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8th Agricultural Crop Research Symposium 2019

FROM SEED TO NUTRITIOUS FOOD FOR GENERATIONS

agriculture
& rural development

Department:
Agriculture and Rural Development
PROVINCE OF KWAZULU-NATAL

THE 8TH RESEARCH AND TECHNOLOGY TRANSFER SYMPOSIUM

Organising Committee
2019

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FOREWORD FROM THE DIRECTOR

Dr. F.N.P. Qwabe
Director: Agricultural Crop Research Services

The South African Government has identified Agriculture as a major driver of the economy of the country. The agricultural development imperatives emanate from the National Development Plan; main issues covered under Outcome 7 of Medium Term Strategic Framework (2014-2019) and Goal 1: Inclusive Economic Growth of the Provincial Growth and Development Plan (PGDP). PGDP Strategic Objectives 1.1 directs focus to the promotion and development of agricultural potential in KZN as well as ensuring sector growth; employment creation and food security of the province.

South Africa's population will reach close to 60 million by the year 2050 (Stats SA). As a result, the country will have to provide for an additional 20% volume in food requirements for its expanded population and diminished productive agricultural land. Climate change could also diminish the potential of agricultural land and increase poverty especially in rural areas.

The Province of KwaZulu-Natal (KZN) has the second largest population in the country with a total population of 10 267 300 million. An estimated 3.5 million citizens in KZN, according to Provincial Growth Development Strategy, experience various forms of food insecurity, and in need of assistance. KZN has the highest diseases burden in the country with high incident of malnutrition.

Continuous and substantial investment into a needs-driven research and technology development programme is essential to provide solutions to problems, offset constraints and to offer new and innovative technologies, which will ensure sustainable agricultural production in KwaZulu-Natal in the future.

The Directorate: Agricultural Crop Research Services' one of the line functions of the KwaZulu-Natal Department of Agriculture and Rural Development has 285 on its establishment. Three Sub-directorates with respective divisions are involved in Agricultural Crop Research and technology development:

1. Analytical Services (Laboratory Analytical Services, Bio-datametrics & Bioinformatics, Biochemistry, Soil Fertility Research),
2. Crop Production Research Services (Agronomy, Horticulture, [Juncao Mushrooms], Crop Protection) and
3. Farming Systems Research

The four pillars of Agricultural Crop Research Services are as follows:

1. Agricultural research on-station and off-station through Farming System Research,
2. Laboratory Services: soil, plant, plant health, water and animal feed,
3. Maintenance of research infrastructure,
4. Transfer of technology developed.

The Research Technology Transfer Symposium is an opportunity for researchers and their teams to share with colleagues and clients, information emanating from research. Following final and progress report feedback sessions conducted by the Sub-directorates during September 2018, those reports with a clear message or recommendation were identified to be included in the Symposium programme. A further addition to the symposium are talks, which addresses MEC pronouncements for 2018/19 financial year. The value thereof is the opportunity to see technology being developed or practiced in the field.

For the 2018/19 Symposium, seven talks will be presented. This provides a platform for discussion and debate around the subject while simultaneously creating an opportunity to identify further research needs.

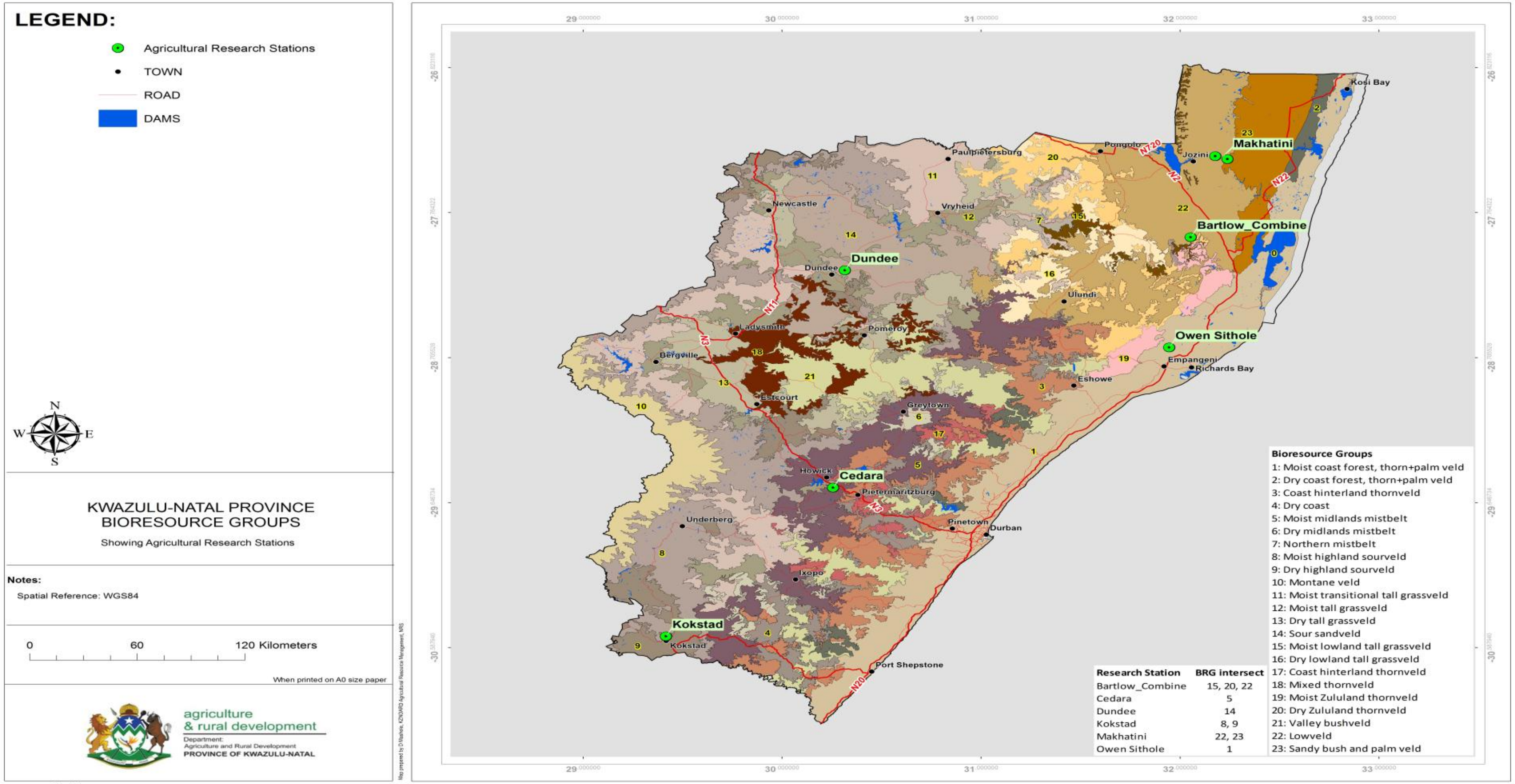
The Research Proceeding records summaries of the talks, a list of the current research projects, as well as the research projects approved during 2018/19. It also documents a list of staff currently involved in research and technology development.

Thanks are due to the Organizing Committee and to those presenters participating in the Symposium.

You are therefore, encouraged to enjoy the Symposium and make full use of the opportunity to engage, to network and to communicate with fellow scientists and colleagues – all to the benefit of those within our Province.

Dr. Fikile Qwabe
(Director: Agricultural Crop Research Services)

MAP OF KZN DARD RESEARCH STATIONS



Disclaimer:
All information relating to the Bioresource Classification Program of KwaZulu-Natal must be regarded as a first approximation. While every reasonable effort has been made by the authors to obtain objective and realistic results, neither they nor the Department of Agriculture of KwaZulu-Natal make any warranty, or assume any legal liability or responsibility for the accuracy, completeness or usefulness of any information, product or process disclosed in reports relating to the Bioresource Program.

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Ms Thembeka Mlambo: Secretary

Dr Fikile Qwabe: Director: Agricultural Crop Research Services (ACRS)
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THE 8TH RESEARCH TECHNOLOGY TRANSFER SYMPOSIUM PROGRAMME

"From Seed to Nutritious Food for Generations"

Cedara Auditorium, 20 February 2019

08h00 - 08h30	**REGISTRATION**	
SESSION ONE		***Chairperson: Dr. Fikile Qwabe*** ***(Director: Agricultural Crop Research Services)***
08h30 - 08h35	Opening Prayer	**Mr. B. Mashiyana**
08h35 - 08h40	Welcome	**Mrs F.N. Mkhize** (Chief Director: Agricultural Research, Development and Training Institutes)
08h40 - 08h50	Opening	**Mr. M. Sifundza** (Deputy Director General: Agricultural Research, Development and Training Institutes)
08h50 - 09h45	Keynote address	**Dr. Kingstone Mashingaidze** *(Programme Manager: Agricultural Research Council-Grain Crops Institute)*
09h45 - 10h15	**REFRESHMENTS & POSTER VIEWING**	
SESSION TWO		***Chairperson: Mr. A.J. Arathoon***
10h15 - 10h40	Introduction to aphids and their role in spreading potato and banana virus diseases	**Mr. H. Ramanand** *(Crop Protection Services Division , Cedara)*
10h40 - 11h05	Value adding to peach fruit	**Dr. K.M. Mkhathini** *(Horticulture Services Division , Cedara)*
11h05 - 11h30	The potential of indigenous leafy vegetables in improving food security	**Ms. N.N. Manyoni** *(Crop Protection Services Division, Cedara)*
11h30 - 11h55	The comparison of phosphorus analysis in South African soil laboratories	**Mr. B.K. Mashiyana** (Analytical Services, Cedara)

THE 8TH RESEARCH TECHNOLOGY TRANSFER SYMPOSIUM PROGRAMME

"From Seed to Nutritious Food for Generations"

Cedara Auditorium, 20 February 2019

SESSION TWO		***Chairperson: Mr. A.J. Arathoon***
11h55 - 12h20	The production of macadamias in KwaZulu-Natal	**Mr. R. Osborne** *(Horticulture Services Division, Cedara)*
12h20 - 12h45	Cover crops for maize silage - A field trial at Cedara	**Dr. A. Manson** (Analytical Services, Cedara)
12h45 - 13h10	Significance of groundnut production and nutritional value for food security	**Mr. S.B. Radebe** *(Agronomy Services Division , Dundee)*
13h10 - 13h30	**CLOSURE**	**Dr. Fikile Qwabe** *(Director: Agricultural Crop Research Services)*
13h30	**LUNCH**	

ABSTRACTS:

ORAL PRESENTATIONS

INTRODUCTION TO APHIDS AND THEIR ROLE IN SPREADING POTATO AND BANANA VIRUS DISEASES

Hiresh Ramanand

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Aphids (Hemiptera: Aphididae) are small, ovate, soft-bodied phloem feeders. They are important agricultural pests both as direct parasites to crops and more importantly, as vectors of viral diseases. Aphids are the most prevalent insect vectors of virus disease with over 200 species known to transmit plant pathogenic viruses. In South Africa, aphids are key vectors of viral diseases which negatively impact banana and potato production.

Banana bunchy top disease (BBTD), caused by banana bunchy top virus (BBTV) is the most devastating virus disease of banana in South Africa. BBTV was identified in South Africa in 2015, on banana plantations in KwaZulu-Natal (KZN). The recent outbreak of the disease in South Africa caused major concern to banana growers, as yield losses of up to 100% can be recorded. This virus is transmitted by the banana aphid, *Pentalonia nigronervosa* Coquerel. Symptoms include dwarfing, leaf atrophy, narrow upright leaves, chlorosis of leave margins, stunting and dark green streaks on leaves, petioles and pseudostems. Advanced symptoms include a progressive shortening of leaves that become more erect, causing a bunchy appearance and thus giving rise to the name ‘bunchy top’. Management involves scouting for aphids, planting of healthy suckers, no movement of infected plant material and immediate insecticide treatment. With regard to potatoes, two of the viruses transmitted by aphids which are of global economic importance to the potato industry are potato virus Y (PVY) and potato leafroll virus (PLRV). These two viruses are of economic importance to potato seed producers, since it is illegal to market virus infected seeds in South Africa. In KZN, dominant vectors of PVY are *Rhopalsiphum padi* L., *Sipha flava* Forbes and Aphis species; whereas, in the case of PLRV, Aphis species are dominant. Although not a dominant vector in KZN, the peach-potato aphid, *Myzus persicae* Sulzer, is capable of transmitting both viruses. PVY is responsible for a reduction in tuber quality and yield losses which may be as high as 80%. Symptoms of PVY infection are mosaic, crinkling, and necrosis of leaves. Secondarily infected plants are stunted and have brittle foliage. In the case of PLRV, this viral disease can be responsible for individual plant yield losses of up to 50%. Globally, annual yield losses resulting from PLRV is estimated at 20 million tons. Symptoms of PLRV include reddening and brittleness of leaves, stunting, necrosis and characteristic rolling or cupping of foliage. Management of PVY and PLRV involves planting virus free seed, spraying, or preventative measures such as making use of aphid monitoring and the determination of vector pressure. To date, work has focused on managing these viral diseases; however, challenges remain. Furthermore, little effort has been made in order to understand the ecology of these aphid vectors, as well as, general aphid management. Aphid control is imperative to reduce the vector of the virus.

In conclusion, management of banana and potato viral diseases, together with aphids, remains crucial in order to maximize production and minimize losses for all farmers in KwaZulu-Natal. This will in turn keep costs low for the daily consumer, without deflecting on quality.

VALUE ADDING TO PEACH FRUIT

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Limited access to storage and processing facilities contribute a significant percentage to fresh produce losses by subsistence farmers in the Sub-Saharan Africa. South Africa is not an exception. The contributing factors include harvesting and handling techniques, climatic and weather conditions, unsuitable transport use, packaging and storage facilities, market status, pests and diseases.

The aim of the study was to dry white and yellow peach landraces into peach slices using a tunnel dryer, heated by a freely available solar energy. The purpose was to determine the effects of tunnel and ambient relative humidity and temperature and pre-treatments on the quality of dried peach slices. Drying is defined as the process of moisture removal due to simultaneous heat and mass transfer.

A parabolic solar tunnel dryer was designed and installed at Cedara Research Station. After harvesting, diseased, spotted and bruised fruit were removed and the remainder were stored overnight in a cold room with temperature and relative humidity settings at 5°C and 85% respectively. The following parameters were determined: ambient temperature and relative humidity; tunnel temperature and relative humidity and their relationships were determined. Drying of peach fruit slices was performed, with three pre-treatments (control, lemon juice and ascorbic acid). Drying patterns of peach slices were monitored. The dried products were stored for six weeks. After six weeks, taste testing of dried products was perfomed.

There was an inverse proportion between temperature and relative humidity. There was a direct proportion between ambient and tunnel temperature. The relative humidity had a strong negative relationship to temperature.

White lemon-treated and white untreated slices had a significant drop in moisture content in the first six hours of slice drying. The yellow control and the white ascorbic acid treatment followed similar trends from the 0 - 22nd hour of drying. Except for the yellow control and white ascorbic acid, all treatments were significantly different during the 8th hour of drying.

With regards to colour, both controls of white and yellow fruits turned brown during the processing and drying period and hence they scored lowest in colour rating, followed by lemon juice. Ascorbic received the highest colour score. With regards to taste, ascorbic acid received the highest score for both yellow and white fruit. With regards to texture, white slice ranked higher than yellow for the lemon treatment. With regards to mouth feel, the white slice of ascorbic acid and lemon treatments were rated highest scores than the control for both white and yellow cultivars. Overall, the white and yellow slices with ascorbic acid had the highest acceptability scores than the controls. Also white slice for the lemon juice treatment was ranked similar to ascorbic acid acceptability.

The temperature in and out of the tunnel improved the drying conditions, with the tunnel always warmer than ambient temperature. Ambient moisture percentage showed to be very high at night and that can negatively affect the product being dried by favouring growth of grey mould. Increasing tunnel temperature reduces the relative humidity amount, enabling drying to occur. During drying, white fruit slice was noticed to dry much quicker than yellow. That affected the slice final products of the white peach by shrinking and getting harder or darker products for the control. Where pre-treatments were used to mitigate dark colour change, ascorbic acid and lemon were both effective in improving the acceptability of the white slice. Lemon juice did not improve the yellow slice product acceptability. It is important that during the night, products being dried are removed and stored in sealed containers or plastic bags to avoid remoistening.

THE POTENTIAL OF INDIGENOUS LEAFY VEGETABLES IN IMPROVING FOOD SECURITY

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Leafy vegetables are plant species of which leafy parts (sometimes including young, succulent stems, flowers and very young fruit) are used as a vegetable. Among these, are indigenous leafy vegetables (known as 'imfino' in isiZulu), defined as plant species that have their origin in South Africa or were introduced to the country so long ago that they are now recognized as traditional crops. Indigenous leafy vegetables (ILV) are cooked and eaten as a relish with a starchy staple food such as stiff porridge or phutu. In KwaZulu-Natal, the most widely consumed indigenous leafy vegetables are black jack, amaranth and pumpkin.

Consumption, perceptions and awareness on indigenous leafy vegetables

The consumption of ILV has declined as they are often considered nutritionally inferior compared to commercial vegetables. The decline in consumption is also due to them being perceived as poor man's food, particularly by young people. In addition, ILV are still considered as weeds, as a result, are removed from cultivated fields. Furthermore, agricultural policy makers and researchers have focused almost exclusively on commercial leafy vegetables, overlooking the importance of ILV. Hence, extension workers have been biased towards promoting the cultivation of commercial leafy vegetables

Potential to contribute to food security

Food security goes beyond food availability, it also takes into consideration the ability to access nutritious food. Several studies have shown ILV to be better sources of nutrients compared to commercial leafy vegetables. For example, higher amounts (mg/100 g) of calcium (Ca), iron (Fe), vitamin A, vitamin C and protein (%) were found in amaranth than in cabbage and spinach. Similarly, amaranth fresh leaves were found to contain high amounts (mg/100 g) of vitamin A and C, Ca, Fe and protein (g) compared with spinach, cabbage and lettuce. When nutrient values (mg/100 g) of cooked pumpkin leaves were compared to spinach and cabbage leaves, higher amounts of Ca, magnesium (Mg), phosphorous (P), Fe, zinc (Zn), vitamin A, E and B6 and protein (g) were found in pumpkin leaves whereas spinach and cabbage contained lesser amounts. Cooked black jack leaves (% RDI/100g) were also found to have higher amounts of Ca, Mg, Fe and manganese (Mg) than cabbage leaves. However, the nutrient composition of ILV may differ depending on the cultivation environment, soil fertility, variety, maturity and production practices used.

Medicinal uses

Indigenous leafy vegetables are not only edible but are also used for medicinal purposes. For instance, different parts of black jack have been used to treat stomach pains, wounds, inflammation, diabetes and many other illnesses. Amaranth is reported to be used to treat diabetes, pain, diarrhea, urinary infections and gynaecological conditions. Pumpkin seeds are regarded as good sources of Zn which assists in the prevention of chronic diseases. Moreover, pumpkin is also reported to assist in the reduction of blood cholesterol as well as reducing the risks of different types of cancers.

Other benefits

Indigenous leafy vegetables grow naturally when soils are disturbed, grow in low fertile soils, are drought, disease and pest tolerant and have a short growing season than exotic species.

Suggested way-forward

Information regarding the nutritional value of ILV should be used to encourage the production and consumption of ILV and this will play a significant role in enhancing food security in the province as a whole. Presently, very little knowledge regarding the production ILV is available, particularly under local conditions therefore, agricultural research should not only focus on commercial crops but also on indigenous crops. This focus may include domestication and maximum production of these vegetables, agro-processing of the produce, as well as documenting and correction of anti-nutritional factors such as phytate and tannis in ILV. Moreover, preservation of genetic diversity of ILV is also vital, to avoid potential erosion of genetic material which could be of aid in breeding for sustainable production of nutritious food for generations.

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THE COMPARISON OF PHOSPHORUS ANALYSIS IN SOUTH AFRICAN SOIL LABORATORIES

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Soil testing is the key component for determining the need for phosphorus (P) fertilization. Moreover, if fertilization is required, test results guide the rate of application recommended to optimize production. Clients come with soil results from different soil laboratories and ask for recommendations. By standardizing soil P results there will be a better understanding thereof. Service delivery to clients will be improved since recommendations will be given beyond analysis based on Cedara extraction method (Ambic-2). The aim of this project was to compare phosphorus analysis results done by South African soil laboratories.

One hundred air dried soil samples taken at 150 mm depth and crushed to pass a 1 mm sieve were split to approximately 350 g and analysed by six laboratories. Soil testing methods were according to AgriLASA Soil Handbook Revision 2004. Results were compared and methods correlated.
Laboratories and extraction methods

- ARC ISCW - Bray 1 (P, K, Mg, Na, pH, R)
- BEMLAB - P Bray1, 2 and Olsen
- Cedara - Ambic 2
- NviroTek - Olsen P, Mehlich III package (Includes: pH, P Bray I/II, Ca, Mg, K, Na, Fe, Mn, Cu, Zn, B, S, P (Mehlich).
- SASRI - Truog (samples with pH up to pH 5,50).
- Resin: for samples of all pH levels

SGS – P Bray I, Bray 2 P, Olsen P,

Regression analysis shows that a simple linear model relating Ambic-2 P to Bray-1 P explains 87% of the variation. The relationship between Ambic-2 P and Bray-2 P is also tight, but coefficients of determination (R^2) are lower for the linear models relating Ambic-2 P to the other extractants. The R^2 decreases in the order Bray-1 P >

Bray-2 P > Olsen P > Mehlich-III P > Resin P > Truog P.

Effects of soil pH_{KCl}

The predictability of Ambic-2 P using Bray-1 P and Bray-2 P was high across all pH ranges in this data set.

Effects of soil sample density

Soil texture can also affect the extractability of P from soils. In the routine laboratory, the density of dried and milled samples is measured and used as an index soil texture. Sample density was used to divide soils into different groups.

It appears that texture has little effect on the relationship, except in the case of the sandiest soils. The regressions suggest that the predictability of Ambic-2 P using most other extractants would be improved if sandy soils were excluded from the calibration set. The exception to this trend was the Resin P vs Ambic-2 P relationship (where R^2 dropped when sandy soils were excluded).

Separate calibrations have been developed for different groups of soils and are available in the final report.

This study reveals that Bray 1 and Bray 2 methods are the most comparable with Ambic 2 for extraction of P in most cases across soil properties considered. There is now calibration to compare if farmers have soil test results from other laboratories using calibrated methods.

THE PRODUCTION OF MACADAMIAS IN KWAZULU-NATAL

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Macadamias are indigenous to eastern Australia, and are members of the *Proteaceae* family. Although valued by aboriginal Australians for thousands of years, commercial macadamia production is less than 100 years old. Since 2012, the South African macadamia industry's production has grown to equal that of Australia, with both countries together accounting for around 56 per cent of world production in 2017. Total world macadamia exports account for less than three per cent of the combined annual tree nut total.

Macadamias were first introduced into South Africa in the 1960's, and the local industry has expanded more than 20-fold in the last 20 years with over 46 000 tons produced in 2015. The crop value has grown from R32 million in 1991 to over R4 billion in 2015. There are approximately 32 000 hectares planted in South Africa, and the industry is continuing to expand by an estimated 4000 to 5000 hectares per annum. Mpumalanga is the largest production area, and produces about 51 per cent of the country's crop. The industry is export-based with more than 95% of annual production shipped to international markets.

In KwaZulu-Natal (KZN), large-scale production began in the south (Ugu District), where farmers were looking for alternatives to bananas and sugar cane. In recent years, new orchards have been established throughout the coastal belt of KZN. There are now over 8400 ha of macadamias in the province (about 21% of the total in South Africa). The recommended growing areas are restricted to the coastal hinterland from Port Edward in the south all the way to the northern border. Temperature is a critical parameter affecting macadamia yields. Optimum temperatures are between 25 and 30°C; potential nut yields increase with increasing time within these limits. Long periods above 30°C can lead to heat stress, reduce fruit set and cause nut drop before maturity. Along the KZN coast, the ocean moderate maximum temperatures, and high yields are possible. Cooler conditions at altitudes greater than 600 m reduce yields of high-quality kernels, shells are thicker, and trees take longer before bearing. Rain-fed (dryland) production of macadamias is possible where the mean annual precipitation exceeds 800 mm, but trees respond well to supplementary irrigation which generally helps to bring young trees into production earlier. Soils should be well-drained, but fairly shallow soils can be productive, especially those with substrates that allow deep root penetration (such as soft lithocutanic horizons). Deep ripping and ridging before establishment will improve tree growth in sub-optimal soils. Steep land can be used for this crop, but best results are achieved with terracing, which can be expensive.

South African macadamia production is continuing to expand with Mpumalanga and KZN showing the biggest growth. Industry figures project a 40% increase production of nut in shell (NIS) to a total of 64 800 tones by 2020. KZN has overtaken Limpopo Province to become the second largest producer of macadamias after Mpumalanga. There are approximately 8500 hectares of macadamias in KZN, which produces 21 per cent of the total crop. Macadamias grown at low altitudes where winter temperatures are generally warm produce nuts with thinner shells compared to nuts grown at higher altitudes. This results in improved nut quality with a higher proportion of kernel to whole nut after shelling. Macadamia nuts from the North Coast of KwaZulu-Natal have thinner shells than nuts from the cooler South Coast. In Mpumalanga and Limpopo, macadamias are grown at altitudes between 600 and 1200 m. Evidence suggests that macadamias produced in the warmer coastal areas of KZN should be of a higher quality compared to nuts grown in Mpumalanga, which will be a strong competitive advantage.

Although macadamias are a high-value crop, it takes around seven years to recover establishment costs and generate a profit, which means for the first six years after planting there is no income (despite annual expenses). At current prices and exchange rates, macadamias have an expected net return of around R 300 000 per hectare once full production is achieved after year ten.

COVER CROPS FOR MAIZE SILAGE – A FIELD TRIAL AT CEDARA

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Production of silage maize leaves little residue for farmers that wish to practice no-till. In 2003 a cover-crop trial was initiated to investigate the consequences of winter cover crops in systems where silage maize is grown every summer season. In the winter of 2010, treatments were altered to include grass-legume combinations of the most promising cover crops. In January 2012, the plots were split for nitrogen.

Cover crop yields were relatively high in 2017, because autumn and winter rainfall were higher than average. Notable this season was the lack of cover-crop yield response to residual N in most treatments. All of the grass cover crop and grass-vetch treatments responded positively to residual N. Note that no fertilizer was applied to the cover crops. The highest yield achieved was the black oats and vetch treatment with N; the other treatments with black oats and N also yielded well, as did the black oats with vetch at zero topdressed N.

Maize yields were fair. The main effect of N and the main effect of cover crop treatments on yield were significant ($P<0.05$), but the N x cover crop interaction was not significant ($P=0.76$). Without topdressed N, the treatments that included vetch as a cover crop produced more than 9 t silage DM/ha (maize after vetch as a single cover produced 12.13 t/ha). The N fixed by the vetch explains the good yields at zero N.

In the treatments supplied with 120 kg N/ha at topdressing, four treatments produced more than 16 t DM/ha (the weed-free control, the “white clover”, and the two grass-vetch mixtures).

Nitrogen fertilizer application increased the concentration of several minerals in the silage and in the leaf samples taken at silking. Increased concentration at both times of sampling were observed for N, Ca, Mg, Cu and Mn, whereas N effects on other minerals were less consistent. Interactive effects of N and cover crops on P and Zn concentrations were noted – this may have been due to different mycorrhizal effects in the different treatments.

For crops grown under conditions without significant nutrient stress, mycorrhizae have been known to have negative effects on crops yield – this may be one of the reasons that the weed-free control continues to perform well. Higher soil water content at planting probably also contributes to good yields in weed-free plots without cover crops.

No-till cropping without cover seldom performs as well as that with cover; in this trial this is not true. This may be due to the flat terrain of the site; another contributing factor is the development of cryptogammic (biological) crusts on the soil surface in the plots with little residue – these crusts have developed with the growth of moss and algae, and favour water infiltration more than structural or depositional crusts that might otherwise form.

This trial continues to show the following: That cover crops have little positive or negative effect on the following maize crop; however, because the site is flat, potential benefits from reduced soil erosion and increased infiltration are minimised. Financially, the cost to the farmer of establishing winter cover crops would generally be recovered through their use for fodder and/or the benefits gained by reducing N fertilizer inputs (when using legume cover crops). Long-term costs and benefits will become clearer with time.

The trial continues to progress as planned. It offers opportunities for additional studies concerned with cover crop effects on soil properties; these include the study of water relations and microbiological studies, one of which is underway.

SIGNIFICANCE OF GROUNDNUT PRODUCTION AND NUTRITIONAL VALUE FOR FOOD SECURITY

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Groundnut, *Arachis hypogaea L*., Fabaceae, is an energy-dense and nutritious crop. Groundnut has several uses and consumption pattern worldwide, which is oil, peanut butter, roasted and salted nuts, boiled or roasted in-shell nuts and other confectionery products. It is the most important oilseed crop in the world; it contains 48 – 50% oil, 26-28% protein and is a rich source of dietary fiber, minerals and vitamins. The overall South Africa's area of cultivation of groundnut has decreased over the past 12 years due to various reasons. When compared to maize, soybeans and sunflower seed, groundnut production was the only crop that showed a significant production decrease in the past 12 years. Over the past decade, food security has been a major global challenge especially in less developed countries, where over 1 billion people are estimated to suffer from the lack of sufficient dietary energy availability and over 2 billion people are affected by the lack of micronutrients. Global food security is achieved when all people at all times have access to adequate affordable, safe and nutritious food to meet all their dietary requirements and food preferences in order to live a productive and healthy life. An addition of groundnut in the diet will provide essential nutrients for children and adults for normal healthy body development.

In South Africa, groundnuts are grown in the summer rainfall areas under irrigation or rainfed conditions. High mechanization and labour costs limits overall groundnut production nationally. It was indicated that from 1970 to 1982, the yearly average production was 204 000 tonnes compared with an average production of 94 000 tonnes from 1982 – 1994. These figures show a reduction of approximately 50%, due to mainly erratic rainfall, harvesting problems, diseases and nematodes. South African population has grown; the middle-class has grown and displayed changes in their diets, consuming more high protein foods such as chicken and meat, which increases the demand for feed (yellow maize and soybeans). However, population growth has not benefited the groundnut industry. The South African edible groundnut consumption has decreased over time. According to Grain SA (2015), in 2014/2015 South African's groundnut production amounted to 74 500 tonnes, which is 80% higher than the previous season. This increase was due to an increase in area planted from 46 900 ha to 52 125 ha. However, this was still 35% lower than the 2004/2005 production, which was planted on 71 500 ha. The above mentioned information indicates that groundnut industry in SA faces serious challenges, which need to be addressed immediately.

Groundnut kernel skins have an abundant amount of natural antioxidants and a high content of dietary fibre. This is with regard to the different types, be it light-roasted or dark-roasted**.** Groundnut skins are rich in phenolic compounds. Antioxidants from kernel skin help to protect the body from oxidative stress, which occurs in cases of various cancers and diseases. Groundnuts are extremely high in protein and medical practitioners have advised that groundnuts should be incorporated in the diet for children, vegetarians, and protein deficient people.

The restoring of edible groundnut consumption will ensure food security and reduce malnutrition challenges. Groundnut kernels can be prepared by mixing them with samp, beans and meat, which is a common dish consumed by people in the UMkhanyakude area.

Restoring interest and investment in groundnut crop may offer a solution to food insecurity and reviving groundnut production in potential areas and in areas that used to produce the crop. Groundnut is a cash crop and nutritious food; its production should be readopted in communities struggling with income. The public should be aware of the nutritious and health benefit of the crop.

ABSTRACTS:

POSTER PRESENTATIONS

EFFECT OF SEEDING RATE ON EDAMAME (VEGETABLE SOYBEAN) CULTIVARS WITH DIFFERENT MATURITY GROUPS

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Edamame (*Glycine max* (L.) Merrill) pods are harvested when bright green and the beans have filled 80 - 90% of the pod. The pods are boiled for a few minutes and then the beans are squeezed out and eaten as a snack or included in salads, stews and soups. The beans are larger, more tender and have a “nuttier” flavour than grain soybean.

Recommendations for suitable seeding rates to optimize edamame production are not consistent. Researchers recommended plant populations varying from 43 000 to 430 500 plants ha^{-1}. Therefore, research trials were conducted at the Cedara Research Station to determine the optimum seeding rate for edamame cultivars with different maturity groups.

The cultivars, AGS 292 (112 days after planting to mature harvest (DAP)), AGS 353 and AGS 354 (134 DAP), and Lightning (147 DAP), were hand-planted at 50 000, 75 000, 100 000, 150 000, 200 000 and 250 000 seeds ha^{-1} into a Hutton soil in the 2013/14, 2015/16 and 2016/17 growing-seasons. The crops were grown under dry-land conditions and harvested at seed maturity. The experiments had randomized complete block designs with three replicates. Fertilizer was applied to obtain optimum yields, based on the results of soil sample analyses. Weeds, insects and diseases were controlled agro-chemically throughout the growing-seasons.

Due to variations in rainfall quantity and distribution, mean bean yields of 3.09, 2.35 and 3.56 t ha^{-1} were produced in the 2013/14, 2015/16 and 2016/17 growing-seasons, respectively. The low yield in the 2015/16 season was due to hot conditions during the vegetative growth stages and below-average total rainfall (529 vs. 663 mm), which resulted in short plants bearing few branches and pods.

AGS 292 had the shortest plants with the fewest branches and pods plant^{-1}, whilst Lightning had the tallest plants with the highest number of branches and pods plant^{-1}. ASG 353 and AGS 354 had very similar growth habits. Mean plant height increased significantly from 50 000 to 150 000 seeds ha^{-1}, but the number of branches plant^{-1}, pods plant^{-1} and 100-bean mass decreased significantly as seeding rate increased. Therefore, edamame plants respond to decreasing plant populations by producing more branches and more pods plant^{-1} containing larger beans. AGS 292, AGS 353 and AGS 354 had significantly larger beans (mean = 45.3 g per 100 beans) than Lightning (29.3 g per 100 beans). The small bean size of Lightning did not always meet the market requirement of ≥ 30 g per 100 mature seeds.

In the 2013/14 season, no significant differences in yield were measured between the seeding rates, indicating that 50 000 seeds ha^{-1} were sufficient. However, in the 2015/16 and 2016/17 seasons, and overall, yield was optimized at 150 000 seeds ha^{-1}.

AGS 353 (mean yield = 3.60 t ha^{-1}) showed no significant yield response to seeding rate, indicating that this cultivar can be planted at 50 000 seeds ha^{-1}. To yield optimally, AGS 292 (mean yield = 1.77 t ha^{-1}) required 150 000 seeds ha^{-1}, whilst AGS 354 (mean yield = 3.56 t ha^{-1}) and Lightning (mean yield = 3.08 t ha^{-1}) required 100 000 seeds ha^{-1}. As AGS 353 and AGS 354 produced the highest mean yields, these cultivars are recommended for growing in KwaZulu-Natal. However, AGS 353 may be preferred, because it can be planted at a lower seeding rate than AGS 354.

EFFECT OF SEEDING RATE ON MAIZE CULTIVARS WITH VARYING MATURITY GROUPS AT CEDARA

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There is a perception that higher seeding rates are required for quick-maturing cultivars than for medium-maturing cultivars in the high potential dryland production areas of KwaZulu-Natal. However, there is concern that greater competition between plants will result in lower yields, particularly during dry seasons. The current recommendations are 40 000 – 45 000 seeds ha^{-1} for medium-maturing cultivars and 45 000 – 70 000 seeds ha^{-1} for quick-maturing cultivars. A research project was conducted at the Cedara Research Station to confirm these recommendations.

Eight maize cultivars with growing-season lengths ranging from ultra-quick to medium, were hand-planted at 40 000, 60 000, 80 000 and 100 000 seeds ha^{-1} into a Hutton soil in the 2015/16, 2016/17 and 2017/18 growing-seasons. The crops were grown under dry-land no-till conditions. The experiments had randomized complete block designs with three replicates. Fertilizer was applied to obtain 10 t ha^{-1} grain yields.

Mean grain yields of 7.32, 10.47 and 9.21 t ha^{-1} were produced in the 2015/16, 2016/17 and 2017/18 growing-seasons, respectively. The low yield in the 2015/16 growing-season was due to below-average rainfall (529 vs. 663 mm). Dry conditions in January (21 mm) and hail-damage in February 2018 resulted in a significantly lower yield in the 2017/18 growing-season compared to 2016/17 growing-season.

The percentage of lodged plants increased significantly from 40 000 to 80 000 seeds ha^{-1}. The ultra-quick (UQ) cultivars had significantly better standability.

The number of cobs plant^{-1} decreased significantly from 40 000 to 80 000 seeds ha^{-1}. 100-kernel mass and grain mass plant^{-1} decreased significantly as seeding rate increased from 40 000 to 100 000 seeds ha^{-1}.

In the 2015/16 and 2016/17 seasons, and overall, yield was optimized at 60 000 seeds ha^{-1}, whilst in the 2017/18 season it was optimized at 80 000 seeds ha^{-1}. In each season, no significant interaction was measured for yield between the cultivars and seeding rates. However, a combined analysis of the three seasons showed that PAN 4A-111 and DKC 71-44B required 40 000 and 80 000 seeds ha^{-1}, respectively, to yield optimally (Table 1). The other cultivars required 60 000 seeds ha^{-1}.

TABLE 1 Mean yield of the eight cultivars at the four seeding rates combined for the 2015/16, 2016/17 and 2017/18 growing-seasons at Cedara

	Seeding rate ha^{-1}				
Cultivar	**40 000**	**60 000**	**80 000**	**100 000**	**Mean**
	(t ha^{-1})				
BG 3492B (UQ[#])	8.24 ^{hi}	9.54 $^{b-e}$	9.27 $^{c-g}$	9.29 $^{c-g}$	**9.09**
LG 3607Y (UQ)	7.12 ^{j}	8.26 ^{hi}	8.62 $^{f-h}$	8.89 $^{e-h}$	**8.22**
PAN 4A-111 (Q)	9.72 $^{a-d}$	10.34 ^{a}	10.22 ^{ab}	9.64 $^{a-d}$	**9.98**
DKC 71-44B (M-Q)	7.74 ^{ij}	8.92 $^{e-h}$	9.95 $^{a-c}$	9.71 $^{a-d}$	**9.08**
LS 8538R (M-Q)	7.43 ^{j}	8.39 ^{hi}	8.57 $^{f-h}$	8.59 $^{f-h}$	**8.25**
PAN 6P-110 (M)	8.39 ^{hi}	9.30 $^{c-f}$	9.38 $^{c-e}$	8.98 $^{d-h}$	**9.01**
DKC 73-74BR (M)	8.43 $^{g-i}$	9.69 $^{a-d}$	10.20 ^{ab}	9.51 $^{b-e}$	**9.46**
LS 8518 (M)	8.58 $^{f-h}$	9.59 $^{a-e}$	8.86 $^{e-h}$	8.54 ^{gh}	**8.89**
Mean	**8.21**	**9.26**	**9.38**	**9.14**	**9.00**
LSD (P<0.05) Cultivar			0.381		
LSD (P<0.05) Seeding rate			0.269		
LSD (P<0.05) Cultivar x seeding rate			0.762		
CV%			9.1		

[#]UQ = Ultra-quick maturing; Q = Quick maturing; M-Q = Medium-quick maturing; M = Medium maturing.
Figures with the same superscript letter are not significantly different (P<0.05).

The results indicate that medium-maturing cultivars should be planted at a higher seeding rate (60 000 seeds ha^{-1}) than those recommended (40 000 – 45 000 seeds ha^{-1}), even when dry conditions, similar to those in the 2015/16 growing-season, are expected. Therefore, the quicker-maturing cultivars do not need to be planted at higher seeding rates than the medium-maturing cultivars, except for DKC 71-44B, which should be planted at 80 000 seeds ha^{-1}.

As lodging was significantly higher at seeding rates > 40 000 seeds ha^{-1}, cultivar selection for good standability is important to avoid yield losses.

PAN 4A-111 (Q) is recommended for the KwaZulu-Natal Midlands due to its good standability and high yielding ability in all three seasons, and due to the lower seed cost.

EFFECT OF SEEDING RATE ON MAIZE CULTIVARS WITH VARYING MATURITY GROUPS AT KOKSTAD

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There is a perception that higher seeding rates are required for quick-maturing cultivars than for medium-maturing cultivars in the high potential dryland production areas of KwaZulu-Natal. However, there is concern that greater competition between plants will result in lower yields, particularly during dry seasons. The current recommendations are 40 000 – 45 000 seeds ha^{-1} and 45 000 – 70 000 seeds ha^{-1} for medium-maturing and quick-maturing cultivars, respectively. A research project was implemented at the Kokstad Research Station to confirm these recommendations.

Eight maize cultivars with growing-season lengths ranging from ultra-quick to medium, were hand-planted at 40 000, 60 000, 80 000 and 100 000 seeds ha^{-1} into a Clovelly soil in the 2015/16, 2016/17 and 2017/18 seasons. The crops were grown under dry-land conditions. The experiments had randomized complete block designs with three replicates. Fertilizer was applied to obtain a 10 t ha^{-1} grain yield.

Mean grain yields of 6.70, 10.51 and 11.18 t ha^{-1} were produced in the 2015/16, 2016/17 and 2017/18 growing-seasons, respectively. The low yield in the 2015/16 growing-season was due to below-average rainfall (457 vs. 598 mm). Above-average rainfall was received in the 2016/17 and 2017/18 seasons, but severe hail-damage in February 2017 resulted in a significantly lower yield in the 2016/17 growing-season compared to the 2017/18 growing-season.

The percentage of lodged plants increased significantly from 40 000 to 100 000 seeds ha^{-1}. BG 3492B, DKC 71-44B and DKC 73-74BR displayed significantly better standability than the other cultivars.

The number of cobs plant^{-1} and grain mass plant^{-1} decreased significantly as seeding rate increased from 40 000 to 100 000 seeds ha^{-1}.

TABLE 1 Mean yield of the eight cultivars at the four seeding rates combined for the 2015/16, 2016/17 and 2017/18 growing-seasons at Kokstad

	Seeding rate ha^{-1}				
Cultivar	**40 000**	**60 000**	**80 000**	**100 000**	**Mean**
			(t ha^{-1})		
BG 3492B (UQ#)	8.69 $^{i-l}$	11.01 ^{ab}	11.63 ^{a}	11.28 ^{a}	**10.65**
LG 3607Y (UQ)	8.95 $^{h-l}$	9.94 $^{c-g}$	10.04 $^{b-f}$	10.83 $^{a-d}$	**9.94**
PAN 4A-111 (Q)	9.32 $^{e-k}$	10.24 $^{b-e}$	9.41 $^{e-k}$	8.61 $^{j-l}$	**9.40**
DKC 71-44B (M-Q)	8.75 $^{i-l}$	9.11 $^{f-l}$	9.90 $^{d-h}$	10.90 $^{a-c}$	**9.67**
LS 8538R (M-Q)	9.19 $^{f-l}$	9.38 $^{e-k}$	9.13 $^{f-l}$	9.28 $^{e-k}$	**9.25**
PAN 6P-110 (M)	8.75 $^{i-l}$	8.93 $^{i-l}$	8.66 $^{i-l}$	9.05 $^{g-l}$	**8.85**
DKC 73-74BR (M)	8.94 $^{h-l}$	9.52 $^{e-j}$	9.60 $^{e-i}$	9.08 $^{f-l}$	**9.29**
LS 8518 (M)	8.29 ^{l}	9.24 $^{f-l}$	8.77 $^{i-l}$	8.45 ^{kl}	**8.69**
Mean	**8.86**	**9.67**	**9.64**	**9.69**	**9.47**
LSD (P<0.05) Cultivar			0.484		
LSD (P<0.05) Seeding rate			0.342		
LSD (P<0.05) Cultivar x seeding rate			0.968		
CV%			11.0		

#UQ = Ultra-quick maturing; Q = Quick maturing; M-Q = Medium-quick maturing; M = Medium maturing.
Figures with the same superscript letter are not significantly different (P<0.05).

In the dry 2015/16 season, no significant interaction was measured for yield between the cultivars and seeding rates. Yield was optimized at 40 000 seeds ha^{-1}. However, in the 2016/17 and 2017/18 seasons, and overall (Table 1), mean yield was optimized at 60 000 seeds ha^{-1}, but some cultivars, e.g. LG 3607Y and DKC 71-44B, responded inconsistently to seeding rate in those seasons.

The results indicate that the ultra-quick cultivars, BG 3492B and LG 3607Y, and the medium-quick cultivar, DKC 71-44B, require higher seeding rates (60 000 and 100 000 seed ha^{-1}, respectively) than the other cultivars (40 000 seeds ha^{-1}) to yield optimally. However, if a dry season is expected, as in the 2015/16 season, all the cultivars should be planted at 40 000 seeds ha^{-1}.

As lodging increased significantly at seeding rates > 40 000 seeds ha^{-1}, cultivar selection for good standability is important to avoid yield losses at harvesting.

BG 3492B (UQ) is recommended for the cool production areas of KwaZulu-Natal due to its excellent resistance to lodging and its high yielding ability in all three seasons. The high yield obtained at 60 000 seeds ha^{-1} warrants the additional seed cost.

SWEET POTATO PRODUCTION

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Sweet potatoes are ideally suited to resource-poor farmers as they have a high yield potential with minimal reliance on agrochemicals. They are drought tolerant, and are able to produce in low fertility soils. Sweet potato roots are high in carbohydrates and orange-fleshed cultivars have high levels of beta-carotene.

Climate

- Sweet potatoes require a long, warm frost-free growing period of four to five months. Cool soil temperatures reduce root growth and can result in higher proportions of small roots. Growth is severely retarded below 12^{o}C

Soils

- Can be grown on a wide range of soils, but sandy loam soils are best
- High clay content can result in misshapen roots
- Poor drainage can cause root rots

Fertilization

- Very efficient root system can tolerate low phosphorus and/or high acid soils
- If possible, take a soil test to get fertilizer recommendations

Popular Cultivars

Older cultivars such as Blesbok are generally white-fleshed with a red skin. New varieties have been released which are yellow or orange-fleshed. These include Impilo, Ndou, and 199062.1.

Optimum planting times

The optimum planting times for sweet potatoes across climatic conditions are:

Cool areas, moderate to heavy frost	- Nov
Warm areas, light frost	- Sept / Oct - Dec
Hot areas, frost free	- Aug - Mar

Planting

- Use 30 cm vine cuttings from fresh healthy mother stock
- Best done on prepared ridges 30 to 40 cm high, 90 cm apart
- Space cuttings 30 cm apart in the row
- Population = 30 000 to 35 000 plants/ha

Irrigation

- Needs to be applied directly after planting
- Irrigate with low volumes two to three times per week until established
- 30mm of irrigation/rainfall required per week
- Stop irrigation three weeks before harvest to condition roots

Weed control

- Use registered pre-emergent herbicides to prevent competition
- Control weeds until crop canopies (usually at 6-8 weeks)

Harvesting

- Remove tops before lifting
- Lift with mechanically or by hand with forks
- In areas experiencing severe frost, roots need to be lifted before the onset of these conditions

In areas with light or no frost, roots can be stored in the soil and lifted as needed

Pests

Nematodes are a major problem. Weevils, hawk moth larvae, leaf-miners, red spider mite and soil insects can cause damage.

Diseases

Virus degeneration is the main problem. Post-harvest tuber rots of uncured tubers can cause large losses.

Yields (t/ha)

Conservative: 15 to 20 Average: 30 Good: 40+

SOIL HEALTH

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Soil provides a number of key environmental and economic services that are vital to life, including the production of food, fibre, fuel and income, the continued provision of clean water, and the storage of carbon and reactive nitrogen. Thus, soil health, or the continued capacity of the soil to function, is critical to human survival. Soil health is directly affected by the chemical, physical and biological properties of the soil and a balance between these properties is necessary for agricultural productivity.

Whilst we have addressed the chemical constraints to soil health through standard soil nutrient analysis, the millions of astoundingly diverse organisms that live in the soil have largely been an unexplored frontier.

Our objective is to create awareness of the biological component of the soil, and increase our research efforts to understand the role of soil biology, particularly microbiology, on the health of our soils in KwaZulu-Natal and how biological properties and processes contribute to the sustainability of agriculture and ecosystem services.

This will enable us to, ultimately, define and recommend agricultural practices that increase the abundance and diversity of soil organisms and manipulate soil biology for the production of high yielding, high quality crops in a sustainable manner.

SCLEROTINIA STEM ROT

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Sclerotinia sclerotiorum (Lib.) de Bary is a fungus that feeds on the plant tissue, causing plant rot. *Sclerotinia sclerotiorum* was first confirmed in South Africa in 1979 and has become increasingly more common and severe over the years. This fungus is found worldwide and has a wide host range including important South African crops like canola, drybean, soybean and sunflower.

Symptoms of sclerotinia may be observed on stems, leaves, pods and seed. Symptoms of sclerotinia stem rot include Symptoms may be observed on stems, leaves, pods and seed. Symptoms of SSR include water-soaked lesion that rapidly progress along and around the stem. Infected stems become bleached and stringy. Lesions may change from tan to white as the disease progresses in stem tissue, which results in the development of a fluffy white mould on the surface of infected stems. Severe infection weakens the plant resulting in wilting, lodging and death of the plant. Sclerotinia stem rot often occurs in patches in the field and are visible as yellow, dying plants and sclerotia may be produced inside and outside of stems and pods.

No single disease management practice effectively prevents infection of soybeans by *S. sclerotiorum*. The integration of various measures may reduce disease severity and minimize yield loss, such as chemical control, cultivar, sanitation practices, crop rotation, tillage, irrigation and canopy management.

The integrated pest management practise of scouting, monitoring for disease, and taking accurate notes about where and how much SSR occurs in each soybean field from year to year, is important for disease management planning. Tracking disease incidence across years will help in determining the potential sclerotia load present in a particular field.

THE EFFECT OF FUNGICIDE APPLICATION ON DIFFERENT GROWTH STAGES TO CONTROL GREY LEAF SPOT ON MAIZE

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Grey leaf spot on maize, is caused by the fungus *Cercospora zeina* Crous and U. Braun, has become the most important foliar disease of maize worldwide. The disease was first identified in KwaZulu-Natal in 1989/90 and has since become endemic to maize producing areas in South Africa. Early grey leaf spots are observed on the leaf as small, pinpoint lesions surrounded by a yellow halo. As the lesions mature, they elongate into narrow rectangular brown to grey spots. Lesions expand parallel to the leaf veins. As the disease progresses, lesions coalesce and blighting of the whole leaf may result. Under favourable conditions, blighting progresses upwards on the plant and the whole plant may die before the crop reaches maturity and yield loss may result. Documented yield losses of maize attributed to grey leaf spot vary from 11 to 69%, with estimated losses as high as 100%.

Previously it was recommended that fungicide spraying should commence when disease was present (2-3% disease) with further spray applications to provide disease control until physiological maturity when using tolerant cultivars.

Farmers have shifted away from disease tolerant cultivars to high yielding susceptible cultivars. The challenge for producers to stay economically viable is intense and many producers have not only switched to no-till practices, but have also been practising mono-cropping maize. Consequently, there has been a tremendous build-up of infected residue which forms the reservoir for an increasing inoculum.

The combination of susceptible cultivars, late spray application and consequent high inoculum level has led to poor disease control. The effect of timing and frequency of fungicide treatments for the management and control of grey leaf spot was quantified. Tolerant and susceptible maize cultivars were hand-planted in a split plot design with three replications. The inoculum level was the main plot with cultivars and spray timing as sub-plots. Fungicide (azoxystrobin 250 g ai/L) was applied at 21 and 30 day intervals. The timing of fungicide spray commenced at the different leaf stages: V3, V5, V8 and V12.

Significant differences were obtained among yield, cultivar and spray treatments. The control had significantly higher disease pressure, irrespective of the cultivar used. Results significantly indicate that fungicide spray application interval is critically important for obtaining high yields with minimum disease incidence. Fungicide spray application at 21 days is significantly better in terms of lower disease pressure and high yields as compared to spray applications every 30 days.

The trend indicates early spray application (V3 and V5) lowers disease severity and increases yield. Inoculated treatments had a higher disease severity showing that increased inoculum and delayed spray applications are the perceived fungicide "failure".

It is recommended that fungicides should be applied early in the maize growing cycle (V5) and applied every 21 days as this will significantly increase yield and lower grey leaf spot incidence. Spraying from V5 will result in a total of three spraying operations, at 500 ml/ha spray dosage of azoxystrobin 250 g ai/L, this is a total of 1.5 L per/ha throughout the growing season.

MAJOR INSECT PESTS OF MAIZE IN SOUTH AFRICA: FALL ARMYWORM, *SPODOPTERA FRUGIPERDA* SMITH (LEPIDOPTERA: NOCTUIDAE)

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Fall armyworm, *Spodoptera frugiperda* Smith (lepidoptera: Noctuidae), is a migratory insect pest that feeds on more than 80 plant species but primarily prefers maize and sorghum, resulting in a lot of damage to the leaves and seed kernels of both crops in the field. This pest has a voracious appetite, reproduces and spreads quickly, given the right environmental conditions. The species is indigenous to the tropical regions of the western hemisphere, from Argentina to the United States of America (USA).

Estimates suggest that over 400 million dollars of maize production are lost annually through crop damage. In South Africa, the pest was positively identified in 2017, with little scientifically known about its impact, although there have been mixed reactions from maize farmers to date. This pest has since been recorded in all nine provinces of the country. Adult female moths lay eggs in clusters of ca. 200 eggs per cluster. Egg clusters are covered with greyish scale or bristles. Egg clusters are generally laid on the undersides of leaves. In two to three days the eggs will hatch into tiny larvae. Their feeding results in semi-transparent patches on the leaves. If not managed early they can enter the whorl and become extremely difficult to manage. Caterpillars can be greenish or brownish with stripes along the lengths of their bodies. Larger adults (ca. 1 - 3 cm) often have a visible inverted ‘Y’ shape on their heads and four distinct dots towards the end of their body. When the caterpillar is fully grown, it drops to the ground and forms a pupa. An adult moth emerges about eight days later to begin the cycle all over again. Infestation levels by larvae can result in a 15 – 73% reduction in maize yield. Currently, in South Africa, management has relied on early detection, in the form of either scouting or pheromone baited traps and the use of registered pesticides. It is imperative that chemicals are rotated from different pesticide chemistries to avoid pesticide resistance.

In conclusion, *S. frugiperda* is a relatively new but potentially very serious agricultural pest that should not be undermined by South African farmers. It is vital to identify the pest early in the growing season and initiate available control measures. Should no action be taken against this pest upon detection, the risk of losing the entire crop becomes extremely high.

PLANT HEALTH DIAGNOSTICS

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Analytical Services: Plant Health Diagnostics, Cedara Research Station
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Plant Health Diagnostics is a subdivision of Analytical Services tasked by the KwaZulu-Natal Department of Agriculture and Rural Development to provide a plant health diagnostic and advisory service to plant growers who submit plant, water and growing medium samples for diagnosis or tests pertaining to plant health. Plant Health Diagnostics is equipped with a modern and high quality Nikon stereomicroscope and compound microscope, laminar flow benches and autoclaves used for sterile work, and equipment for DNA extraction and PCR inclusive of a Bio-Rad Miniopticon real-time PCR thermal cycler.

Diagnosis of diseased plants by identification of pathogenic fungi, bacteria and micro-arthropods; and pathogen screening tests on plant material received comprises the greatest part of the service. Pathogen-specific detection tests on water and growing media are also major components of this service. Quantification of plant-parasitic nematodes in soil samples can be conducted. Since 2017 PCR diagnostic tests for detection of target micro-organisms in support of microscopy and isolation methodologies has become a well-established component of the service. Identification of many micro-organisms initially detected by PCR, via DNA sequencing of PCR DNA-amplicons has been achieved through a service level agreement established with Inqaba Biotec late in 2017.

Our poster provides contact information and illustrates examples of diagnoses, equipment and diagnostic test results with brief summaries of the methodology applied.

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CURRENT RESEARCH PROJECTS IN 2018/2019

Researcher	Title	Location
Analytical Research Services		
Biochemistry		
Sheryllyn Naidoo	Ammonia oxidising bacteria as good microbial indicators of the nitrogen cycle when monitoring soil status	Cedara & Loskop
Soil microbiology		
Charmaine Mchunu	Soil N and microbiology	Cedara & KZN
Soil fertility		
Nicky Findlay	Cultivar effects on yield response of selected staple agronomic crops to soil acidity and P deficiency	Cedara
Alan Manson	Cover crops for maize silage system production	Cedara & KZN
Charmaine Mchunu	The improvement of FERTREC nitrogen recommendations	Cedara & KZN
Michael Relihan	In depth research on diseases associated with infection by *Lagena* species on pepper & other crops	Cedara & UKZN
Guy Thibaud	Tillage effect on N requirements	Loskop
Agronomy Services Division		
Ernest Ntombela	National dry bean cultivar trial	Cedara
James Arathoon	National soybean cultivar trial	Cedara
	Effect of seed rate on maize production	Cedara, Dundee & Kokstad
Lindani Zulu	The effect of added nitrogen through a legume-maize rotation on maize yields	Dundee
Noxolo Mtumtum	Maize silage cultivar evaluation trial	
	The effect different nitrogen rates have on wild watermelon	Kokstad
	Long season maize cultivar trial	
	Integration of soybean (*Glycine max* (L) Merrill) into small-holder maize production system in KwaZulu-Natal	Cedara
	Effect of intercropping with a forage legume on maize forage yield and quality	Kokstad

CURRENT RESEARCH PROJECTS IN 2018/2019

Researcher	Title	Location
Agronomy Services Division		
Morgan Naidoo	Elite potato cultivar trial	Cedara
	Commercial potato cultivar trial	Cedara
Sibonelo Gumede	The response of three grain sorghum cultivars to chemical bird netting control treatments	Makhathini
Sibusiso Radebe	The effect of gypsum and lime application on soil properties and groundnut yields	Dundee
	The effect of earthing-up on groundnut production	Dundee
Crop Protection Services Division		
Suzette Bezuidenhout	Different weed control methods to reduce *Ipomoea purpurea* (common morning glory) emergence and growth	Cedara
Archana Nunkumar	Evaluation of soybean, dry bean and sunflower cultivars for tolerance to different strains of *Sclerotinia sclertiorum*	Cedara
	Management of nematodes and scab on potatoes	Dundee
	Studies on grey leaf spot on ryegrass	Cedara
	Co-operative breeding trials with ACCI UKZN	Cedara
Hiresh Ramanand	Controlling aphid and viruses in potatoes	Cedara
	Evaluation of different fall armyworm lures for efficacy	Cedara
Khethuxolo Mbotho	Different maize planting date and seeding rates	Cedara
Nonduduzo Manyoni	Weed management strategies for pumpkin	Cedara
Horticulture Services Division		
Comfort Dlamini	Evaluation of mango cultivars under irrigation conditions at high density planting	Makhathini
	The effect of intra-row spacing, row spacing and planting date on green maize ear size	Makhathini
Maxwell Mkhathini	Tomato spacing and nitrogen application	Msinga
	Postharvest handling and value adding to peach fruit	Impendle
	Cabbage and cauliflower cultivar evaluation	Cedara
Rob Osborne	Sweet potato cultivar evaluation	Cedara

CURRENT RESEARCH PROJECTS IN 2018/2019

Researcher	Title	Location
Horticulture Services Division		
Rob Osborne	Control of downy mildew	Cedara
Rob Osborne	Tissue culture of sweet potatoes	Cedara
Sandile Zulu	Bark and much effect on tomatoes	Cedara
Tony Naicker	Evaluation of indigenous pumpkins for use in sustainable agriculture	Cedara
Farming Systems Research		
Sibusiso Madiba	Equipment availability for small scale farmers in KZN	Creighton
Sibusiso Madiba	Maize production in rural small scale areas	Potshini
Thami Mpanza	The effect of row spacing orange flesh sweet potatoes (OFSP) and maize on soil moisture, land use efficiency and yield under different row spacing	Maphumulo

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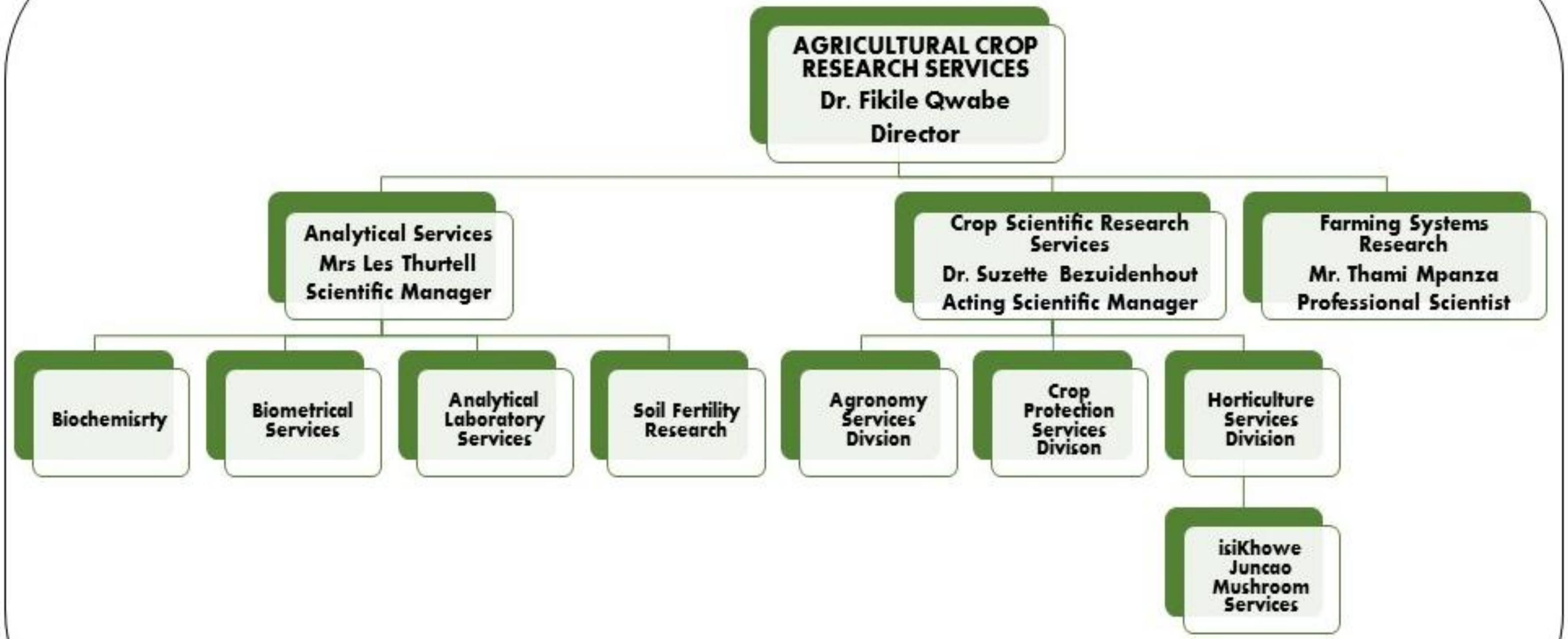
PROVINCE OF KWAZULU-NATAL

Agricultural Crop Research Services Organogram



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Vacant					
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