocating the old pile to a new site adjacent to the old one. It was first turned, following construction on 7 April, then 26 May, 8 July, 26 July, 1 November and 11 November 2012. The irregular times of turning are due to weather conditions.

Attached in the appendix is a copy of compost results made with bagasse and turned using the compost turner, with similar results to the static pile.

SAMPLE 2 – ROSS – GREEN ROW 2:

The base organic material used was the rain saturated bagasse, a small truck load of aged wood-chip and about 5% by volume of old compost, green row1. No added nitrogen product. The components were mixed by hand with a garden rake but only in the top 30cm. No machine turning before planting.

Other than in the old compost, very little of the minerals in the feed stocks would be plant available until decomposed. Thus a small quantity of mineral fertilisers, high Ca% liquid Ca, molasses and gibberellic acid (a plant growth hormone) were added to support plants and biology.

Many species of plant and seeds were broadcast, watered and covered with a compost cover for one week. Initial germination was strong but hot tropical summer weather eliminated growth of most plants. Best surviving species were:- forage sorghum, pigeon pea, loofah, sunflower, soybean, sweet potato, mugwort, rattlepod, kenaf and lab lab. Vegetable, flower and temperate zone plants did not survive the mixture of tropical heat and the poor growing medium of bagasse.

COMMENT:

Home gardening in the tropics is usually not begun until after the high temperature humid wet season is over – about April or May. Producing compost in the heat of summer with set season rainfall was an attempt to reduce water cycle costs.

Perhaps if the pile was started in the cooler Autumn months, many of those nutritional plants would survive.

In all 45 varieties of plants were tried between late November 2011 and mid March 2012. Late plantings were in areas where non-suited plants collapsed. Not all legume seed was inoculated. Lists of plant varieties tried and some plant stimulating practices, tried for the experience with only observations recorded are listed below.

The objective was to improve nutritional content of composts by composting the entire plants green, instead of just the mineral depleted dead foliage. Plants harness the sun's energy and consume CO₂, releasing oxygen and with the carbon build their carbon structures whilst producing sucrose foods for soil biology. Some plants originating from cold country origins are known to hold minerals in branches or roots, e.g. comfrey, during winter.

PLANT SPECIES IN GREEN ROW 2:

Seeds and seedlings

Borage	Yarrow	Sugar-drip
Sorghum		
Chickpea	Leucaena	Nasturtiums
Corn	Dill	
Soybean	Rattlepod	Pigeon Pea
Mungbean	Plantain	Ceylon spinach

Melons	Dark Red Leaf	Loofah
Sugar-beet	Pigweed	Devil's Fig
Sunflower (2 varieties)	Tree Cabbage	Tomatoes
Dandelion	Thyme	Cassava
Oats	Valarian	Drumstick Tree
Sweet Leaf	Kenaf	Salad Mallow
Sweet Potato	Bamboo	Vetiver Grass
Tarragon	Taro	Galangal
Tumeric	Queensland Arrowroot	Egg-Plant
Mugwort	Basil	Red Leaf
Aramanth		

LIST OF MINERALS, HORMONES, PLANT STIMULATING PRACTICES TRIED:

Alroc Extra-Phos	Molasses	Vitamin B12
Alroc Organic Horse Ammonia	Raw Sugar	Sulphate of
Alroc Active 8 (Liquid)	Dolomite	
Alroc N-Rich (Liquid)	Fe Celate Powder	Liquid Fish and
Kelp		
Alroc Liquid Calcium	Mo Powder	
Alroc Vital Kelp		

BD 500 – Biodynamic 500 – 85g in 2 ½ litres of water stirred left and right circles for 30 minutes and applied after sundown on the full moon.

Stinging Nettle Ferment

ORMES sea product

Charlie Carp Liquid

Giberelic Acid (used in grape industry – made in China)

Sonic Bloom Treatment – under leaf sprayed with a selection of above products before 9.00am or late afternoon. Ten minutes before start of spraying play selected music

- Bach's E Major Concerto for Violin – Hilary Hahn, violin
- Louis Armstrong – The Very Best Of
- Glen Miller and his Orchestra
- The Essential Ravi Shankar
- Australian Bird Calls – David Stewart

This gentle music opens or keeps open a plant's leaf stomata and improves absorption of the spray. Continue music 30 minutes after finish of spraying. Do not use heavy metal or rock and roll music. A loud speaker mounted on a tractor will cover 40 acres with sound so try not to annoy neighbours.

OBSERVATIONS:

As feed stocks we have used cane trash, feed lot manure, bagasse, chicken manure, regional council green waste, sensitive weed, green plants particularly legumes and bulking agents of wood-chip and cane billets and sugar mill mud as a nitrogen source.



Photo 3: Variety of Feed Stocks

Photo 4: More Feed Stocks

If we exclude the freight, costly off-farm inputs, our best analysis are from a 100 metre long row built of slashed sensitive weed with 10% by volume of mill mud (Oct 2009) and Green Row 1 with over 50% green plants, mainly lab lab, and no mill mud or any other nitrogen source (April 2011)

Carbon, calcium, nitrogen and micronutrients were 50 to 100% higher with both weed and green plant composts.

QUOTE: “The environment draws out the plant’s potential. Poor soil will grow poor crops. Residue’s from those crops produce poor quality compost.” From Genetics and the Manipulation of Life by Craig Holdredge

The sensitive weed had self sown on a cane paddock top dressed with compost prior to the wet season and the lab lab was grown on a row of old compost.

BRIX LEVELS:

Simultaneously with Walker’s five year old sugar cane plot a number of small vegetable trials were conducted and brix or taste levels recorded.

Pumpkins grown on a 70M long old compost row cropped heavily with strong local demand because of their “sweetness”.

Commercial tomato brix levels at supermarkets were at 5% and tasteless. When grown at home with compost and liquid calcium added they measured 7 – 10% brix and were sweet. Pitaya (dragon fruit) from supermarkets tested 9 or 10% brix and tasted acidic. When grown with compost and liquid calcium added they tested 15 – 17% brix and the acid taste replaced by a sweetish flavour. The higher brix reading indicates a greater uptake of minerals by the plant and therefore a nutritionally superior food for human or animal.

SUGAR CANE QUALITY:

An Indian sugar cane person travelling Queensland, after eating some Queensland sugar cane, commented that it didn't taste the same as Indian sugar cane.

John Walker harvested in 2012 a block of sugar cane of which half had received an application of compost on top of the granular fertiliser applied to the entire block. We received heavy un-seasonal rain in July. At harvest the granular ONLY had heavily suckered but there were no suckers where the compost was applied.

In the fifty years to 2000 AD some 52 varieties of sugar cane were grown on our Oakenden soils. In the 1940's sugar canes were thick, low sticks to the stool, multicoloured rind e.g. red, brown, purple/black, tall and some cyclone resistant. Today's sugar canes appear mostly white/green, heavy stoolers, longer ratoons, brittle compared to old noble canes and susceptible to cyclone damage.

A few of the old noble canes were: Trojan, CO290, Badilla, Comas, POJ2878, Pindar. Most of these canes required fertile soils and good crops were produced with lower fertiliser rates than we use today.

A comparison of brix levels, of varieties, over the past 50 years, (say back to 1940), or alternatively, of Indian canes might be of value.

USING COMPOST:

Compost, of any quality, is a soil amendment with long term soil building qualities not found in salt based artificial fertilisers. It is not a replacement for fertilisers in the short term. Our experience is that our highest cane production resulted from the use of both fertiliser and compost. In our cane we used 50 – 50.

Compost can raise soil organic carbon in cultivated soils by 0.1% per annum. Many of today's farm soils have less than 1% SOC. Aim for a SOC of at least 2 ½ % or 4 -5% OM. Raising OM in soils increases its water holding capacity, stores more minerals, provides food and accommodation for the soil food web to release these minerals in plant available form. Over time mineral content of soils will build but are not leached from the soil similar to salt based fertilisers. It is believed these minerals are in the dead bodies of the micro-organisms which gives a gumminess feel to the compost. Their deceased bodies stick to clay and organic matter in the soil and do not leach with rainfall.

Applying compost improves microbial diversity and population in the soil. Healthy balanced soils have a ratio of good soil biology over pathogens of between 5 and 10 - 1 pathogen. This maintains control of plant diseases.

Maintain nitrogen fertilisation in early years as nitrogen levels in compost are low and only released slowly, some suggest very little release in the first year after application. Use an independent laboratory to analyse your product and calculate your field application rate on your phosphorus needs. After a few years of compost application try a few strip trials with reduced, or eliminated P and K. In our soils an application of 20 litres per hectare of high calcium liquid Ca increased cane height by about 30cm. Calcium will support soil biology. Twenty litres per hectare of molasses was added with the Ca as a carbohydrate food source for the biology.

WALKER 6HA TRIAL SITE:

This site has 3 fertiliser rates.

- Compost only
- Recommended granular fertiliser only
- 50/50 of each of the above

2013 will be the fifth and final crop in the cycle. Each rate is replicated three times across the field.

Compost only strips are usually a paler green than strips with granular fertiliser for 5 or 6 weeks longer into the main growth season. For the first time a top dressing of urea was applied across the site. No colour variation in the leaf across the whole trial, for the first time. At the end of April 2013 there is no visible difference in cane height across the block. Harvest will be about November 2013.



Photo 5: Paler strips where compost is applied 2013

Photo 6: Same block 5 May

A graph of past harvest results is attached.



added fertiliser

Photo 7: Potted corn in various mediums:

Five weeks after planting. No

24- 10-12

Above is a photo of our potted corn experiment. Ten pots were filled with a variety of growing mediums, no fertilisers added.

- Pot 2 (left in photo) 100% old compost – over 2 years old and had already grown a crop of pumpkins and later tomatoes. Illustrates slow release of N.

- Pot 5 (middle in photo) Alluvial creek soil – grown cane for about 70 years
- Pot 8 (right in photo) An organic potting mix from Bunnings

Other pots were similar to pots 5 and 8

Believing the experiment was contaminated somehow, it was repeated two months later. Resulting growth differences were the same.

PRODUCTION COST OF STATIC PILE COMPOSTING:

Bulking agents used increased pockets of air stored inside, or flowing through, the pile. Turning time was reduced by about two thirds compared to the Lubke system. A detailed record of times involved was not kept as procedures were being developed and compared and volumes were necessarily small until appropriate formulas were known. Additional cost was incurred in sourcing bulking-up feed stock and chipping branches or forage sorghum or accessing old cane billets.

Growing green feed stock on-farm will have land preparation, seed, planting and harvesting costs.

Overall, despite a substantial saving in turning costs, little cost reduction in static pile composting is expected.

A rough estimate of cash outlay of \$20 - \$25 per tonne is envisaged.

BAGASSE AS FEED STOCK:

The saturated bagasse feed stock was not analysed and in Green Row 2 no additional nitrogen source was added.

Our conclusion is that we found no nutritional advantage using saturated bagasse in static pile composting. Cane trash and mill mud will provide a compost of equal or superior nutritional content.

See Lab Job No C5182

BRIEF POSITIVES:

Compost raises SOC @ 0.1% pa, quicker in managed pasture. Improves water retention. A slow release product, one application may give benefits up to 2 and 3 years after application, supplies many macro and micro nutrients. Usually will not leach nutrient with heavy rainfall, but cover curing piles. Use 50% green foliage to improve mineral levels. Fertiliser, especially P and K may be reduced or eliminated over time – run strip trials. Grow feed stocks in fertile soil or add ample compost to soil to improve mineral values. Deep rooted weeds will collect minerals from below the top soil so make rich compost.

Continue your nitrogen application until carbon and organic matter content of soil improves.

BRIEF NEGATIVES:

Carting feed stocks more than 50klm substantially increases cost of manufacture. Don't permit pile to exceed 65 degrees C or feed stocks may be ashed.

Ashed feed stocks repel water.

Be aware of potential harmful level of chemicals in some feed stocks: Muriate of potash (KCL) high chloride content, cadmium in filter mud, antibiotics used at feedlots, herbicides and pesticides.

Slow and low release of nitrogen for the 12 months after application

Remember this is not a concentrated salt artificial fertiliser taken in as plant drinks. It is an organic soil amendment and will rebuild soil fertility from which the plant benefits.

TURNING:

Regular turning looses C and N, perhaps other minerals also.

Maintain ample O₂ for aerobes.

Bulk up feed stocks to lock in O₂ to minimise turning.

Maintain adequate moisture level.



Photo 8: Aeromaster compost turner

NUTRITION IN COMPOST:

Our current project sought to establish guidelines for a farmer to produce as economically as possible, a compost of good quality in nutrition and biology. Recorded below is an international guide to elemental parameters, with our results below.

Minimum and maximum results achieved.

	N%	P%	K%	S%
C%				

Theirs 6-20	0.5-2	0.5-1	0.5-20	0.1-0.5
ANS P/L 3-14	0.24-1.11	0.13-0.46	0.17-0.59	0.04-0.14

	Ca%	Mg%	Na%	Zn ppm
Fe ppm				
Theirs <10,000	3-40	0.3-20	0.1-10	85
ANS P/L 66-22,981	0.28-1.47	0.08-0.27	0.01-0.03	3.9-75

	B ppm	Si ppm	Cu ppm	H+%
MO				
Theirs -	1-20	<1,500	20	Nil
ANS P/L 1.06-3.3	0.28-11	112-2086	1.6-20	0-4

	Co ppm	Humic Acid
Theirs	-	?-18
ANS P/L	5.4-11	8.2-11.3

It is likely the international numbers are of composts of animal and bird manures or mushroom shanks. Note our high Si ppm. Sugar cane, our main feed stock is a high silica plant. One long time commercial operator in the USA using static pile composting techniques claims to have achieved 2% N, 2%P, 2%K. Selected reading titles in appendix.

Many native Australian plants are rich in minerals with many species protected.

Recommendations:

OUR RECOMMENDATIONS:

Compost will build soil organic carbon, hold minerals, provide food and accommodation for soil biology.

Start simple with equipment on hand.

- bucket on end loader
- or build tipping bucket on tractor linkage



Photo 9: Home-made loader bucket on three-point linkage



Photo 10: Front end



Photo 11: John Ross' home made compost applicator

FEED STOCKS:

- Use available on-farm wastes:- cane trash, banana plants, tamarind and mango branches and leaves, weeds
- Grow legumes close by as a nitrogen source, harvest green, inoculate seed

- To increase other mineral content refer to plant mineral analysis in background notes of our meeting of 11-10-2011 giving mineral concentration of some 40 plants. Plants grown in poor soils will have lower concentrations. Variation in compost may be minimal.
- Use 40% by volume of a bulking agent to hold O₂ in compost row – cane billets, wood chip, branches and weeds
- Turn about monthly to release excess CO₂ in row, created by aerobic organisms

MONITORING

- Purchase temperature probe – see appendix
- Alternatively insert a broom handle into pile and leave there. Withdraw as required. If uncomfortably hot to hold, then too hot – turn and water
- Monitor moisture content using hand squeeze test. A handful of curing feed stock when squeezed hard should slowly run drip trails on outside of fingers. If water runs off – too wet and if no drip trails - too dry. Water as you turn if too dry
- Smell test for anaerobic decomposition – sour smell means pile is short of O₂ and consists of anaerobic by-products – alcohols and formaldehyde, which are detrimental to plant health and growth
- Turn monthly for 20 – 26 weeks
- To analyse contact an independent laboratory that will test for available and total nutrients as taught by Dr Carey Reams.

See appendix for lab contact

APPLICATION:

- If soil analysis available, calculate from compost analysis amount of phosphorous required to match recommendation.
- Apply granular nitrogen as recommended in first year
- Second year run strip trials with only 50% of nitrogen recommendation and compare results
- Expect application target of 10 – 20T/HA. If SOC is below 1% heavier applications may be helpful during early years
- If practical use strip trials of compost with variable rates of P & K which may build in soil reserves more quickly



Photo 12: ANS's Compost applicator

GENERAL:

Spread compost on the field where your feed stocks are grown. We believe that long term the nutritional content of your feed stocks will improve.

Apply 20L/HA of high calcium liquid calcium plus 20L/HA of molasses to feed and support biology. Calcium leaches, so many tropical soils may have a deficiency of calcium for optimum growth. Again try strip trials to monitor.

Analyse soil every second year so that after 5 years you have a mineral trend from three analysis. Assess if P and K can be reduced or eliminated.

Monitor cane from compost treated and control soils (your standard practice) with a refractometer, for sugar content.

Use compost in the home garden as an experiment in brix and taste changes of fruits and vegetables. Add an annual application of compost – 50 to 100 mm deep – plus a high calcium liquid calcium – about ½ litre to 9 litre water-can, with same rate of molasses if available.

See appendix for calcium source.

FARMING NUTRITION IN AUSTRALIA TO 2100 AD:

In the 1840's the German Chemist Justus von Liebig demonstrated that if NPK nutrients were provided in a salt based form they would dissolve in ground water and be taken in by plants as they consumed water and the artificial fertiliser industry was born. Many northern hemisphere lands are covered by deep ice flows during the earth's repetitive 100,000 year cycles of ice ages during which ice crushes mountain rocks and re-mineralises their soils. We are at the end of a repetitive 11 to 12,000 year inter-glacial warm era when plants and animals flourish.

Australia is isolated from those soil re-mineralising natural events. An old land of droughts and flooding leaching rains, and since WW2 chemical agriculture with mono-cultural practices, like agriculture in the USA many of our soils now have only 0.5% soil organic carbon where a minimum requirement for a healthy soil is 2 ½ %.

Minerals are held in the soils organic matter for the short term and the SOC providing plant benefits long term, decades to hundreds of years. In the absence of volcanoes or ice ages, it will be up to farmers to regenerate healthy soils.

Soil OM provides housing and accommodation for an active Soil Food Web, who in turn make the stored minerals available to plants as required. Simplistic NPK salt based fertilisers are frequently leached into the groundwater before the plant has had access to the nutrients, or may tie up with other elements, e.g. calcium, and become unavailable to plants.

In some countries muriate of potash, KCL, is 47% chloride and fatal for soil biology it comes in contact with. Monitoring food by nutritional analysis in the UK from 1940 to 1991 and more recent tests in the mid-west states of USA, show that the nutritional (mineral) value of fruit vegetable, nuts and meat but not ocean fish, has declined by 40% to 60%.

The cost of NPK to farmers is often related to the cost of crude oil or the volume of world phosphate reserves over which a farmer has no control. In 2007 -08 an era of “peak” oil crises, some fertiliser prices rose from \$450 to \$1800 per tonne. CSIRO has forecast that soaring prices will be a recurring event this century. Meanwhile world population, now nearly seven billion, is forecast to rise to 12 billion, with Australia at 52 million by the end of 2100 AD.

For farmers to be viable and capable of supplying adequate food of good nutritional value they will need to be in control of their farm inputs and the COST of those inputs. Rebuilding soil health and fertility is an immediate priority for producing sufficient nutritional food for a fast growing population.

THE FORMULA:

Quality compost is part of the formula for our survival, as a species, into the future. Compost builds SOC and adds a wide spectrum of macro and micro-nutrients in non-leachable form, improves field biology and diversity and thus plant health, and can be produced cheaply on-farm with minimal off-farm purchases. Cost of compost production varies with cost of accessing feed stocks and the methodology practiced. If feed stocks need to be freighted in over 100klm this can double cash COP. Cost varies significantly dependant on the volume of annual production

This fact suggests that co-operative compost production on one of several member neighbouring farms would minimise equipment start up cost and COP.

With appropriate equipment and feed stock available on-farm average quality compost can be produced for around \$20 per tonne. Depending on the nutritional content of compost, from 10 to 20 tonne per hectare may be required as an initial application where SOC is low. A top dressing of nitrogen is required for gross feeding crops like sugar cane to supplement low levels and slow release of N in compost. In our trials over 5 years SOC can build in cultivated crops at 0.1% per annum. Depending on the feed stock used, or the quantity of, granular P and K may be able to be reduced with in a few years.

Again monitor with strip trials.

DEFINITION OF SUSTAINABLE AGRICULTURE:

A system of agricultural production, can be used indefinitely, whilst enhancing the soil and the environment. Produces nutritional foods, reverses the consumption of energy and depletion of non-renewable energy resources yet is an economic system for crop and livestock production,

- management of soils water capacity
- Provides a large dose of beneficial microbial by-products: enzymes, root stimulants and humic compounds
- beneficial microbes provided by quality humified compost helps the crop defend itself against diseases by attaching themselves to the plant's roots, crowding out pathogenic microbes.

ASSISTANCE:

For further assistance our contacts are:-

John Ross, PO Box 181, ETON QLD 4741 – Phone 07 49 541 289

Barbara Walker, PO Box 145, MIRANI QLD 4754 – Phone 07 49 591 042 –
email: bwalker@activ8.net.au

Happy composting from all at Advanced Nutrient Solutions Pty Ltd

APPENDIX:

For further reading

By Pam Pittaway Queensland soil scientist at Laidly
List of info e-mailed by Pam

The Rodale Book of Composting
Fletcher Sims Compost

The Secret Life of Compost

The above books are available from David von Pein, PO Box 7964, TOOWOOMBA
MC 4352 PHONE 07 46 357 065

Temperature probe – David von Pein

Refractometers – David von Pein

Copy of any relevant graphs by Phil Ross

Copy of potted corn dated 24 – 10 – 2012

Laboratories below

Safe Fertilisers P/L

Lot 66 Chum Street

DINMORE QLD 4303

Phone 07 55 938 042

Soil Sample 2012 Granular at 30cm

Soil Analysis Report
EJ & BA Walker - 28-Nov-2012 3:10 October 2012
Page 1 of 4

PRODUCT RECOMMENDATION SUMMARY - EJ & BA Walker

Element	Unit	Value	Recommendation
Calcium	mg/kg	1542	2337
Magnesium	mg/kg	653	530
Potassium	mg/kg	659	313

Soil Sample 2012 Granular at 60cm

Soil Analysis Report
EJ & BA Walker - 28-Nov-2012 3:10 October 2012
Page 1 of 4

PRODUCT RECOMMENDATION SUMMARY - EJ & BA Walker

Element	Unit	Value	Recommendation
Calcium	mg/kg	1542	2337
Magnesium	mg/kg	653	530
Potassium	mg/kg	659	313

Soil Sample 2012 Granular at 30cm

Soil Sample 2012 Granular at 60cm

John Ross' analysis A5994

COMPOST ANALYSIS REPORT - RESULTS OF COMPOSTABLES AND TOTAL NUTRIENTS

Sample	Block	Units	Value
1	Walker	mg/kg	1542
2	Walker	mg/kg	653
3	Walker	mg/kg	659

Handwritten note: 100% LEGUME GROWN, 2000 AND 2001 TO TURNING SITE. WOOD BROWN (SELF WOUND) ON ONE HAND TO BE RECORDED WITH COMPOST.

Totals of Job No A5994

COMPOST TOTALS ANALYSIS REPORT

Sample	Block	Units	Value
1	Walker	mg/kg	1542
2	Walker	mg/kg	653
3	Walker	mg/kg	659

John Ross' analysis A5994

Totals of Job No A5994

COMPOST 'AVAILABLES' ANALYSIS REPORT

2 samples supplied by EJ BA Walker on 14th March, 2013 - Lab Job No. C5182.

Analysis requested by Barbara Walker.

Sample 1	Sample 2	Averages	Min	Max
Sample/Block ID:	Walker	Ross - 30 Random Green Row 2 Compost Samples	30 Random Compost Samples	30 Random Compost Samples
Crop:		N/G	N/G	
Client:		B Walker	B Walker	
Nutrient	Units	C5182/1	C5182/2	Indicative guidelines only- refer Note 12
Calcium	Ca mg/kg	1542	2337	1031
Magnesium	Mg mg/kg	653	530	382
Potassium	K mg/kg	659	313	5,579

Phosphorus	P	mg/kg	31.8	97.1	1,180	12.8	12,474	
Phosphorus	P	mg/kg	106.3	269.5	1,257	133	5,023	Bray1
Phosphorus	P	mg/kg	425	750	2,219	355	10,735	Colwell
Phosphorus	P	mg/kg	426	1506	4,431	447	12,039	Bray2
Nitrate Nitrogen	N	mg/kg	6.9	13.2	493	1.2	3,896	KCl
Ammonium Nitrogen	N	mg/kg	16.9	13.6	559	2.0	3,318	
Sulfur	S	mg/kg	12.1	17.1	823	57	4,295	
Calcium	Ca	cmol+/Kg	12.02	16.46	30.74	9.67	62.95	Ammonium Acetate + Calculations
Ca	kg/ha		5397	7389	13,658	4,330	28,203	
Ca	mg/kg		2410	3299	6,147	1,933	12,591	
Magnesium	Mg	cmol+/Kg	6.25	4.34	19.71	4.18	48.32	
Mg	kg/ha		1701	1181	5,248	1,123	12,988	
Mg	mg/kg		759	527	2,365	501	5,798	
Potassium	K	cmol+/Kg	2.15	0.99	20.40	0.13	57.30	
K	kg/ha		1883	867	17,705	100	50,059	
K	mg/kg		841	387	7,955	50	22,348	
Sodium	Na	cmol+/Kg	0.19	0.09	8.09	0.37	33.07	
Na	kg/ha		96	44	4,143	170	17,036	
Na	mg/kg		43	20	1,861	85	7,605	
Aluminium	Al	cmol+/Kg	0.02	0.05	0.06	0.00	0.22	KCl
Al	kg/ha		4	11	13	0	45	
Al	mg/kg		2	5	6	0	20	
Hydrogen	H+	cmol+/Kg	0.20	0.36	0.15	0.00	1.56	Acidity Titration
H+	kg/ha		5	8	3	0	31	
H+	mg/kg		2	4	1	0	16	
Effective Cation Exchange Capacity	cmol+/Kg		20.83	22.29	79.1	26.8	147.9	Calculation
Calcium	Ca	%	57.7	73.8	41.7	10.8	66.6	Base Saturation Calculations
Magnesium	Mg	%	30.0	19.5	24.0	12.4	36.5	
Potassium	K	%	10.3	4.4	24.0	0.3	50.4	
Sodium - ESP	Na	%	0.9	0.4	10.0	0.8	23.7	
Aluminium	Al	%	0.1	0.2	0.1	0.0	0.3	
Hydrogen	H+	%	1.0	1.6	0.2	0.0	2.2	
Calcium/Magnesium Ratio	ratio		1.9	3.8	1.99	0.38	5.36	Calculation
Zinc	Zn	mg/kg	17.2	8.0	85	25	311	DTPA
Manganese	Mn	mg/kg	14	21	112	9	511	
Iron	Fe	mg/kg	343	193	207	38	422	
Copper	Cu	mg/kg	2.3	2.1	20	1.3	70	
Boron	B	mg/kg	0.55	0.41	6	0.7	20	CaCl2
Silicon	Si	mg/kg	93	109	

Notes:

- 1: Effective Cation Exchange Capacity = sum of the exchangeable Mg, Ca, Na, K, H and Al
- 1a: Soluble Salts included in exchangeable Cations - NO WASHING/ REMOVAL OF SOLUBLE SALTS
- 2: Methods from Rayment and Higgins, 1992. Australian Laboratory Handbook of Soil and Water Chemical Methods.
- 3: 'Reams' 'Morgan 1 Extract' available nutrient testing adapted from 'Science in Agriculture' and 'Non-Toxic Farming' and Lamonte Soil Handbook.
- 4: All results as dry weight, 40°C oven dried soil lightly crushed
- 5: For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
- 6: 1 cmol+/Kg = 1 meq/100g; 1 Lb/Acre = 2 ppm (parts per million); **kg/ha = 2.24 x ppm; mg/kg = ppm**

7. Conversions for 1 cmol+/Kg = 230 Kg/Hectare Sodium ; 780 Kg/Ha Potassium ; 240 Kg/Ha Magnesium ; 400 Kg/Ha Calcium.
8. *Guideline values for phosphorus have reduced in accordance with Australian soils*
9. Organic Matter = (%C Total Carbon) x 1.75
10. Sample digested with Aqua Regia acid for total nutrients/ salts and metals. 'Totals' guidelines are only included to provide typical nutrient storage.
11. Chloride calculation of Cl mg/L = EC x 640 (considered as an estimate, most likely over-estimate)
12. Guidelines provided are suggestions only and based on 'Albrecht' and 'Reams' concepts
13. Results for 'TOTAL' - Acid Extractable Nutrients indicate a store of nutrients and should not be used for fertiliser application rates

Compost Analysis Job No C5182