agriculture
& environmental affairs

Department:
Agriculture
& Environmental Affairs
PROVINCE OF KWAZULU-NATAL

ANNUAL RESEARCH TECHNOLOGY TRANSFER SYMPOSIUM

PROGRAMME & SUMMARIES

FEBRUARY 2014

ANNUAL RESEARCH TECHNOLOGY TRANSFER SYMPOSIUM ORGANISING COMMITTEE

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Dr Meshack Radebe

Message from the Honourable DR B. M. RADEBE

MEC: KwaZulu-Natal Department of Agriculture and Environmental Affairs

I am grateful to contribute to the 2013/14 Research Technology Transfer Symposium proceedings booklet. These proceedings contain the progress with regard to research projects conducted by my Departmental staff, and which are funded by the KwaZulu-Natal Department of Agriculture and Environmental Affairs on a yearly basis.

We all know that poverty and food insecurity remain the greatest challenge faced by our Province and our country, and both are severely impacted by climate change.

The National Development Plan (NDP) of Government aims to eradicate poverty, increase employment and reduce inequality by 2030. The NDP lays the foundation for long-term planning for a radical socio-economic agenda over the next 20 years. Its implementation will be a people driven process to which everyone will be able to contribute. Improved food security and smallholder farmer development and support (technical and infrastructure) for agrarian transformation are some of the policy imperatives identified by the NDP and will be focussed on in the coming Medium Term Strategic Framework (2014 – 2019).

To address issues of poverty, food insecurity and climate change, the agricultural sector will have to play a central role. The KwaZulu-Natal Department of Agriculture and Environmental Affairs, through an innovative agricultural research and technology development programme, will ensure technology transfer through technical support, analytical and diagnostic services to support agriculture moving forward in KwaZulu-Natal.

The annual Research Technology Transfer Symposium allows Departmental researchers to present their latest research findings and recommendations. The Symposium is an important channel for the exchange of information between researchers and agricultural practitioners. It provides a valuable opportunity to stay abreast of latest developments in technology and advances in the agricultural field that enhance food security and sustainable land use for

clients. It also presents an opportunity to network with clients and get feedback for future research needs.

I wish to take with opportunity to thank institutions such as Agricultural Research Council, Universities, Private Sector, NGO's and Commodity Organizations for the research work they do in the Province to contribute to a food secure Province.

I wish you a fruitful and successful symposium.

Kind regards

MEC DR B. M. RADEBE
KwaZulu-Natal Department of Agriculture and Environmental Affairs
19 February 2014

Foreword

The Research and Technology Development Directorate of the KwaZulu-Natal Department of Agriculture and Environmental Affairs is committed to research and technology development throughout the Province. The Directorate contributes to the strategic outcomes of the Department by providing essential technology and information necessary to:

- improve food security
- address malnutrition
- reduce poverty
- contribute to the expansion of high value crops within sustainable systems
- promote sustainable economic and environmentally sound development
- support departmental programs with technical advice and research as required and
- to add to the pool of knowledge.

There are five divisions within the Directorate:

1. Analytical Services

    Laboratory Analytical Services

    Bio-datametrics & Bioinformatics

    Biochemistry

    Soil Fertility Research

2. Crop Production Research Services

    Juncao Mushrooms

    Agronomy

    Horticulture

    Crop Protection

3. Livestock Production Research

    Animal Science

    Grass & Forage Science

4. Farming Systems Research

5. Agricultural Research Farms (Six Farm Services)

    3 Coastal and 3 Inland Farms

The objective of the symposium is for researchers and their co-workers to share their research findings. However, this forum also provides an opportunity for the researchers to

receive feedback of research needs and future possibilities to enhance agriculture through science. For the 2014 Symposium 21 talks are to be presented, giving Professional Scientists and Scientific Technicians an opportunity to report back on relevant research results. To this end, Sub-directorates held Progress Report feedback sessions during September 2013 where progress within research projects was presented for evaluation. From these sessions, Final and Progress reports with an appropriate message or recommendation were identified to be included in the Symposium programme. This followed feedback from previous years where delegates requested that talks at the Symposium need to include a “take away” message or recommendation.

In spite of the vast agricultural potential of our Province (which has yet to be fully exploited) research will have to continue to respond to the many challenges and constraints. This needs to be addressed by providing the knowledge and technologies to make answers and solutions available that will allow the farmer to produce adequate food of the necessary quality - and even to make use of export opportunities. The demands on agriculture to become more efficient and productive are greater than ever, and research will have to address this in research programmes.

I would like to thank the Organizing Committee and the presenters for participating in the Symposium. The Research Proceedings contains summaries of the presentations, a list of the current research projects as well as the research projects approved during 2013. A list of staff involved in research and technology development is included for future reference.

You are invited to enjoy the Symposium by making full use of the opportunity to engage, to network and to communicate with fellow scientists and colleagues with a view to ensuring a secure and sustainable future for our province.

Hannes de Villiers

Senior Manager: Research & Technology Development

Members of the Research Project Committee

- Dr Hannes de Villiers: Chairman
- Mrs Michelle Larsen: Admin Support
- Dr Trevor Dugmore: Acting Scientific Manager: Livestock Production Research
- Mrs Les Thurtell: Scientific Manager: Analytical Services
- Mr Thami Mpanza: Acting Scientific Manager: Farming Systems Research (FSR)
- Mr Ian Macdonald: Scientific Manager: Crop Production Research Services
- Ms Fikile Qwabe: Professional Scientist (Crop Production)
- Mr Bright Mashiyana: Link between R&TD and Extension and Projects
- Mr Francois du Toit: Acting Deputy Manager: Farm Services
- Dr Alan Manson: Professional Scientist (Soil Fertility Research)
- Dr Suzette Bezuidenhout: Professional Scientist (Crop protection)
- Mrs Nomfuzo Mkhize: Senior Manager, Livestock Programme
- Mr Rob Osborne: Professional Scientist (Horticulture)
- Mrs Cathy Stevens: Biometrician

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KZNDAE ANNUAL RESEARCH TECHNOLOGY TRANSFER SYMPOSIUM 2014

PROGRAMME: WEDNESDAY, 19 FEBRUARY

07h45 - 08h30	Registration	
08h30 - 08h40	Welcoming and prayer	Mr Bright Mashiyana *(Regional co-ordinator: Analytical Services)*
	Opening	The Honourable Dr B.M. Radebe: *MEC*
08h40 - 09h10	Introduction of guest speaker	Mrs Les Thurtell *(Scientific Manager: Analytical Services)*
	Keynote address	Dr Neil Miles *(Senior Soil Scientist: SASRI)*

SESSION ONE		**Mr Ian Macdonald: Chairperson**
09h15 - 09h30	The untold story of the pig farming sector of rural KwaZulu-Natal: A case study of uThukela district	Sibongiseni Gcumisa *(Farming Systems Research)*
09h30 - 09h45	A review of the principles of veld management and the consequences of poor veld management	Sheila Househam *(Grassland Science)*
09h45 - 10h00	Sweet potato vine multiplication for small-scale farmers in KwaZulu-Natal	Tony Naicker *(Horticulture)*
10h00 - 10h15	Essential oil production in KwaZulu-Natal (tea tree)	Maria de Figueiredo *(Biochemistry)*
10h15 - 10h30	Dry bean cultivars for KwaZulu-Natal	Ernest Ntombela *(Agronomy)*
10h30 - 10h50	**TEA**	
10h50 - 11h05	A small-scale dairy system	Peter Oosthuizen *(Animal Science)*
11h05 - 11h20	Attributes of an ideal green maize hybrid and production constraints in KwaZulu-Natal	Fikile Qwabe *(Horticulture)*
11h20 - 11h35	Soil acidity and nitrogen studies under no-till maize in KwaZulu-Natal	Guy Thibaud *(Soil Fertility Research)*
11h35 - 11h50	Living with ticks	Joanne Mann *(Animal Science)*
11h50 - 12h15	**DISCUSSION**	

12h15 - 13h00	**LUNCH**	
SESSION TWO		**Ms Fikile Qwabe: Chairperson**
13h00 - 13h15	The effects of different planting populations and corresponding seeding rates on Chicory	Ndu Manyoni *(Intern: Crop Protection)*
13h15 - 13h30	The production of sweet potatoes	Victor Roberts *(Soil Fertility Research)*
13h30 - 13h45	Tillage and carbon dynamics in KwaZulu-Natal's small-scale farming systems	Charmaine Mchunu *(Soil Fertility Research)*
13h45 - 14h00	Vegetable soybean production	James Arathoon *(Agronomy)*
14h00 - 14h15	Revitalisation and preservation of the indigenous Zulu sheep (Imvu) in KwaZulu-Natal	Erika van Zyl *(Animal Science)*
14h15 - 14h30	Potato production for small-scale farmers	Morgan Naidoo *(Agronomy)*
14h30 - 14h45	**DISCUSSION**	
14h45 - 15h00	**TEA**	
SESSION THREE		**Mr Thami Mpanza: Chairperson**
15h00 - 15h15	Multi-season maize cultivars for Northern KwaZulu-Natal	Nox Mtum-tum *(Agronomy)*
15h15 - 15h30	Growth rates of pigs fed on incremental levels of *Acacia tortilis* leaf meal-based diets	Mbongeni Khanyile *(Animal Science)*
15h30 - 15h45	The Cedara Plant Disease Clinic	Archana Nunkumar *(Plant Health Centre)*
15h45 - 16h00	Winter cover crops for maize silage production	Alan Manson *(Soil Fertility Research)*
16h00 - 16h15	Mulch effect on weed growth, soil moisture and yield of groundnuts under KwaZulu-Natal conditions	Sibusiso Radebe *(Farming Systems Research)*
16h15 - 16h30	The use of allelopathy in a weed management strategy	Suzette Bezuidenhout *(Crop Protection)*
16h30 - 16h45	**DISCUSSION**	
16h45 - 16h50	**CLOSURE**	Dr JF de Villiers *(Senior Manager: R&TD)*

THE UNTOLD STORY OF THE PIG FARMING SECTOR OF RURAL KWAZULU-NATAL: A CASE STUDY OF UTHUKELA DISTRICT

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Introduction

This survey was done in the rural areas of uThukela District in KwaZulu-Natal of RSA to assess the status of pig farming and contribution of pig farming to the livelihood and fighting poverty in uThukela District. The study was motivated by the fact that no studies have been done to date to try and understand pig production in rural uThukela District. Furthermore, farmers were constantly raising concerns about issues such as the slow pig growth which was of concern. It was therefore evident that the whole sector needed to be investigated and understood if solutions to the constraints were to be found and to further improve pig production.

Materials and Methods

A farming systems approach was used in conjunction with a cross-sectional survey method using a structured questionnaire in face-to-face interviews with farmers for the collection of data. The study involved 4 local rural municipalities with a population of 4205 people who owned 2555 pigs. The sample size was 533 pig farmers/respondents. The data included the demographic characteristics of pig farmers, pig production and management practices, the role of pigs in both the social and economic lives of people and the constraints and opportunities of pig farming. The data was analysed using descriptive statistics such as means, frequency tables, percentages, ANOVA and subjected to chi-square tests.

Results and Discussion

Farmers who are employed tend to own more pigs (P <0.05). Likewise, the higher the education level of the farmer the more pigs they own (P <0.05). Employed farmers are more likely to sell their pigs as compared to the unemployed. The unemployed mostly kept pigs for own or household consumption. In general, 63% keep pigs for household consumption and 33% use pigs as a source of income. With regard to gender, more females (P <0.05) tended to rear pigs compared to their male counter parts. The majority of farmers (62 %) interviewed were over the age of 46 years. Indigenous or local breeds of pigs are still reared in the study area. An association between indigenous pigs and smaller litter size (P < 0.05) was demonstrated as well as between Large White and larger litter size (P < 0.05). The marketing of pigs is mostly done within the communities. With regard to feeding and feed types, the majority of the respondents (81%) use swill to feed their pigs, 16% feed commercial feed and 2% feed maize and vegetables. Farmers feeding commercial feed tend rear more pigs as compared to those who feed their pigs on swill, vegetables and maize (P <0.05).

The present study shows that pigs play a significant role in the lives of the rural people mainly as a source of protein among the unemployed as opposed to being a source of income. Interventions to address proper feeding, housing and management of pigs are needed to assist the farmers realise the full potential of rearing pigs. Given that most pigs produced in the study area are marketed mostly in the area, it means that most pigs are slaughtered outside the abattoir. Therefore, future studies to investigate if this poses a health hazard to the local population are recommended.

Conclusion

The study concluded that pigs have a vital social and economic role in the lives of the rural people of KZN for income generation and household consumption. The main constraints are wide spread poverty and lack of management skills in pig production, nutrition, health, housing and management. Government intervention is necessary to help farmers to improve pig production and management as a means of poverty alleviation and household food security.

A number of areas that are of most importance for the Government to intervene include youth involvement, marketing of rural pigs, feeding, housing and application of good management. Youth need to be motivated to see importance of agriculture and this can be best achieved by educating the youth through bursaries to study in areas such as Cedara and OSCA College. Marketing of rural pigs has no formal market and thus slaughtering and handling of meat are not monitored therefore could be a potential source of zoonotic diseases. Government should not interfere with the local market but must develop standards and market places. KZNDAEA animal health technicians also need to mentor and observe the farmers on the required healthcare and biosecurity routines and educate farmers to curb potential disease spread.

Feed and housing require more investigation, cheaper alternative feeds for feeding rural pigs while meeting the required nutrients of the animal. Simpler, smaller and easily movable pig houses that can be used by farmers keeping few pigs need to be looked at as well. Finally Government needs to train farmers on pig production practices, keeping financial and production record which are crucial especially to those that aim at making pig farming a business venture.

A REVIEW OF THE PRINCIPLES OF VELD MANAGEMENT AND THE CONSEQUENCES OF POOR VELD MANAGEMENT

Sheila D. Househam

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Introduction

The objectives of grazing and browsing management are to maintain or create a favourable species composition, maintain optimum quantity and quality of plant food and maintain the highest animal productivity within the constraints of the farm. In order to do this, the following factors can be manipulated: stocking rate, grazing program, resting program, the use of fire and animal type. Grazing capacity is an important factor in veld management. It is the area of land required to maintain a grazing animal unit over an extended period without degradation to the vegetation or soil. Should the grazing capacity of the veld be exceeded, then degradation will begin. There are two types of grazing systems – continuous grazing and rotational grazing. Continuous grazing involves one group of animals on an area of land for an entire grazeable period. Rotational grazing involves at least one camp more than there are groups of animals and the livestock rotate between these camps within a grazing season.

Discussion

Veld assessments need to be done at regular intervals in order to determine the grazing capacity of a rangeland. Veld assessments give an indication of what species are present and how vigorous the plants are. Once these assessments have been done, areas can be fenced into uniform camps and the livestock numbers can be matched to the grazing capacity and camp size. Palatable areas need to be separated from unpalatable areas based on uniformity – these are known as veld types. The number of animals that can be run on a farm must not exceed the grazing capacity of the farm. If this happens, there will be insufficient food for livestock; veld productivity will decrease as a result of overgrazing and ultimately, the farmer will lose money. The stocking rate that is implemented is dictated by the

condition of the veld, as indicated by a veld assessment. Exceeding grazing capacity occurs in two forms: keeping animals in a camp for too long (not enough time allowed for grasses to recover) and carrying too many animals on an area of land. Both have serious consequences. Not allowing a grassland sufficient time to recover will deplete the carbohydrate reserves and the plant will lose vigour. Loss of vigour can ultimately lead to species dying out of the grassland due to overutilization. Carrying too many animals on an area is called overgrazing and this usually occurs for extended periods of time. Exceeding grazing capacity decreases the productivity of grasslands, decreases biodiversity and ultimately leads to erosion.

Research has proven that steep slopes need to have lighter stocking rates than flatter slopes, in order to prevent degradation and erosion. The grazing of sheep on very steep slopes is not recommended – degradation will occur at a rapid rate. There are several systems that can be used for implementing grazing rotations. The system implemented is determined by the degree of management available. The more complex grazing systems need a higher level of management than the simpler grazing systems. The system that can be used in communal areas is the three-camp system. Continuous grazing in communal areas is an option, as long as the grassland is allowed to have a full seasons rest at least once every three to five years. If grasslands are utilized by sheep alone, then rests every second year are needed. Time cattle spend in a camp is important, as is time cattle are out of the camp. Grasslands needs to have a full season's rest to allow it to regain vigour and to set seed. Burning to stimulate a spring flush is not recommended. Not only will a burn remove any cover that is holding the soil (preventing erosion), it will force the grass to grow at a time when it is not conducive to do so, resulting in decreased vigour. Another important factor to consider is the animal type – match the animal to the environment.

Conclusions

The veld is the only asset many farmers have at their disposal. The tools available to a farmer for veld management include stocking rate, grazing program, resting program, the use of fire and animal type. The objective of veld management is to provide good soil cover with edible perennial grass plants that ensure long-term sustainable production with maximum financial return.

SWEET POTATO VINE MULTIPLICATION FOR SMALL-SCALE FARMERS IN KZN

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Background

Sweet potatoes as a crop have been cultivated widely throughout KZN for many years on both a commercial and subsistence level. However, the lack of good quality, virus-free planting material is a major constraint to sweet potato production amongst small-scale farmers. The discipline of Plant Breeding, UKZN in conjunction with the Horticultural Science section at Cedara developed and released several new locally adapted cultivars. The Centre for Potato Improvement (CIP) based in Lima, Peru has released a number of improved sweet potato lines in Africa and in particular is promoting the use of orange fleshed cultivars in Sub-Saharan Africa to combat vitamin A deficiency, which is prevalent in the diets of rural people in this region.

The Horticultural Science section has multiplied up and distributed relatively large quantities of high quality, disease-free sweet potato planting material, with the specific intent of improving the food security and nutrition of rural communities.

Results

This project was not a trial, but involved the distribution of planting material of selected sweet potato cultivars, namely A40, Beauregard and 199062.1 into communities, for home plantings and plantings within community gardens. Mother stock is maintained in the Cedara greenhouses which are used to establish nursery blocks at the Makhathini Research Station. Vine cuttings are distributed to various clients comprising individual farmers, NGO's, Departmental Extension Officers and Officers from the Department of Health.

Methods

Virus free sweet potato vines were cut into 7cm lengths, dipped into spore kill then planted in seedling trays to bulk up in the greenhouses at Cedara. In March, when the vines were a length of 40cm, they were cut into approximately 30cm long pieces using a hedge trimmer. The vines were then planted at Makhathini research station for multiplication. The land was ploughed, disked and rotavated after which it was ridged for a fairly good soft seed bed. The ridges were 30cm high. The inter row spacing was 90cm. On the ridge, holes were opened to a depth of 15cm in the moist soil. The intra row spacing of the holes was 30cm. The vines were then planted to a depth of approximately 15cm after which the herbicide linnex was applied to control the weeds. The sweet potato vines were then irrigated.

Conclusions

Over a period of several months, from September 2013 to March 2014, approximately 60 000 cuttings were distributed. Based on the amount of planting material distributed throughout the province over the past four seasons, it is estimated that between 700-1000 tonnes of sweet potatoes were produced and this has contributed to improved food security of rural house-holds. Based on the interest shown in the sweet potato vines, it is recommended that extension officers and NG'Os distribute the vines to interested and suitable small scale farmers.

ESSENTIAL OIL PRODUCTION IN KWAZULU-NATAL (TEA TREE)

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Tea Tree essential oil is one of the many essential oils produced in KZN. Tea Tree oil is used as natural medicine due to its anti-microbial properties in mouth wash preparations against throat infections, Oral Thrush and Gingivitis; in cosmetic preparations in the form of creams, soaps and lotions to diminish skin spots and blemishes and in the treatment of fungal and bacterial infections such as Athlete's Foot and in shampoos to combat lice.

The effectiveness and market acceptance of Tea Tree oil depends on its chemical composition. In addition, the amount of oil obtained per ha will determine its economic viability. The annual potential oil yield per ha is 400 kg. However, a variety of factors influence both the quality and quantity of Tea Tree oil. Tea Tree was collected monthly from two Tea Tree research trials at Cedara and Ixopo, respectively. The Tea Tree was steam distilled in the laboratory, the oil extracted quantified and its chemical composition determined. Results from the Cedara trial showed that the quality and quantity of Tea Tree oil varies within and from season to season and that temperature and rainfall also have an effect on these parameters. The study at Ixopo showed that South-facing trees produced more oil than the North-facing ones and that higher quantity of oil was extracted from the young growth.

Tea Tree oil producers can sell their oil in big quantities from two litres to two tons. This is sold to both local and international buyers. Small amounts can also be supplied to pharmacies and general public in twenty ml bottles. Tea Tree oil producers can also use the oil to manufacture their own products.

Quality, quantity, continuity and good market strategy are important ingredients for a sustainable essential oil industry.

DRY BEAN CULTIVARS FOR KWAZULU-NATAL

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Introduction

The Agronomy Section, the Agricultural Research Council – Grain Crops Institute and seed companies, annually conduct dry bean cultivar evaluation trials at various localities in KwaZulu-Natal. These trials form part of the National cultivar trial, which is conducted in the major production areas of South Africa.

Materials and methods

The cultivars evaluated included four small-white and twenty six red speckled sugar bean varieties. The trials were planted in 0.75 m wide rows at a seeding rate of 180 000 seeds/hectare. The crops were grown under dry-land conditions and were fertilized for optimum yields, based on soil analysis recommendations from the Cedara Analytical Laboratory. Weeds and insects were controlled throughout the growing-season. At Cedara, Kokstad and Greytown, the trials were duplicated with one trial being sprayed regularly with fungicides from flowering and the other not sprayed, so as to determine the cultivars' tolerance to fungal leaf diseases.

Results and Discussion

Due to differences in the climatic conditions at each locality and within each season, individual cultivar performance may have been affected. Cultivar recommendations are therefore based on three seasons' data, thus providing more reliable information.

Of the small white cultivars, Teebus produced the lowest yields at three of the four sites (Table 1) and is highly susceptible to rust, but remains the best cultivar for canning qualities. Teebus RR1 displayed good adaptability to all the localities and is resistant to rust.

Of the red speckled sugar beans, RS-6, Tygerberg and Sederberg performed consistently at all the localities, whilst some of the other cultivars performed

differently at each site. For example, OPS-RS2 and RS-5 yielded best under the cooler conditions at Kokstad, whilst PAN 9249, which had the largest seeds, and PAN 9292 yielded best under the drier conditions experienced at Greytown. Leaf diseases were not a problem in Kokstad during the past three seasons.

TABLE 1. Yields recorded in the fungicide-applied trials for the four small-white cultivars and the ten highest yielding red speckled sugar bean cultivars at the different localities

KOKSTAD#		CEDARA*		LOSKOP*		GREYTOWN*	
Cultivar	**t/ha**	**Cultivar**	**t/ha**	**Cultivar**	**t/ha**	**Cultivar**	**t/ha**
SMALL WHITE BEANS							
Teebus RR1	3.98	Teebus RR1	2.88	Teebus RCR2	2.96	Teebus RR1	1.84
PAN 123	3.91	Teebus	2.60	PAN 123	2.92	PAN 123	1.64
Teebus RCR2	3.87	PAN 123	2.42	Teebus RR1	2.91	Teebus RCR2	1.59
Teebus	3.00	Teebus RCR2	2.35	Teebus	2.47	Teebus	1.20
RED SPECKLED SUGAR BEANS							
OPS-RS2	4.17	DBS 840	3.49	RS-6	3.23	RS-6	1.77
RS-5	4.01	PAN 9213	3.32	PAN 9213	3.22	Sederberg	1.64
Werna	3.92	PAN 148	3.29	Tygerberg	3.11	Werna	1.62
Tygerberg	3.90	RS-6	3.27	DBS 840	3.01	DBS 840	1.62
PAN 116	3.86	DBS 830	3.14	OPS-RS4	2.93	PAN 9249	1.56
Sederberg	3.84	Jenny	3.13	DBS 310	2.90	PAN 9292	1.54
Ukulinga	3.81	Kranskop	3.13	DBS 830	2.88	OPS-RS4	1.53
PAN 148	3.81	Tygerberg	3.11	Sederberg	2.88	Tygerberg	1.53
RS-6	3.80	Sederberg	3.10	Kranskop	2.86	PAN 116	1.52
OPS-RS4	3.72	OPS-RS4	3.08	Kranskop HR1	2.80	PAN 9213	1.51

#Seasons 2009/10, 2010/11 and 2012/13 *Seasons 2010/11 to 2012/13

Conclusions

As cultivars perform differently at the various localities, cultivar selection should be based on consistency and adaptation to the climatic conditions. In areas where leaf disease pressure is expected to be high, fungicides must be applied regularly from flowering and more resistant cultivars should be grown.

SMALL SCALE DAIRY SYSTEM

P.A. Oosthuizen[1], E.A. van Zyl[1] & P.P. Msuntsha[1].

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Objectives

1. To demonstrate the management system, fodder flow and effective use of waste in a small scale dairying system.
2. To test the milk production of the Nguni x Jersey cross bred cow in a small scale system using restricted suckling.
3. Compare the milk production of the Jersey x Nguni cross cows with that of the Nguni x Friesland cross cows.

Materials and Methods

In the report period eleven cross bred cows were milked by using a two point milking machine. One quart was not stripped of milk – left for the calf to suckle. Inter calving periods, milk yields and lactation periods were recorded. During the report period two Friesland cows and three Nguni x Friesland heifers were acquired from Cedara. These animals were tested and compared to the production of the Nguni x Jersey currently on the Research station. Throughout the year milk samples was taken and sent to Allerton Veterinary Laboratory to test for Contagious Abortion and Tuberculosis. Somatic cell counts were also monitored from individual animals and animals with high counts were treated. Income from the dairy and expenditure regarding the cost of on-farm produced feed and bought feeds are taken into account.

Discussion

The newly acquired Friesland x Nguni crossbred from Cedara is comparing well to one of the Jersey x Nguni crossbreds during the same period: The FxN cross peaked in April at 248.4 litres month^{-1}. In the same month (April) the Jersey crossbred achieved 291.1 litres month^{-1}. To date of this report, these cows are still in lactation. For the report period high ICP's were recorded because of an infertile bull.

Completed lactation periods (x3) were:

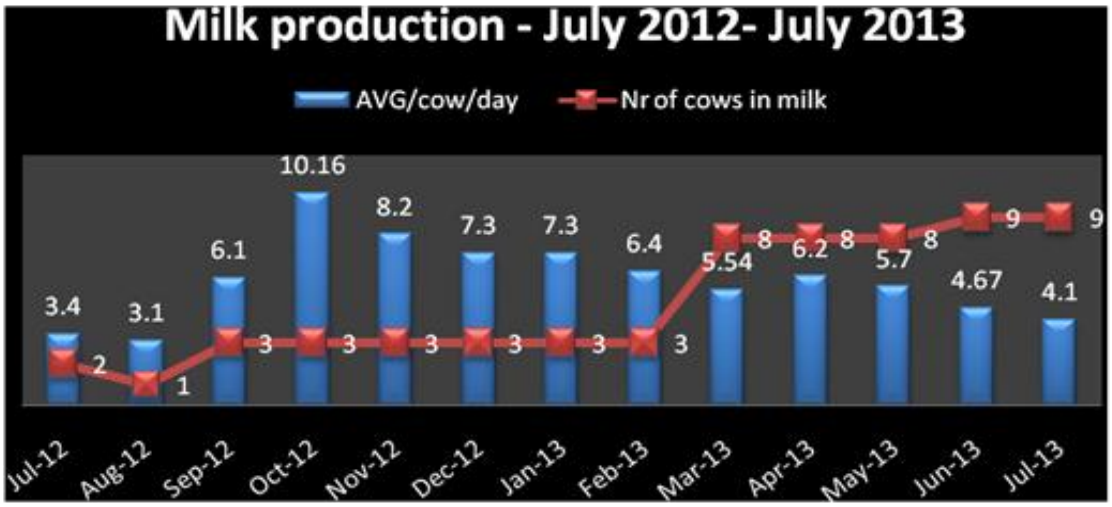
152 days with 1640 litres produced,

197 days and 1383 litres produced and

213 days with 1265 litres produced.

Cows are dried when production falls below 1 litre per milking.

TABLE 1. Monthly average milk production from July 2012 to July 2013



A potential income of R33 695 can be expected from these 11 cows if one litre of fresh milk can be sold for R3.50 (rural going rate price for milk). The feasibility of purchased feed to increase milk production must be evaluated. Calves are reared by the mothers, but were not taken into monetary account.

Conclusions

In this system the cow rears her own calf, which brings down costs in the dairy. Continuous selection against low producers must be done to cull such animals. This is not a breeding project so the numbers of breeding stock does not allow for the breeding of a high producing crossbred, but indications are there that some of the crossbred cows can obtain yields of more than 10 litres day^{-1}. If calves are reared properly, young weaners can be sold at a profit with the minimum of input. Sale of milk alone will not make any profit, but value adding to the product, as well as the sale of young animals might prove profitable.

ATTRIBUTES OF AN IDEAL GREEN MAIZE HYBRID AND PRODUCTION CONSTRAINTS IN KWAZULU-NATAL, SOUTH AFRICA

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[2]University of KwaZulu-Natal, P. Bag X01, Scottsville 3209, South Africa

Introduction

Green maize provides food security, with potential to generate cash income for rural households in South Africa. However, research on green maize production has been scarcely reported, which negatively impacts on both variety development and management. The study aimed to determine the "ideal" quality and agronomic traits, production constraints, production trend and enterprise viability for green maize hybrids.

Materials and Methods

A case study was conducted at Mjindi and Ndumo irrigation schemes in KwaZulu-Natal. A formal questionnaire was deployed on 64 out of 100 green maize producers interviewed in a structured, one-on-one format. The data were analyzed using the SPSS computer programme.

Results and Discussion

There are limited hybrid options for green maize production due to lack of general adaptation and value for use. The current hybrids were bred for grain production and lack some key green maize traits. There are no suitable green maize hybrids which are adapted to extremely hot conditions in summer, while only two hybrids SR52 and SC701 are grown in winter. The desired traits were a combination of sweet taste, long shelf life and large ears. Complementary traits were high grain yield potential,

high selling ability, flint and white grain, medium ear placement, short maturity period, medium plant height, and good roasting ability. Enterprise budget analysis revealed a total production cost of R11 000 ha^{-1}. The study showed an average return of R21 000 ha^{-1} and gross margin of R10 000 ha^{-1}. Green maize was produced in two seasons per year; because the niche environment allows both winter and summer production (May-October, and November-April). Consequently, income was doubled to about R35 000 ha^{-1}. Nonetheless, the study also reveals that there is room for improvement which can be achieved by growing appropriate hybrids under better management to obtain first grade green ears which can earn market premium price. The major constraints included poor cultural practices which compromised both quality and yield. Thus a declining production trend was observed.

Conclusions

There is thus a great potential for green maize production in the study area. However, lack of suitable green maize hybrids appeared to be the major hindrance. Future studies should aim to improve both the genetics and production economics. More income can be generated if desired traits for the consumers can be incorporated in hybrids to enable farmers to obtain a premium on green maize sales.

SOIL ACIDITY AND NITROGEN STUDIES UNDER NO-TILL MAIZE IN KWAZULU-NATAL

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Introduction

While extensive research has been conducted on soil acidity and liming, and on nitrogen fertilization for maize under conventional tillage in KwaZulu-Natal, there is a lack of similar information under no-till. The efficacy of surface-applied lime for correcting soil acidity or at least preventing soil acidification in no-till systems is contentious. Similarly, various studies have shown that more N fertilizer is typically needed for no-till, especially in the short term (e.g. < 10 yrs), but there is no consensus on the extra quantity required relative to conventional tillage. Differences in the efficacy of various N sources (e.g. urea and LAN) tend to be more pronounced under no-till, especially where regular surface liming is practiced. With the increasing adoption of no-till cropping by farmers, this research needs to be conducted so that appropriate advice can be given to no-till farmers.

Materials and Methods

An experiment comprising three annual rates of unincorporated, surface-applied lime (0, 0.75, 1.5 Mg ha^{-1}), and two sources of nitrogen fertilizer (LAN, urea), applied as a topdressing to maize at the rates of 0, 60, 120 and 180 kg ha^{-1}, was initiated on an existing no-till field in the Karkloof in the 2001/2002 season. A second experiment comprising three tillage regimes, namely no-till (NT), annual conventional tillage (CT), and periodic tillage involving conventional tillage followed by four seasons of no-till ($CTNT_4CT$), two sources of nitrogen (urea, LAN), and five rates of application (0, 40, 80, 120, 160 kg ha^{-1}), was initiated on an existing no-till field in the Loskop area, in the 2003/2004 season.

Results and Discussion

Highly significant positive responses to both N rate and source and to lime were recorded in the Karkloof. The average yield response to lime and N was

approximately 2 and 5 Mg ha^{-1}, respectively. Yields were influenced by a significant positive interaction between N and lime rate. In the absence of lime, maize response to N amounted to 4.18 Mg ha^{-1} compared to 5.66 Mg ha^{-1} at the highest rate of lime. Irrespective of the lime rate, maize yield response to N was not statistically significant above an application rate of 120 kg ha^{-1}. Yield differences between LAN and urea were not evident at 60 kg N ha^{-1}. However, at 120 and 180 kg ha^{-1}, LAN was superior to urea by an average of 0.7 Mg ha^{-1}. In the absence of applied lime, the surface soil (0-5 cm) has acidified dramatically over the past 12 years. Annual surface application of lime has proved highly effective in preventing soil acidification, even at the highest rate of N used. At the lower rates of N, acid saturation levels have been reduced to less than those found at the start of the experiment. Owing to hard soil surface conditions under NT compared to CT at Loskop, seed placement in NT was shallow, resulting in poor germination and a significantly reduced plant population. Maize yields under NT were significantly lower than those under CT at all rates of N applied, due to the very low plant population. Maize yields were not influenced by a significant tillage x N rate interaction. Neither was yield influenced by either a tillage x N source or N rate x N source interaction, as noted in the exceptionally wet 2010/2011 season.

Conclusions

Surface applied lime was beneficial in terms of increasing maize yield under no-till. This can be attributed to the fact that the lime has prevented acidification of the soil profile down to a depth of 0.6 m and, in some cases, has reduced acid saturation levels to below those found at the start of the experiment. It is, however, important that farmers correct soil acidity problems before converting to no-till, to ensure optimum rooting depth and maximum recovery of applied N. Attempting to plant into No-Till under very dry soil surface conditions led to a significant reduction in plant population, which impacted negatively on maize yield. Results to date show that similar maize yields are achievable with NT compared to CT, provided extra N fertilizer (40-60 kg N ha^{-1}) is used for NT.

LIVING WITH TICKS

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Why should beef cattle live with ticks?

The presence of cattle and KZN's temperature and humidity conditions make an ideal environment for ticks to survive and reproduce. Ticks hinder cattle production through their blood sucking habits; blood loss (under severe infestation), physical damage to ears, teats and hides by abrasive mouth parts and the transmitting of tick-borne diseases (heart water, red water and gall sickness). Although it would appear beneficial to have an intensive dipping program to "get rid" of ticks it is not a viable solution in the long-term. Multi host ticks are not always present on cattle. For example wild animals such as hares, buck, mongooses are hosts for the larval and nymph stages of the brown ear tick. All stages (larval, nymph and adult) of the brown ear tick feed quickly on the host, within 4 to 7 days. The other factor to consider is that an intensive dipping program is not the answer to the tick-borne disease (TBD) threat. The most effective way for cattle not to be susceptible to TBD is to have immunity against the disease. This entails exposure ("challenge") to the disease (via infected ticks) at a young age (6 to 9 months) when the animal has a natural immunity to fight off the disease i.e. calves under 9 months of age should not be dipped to aid in the acquiring of immunity against TBD. Even adult cattle need to have on going exposure to infected ticks to maintain immunity against TBD. If cattle are not exposed to infected ticks as a result of an intensive dipping program then there will be a breakdown in TBD exposure. Cattle then become naïve and are susceptible to contracting TBD.

How is it possible for beef cattle to live with ticks?

1. Practice strategic dipping. Cattle are dipped at pre-determined times to control future tick populations even if ticks can't be seen on cattle. For example, cattle should be dipped in early spring after approximately a few weeks of warm

weather when larvae have hatched (no ticks will be visible with the naked eye at this stage).

2. Practice tactical dipping. Cattle are dipped when a certain number of engorged blue ticks are visible.
3. Ensure the correct dip to water ratio, i.e. use dip at prescribed strength. Don't use dip at double strength as it increases the rate at which dip resistance occurs.
4. Ensure effective application/cover of the dip on cattle.
5. Choice of dip depends on previous use of dips and current resistance to dips.
6. Be aware of active ingredients of dips. Don't switch between active ingredients. Use one active ingredient until resistance to it has been established.
7. If dipping interval is 2 weeks or less, then the dip has not worked. The larval and nymph stage of the blue tick have not been killed by the dip. Investigate dip concentration on site and then pursue dip resistance testing.
8. Do dip resistance testing when changing dips.
9. Don't dip calves under 9 months for immunity purposes. Spot treat ears and udders with tick grease if necessary.
10. If farm conditions are not favourable to challenge cattle with TBD infected ticks then vaccination of weaners should be considered.
11. When buying new cattle, don't import foreign ticks onto your farm. Ensure that cattle are tick free before arriving at your farm.
12. Ideally, the best way to live with ticks is to select for tick resistant cattle. This would entail inspecting cattle before dipping, record which are carrying fewer ticks and then sort them to not get dipped. Over time tick susceptible cattle should be culled.
13. Choose a breed that is tick resistant. The results of a study comparing the number of adult *R. decoloratus* (blue tick) ticks over a two year period were as follows: Nguni 4%, Brahman 8%, Afrikaner 10%, Bonsmara 17% and Simmentaler 61% (Rechav & Kostrzewski, 1991).

In conclusion, tick control requires an integrated approach, implementing as many of the above mentioned points as far as possible.

THE EFFECTS OF DIFFERENT PLANTING POPULATIONS AND CORRESPONDING SEEDING RATES ON CHICORY (*Cichorium intybus* L.) YIELD

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Introduction

Chicory (*Cichorium intybus* L.), belonging to the Asteracea family is a long-day, perennial and a tap rooted herb. In different countries, chicory is grown for a number of reasons however, in South Africa, chicory is grown mostly for the preparation of coffee powder whereby the roasted chicory is mixed with coffee beans. Chicory has small seeds, which are 1 mm in diameter which, together with poor planting practices, contribute to poor germination and plant stands resulting in poor yields. Balan EC (Benfluralin) is currently the only herbicide registered for weed control in chicory; however its action is limited to grass weed species. It is therefore a challenge for developing farmers to reach economic yields of 40 t ha^{-1}. The objectives of the study were to determine the optimal plant population as well as the optimal seeding rate under two weed management practices, a stale seed bed and pre-and post-emergence herbicides.

Materials and methods

The experiment was conducted at Cedara, C2 range five. A stale seed bed was achieved by applying Gramoxone approximately six and two weeks before planting the chicory. The pre-emergence herbicides; Dual S Gold EC and Hammer SL were applied one week prior to planting. Chicory seeds, (cv. Orchies) were planted mechanically at 4 kg ha^{-1} using a hand planter. To acquire different plant populations, the inter-row plant spacing were adjusted by thinning seedlings to achieve plant populations of 83 333, 111 111, 166 666, 222 222 and 333 333 plants ha^{-1}. Seeds were also planted by hand to obtain the above plants per hectare. The post-emergence herbicides Gallant EC and Cysure SL were applied four weeks after thinning. Chicory roots were harvested 150 days after planting, average yield (t ha^{-1}),

root mass (g), diameter (cm), length (cm) and total soluble solids (TSS) were evaluated.

Results

A plant population of 111 111 plants ha^{-1} and a seeding rate of 333 333 seeds ha^{-1}, in combination with pre- and post-emergence herbicides obtained the highest chicory yields. A root yield of 8.08 t ha^{-1} was achieved at a seeding rate of 333 333 seeds ha^{-1} and 13 t ha^{-1} was achieved at a plant population of 111 111 plants ha^{-1}. The application of pre- and post-emergence herbicides significantly affected root mass. Heavier roots were produced at different seeding rates compared to the different plant populations. The highest root mass of 342 g, was measured at a seeding rate of 166 666 seeds ha^{-1}, while at a plant population of 83 333 plants ha^{-1}, the highest root mass of 223.6 g was recorded. Root diameter was not significantly affected by the combined effects of sowing technique and weed management practice. However, the largest root diameter, greater than 5 cm, was found at a seeding rate of 166 666 seeds ha^{-1} in combination with pre- and post-emergence herbicides. No significant differences were measured among the interactive effects of sowing technique and weed management practice on root length. The longest roots (18.46 cm) were obtained at a plant population of 333 333 plants ha^{-1}. Total soluble solids were not significantly affected by the interactive effects of sowing technique and weed management practice.

Conclusions

A plant population of 111 111 plants ha^{-1} and a seeding rate of 333 333 seeds ha^{-1}, in combination with pre- and post-emergence herbicides obtained the highest chicory yields. The commercial plant population is 150 000 – 180 000 plants ha^{-1}. The intention of the trial was to increase both plant populations and seeding rates in order to obtain higher yields. However, this was not the case as yields obtained were below the economic target of 40 t ha^{-1}, possibly due the excessive plant populations and seeding rates, resulting in small and unmarketable roots. The application of Dual and Hammer, combined with Gallant and Cysure in this experiment had a beneficial effect on weed control, compared to the preparation of a stale weed seed bed using Gramoxone.

THE PRODUCTION OF SWEET POTATOES.

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Introduction

This report looks at a brief review of the cultivation of sweet potatoes and then considers some of the research that is being undertaken to establish fertilizer norms (especially P) for sweet potatoes.

The sweet potato (*Ipomoea batatas*) is a dicotyledonous plant that belongs to the family *Convolvulaceae*. Its large, starchy, sweet tasting tuberous roots are an important root vegetable. Sweet potatoes are used for human consumption, as livestock feed, and in industrial processes to make alcohol and starch, and products such as noodles, candy, desserts, and flour. The green leaves of the plant may also be consumed by humans and animals.

The sweet potato is high in carbohydrates and vitamin A and can produce more edible energy per hectare per day than maize, wheat, rice or cassava. The yellow-orange flesh varieties also provide Vitamins A and C. Sweet potato varieties with dark orange flesh have more beta carotene than those with light coloured flesh, and their increased cultivation is being encouraged in Africa, where vitamin A deficiency is a serious health problem. Additionally, the green leaves of the plant can be consumed, providing additional protein, vitamins and minerals.

Sweet potatoes are grown on a variety of soils, but well-drained light and medium textured soils with a pH(H_20) range of 4.5 - 7.0 are more favourable for the plant. They can be grown in poor soils with little fertilizer and have a good tolerance of drought.

Sweet potatoes are not tolerant of frost. This results in the production of cuttings for spring plantings being limited to frost free areas or in tunnels. Build-up of viruses in

sweet potato plants can severely limit production. It is essential to use virus free material and not use the same material year in and year out.

The production of sweet potato has increased dramatically in KwaZulu-Natal, and it has potential to greatly increase household food security as well as become an alternative crop for commercial production. However, the minimum soil P for this crop under KwaZulu-Natal conditions is not known. The response to P applications is also not known. The research component of this talk reports on a project aimed at establishing the minimum soil P requirement of sweet potatoes and the response to additional P fertilization.

Materials and Methods

The trial is laid out as a factorial (2x5) in a randomised block design with 4 reps. Treatments are 2 sweet potato cultivars (A40 and 19090) and 5 levels of P applied (0, 15, 30, 45 and 60 kg P/ha).

Results

There was a significant response to applied P ($P < 0.01$). However, this response was to a very low level of applied P of 15 kg/ha, although there was an upward trend to 30 kg P/ha applied. Considering the low soil P this indicates that sweet potatoes are highly efficient at extracting P from the soil.

Discussion and Conclusions

Sweet potatoes have the potential to greatly alleviate household food security shortages. They are a crop that requires low fertility and has good drought tolerance. The production of cuttings over winter and the build-up of viruses can be limitations to production.

TILLAGE AND CARBON DYNAMICS IN KWAZULU-NATAL'S SMALL-SCALE FARMING SYSTEMS

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Introduction

Minimal Tillage (No-Till) is promoted as the best land management practice for soil rehabilitation and conservation, as well as aiding soils in cropping systems to act as a sink for atmospheric carbon. With No-Till owing its success to minimal soil disturbance and at least 30% of soil surface coverage, the benefits of this practice were assumed to be hindered in residue scarce small-scale farming systems. However, work done in KwaZulu-Natal, Bergville, showed that No-Till practiced under grazed crop-residue could still yield positive benefits, which were reduced soil erosion; CO_2 emissions and increased C storage. Having observed minimal soil disturbance as the key factor contributing to soil conservation in No-Till, the issue of residue scarcity still remained a challenge in small-scale cropping systems attaining other benefits of the practice. Hence, this study evaluated the effect of tillage and different mulching systems on soil conservation and health, by assessing soil erosion; aggregate stability; C stocks; microbial activity and CO_2 emissions.

Materials and methods

For this study, the site was managed under conventional tillage (CT) and No-Till regimes, with the No-Till portion being under four different mulch management systems. Thus, treatments evaluated for this study were CT; No-Till with free grazing (NT+Gr); No-Till with mulch (NT+Mulch); No-Till with bare soils (NT+Bare) and No-Till with high density stocking rate (NT+IntGr). To evaluate soil erosion, three 1 m^{-2} (1 × 1 m) runoff plots were installed on each treatment plot and runoff was collected after every erosive rainfall event during the 2011/2012 and 2012/2013 rainy seasons. Soil losses were computed as a product of total runoff volume and sediment concentration for each treatment. Soils were sampled at 0 – 0.05 m to evaluate the effect of treatment on aggregate stability, C stocks and microbial activity. Cumulative CO_2 emissions were evaluated *in-situ* during the 2012/2013

rainy season. All data was run through an Analysis of Variance and Fisher's protected least significant difference test using GenStat.

Results

Table 1. Fisher's protected least significant difference test for various parameters assessed in this study

	Runoff	SL	MWD	SOCs	FDA	CO_2
	(L)	(g m^{-2})	(mm)	(kg m^{-2})	(µg g^{-1} h^{-1})	(g C CO_2 m^{-2} h^{-1})
Treatment						
NT+IntGr	53.23 ^{bc}	1.12 ± 0.45 ^{a}	2.09 ± 0.14 ^{b}	14.24 ± 0.83 ^{b}	10.71 ± 0.61 ^{a}	0.97 ± 0.15 ^{a}
NT+Bare	63.97 ^{c}	2.69 ± 0.51 ^{c}	1.52 ± 0.07 ^{a}	10.64 ± 0.50 ^{a}	7.94 ± 1.49 ^{a}	1.86 ± 0.30 ^{b}
NT+Mulch	27.35 ^{ab}	0.46 ± 0.04 ^{a}	2.12 ±0.16 ^{b}	11.32 ± 0.60 ^{a}	10.90 ± 1.31 ^{a}	1.29 ± 0.10 ^{ab}
NT+Gr	11.73 ^{a}	1.04 ± 0.15 ^{ab}	1.55 ± 0.18 ^{a}	11.49 ± 1.24 ^{a}	9.83 ± 0.90 ^{a}	1.69 ± 0.15 ^{ab}
CT	19.05 ^{ab}	1.32 ±0.01 ^{bc}	1.44 ± 0.16 ^{a}	11.94 ± 0.90 ^{a}	16.20 ± 0.59 ^{b}	2.72 ± 0.46 ^{c}

SL = soil losses, MWD = mean weight diameter, SOCs = soil organic carbon stocks, FDA = Fluorescein diacetate hydrolysis assay and CO_2 = cumulative CO_2 emissions from soils during the rainy season. Letters indicate the statistical significance effect of the treatment on the particular parameter, thus, each mean is compared to means on the same column. Significant difference was considered at $p \leq 0.05$. n=9.

Discussion and Conclusions

Overall observations from this study, presented on Table 1, illustrated that No-Till practiced on bare soils results in significantly higher soil losses compared to all considered treatments, due to unprotected soil surfaces. Aggregate stability was highest on treatments with crop residue left on the surface after harvesting. This resulted from the presence of organic matter promoting higher microbial biomass and activity at the soil surface; these are essential in stabilising soil aggregates and structure. CT systems significantly increased microbial activity and CO_2 emissions, since tillage increases aeration in soils and exposes organic matter that can be decomposed for nutrient turnover and increased CO_2 emissions. Thus, conclusions from this study were:

i) NT+Bare systems may result in higher soil losses compared to CT regimes, therefore, minimal soil cover (± 10%) is important in No-Till systems.

ii) For small-scale farming systems, No-Till practised with minimal residue (grazed) may still result in reduced soil losses and CO_2 emissions compared to CT. However, soil structure and nutrient turn-over may not be increased as much as in systems where more than 30% of the soil surface is protected by mulch.

VEGETABLE SOYBEAN PRODUCTION

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Introduction

Vegetable soybeans (*Glycine max* (L.)) are the same species as grain soybeans, but they have been bred as speciality cultivars for human consumption. They are harvested at the green pod stage when the beans have filled 80 – 90% of the pod. The beans are larger, sweeter, more tender and have a nuttier taste than grain soybeans. They are regularly eaten in the East, where they are called mao dou ("hairy bean") or edamame ("beans on branches"). Due to their tastiness and the known health benefits of soybean isoflavones, the crop is now planted in many other parts of the world. In South Africa no commercial production exists to date, but research on the crop is currently being conducted at Cedara.

Materials and methods

The research work is focused on cultivar evaluation, seeding rate, fertility requirements and fungicide and inoculant seed treatments.

- Twenty one cultivars are being evaluated for their adaptability and yield at a seeding rate of 266 666 seeds/ha in rows spaced 0.75 m apart.
- The yield production of three cultivars is being evaluated at seeding rates from 50 000 to 250 000 seeds/ha.
- The effect of different application rates of phosphorous (0, 30 and 60 kg/ha) and potassium (0, 40, 80, 120 and 160 kg/ha) on production is being evaluated on two cultivars on a K deficient soil.
- The effect of four fungicide and four inoculant seed treatments on emergence, nodulation and yield is being evaluated on four cultivars.

Results and discussion

All of the cultivars, which are non-GMO and have a range of growing-season lengths, displayed good adaptability to the conditions at Cedara. However, individual performance varied over the seasons (2010/11 to 2012/13) primarily as a result of the prevailing climatic conditions. Drier conditions later in the 2011/12 season resulted in lower yields from the long-season cultivars, whilst in the 2012/13 season a severe hail-storm resulted in lower yields from the short-season cultivars.

Previous work conducted at Cedara with seeding rates from 200 000 to 500 000 seeds/ha resulted in no significant differences in yield. In the 2012/13 season seeding rates from 50 000 to 250 000 seeds/ha also resulted in no significant differences in yield being recorded. However, the percentage export marketable pods (pods containing ≥ 2 beans) and yield were highest at a seeding rate of 150 000 seeds/ha. Bean size requirement (≥ 30 grams per 100 dry seeds) was also met at this seeding rate.

A significant increase in pod and bean yield was recorded for both cultivars from the K application rate of 0 kg/ha to 40 kg/ha. Applications above 40 kg/ha K did not increase yields significantly. No significant differences in yield were measured for the different P application rates. The results are based on one season's data.

The fungicides, Thiram and Captan, improved plant population but reduced nodulation, whilst the inoculants, Soycap and Eco-soy, increased nodule number significantly above the control treatment (no inoculant). However, no significant differences in seed yield were recorded among the different seed treatments, but significant differences were recorded among the different cultivars.

Conclusions

Although the long-season cultivars produced higher mean yields, short-season cultivars are also recommended, so that the marketing period can be extended for as long as possible. More data needs to be collected before recommendations can be made on seeding rates, fertilizer requirements and fungicide and inoculant seed treatments.

REVITALIZATION AND PRESERVATION OF THE INDIGENOUS ZULU SHEEP (IMVU) IN KWAZULU-NATAL

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Objectives of the indigenous Zulu sheep (Imvu) programme

The objectives are to compile an extensive literature review of relevant information on the breed, the development of a database of Imvu farmers, gene conservation of the breed, the development of a policy for distribution of rams to Imvu farmers and research to characterize the production and adaptability traits of the breed.

Achievements to date

A review on all relevant literature is in the process of peer reviewing. A summary of Imvu production data is presented in Table 1. The development of a database, based on a survey and supported by information from a questionnaire, includes localities of owners, sheep numbers and farm practises is in an advanced phase. Flocks for gene conservation and the evaluation of the production characterises of the breed have been establishment on the Dundee and Makhathini Research Stations. A proposed policy for rams to be distributed to Imvu breeders has been developed.

Table 1. General information on Imvu production figures

Lambing %	Year old surviving rate (%)	Ave. Birth mass lambs (kg)		Ave. mass (kg) 100 days	Ewe mass pre-lambing (kg)
		Male	Female		
136	69	3.1	2.9	14.7	30.2

The majority of farmers that participated in the survey mentioned the mortality of lambs between 4 to 12 months of age, which is supported by the literature review (Table 1 –31% mortality).

Research conducted at Dundee Research Station, winter 2013

A pilot trial to determine the growth rates in Imvu (Indigenous Zulu sheep) and Merino lactating ewes and their lambs on poor (poor veld supplemented by *ad lib* hay) and better (grazing maize) feeding conditions during winter was conducted.

Materials and methods

Ewes with single lambs from both breeds were blocked for weight and allocated to either the *Eragrostis* hay on veld treatment or the grazing maize treatment, both with lick. Grazing commenced on 3 July 2013 and continued for 76 days until mid-September, when the lambs were weaned.

Results

The growth rates of the sheep over the trial period are summerized in Table 2.

Table 2. The average daily gain (ADG) of Merino and Imvu lactating ewes and their lambs over the trial period of 76 days

	ADG: Ewes (g ewe^{-1} day^{-1})		ADG: Lambs (g $lamb^{-1}$ day^{-1})	
Treatment	Hay	G. maize	Hay	Grazing maize
Merino	-47.2	86.6	60.3	220.4
Imvu	-15	30.7	45.6	132.9

Discussion and Conclusions

The results show that grazing maize can be considered as an overwintering strategy for Imvu sheep, where improved performance is needed. Lambs weaned at 19.5 kg on grazing maize, compared to the 14.7 kg for lambs under natural conditions (Table1). Lambs fed hay, supplementary to veld in winter, had weaning weights of 15.9 kg. Where feeding circumstances are poor, the Imvu could be considered as the hardier, probably more adapted breed between the two breeds.

Way Forward

The trial will be repeated in winter 2014 to confirm findings statistically and to comment on the financial viability of the system.

POTATO PRODUCTION FOR SMALL-SCALE FARMERS

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Introduction

Commercially available potato cultivars need to be tested at various sites throughout KwaZulu-Natal to determine their adaptability and production potential under small-scale farmer management practices.

Methods and Materials

Cultivar trials were conducted at the Nyangweni and Ndwedwe Training Centers for three seasons, 2010 to 2012. Twelve to eighteen cultivars were planted during May of each year in a randomized block design with three replicates. Four rows of 5 m were planted per plot with the seed spaced 0.3 m apart in the row. The row width was 0.9 m.

In addition to the cultivar trials, seven demonstration trials, each 0.1 ha in size, were conducted together with Potato SA. These were planted in various rural communities in KwaZulu-Natal to encourage small-scale farmers to become commercial producers. Two cultivars were used in these demonstrations.

In both the cultivar trials and Potato SA demonstrations, fertilizer was applied according to recommendations for a 40 t/ha yield. Weeds, insects and diseases were controlled and irrigation was applied when necessary.

Results and discussion

Uneven application of irrigation water at Nyangweni in 2010 affected the yields of certain cultivars, e.g. Sifra (Table 1). In 2011 irrigation was more reliable, resulting in good yields at both sites. However, in 2012, burst municipality pipe lines resulted in insufficient irrigation water and consequently lower yields, especially at Nyangweni. Although their yields may be reduced by blight, Mondial and Sifra are cultivars recommended to small-scale farmers because of their early tuber initiation and high yield potential.

Table 1. Yields obtained from the highest producing cultivars in the different seasons at the two production sites

	2010	2011		2012	
Cultivar	**Nyangweni**	**Nyangweni**	**Ndwedwe**	**Nyangweni**	**Ndwedwe**
			(t/ha)		
Mozart	43.0	_	_	_	_
Hertha	42.0	_	_	18.0	20.0
Mondial	42.0	39.0	39.0	16.0	38.0
Sifra	27.0	30.0	45.0	14.0	32.0
98F-164-1	_	45.0	46.0	_	32.0
Ronaldo	_	36.0	36.0	15.0	33.0

In the Potato SA demonstrations the yields obtained ranged from 10 t/ha to 45 t/ha, depending on crop management and availability of irrigation. Seven small-scale farmers progressed to commercial production, with each farmer planting four or more hectares.

Conclusions

Uneven and insufficient irrigation are the main factors contributing to low yields. Therefore, more reliable cultivar data and higher yields could potentially be obtained at the Training Centers and in the Potato SA demonstrations if sufficient even irrigation could be applied.

MULTI-SEASON MAIZE CULTIVARS FOR KWAZULU-NATAL

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Introduction

New maize cultivars are developed regularly to address agronomic challenges and are subsequently introduced into the market. Performance of new cultivars may not have been tested in localities before their release to the market. The Agronomy Section, the Agricultural Research Council – Grain Crops Institute and seed companies, conducted maize cultivar evaluation trials at various sites in KwaZulu-Natal. These on-going trials form part of a national cultivar trial conducted in the major grain producing areas of South Africa.

Materials and methods

A maize field experiment consisting of fifty different cultivars was conducted at Loskop, Kokstad and Mistbelt during the 2009/10 to 2012/13 growing season to determine the best performing cultivars at these sites. The trials were planted in 0.75 m wide rows at a seeding rate of 44 444 seeds ha^{-1}. The crops were grown under dry-land conditions and were fertilized for a 10 t ha^{-1} grain yield, based on soil analysis recommendations conducted by the Cedara Analytical Laboratory. Weeds, insects and diseases were controlled throughout the growing-season.

Results and discussion

Cultivar recommendations should be based on the three or four seasons' data, as this provides more reliable information. Only ten of the fifty cultivars were consistently evaluated in the last three to four seasons (Table 1).

Some cultivars such as PAN 6Q-308B, showed better adaptability as they performed well at all localities, while others only performed well at certain localities such as PHB 32W72B performed well at Kokstd and Mistbelt and LS 8529 performed well at Loskop.

Table 1. Mean yields of the ten highest yielding cultivars recorded at the different localities over four seasons

Kokstad*		Mistbelt^		Loskop#	
Cultivar	**(t/ha)**	**Cultivar**	**(t/ha)**	**Cultivar**	**(t ha^{-1})**
PAN 6Q-308B	9.32	PAN 6Q-445B	10.17	PAN 6P-110	9.96
PHB 32W72B	9.18	PAN 6Q-308B	9.46	PAN 6Q-445B	9.75
PAN 6Q-708BR	8.83	PAN 6Q-708BR	9.34	PAN 6Q-245	9.71
PHB 31M09	8.79	LS 8518	9.22	LS 8529	9.45
PAN 6Q-445B	8.43	PAN 6Q-508R	9.14	PAN 6Q-708BR	9.44
DKC 78-35R	8.36	PAN 6P-110	9.09	PAN 6Q-508R	9.13
PAN 6P-110	8.19	PHB 32W72B	8.83	PAN 6Q-308B	9.02
PHB 30D09BR	8.15	PHB 30D09BR	8.80	LS 8518	9.01
LS 8518	7.84	DKC 78-15B	8.73	DKC 77-85B	8.96
PAN 6Q-508R	7.74	PHB 31M09	8.63	DKC 78-35R	8.68

* Seasons 2009/10, 2011/12 and 2012/13 – representing “cool” production areas
^ Seasons 2009/10 & 2010/11 & 2011/12 (Cedara , Greytown and Mooiriver) - representing “moderate” production areas
# Seasons 2010/11, 2011/12 and 2012/13 – representing “warm” production areas

Conclusion

Cultivars perform differently at different localities due to climatic and soil conditions. Correct cultivar selection according to the farmers’ production area (cool, moderate or warm production area) is therefore highly recommended. The trial will be planted again in the 2013/14 at these localities. A trial will also be conducted at Dundee.

Take home message:

Successful maize production is based on:

- Fertilizing the crop based on the analysis of soil samples taken from the site.
- Planting during the optimum period
- Good land preparation.
- Cultivar selection.
- Control of weeds, insects and diseases.

GROWTH RATES OF PIGS FED ON INCREMENTAL LEVELS OF *ACACIA TORTILIS* LEAF MEAL-BASED DIETS

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Introduction

Smallholder pig production in Southern Africa is constrained by feed shortages and the demand for cereals to feed the ever- growing human population in Southern Africa makes it imperative to identify alternative feedstuffs for feeding pigs. Leguminous leaf meal inclusion in pig diets can reduce the soybean proportion in conventional pig diets. *Acacia* leaves, for example, have a relatively high crude protein (CP), favorable mineral concentration. The objectives of the current study were to evaluate nutritive value of Acacia leaf meals and to determine the response in growth performance of finishing pigs fed on incremental levels of *Acacia tortilis* leaf meal.

Materials and method

Eight trees of each of the following five dominant leguminous trees; *A. tortilis, A. robusta, A. nilotica, A. nigrescens* and *A. xanthophloea*, were individually hand harvested from the same grazing camp at Makhathini Research Station, Jozini, South Africa. Leaves were harvested by cutting branches off the tree, drying under shady for 3- 4 days to prevent damage of heat sensitive nutrients. Dried branches were careful beaten by stick to release leaves. Leaves were sieve through 2mm sieve to get rid of thorns and twigs and bagged in airtight bags until needed for chemical analysis. Following the evaluation of leaf meals on chemical composition, *A. tortilis* was selected. Thirty finishing male F_1 hybrid (Landrace × Large White) pigs with an initial weight of 60.6 (s.d. = 0.94) kg were randomly allotted to six dietary treatments containing 0, 50, 100, 150, 200, 250 g/kg DM inclusion levels of *A. tortilis*

leaf meal. Each treatment diet was offered *ad libitum* to five pigs in individual pens for 21 days.

Results and Discussion

Acacia tortilis and *A. xanthophloea* leaf meals had the highest CP and fat content among all the *Acacia* species. The Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF) concentrations in the leaves varied significantly across *Acacia* species. Average daily feed intake (ADFI), average daily gain (ADG) and gain: feed ratio was measured every week. There was an increase in both ADFI and ADG as *A. tortilis* leaf meal increased, before they started to decrease. Using piecewise regression (broken-stick analyses), it was observed that *A. tortilis* leaf meal can be included up to 150 g/kg DM in finisher pig diets. The gain: feed ratio was linearly reduced with incremental levels of *A. tortilis* leaf meal in the diets.

The high CP content, moderate ADF, NDF and proanthocyanidins composition of the leguminous forages in the current study concur with earlier reports in the literature. . The observed increase in ADFI and ADG when leaf meal was included in the ration up to 150g/ kg DM concurs with a recent report by Halimani et al. (2005). Inclusion of leaf meal above 150g/ kg was associated with depressed ADFI and ADG.

Take home message

Acacia tortilis leaf meal can be included up to 150 g/kg DM in finisher pig feeds, without negatively affecting animal performance. The ability with which pigs utilize leaf meal-based diets improves with duration of exposure (adaptation) to such diets.

CEDARA PLANT DISEASE CLINIC

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Introduction

The primary function of a plant disease clinic is diagnosis of biotic and abiotic diseases of agricultural crops. The plant disease clinic is often used to develop diagnostic techniques, describe new diseases and support field research projects. It can also provide a base for undertaking survey of crop problems and serve as a centre for disseminating information. Plant clinics are at the interface between extension services and the farming community and perform the major task of bringing technical assistance directly to the farmer.

Materials and Methods

The identification of the causal agent is of ultimate importance in diagnosis. Different procedures are used in the plant disease clinic for diagnosis, depending on the symptoms shown by the plant. The plant disease clinic performs identification of fungi, bacteria and nematodes and the diagnosis of viral and abiotic diseases are based on symptoms. Analysis of plant, soil and water material to confirm nutrient disorders is conducted by Analytical Services.

Results

For the 2012/2013 year, agronomic crops were found to be the largest component of samples submitted (110) followed by horticultural crops (80) and soil and water samples (60). This trend in crops changes every year depending on various factors. Water samples submitted have been showing a steady increase over the years. The occurrence of fungal pathogens was the highest, with root rots and damping – off pathogens contributing to a large portion of this. There has been an increase in bacterial diseases and insect damages as from previous years.

Conclusion

The high proportion of plants experiencing disease problems is probably due to the intensive nature of farming the plants. Poor management practices are also a contributing factor for the occurrence of diseases. Disease control recommendations are based on integrated pest management (IPM) practices as well as emphasis being placed on improved management techniques. There has been a marked increase in water samples over the years and results have indicated that the water quality is poor. Future research must focus on the cause of this and how to ameliorate it.

WINTER COVER CROPS FOR MAIZE SILAGE PRODUCTION.

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Introduction

Production of silage maize results in 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.

Materials and Methods

The trial has 9 treatments which are split for N, and 3 replicates. Treatments are: black oat; black oats & grazing vetch; stooling rye; stooling rye & grazing vetch; grazing vetch; white clover; white clover & black oats. There are two control plots per replicate. Split-plots received either zero N or 120 kg N/ha in January.

The cover crops were planted in April 2012, no-till maize was planted in November 2012, and cover crops were planted again in April 2013. Above-ground dry-matter (DM) yield of the maize and cover crops were measured (harvested 18 March 2013). Samples of the maize above-ground dry-matter were analysed for elemental composition.

Results

Cover crops produced much lower yields than in 2012 (Table 1); in 2013 treatments with stooling rye produced 1.44-2.31 t DM/ha (more than 5.8 t DM/ha in 2012) and the grazing vetch produced 1.8-2.1 t DM/ha (4.9 t DM/ha in 2012). The effect of the N applied to the previous maize crop was significant (P=0.012), but the cover crop by N interaction was not significant.

Maize yields show a significant cover crop x N interaction (Table 1): Highly significant responses to N were observed for all cover crop treatments other than those with vetch. At zero N, maize yield following each of the three cover crop treatments including vetch ranged from 9.57 to 14.05 t/ha, whereas maize yield in the other cover crop treatments ranged from 5.59 to 8.82 t/ha. In contrast, at 120 N, maize yields following black oats, black oats and vetch, and stooling rye and vetch had a significantly lower yield than that of the highest-yielding treatment (vetch).

Table 1. Cover crop effects.

Treatment	Cover crop DM yield (t/ha)		Maize DM yield (t/ha)	
	Zero N	120 kg N/ha	Zero N	120 kg N/ha
Black Oats	2.29	2.84	7.80	12.25
Black oats & vetch	3.87	4.55	9.57	11.72
Stooling rye	1.44	1.84	8.82	14.43
Stooling rye & vetch	2.30	2.31	9.68	12.38
Vetch	1.81	2.10	14.05	15.51
White clover	1.18	0.91	7.59	15.16
Clover & black oats	2.08	2.72	6.67	13.51
Control	0.97	0.99	5.59	14.71
LSD (0.05)	0.591	0.591	2.24	2.24

Discussion and Conclusions

The use of vetch as a cover crop, either alone, or planted with a temperate grass, allows N fertilizer savings. At zero N, average above-ground N uptake for the vetch treatment was 115 kg/ha, 82 kg/ha more than the control. This is similar to that of the control at 120 kg N/ha. The vetch-grass mixtures, however, had a much lower effect on above-ground N uptake. This trial will be planted to maize again in spring 2013.

MULCH-EFFECT ON WEED GROWTH, SOIL MOISTURE, YIELD AND YIELD COMPONENTS OF GROUNDNUTS UNDER THE CONDITIONS OF KZN PROVICE

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Introduction

Groundnut 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. Groundnut growers at Matiwane are situated at fairly normal rainfall area of about (600-779 mm) per annum, the drought incidences normally occur in Uthukela District, especially during hot months. In areas where drought stress is common soil moisture is limited. The three mulching materials, white plastic, maize straw and grasses were tested against weed growth, soil moisture, yield and yield components. The aim was to determine soil moisture, yield and yield components and weed growth under five treatments on groundnut production.

Materials and Methods

An experiment was initiated under field conditions on 20 December 2012 at Matiwane farms, (29^{o} 52' 38. 752 E). Treatments were arranged in randomized complete block design (RCBD) with six replicates. The mulching treatments included maize residue, grasses, plastic, No weeding and hand weeding, treatments were applied after one week of planting. Plot size was 3.0 m x 6.0 m with an intra-row spacing of 7.5 cm and inter-row spacing of 60 cm. Plant population used was 222 000 plants per ha. The cultivar used was Kwarts. The soil moisture was measured 30 days after sowing (DAS) and at harvest, taken from 5 cm to 20 cm depth by gravimetric method. Soil samples from different depths were weighed and air-dried. The occurrence, extent and weed types were investigated at 30 DAS in a 900 cm^2 quadrat at four random locations per plot. The experiment was harvested at 150 days. Plants were dug out and left to air-dry. Shoots were taken for dry matter analysis and data collected were analyzed by Genstat. Fisher's protected least significant difference (LSD) test was used to separate mean difference.

Results and discussions

Soil moisture: White plastic, grasses and maize residue significantly (P≤0.018) retained high levels of soil moisture content compared to hand weeding and no weeding treatments. The soil moisture content increased with the depth increase. However, at 10 cm depth mulches had high levels of moisture content. Soil samples taken at harvest were not significant.

Weed infestation: Weed species were highly significant at 30 DAS. Hand weeding significantly reduced weed numbers compared to other treatments. However, No weeding had the highest number of weed species which reduced the yields. Grass, Maize residue and plastic suppressed a significant number of weed species.

Yield and yield components

Hand weeding had significantly high yields, followed by grasses and maize residue, plastic and no weeding with the lowest yields. The results indicate that hand weeded plots did not have weed competition which resulted to high yields. However, uncovered soil surface had the smallest soil moisture percentage. White plastic reduced the plant population giving lowest yields. Maize residue and grasses yields were significantly dependent on the amount of soil moisture content which was consistent throughout. According to BRU data, the optimum groundnut yields under dry land ranges from 1 to 2 t/ha. However, maize residue and grasses increased yields up to 3.3 t/ha.

Conclusion

Mulching materials indicate significance in retaining soil moisture in dry areas of groundnut production. The advantage of the study is that it uses the local available mulching materials. In future these areas could be investigated: soil temperature, the thickness of the mulching material and type. The study is with the aim of reviving groundnut production in the Province. In dry areas where soil moisture is limited and weed problem occur, this study could be of great help. In conclusion grass, Plastic and maize residue retain significant soil moisture in dry areas and improve yields.

THE USE OF ALLELOPATHY IN A WEED MANAGEMENT STRATEGY

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Introduction

Weed interference occurs in any crop production situation and weed management should focus on combining different methods to prevent and manage weed populations, not only in the short term but also in the long term. Using cultural weed management practices are important. This includes production practices that would improve crop competitiveness such as cover crops in combination with conservation tillage. By using allelopathic cover crops, the release of allelochemicals into the environment can enhance weed management. Allelopathy is the release of allelochemicals by some plants that inhibit the growth of others. Field and tunnel experiments were, and still are, conducted to evaluate the weed control abilities of different cover crop species and cultivars in combination with the application of herbicides.

Materials and methods

The effects of two cover crops, *Lolium multiflorum* (Italian ryegrass) and *Secale cereale* (stooling rye), without herbicide use, on the growth of *Zea* mays (maize) and *C. esculentus* (yellow nutsedge) growth was evaluated in the field. There were three control treatments which included weed residues left on the soil surface, application of herbicides and weed control by hoeing.

In a tunnel experiment, *Avena sativa* (oats), stooling rye and three cultivars of annual ryegrass were used to evaluate their influence on maize and yellow nutsedge growth and development.

Currently a field experiment examines the desiccation times of cover crops on their weed control abilities by spraying them, with glyphosate, four and two weeks before planting and at planting. Minimum tillage maize is planted into the residues with selected spraying of pre- and post-emergence herbicides and its growth and development is evaluated.

Results

In the first field experiment, maize emergence and growth were delayed in the presence of residues of both cover crop species, especially in annual ryegrass residues. *C. esculentus* growth was significantly inhibited in the area between the maize planting rows by the cover crops for the first 14 days after maize emergence, but this growth suppressing effect diminished after 28 days.

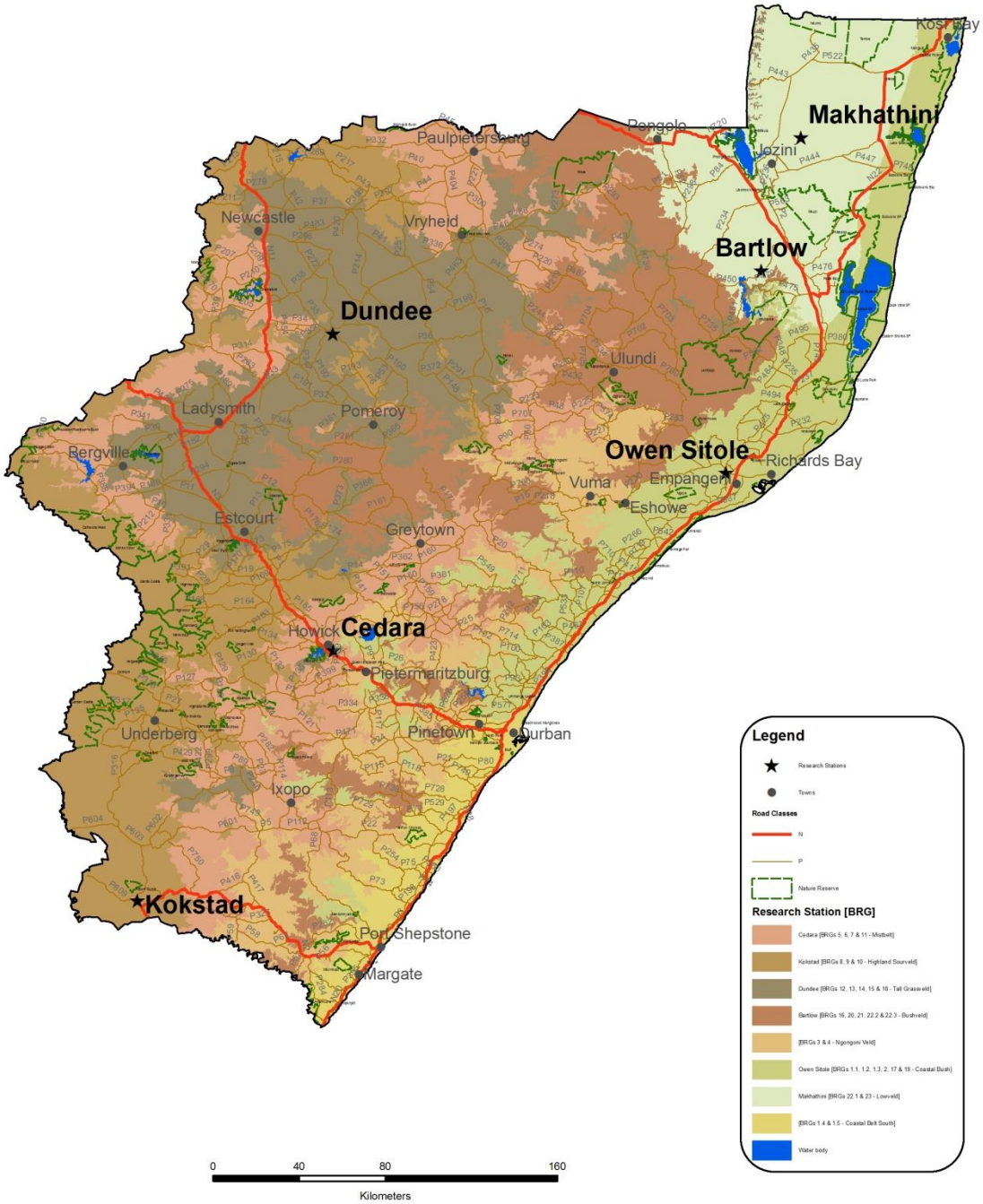
In the tunnel experiment, maize and *C. esculentus* growth were suppressed, especially by the root residues of the cover crops with the annual ryegrass cultivar 'Midmar' being the most suppressive. Chemical analysis of the leachate of root residues indicated the presence of allelochemical phenolic acids and benzoxazolin-2(3*H*)-one (BOA).

Results from the current field experiment, indicate that spraying annual ryegrass at planting reduced weed and maize growth the most. Adequate weed control was not achieved by applying only post-emergence herbicides. Combining annual ryegrass residues sprayed at planting with only post-emergence herbicides applied later in the season, resulted in the lowest maize yields.

Conclusions

Weed growth could be reduced by the allelochemicals leached from cover crop residues but in order to achieve prolonged, effective weed control, the combination of mulch retained on the soil surface and the application of herbicides are required. The effect however, is not selective and the crop is also negatively affected. The effect on weed and crop growth is influenced by the cover crop species planted, the choice of cultivar and the climatic conditions. More research is needed to establish principles of cover crop weed management in order to define its role in a weed management strategy. The use of cover crops for weed control should therefore be considered a tool that is supplementary/complementary to standard weed control practices aiming at managing weed populations in the long-term.

Areas of KwaZulu-Natal served by Research Stations



Agriculture and Environmental Affairs	Prepared by: Clement Adjorlolo Natural Resources Macro Planning	N 1:2,390,000	**PROPERTY** Bioresource Groups	**TITLE** Areas of KwaZulu-Natal served by Research Stations
			CLIENT Research Directorate, KZN DAE	**MAP NUMBER** NRS 001

Research Projects Approved in 2013

Research Leader	Short Title	Location	Period
O Moodley	An investigation of refugia configurations implemented in insect resistant genetically modified maize (*Zea mays*) by means of a farmer survey and field trials	Cedara	2013
D Nash	Raising and managing Friesland dairy heifers for optimum milk production	Cedara	2014-2019
K Mbotho	Response of maize (*Zea mays* L.) seeds differing in chemical composition to water stress during development under controlled temperature and relative humidity conditions	Cedara	2013-2013
S Bezuidenhout	Influence of cover crops and crop rotations on weed density and *Zea mays* (maize) competitiveness	Cedara	2013-2023
SD Household	Lucerne cultivar evaluation at Kokstad and Cedara	Kokstad Research Farm & Cedara	2014-2018
SD Household	Control of *Senecio* species in the Dry Highland Sourveld of KwaZulu-Natal	Kokstad Research Farm	2013-2025
FNP Qwabe	Consumer acceptability of provitamin A bio-fortified green maize	Makhathini Research Farm, Ndumo, Tugela Ferry	2013-2015
NC van Rij	Evaluation of cheaper and more easily accessible agricultural waste for substrate in oyster mushroom production (*Pleurotusostreatus*)	Cedara	2013-2015
ND Dladla	Investigation into the use of pulp waste for production of shiitake mushroom	Cedara	2013-2014
NC van Rij	Effectiveness of six different fungal storage procedures in maintaining the viability of mushroom cultures	Cedara	2013-2014
NC van Rij	Using spent mushroom substrates of Oyster mushroom (*Plueurotusostreatus*) to produce vegetables	Cedara	2013-2014
VG Roberts	Phosphorus fertilizers for resource-poor farmers on acid soils	Mbabazane	2013-2018
AD Manson	Nitrogen Use Efficiency for Vegetables	Cedara	2013-2023
SB Ammann	Evaluation of the effect of Glyphosate, soil temperature and soil moisture on the establishment of ryegrass oversown into kikuyu	Cedara	2014-2017
SB Ammann	Evaluation of *Festuca arundinacea* (Tall Fescue) varieties, herbage quality and grazing management to determine suitability as a lower input pasture for dairy systems	Cedara	2014-2019

Research and Demonstration Projects 2013

Research Leader	Short Title	Location	Period
A Nunkumar	Monitor aphid number in seed potato production	Cedara	2006-2020
A Nunkumar	Epidemiology and control of *Phaeosphaeria* leaf spot in maize	Cedara & UKZN, PMB campus	2009-2016
A Nunkumar	Epidemiological research into grey leaf spot and northern corn leaf blight in KwaZulu-Natal	Cedara	2011-2014
A Nunkumar M Relihan	Plant Health Clinic	Cedara	1998-2030
AD Manson	Cover crops for maize silage system production	Cedara	2011-2020
AD Manson	Soil fertility for truffles	Underberg (D Little farm)	2010-2020
AD Manson	Nitrogen use efficiency for vegetables	Cedara	2013-2023
AJ Arathoon	National soybean cultivar trial	Cedara & Kokstad	- 2020
AJ Arathoon	The evaluation of vegetable soybean cultivars for adaptability and yield	Cedara, Kokstad & Dundee	2009-2013
AJ Arathoon	Influence of different phosphorus and potassium rates on the production of three vegetable soybean cultivars	Cedara	2012-2015
AJ Arathoon	Vegetable soybean cultivar versus seeding rate trial	Cedara	2012-2014
CF Luthuli	Manure as alternative fertilizer for pastures	OSCA	2010-2015
CN Mchunu	Effect of tillage on carbon dynamics in KZN's small-scale farming systems	KZN	2009-2011
D Nash	Raising and managing Friesland dairy heifers for optimum milk production	Cedara	2014-2019
E van Zyl	Genetic conservation and characterization of indigenous sheep	Dundee Research Farm	2007-2020
E van Zyl	Investigate the potential of *Sericea lespedeza* as summer grazing for sheep and establish production norms for NW KZN	Dundee Research Farm	2010-2015
E van Zyl	Bio-active forages: To determine the value of chicory for small stock in a system where chicory is primarily use for root	Dundee Research Farm	2010-2015
F Khubone	Dry bean production in the Ilembe District	Ilembe District	2008-2013
FNP Qwabe	Development of fresh maize hybrid model	Dundee Research Farm	2010-2015
FNP Qwabe	Improving productivity and quality of green maize: Green maize potential of Orange Pro-Vitamin A and Yellow Quality Protein maize	Makhathini, Ukulinga, Tugela Ferry, Dundee & Vryheid	2012-2015

FNP Qwabe	Consumer acceptability of pro-vitamin A bio-fortified green maize	Makhathini Research Farm, Ndumo, Tugela Ferry	2013-2015
FNP Qwabe & C Dlamini	High density litchi cultivar evaluation	Makhathini Research Farm	1997-2014
FNP Qwabe & C Dlamini	Evaluation of mango cultivars under irrigation conditions at high density planting	Makhathini Research Farm	1997-2014
FNP Qwabe & C Dlamini	Demonstration of mango grafting and pruning	Makhathini Research Farm	Ongoing
FNP Qwabe & C Dlamini	Sweet potato demo	Makhathini Research Farm	2004-2018
FNP Qwabe & VAD Gcabashe	Mango cultivar demo	Makhathini Research Farm	Ongoing
FNP Qwabe & VAD Gcabashe	Sweet potato demonstration in support of emerging farmers	Makhathini Research Farm	Ongoing
GR Thibaud	Soil acidity interactions with no-till	Karkloof, KZN	2001-2015
GR Thibaud	Tillage effect on N requirements	Loskop, KZN	2005-2015
J du Toit	Characterization of indigenous goats	OSCA	2007-2014
J du Toit	Night feeding indigenous goats	OSCA	2012-2015
J Mann	Biological control of the blue tick using entomopathogenic fungi in cattle on Cedara	Cedara	2010-2012
J Mann	The grazing of beef breeding cows on kikuyu for 12 months of the year	Cedara	1989-ongoing
M de Figueiredo	The production of rose geranium in tunnels at Cedara	Cedara	2009-2013
M de Figueiredo	The study of factors affecting the oil quality and quantity of rose geranium in a growth room environment	Cedara	2009-2013
M de Figueiredo	Establishment and maintenance of an essential oil trial for demonstration purposes	Cedara	2007-2020
M Khanyile	Feed intake and metabolic response of large white pigs fed on incremental levels of *Acacia tortilis* leaf meal	UKZN, Pietermaritzburg	2012-2013
M Naidoo	Commercial potato cultivar trial	Cedara	- 2020
M Naidoo	Elite potato cultivar trial	Cedara	- 2020
M Naidoo	Potato production demonstrations	Umthentweni, Harding, Ixopo	2009-2015

M Naidoo	Small-scale farmer potato cultivar trials at different Bio-Resource Units in KZN	Highflats, Bulwer	- 2020
M Relihan	Effects of diversely acidic soil sites on mineral levels of potato foliage and on late blight susceptibility, as modified by pre-plant soil application of gypsum, lime or biochar	Cedara	2011-2014
M Relihan	In depth research on diseases associated with infection by *Lagena* sp on pepper & other crops	University of KZN	2009-2015
MF Msomi	Plant introductions – evaluate commercially available summer fodder species for use in KZN livestock production systems	OSCA	Ongoing
MP Sikhakhane	Maize silage cultivar evaluation trial	Kokstad Research Farm	2009-2013
N Mtum-tum	Long season maize cultivar trial	Kokstad, Dundee & Loskop area	- 2020
N Mtum-tum	Short-season maize cultivar trial	Kokstad , Cedara & Dundee Research Farm	- 2020
N Vilakazi	Evaluation of cheaper and more easily accessible agricultural waste for substrate in oyster mushroom production (*Pleurotus ostreatus*)	Cedara	2013-2015
NC van Rij	Effectiveness of six different fungal storage procedures in maintaining the viability of mushroom cultures	Cedara	2013-2014
NC van Rij	Using spent mushroom substrates of Oyster mushroom (*Plueurotus ostreatus)* to produce vegetables	Cedara	2013-2014
NJ Findlay	Catalysis of phosphodieterase by manganese dioxide	Cedara, Danesfort Farm, Kamberg	2013-2014
NJ Findlay	Improving N-use efficiency in pastures	Rosetta	2010-2012
NJ Tembe & NC van Rij	Optimizing substrate requirement in production of Oyster mushroom	Cedara	2012-2013
PA Oosthuizen	An investigation into the effect of different breeding strategies on an Nguni herd's performance	Dundee Research Farm	2008-2020
PA Oosthuizen	Small scale dairying in an integrated farming system	Dundee Research Farm	2003-2020
R Osborne	Sweet potato cultivar evaluation	Cedara and OSCA	2009-2020
S Ammann	Germplasm conservation	Estcourt & other Research Farms	2014-2020
S Madiba	Plant spacing under no-till in maize production in rural communities of KZN	Potshini	2010-2014
S Moodley	Use of essential oils on the control of agricultural pathogens	Cedara, KZN	2009-2015
S Ngcamu	The effect of different management / breeding strategies has on Nguni performance	Bartlow Combine	2012-2022

SA Gumede	The current state, role and the future of goat commercialization in communal areas of KwaZulu-Natal	KZN	2012-2014
SB Radebe	Mulch effect on weed growth, soil moisture, yield and yield components of groundnuts under conditions of KZN Province	Matiwane	2010-2016
SB Radebe	National Soyabean cultivar trial	Dundee Research Farm	2013-2020
SD Househam	The effect of cattle to sheep ratio and stocking rate on veld condition (Simulation Trial) on Kokstad Research Farm	Kokstad Research Farm	1989-2014
SD Househam	The effect of a two-camp "blaze and graze" system on sheep performance, veld condition and soil loss	Kokstad Research Farm	1992-2014
SD Househam	Lucerne cultivar evaluation at Kokstad Research Farm	Cedara & Kokstad Research Farm	2014-2018
SD Househam	Control of *Senecio* species in the Dry Highland Sourveld of KwaZulu-Natal	Kokstad Research Farm	2013-2025
SR Bezuidenhout	Influence of cover crops and crop rotations on weed density and Zea mays (maize) competitiveness	Dundee Research Farm	2013-2023
SR Bezuidenhout	The management of cover crop residues to reduce weed growth in maize	Cedara	2011-2015
SR Bezuidenhout	The influence of different weed types on the growth and development of maize and sunflower	Cedara & Kokstad Research Farm	2008-2014
SR Bezuidenhout	Characterization of the biology of *Cyperus esclentus* (yellow nutsedge) growth	Cedara	2012-2014
ST Gcumisa	The untold story of the pig farming sector of rural KwaZulu-Natal: A case study of Uthukela District	Ladysmith area	2009-2013
TE Ntombela & MP Sikhakhane	National dry bean cultivar trial	Cedara and Kokstad Research Farm & Loskop	- 2020
TP Mpanza	Examining the potential of using grey water generated by the rural households for irrigation of the homestead vegetable gardens	Ladysmith area	2011-2015
VG Roberts	Soil P requirements of vegetables	Dundee Research Farm	2011-2016
VG Roberts	Phosphorus fertilizers for resource-poor farmers on acid soils	Mbabazane	2013-2018
VG Roberts	The improvement of FERTREC nitrogen recommendations	Cedara	1999-2019

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