# *Legume Production*

**SESSION CHAIR: PHILIP R BOTHA**

*Wednesday, 21 July 2010, 14:00-15:00*

*Platform & Poster Presentations*

## POSTER PRESENTATION: SOIL NITROGEN DYNAMICS IN THE PRESENCE OF *TRIFOLIUM REPENS*

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Enhanced plant growth ensures a greater flow of carbon (C) from the atmosphere to the soil. This also increases the soils potential to store organic C. Root growth, size of microbe populations in the rhizosphere, nutrient cycling and nutrient availability are vitally linked, affecting the soil health and therefore, plant growth. Soil carbon is fundamentally linked to the fluxes of soil nitrogen (N). The aim of this trial was to quantify certain fluxes of N at two levels of soil organic C as affected by *Trifolium repens* (white clover).

A closed system was used to measure symbiotic N fixation and N dynamics in two soils with different levels of soil organic matter. The system consisted of a legume-based system containing *Trifolium repens* cv. Haifa, grown from seed for 12 weeks in 5.2 litre pots. Initial and final soil carbon content was measured using the Walkley-Black method. Indirect estimates of $N_2$ fixation were performed using N difference technique. This method yielded significant different levels of symbiotic $N_2$ fixation between the two soils. Total soil N was measured at commencement and termination of the study. Plant and soil ammonium-N ($NH_4^+$-N) and total N were quantified at termination of the study using the Kjeldahl and AgriLASA methods respectively (Table 1). Soil nitrate ($NO_3^-$) content was estimated.

**Table 1:** The mean percentage N derived from the atmosphere (%Ndfa), initial and final soil N content as affected by soil C content (LSD = Least significant difference; [ab]Means with no common superscript differ significantly; *Not detectable)

| Soil C content (%) | Mean %Ndfa | Initial soil N content ($g.kg^{-1}$) | Final soil N content ($g.kg^{-1}$) | Final soil $NH_4$ content ($g.kg^{-1}$) |
|---|---|---|---|---|
| 1.29 | $1.793^a$ | $0.00^{a*}$ | $6.25^a$ | $0.32^a$ |
| 4.25 | $0.680^b$ | $10.0^b$ | $39.0^b$ | $0.08^b$ |
| **LSD (0.05)** | **0.1762** | **2.060** | **2.060** | **0.028** |

Soil C content had a significant effect on the amount of N fixed (%Ndfa), the change in total soil N content as well as on soil $NH_4$ content.

**NOTES:**

# POSTER PRESENTATION: INTERCROPPING AS A LOCAL INNOVATION TO INCREASE BIOLOGICAL PRODUCTIVITY

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Since 1998 the National Department of Agriculture, Fisheries and Forestry made funding available as LandCare grants for the implementation of ecological sustainable projects at community level. The ARC-Institute for Soil Climate and Water received funding for conservation agricultural (CA) projects mostly on the Eastern Seaboard area of South Africa where farmers were empowered with the necessary farming skills and on-farm demo plots. Mixed farming in rural agriculture, however, is a common phenomenon and the then ARC- Range and Forage Institute was tasked to increase the biological production in such a way that biomass was available as a soil mulch as well as for livestock. A proposal was initially drawn up for Mlondozi in the Mpumalanga province that included a demo plot in 2000 and the yield results were promising, especially in terms of total residues available.

A new project was launched at Bergville (Emmaus) in KZN in 2001. The main treatments of the intercropping trial included different planting densities (25 and 50 kg seed ha$^{-1}$) of the legume intercrop components at different planting dates (two weekly intervals). Cowpeas (*Vigna unguiculata*) cultivar Bechuana white and Lablab (*Lablab purpureus*) cultivar Rongai were used for the trial. The biological productivity of the intercrop experiment was measured using Land Equivalent Ratios (LER). The highest LER was obtained from intercropping Lablab at higher planting density during the last season (Table 1). Although this treatment did not differ significantly from the other treatments during the same year, it indicated that continuous intercropping could positively influence a farming system in terms of biological productivity.

**Table 1:** Land Equivalent Ratios of Lablab and Cowpeas intercropped with maize for 2002 – 2004 at Bergville (SEM = 0.27; LSD(5%) = 0.75; CV(%) = 28.7)

| | **Lablab** | | **Cowpea** | |
|---|---|---|---|---|
| Planting Dates | 25 kg seed ha$^{-1}$ | 50 kg seed ha$^{-1}$ | 25 kg seed ha$^{-1}$ | 50 kg seed ha$^{-1}$ |
| **2001/2** | | | | |
| 08 Nov | 1.68 | 1.38 | 1.64 | 1.91 |
| 21 Nov | 1.49 | 1.89 | 1.54 | 2.05 |
| 06 Dec | 1.35 | 1.61 | 1.34 | 1.59 |
| 19 Dec | 0.83 | 1.32 | 0.98 | 1.12 |
| **2002/3** | | | | |
| 04 Dec | 1.17 | 2.37 | 0.94 | 0.97 |
| 19 Dec | 0.83 | 1.21 | 0.83 | 0.81 |
| 07 Jan | 1.68 | 1.19 | 1.48 | 1.45 |
| 22 Jan | 1.28 | 1.28 | 1.20 | 1.32 |
| **2003/4** | | | | |
| 13 Nov | 2.02 | 1.17 | 1.82 | 2.07 |
| 26 Nov | 1.87 | 2.34 | 1.33 | 1.47 |
| 09 Dec | 1.66 | 1.79 | 1.31 | 1.50 |
| 19 Dec | 2.12 | 2.53 | 1.53 | 1.66 |

**NOTES:**

## PLATFORM PRESENTATION: SCREENING AND EVALUATION OF FORAGE LEGUMES IN THE SEMI-ARID COMMUNAL AREAS OF THE EASTERN CAPE PROVINCE: PERSISTENCE AND DRY MATTER PRODUCTION

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Twenty six forage legumes consisting of annuals and perennials were evaluated for growth performance and productivity at five sites; Dudumashe, Lushington, Nyandeni, Rockliff and Roxeni; within the semi-arid communal areas of the Eastern Cape Province. The legumes were sown during autumn and spring seasons in two replications of 2 m x 30 m dimensional plots. After emergence, these species were monitored for growth vigour and density. The performance of legumes was based on the assessment of establishment, resistance to pests and diseases, and dry matter production. Harvesting was conducted once the plants reached physiological mature stages. Accumulated dry matter production for a period of two growing seasons comprising of about two and half years (2007 – 2009) was measured.

There were significant ($P<0.05$) difference in growth vigour and the number of plants (density) between legumes within the same site. Legumes such as *T. vesiculosum, D. intortum, L. corniculatus, B. pelecinnus, M. sativa, L. bainessii T. Hirtum, M. polymorpha, T. repens,T. pretense, C. varia, L. cuneata, O. sativus* and O. *pinnatus* had the highest number of plants at establishment in all sites for both autumn and spring planting seasons. Many of the legumes, especially annuals planted during the autumn planting plots did not survive in the second season at all sites except Nyandeni where some legumes accessions increased significantly. Roxeni had the highest reduction in legumes numbers for both autumn and spring plantings mainly due to continuous drought.

The total dry matter (DM) yield of forage legumes was significantly different ($P<0.05$) between different sites and seasons of plantings. Lushington, however, produced the highest DM yield of 1330 kg $ha^{-1}$ followed by Nyandeni sites with 967 kg $ha^{-1}$. Generally DM production was considerably lower for the drier sites, particularly Roxeni, producing 379 kg $ha^{-1}$, followed by the mortality of the majority of the remaining legumes after the second harvest. Spring planting produced slightly higher DM yield compared to autumn planting season. Plant population and DM production was greatly influenced by rainfall. These wetter sites of Rockliff and Nyandeni had surviving plants with the highest DM production. These forage legumes have the potential to be used in the various livestock production systems of the semi-arid communal areas of the Eastern Cape. There is a need for further investigation on how they can be integrated into these systems.

**NOTES:**

## PLATFORM PRESENTATION: THE EFFECT OF SEED COATING ON MEDICAGO SATIVA L. PRODUCTION

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Poor establishment of lucerne (*Medicago sativa L.*) causes an increase in production costs, which puts a damper on the array of advantages of this species. During the germination and establishment phases, many factors such as competition, chemical influences, inoculation and climate, influence the success of progression to the next physiological phase. If a suitable micro-climate can be created for these early growth stages, a stronger, more profitable stand can be expected. Seed coating technology can, however, provide a more suitable environment for the seeds to germinate and develop in. Coating technology has developed from simple lime coatings to mixtures of advanced protective polymers, nutrients, pesticides and inoculants. In theory, the coating can be customized to optimise survival in a specific environment. In practice, however, improved performance of lucerne stand establishment is the first objective to be met on the path of technological development.

A study to identify the extent of the advantages of seed coating technology on lucerne production was conducted at the Hatfield Experimental Farm of the University of Pretoria. The study consisted of three trials, namely a germination trial, seedling emergence and survival trial, and a field production trial. Each trial evaluated two lucerne cultivars (SA Standard and SuperCuf) and two seed treatments, namely non-coated seeds and coated seeds (AgriCote®). These treatments were evaluated under various environmental conditions to determine the extent of protection and advantages of the coating technology. In the seedling emergence trial, three growth mediums (a sandy loam soil, Hygromix® and Silica Coir Mix) and four water sources (gypsiferous, saline (100 mM), distilled and tap water) were used to create different environments. The rate of seedling growth and survival was determined in this study. The germination trial also had different simulated environments, created with the same aforementioned water sources. Germination rate and percentage were determined. The field trial was conducted using a complete randomised block design. Before the seed treatments were sown in the different plots, the plots were divided in two parts, adding 50 kg N $ha^{-1}$ to one half, leaving the other half of the plants dependent on N (nitrogen) supplied through N fixation. From this trial, total season DM yield was measured and compared.

Preliminary data from the field trial showed that SuperCuf had the highest dry matter yield with the uncoated seeds (conventionally inoculated) and without nitrogen application. SA Standard, on the other hand, had the highest dry matter yield with the AgriCote ® treatment and with nitrogen application at establishment.

**NOTES:**

## POSTER PRESENTATION: TREATMENT OF *TRIFOLIUM REPENS* SEEDS WITH METALAXYL FUNGICIDE

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The impact of pests and diseases on *Trifolium* spp. (clovers), specifically in a grass-clover system, are often not realised by farmers. *Trifolium repens* (white clover) is the host for numerous pathogenic microorganisms. The overall effectiveness of growth and production of clover-crops can be greatly increased by minimising the impact of fungi. This study was performed in order to isolate and identify the pathogenic fungi, which specifically cause *T. repens* seedling deaths in the George district (South Africa). A wide range of fungal genera and species were isolated from diseased seedlings. Those were *Fusarium equiseti*, *Fusarium oxysporum*, *Fusarium scirpi*, other unidentified *Fusarium* species, *Mortierella* spp., *Phoma* sp., *Pythium* spp., *Rhizoctonia* sp., *Rhizopus* sp., and *Trichoderma* spp. Various diseases and disorders with disease-like symptoms, that may be caused by the specific fungal species identified, include root-and-crown rot, damping-off, *Fusarium* wilt, spring blackstem and *Rhizoctonia* foliar blight. The effect that metalaxyl treatment of seeds and soil organic matter has on the protection of the seedlings against pathogenic attacks was subsequently determined.

**Table 1:** The survival percentages of *T. repens* seedlings grown from seeds treated with metalaxyl. The percentage improvement in seedling survival rate is also indicated.

| Soil | Survival (%) | | Improvement |
|---|---|---|---|
| | Treated | Untreated | |
| **1 (1.29% C)** | 65.0 | 55.0 | 10% |
| **2 (4.25% C)** | 86.0 | 70.0 | 16% |

*T. repens* seeds that were treated with metalaxyl showed a superior benefit in soil with a high carbon content compared to a low carbon content. The survival rate of seedlings in the soil with a high carbon content is 86% compared to that of the low carbon soil with a survival rate of 65%. The survival rates of *T. repens* recorded in this study emphasises the importance of organic matter content in soils for sustainable production. Lack of knowledge of soil health and the composition of soil microbial populations are frequently the grounds on which managerial practices, especially fertilisation and irrigation, are blamed as the cause of suboptimal production. Research on soil microbial population dynamics that may positively affect the production potential and sustainability of pastures needs to receive additional attention.

**NOTES:**

## PLATFORM PRESENTATION: EFFECTIVENESS OF INOCULATION AND NITROGEN FIXATION OF *TRIFOLIUM REPENS* AS AFFECTED BY SOIL ORGANIC MATTER

*Pieter A Swanepoel[1,2*#], Philip R Botha[1], Wayne F Truter[2], A Karen J Surridge-Talbot[2] and Alicia van der Merwe[3]*

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Research on efficient management systems to optimise the *Trifolium repens*-*Rhizobium* symbiosis is lacking in South Africa. Soil organic matter is the main attribute towards managing soils with a high quality. The amount of nitrogen (N) fixed by symbiotic rhizobia in root nodules of *Trifolium repens* is ultimately determined by the health of the soil environment. The aim of this trial was to determine the total number of symbiotic rhizobial cells per gram of soil as affected by soil organic matter content and the host plant. Inoculated and un-inoculated *T. repens* seeds were planted on five soil treatments, each with a different level of soil organic matter. The most-probable-number assay (MPN assay) was used to quantify the rhizobial numbers in the soil as affected by soil organic matter and the host plant. The MPN assay aid in predictions of the need to inoculate with species-specific *Rhizobium* bacteria. *Rhizobium* bacteria were detected in all soils. The mean MPN-value ranged from 8907 to 78 *Rhizobium* bacteria per gram of soil. Soil carbon (C) and inoculation had no effect on the amount of *Rhizobium* bacteria present in the soil. The effect of different levels of soil C on the amount of atmospheric N fixed by *T. repens* was assessed by the N difference technique. *Arctotheca calendula* (Cape weed) served as the reference plant. The percentage N derived from the atmosphere (%Ndfa) was determined. The mean %Ndfa differed significantly between soil organic C treatments, with the highest %Ndfa on the soil with the lowest C content (Table 1).

**Table 1:** The mean percentage N derived from the atmosphere (%Ndfa), initial and final soil N content as affected by soil C content. (LSD = Least significant difference; [abcde]Means with no common superscript differ significantly; *Not detectable)

| Soil C content (%) | Mean %Ndfa | Initial soil N content ($g.kg^{-1}$) | Final soil N content ($g.kg^{-1}$) |
|---|---|---|---|
| 1.29 | 1.793[a] | 0.00[a]* | 6.25[a] |
| 2.03 | 1.335[b] | 2.50[b] | 12.5[b] |
| 2.77 | 0.985[c] | 5.00[c] | 17.0[c] |
| 3.51 | 0.897[c] | 7.50[c] | 29.4[d] |
| 4.25 | 0.680[d] | 10.0[d] | 39.0[e] |
| LSD (0.05) | **0.1762** | **2.060** | **2.060** |

Biomass production served as parameter for efficiency of the *Rhizobium* bacteria in the soil. Although the amount of N fixed increased as the level of soil organic matter decreased, the efficiency of N fixation decreased proportionally. This explains the bigger change in soil N content on soil with a high C content (Table 1).

**NOTES:**

## POSTER PRESENTATION: QUANTIFICATION OF NITROGEN FIXATION IN *TRIFOLIUM AMBIGUUM*

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Maintaining highly productive planted pastures sustainably in the Southern Cape region of South Africa has become expensive. Recent elevation of fertiliser-nitrogen (N) prices and a higher demand for milk production per unit area has intensified the pressure on the profit margin of the dairy industry. Seeking biological alternatives for inorganic forms of fertiliser-N have become imperative. The incorporation of legumes in pasture systems in the Southern Cape is economically and ecologically promising. The use of *Trifolium ambiguum* (Kura clover) as a pasture species has generated much interest recently. Seed is not yet commercially available in South Africa. The main setback of incorporating *T. ambiguum* into grass pastures is that nodule occurrence is rare and atmospheric N fixation is subsequently also low. The aim of this trial was to quantify N fixation by *T. ambiguum.* The quantification method used was the N difference technique with *Arctotheca calendula* (Cape weed) as the non-fixating reference plant. Managerial factors, such as manipulation of the soil environment, may enhance N fixation efficiency. Therefore, the impact that soil organic matter content have on N fixation was investigated (Table 1).

Legume response is dependent of intrinsic and external factors, such as plant growth, indigenous *Rhizobium* numbers, effectiveness of indigenous strains and availability of mineral N in the soil. Soil C content had no significant effect on %Ndfa (Table 1). The N content of soil at the time of termination of the trial was significantly higher. The suitability of this species as an alternative source of N in low input pastures is questioned. Further research on the aptness of the species to be incorporated into planted pastures need to be performed.

**Table 1:** The mean %Ndfa, initial and final soil N content as affected by soil C content. (*Not detected)

| Soil C content (%) | Mean %Ndfa | Initial soil N content (g.kg$^{-1}$) | Final soil N content (g.kg$^{-1}$) |
|---|---|---|---|
| 1.29 | 1.3667[a] | 0.00[a]* | 7.500[a] |
| 2.03 | 1.2600[a] | 2.50[b] | 10.25[a] |
| 2.77 | 0.6775[a] | 5.00[c] | 16.00[b] |
| 3.51 | 1.1150[a] | 7.50[c] | 22.70[c] |
| 4.25 | 1.0350[a] | 10.0[d] | 30.20[d] |
| LSD (0.05) | **0.7494** | **2.060** | **4.010** |

**NOTES:**

## POSTER PRESENTATION: QUANTIFICATION OF INDIGENOUS AND INTRODUCED SOIL RHIZOBIA WITH *TRIFOLIUM AMBIGUUM* AS HOST PLANT

*Pieter A Swanepoel[1,2*#], Philip R Botha[1], Wayne F Truter[2], A Karen J Surridge-Talbot[2] and Alicia van der Merwe[3]*

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*Trifolium ambiguum* (Kura clover) is a clover species neither commercially available nor naturally found in South Africa. Its use is currently increasing in developed countries. Research on efficient management systems to optimise the *T. ambiguum-Rhizobium* symbiosis is lacking globally. The most-probable-number (MPN) assay was used in this study to quantify the rhizobial numbers in soil that is able to infect *T. ambiguum*. The spread plate method was performed to verify the results from the plant infection technique. The rhizobial numbers were measured in soils with five levels of soil carbon. Relatively low numbers of *Rhizobium* that are able to form symbiosis with *T. ambiguum* were detected in all soils, except one soil treatment (4.25% C). The MPN of rhizobia per gram of soil ranged from 0 to 436 bacterial cells (Table 1).

**Table 1**: MPN values as affected by soil C content and inoculation. (ND = Not detected)

| Soil C content | Inoculation | Mean MPN-value | P-value | 95% Confidence interval | |
|---|---|---|---|---|---|
| (%) | | | | Upper limit | Lower limit |
| 2.77 | No | 436.44 | <0.00001 | 1659.3 | 114.79 |
| 2.77 | Yes | 125.13 | 0.0030 | 475.7 | 32.91 |
| 4.25 | No | 113.02 | 0.0107 | 452.8 | 29.09 |
| 3.8 | No | 97.83 | 0.0102 | 371.9 | 28.43 |
| 3.8 | Yes | 73.74 | 0.0037 | 420.5 | 25.73 |
| 1.29 | Yes | 51.96 | <0.00001 | 262.6 | 20.89 |
| 2.03 | Yes | 51.26 | 0.00001 | 194.9 | 18.17 |
| 2.03 | No | 26.47 | 0.0158 | 301.9 | 13.67 |

| Soil C content | Inoculation | Mean MPN-value | P-value | 95% Confidence interval | |
|---|---|---|---|---|---|
| 1.29 | No | 23.02 | 0.0160 | 197.5 | 13.48 |
| 4.25 | Yes | 0[ND] | | | |

The MPN values did not significantly correlate with soil organic matter content (Pearson correlation coefficient = 0.07251). Indigenous species-specific *Rhizobium* bacteria were very low in soil. It is necessary to inoculate *T. ambiguum* seed with a species specific *Rhizobium* inoculant.

**NOTES:**

## POSTER PRESENTATION: EFFECTIVENESS OF INOCULATION OF *TRIFOLIUM AMBIGUUM* AS COMPARED TO *T. REPENS*

*Pieter A Swanepoel[1,2*#], Philip R Botha[1], Wayne F Truter[2] and A Karen J Surridge-Talbot[2]*

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The potential of Trifolium ambiguum (Kura clover) as a pasture species has generated much interest recently. Its outstanding root system makes persistency of the species in grass pastures exceptional under heavy grazing regimes. The main setback of incorporating T. ambiguum into grass pastures is that nodule occurrence is rare. This trial aimed to assess the potential of T. ambiguum to be infected by species-specific Rhizobium spp. and nodulate. A commercial inoculant was applied containing the species-specific Rhizobium bacteria. Response to inoculation had a significant effect on nodulation indices, but not on soil Rhizobium numbers. The nodulation indices of the plants after ten weeks were low compared to T. repens. The mean nodulation index for T. ambiguum seeds inoculated and not inoculated was 4.983 and 1.615 respectively. It was 12.159 and 11.303 respectively for T. repens. The major failure in the species to nodulate sufficiently, in order to subsequently fix nitrogen for sustainable low N input systems, makes it unsuitable for dairy production systems in the George region (South Africa).

**NOTES:**

## POSTER PRESENTATION: THE INFLUENCE OF SEED MASS ON GERMINATION AND ESTABLISHMENT OF WHITE CLOVER (*TRIFOLIUM REPENS*) SEEDS AT DIFFERENT PLANTING DATES

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Kikuyu over-sown with ryegrass currently forms the basis of pasture for dairy systems in the Western Cape Province of South Africa. High levels of nitrogen (N) application are needed in this system to sustain pasture productivity and quality. The fertiliser-N input requirement can be reduced by incorporating clover species (*Trifolium* spp.) into grass pasture systems. The establishment of clover in kikuyu pastures is difficult because of the aggressive growth of kikuyu. Germination of clover seeds and the potential of the seedlings to compete with grasses such as kikuyu can, therefore, affect the sustainability of the clover component in grass pastures. There is currently little scientific data available on the impact of seed mass on establishment in white clover (*Trifolium repens)*.

The aim of this study was to determine how seed mass would affect the emergence percentage and mortality rate of white clover seedlings. This study was carried out on the Outeniqua Research Farm near George in the Western Cape Province. Four white clover cultivars, namely Ladino, Huia, Haifa and Regal, were evaluated in this trail. Thousand-seed-mass, germination percentage and field emergence was determined. The thousand-seed-mass differed significantly between cultivars. Seeds were established in the field in a randomised block design with three replications. The four cultivars and four planting dates (17 July, 7 August, 28 August and 18 September 2009) were the treatments, tested in combination. The seedlings were counted weekly to determine the change in seedling emergence over time at different planting dates. The presence or absence of a plant was noted to determine whether a seed had emerged or died after emergence. The treatments were terminated eight weeks after each planting date.

**Table 1:** The thousand-seed-mass, germination percentage under controlled conditions and the field emergence of four white clover cultivars. ([abcd] Means with no common superscript differed significantly)

| Cultivar | Thousand-seed-mass (g) | Germination under controlled conditions (%) | Field emergence (%) |
|---|---|---|---|
| Haifa | 0.653[b] | 87.74[b] | 83.75[b] |
| Huia | 0.709[a] | 95.60[a] | 88.42[a] |
| Ladino | 0.619[c] | 74.98[c] | 75.83[c] |
| Regal | 0.578[d] | 89.83[b] | 77.33[cd] |
| LSD (0.05) | 0.0087 | 3.51 | 3.06 |

There are significant differences in the thousand-seed-mass, germination percentage in controlled conditions and field emergence between the different white clover cultivars. Huia had statistically the highest thousand-seed-mass, germination percentage in controlled conditions and field emergence.

**NOTES:**

## POSTER PRESENTATION: AN EVALUATION OF NODULATION BETWEEN FOUR *TRIFOLIUM REPENS* CULTIVARS IN FIELD CONDITIONS

*Pieter A Swanepoel[1,2*#], Philip R Botha[1], Ilze Fourie[1], Wayne F Truter[2] and A Karen J Surridge-Talbot[2]*

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Nodulation of *Trifolium repens* (white clover) is often poor. Four *T. repens* cultivars have been evaluated in field conditions to determine the effect of *Rhizobium* bacteria on the potential of the cultivars to nodulate. The cultivars Grasslands Huia, Haifa, Ladino and Regal were included in the study. The nodulation index was determined from the size, number and colour of the nodules after eight weeks of growth. The thousand-seed-mass (TSM) of each cultivar was measured to determine the quality and viability of the seed and to determine the interaction between seed mass and nodulation. The biomass production was also measured (Table 1).

**Table 1:** The mean thousand-seed-mass (TSM), biomass production and nodulation indices of each of the four *T. repens* cultivars. (LSD = Least significant difference. [abcd]Means with no common superscript differed significantly)

| Cultivar | TSM (g) | Biomass production (g) | Mean nodulation index |
|---|---|---|---|
| Huia | 0.709[a] | 12.55[a] | 12.98[a] |
| Haifa | 0.653[b] | 4.53[b] | 11.09[a] |
| Ladino | 0.619[c] | 6.64[b] | 10.32[a] |
| Regal | 0.578[d] | 5.11[b] | 7.44[a] |
| **LSD(0.05)** | **0.0087** | **5.036** | **7.654** |

All plants, regardless of cultivar, formed nodules after eight weeks. The mean TSM values of the *T. repens* cultivars differ significantly between all four cultivars (Table 1). The cultivar Huia, with the heaviest seed, had the highest biomass production of the four cultivars. The nodulation potential of the four cultivars tested was similar in the specific environmental conditions (Table 1). TSM had no notable effect on nodulation. The efficiency of the cultivars to fix N is unknown and must still be investigated in future.

**NOTES:**

## POSTER PRESENTATION: THE DRY MATTER PRODUCTION OF PERENNIAL FORAGE LEGUMES

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A large amount of cool season perennial forage legume cultivars are available in South Africa. It is important that these cultivars are evaluated in terms of dry matter (DM) production as high quality forage for animal production. Forage legumes produce a higher quality pasture than pure grass stands and is therefore sown in a mixture with grass. The aim of this study was to evaluate the DM production of 16 perennial cool season forage legume cultivars. This small plot trial was carried out on the Outeniqua Research Farm near George (Altitude 201m, 33° 58' 38" South and 22° 25' 16" East, rainfall 728 mm per year) in the Western Cape of South Africa. The study was executed under sprinkler irrigation on an Estcourt soil type. Tensiometer readings were used to determine irrigation scheduling. The trial was established on the 20th of May 2009. The experimental design was a complete randomised block design. Results are compared over seven cuttings. *Trifolium ambiguum* (Caucasian clover, cv. KTA 202) was, due to unavailability of the seed, planted later than the rest and was only sampled from the fourth cutting onwards.

**Table 1** The dry matter production (kg DM $ha^{-1}$) of perennial forage legume cultivars planted on Outeniqua Research Farm. ([abcde] Means with no common superscript differ significantly (P<0.05); LSD = Least significant difference)

| | Cultivar | Cut 1 | Cut 2 | Cut 3 | Cut 4 | Cut 5 | Cut 6 | Cut 7 | Total |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Palestine | 135[ef] | 1022[bcdef] | 523[fg] | 621[ef] | 640[e] | 200[g] | 144[f] | 3285[f] |
| 2. | Amos | 161[ef] | 829[def] | 1674[abc] | 1903[abc] | 2411[a] | 1957[a] | 1098[ab] | 10034[a] |
| 3. | Quinequile | 74[f] | 888[abcd] | 973[ef] | 1252[bcde] | 1581[bc] | 1084[bcdef] | 1006[abc] | 7403[de] |
| 4. | Rajah | 141[ef] | 687[efg] | 1139[de] | 1678[abc] | 2387[a] | 1653[ab] | 1289[a] | 8974[abcd] |
| 5. | Red Gold | 212[ef] | 609[fg] | 1112[e] | 1223[cde] | 1583[bc] | 1277[abcde] | 687[cd] | 6702[e] |
| 6. | Suez | 188[ef] | 1230[abcdef] | 1766[ab] | 1496[a] | 2336[a] | 1271[abcde] | 1091[ab] | 10117[a] |

| Cultivar | | Cut 1 | Cut 2 | Cut 3 | Cut 4 | Cut 5 | Cut 6 | Cut 7 | Total |
|---|---|---|---|---|---|---|---|---|---|
| 7. | Vendelin | 97$^{f}$ | 686$^{efg}$ | 1459$^{abcde}$ | 1537$^{abcd}$ | 2335$^{a}$ | 1521$^{abc}$ | 999$^{abc}$ | 8634$^{abcde}$ |
| 8. | San Gabriel | 68$^{f}$ | 107$^{g}$ | 194$^{g}$ | 231$^{f}$ | 445$^{e}$ | 407$^{fg}$ | 739$^{bcd}$ | 2191$^{f}$ |
| 9. | DP85-3029 Pepsi | 390$^{cd}$ | 1339$^{abcde}$ | 1249$^{cde}$ | 1581$^{abcd}$ | 1819$^{abc}$ | 1016$^{bcdef}$ | 571$^{de}$ | 7964$^{bcde}$ |
| 10. | Haifa | 955$^{a}$ | 1875$^{a}$ | 1809$^{a}$ | 1650$^{abc}$ | 1821$^{abc}$ | 834$^{cdefg}$ | 497$^{def}$ | 9441$^{abc}$ |
| 11. | Huia | 392$^{cd}$ | 1519$^{abcd}$ | 1297$^{bcde}$ | 1469$^{bcd}$ | 1452$^{cd}$ | 767$^{defg}$ | 552$^{de}$ | 7447$^{cde}$ |
| 12. | Klondike | 637$^{b}$ | 1567$^{abc}$ | 1625$^{abcd}$ | 1979$^{ab}$ | 1824$^{abc}$ | 1433$^{abcd}$ | 647$^{cd}$ | 9713$^{ab}$ |
| 13. | Ladino | 464$^{c}$ | 1633$^{ab}$ | 1395$^{abcde}$ | 1819$^{abc}$ | 2162$^{ab}$ | 1241$^{abcde}$ | 451$^{def}$ | 9165$^{abcd}$ |
| 14. | Regal | 369$^{cd}$ | 1492$^{abcd}$ | 1061$^{e}$ | 1335$^{bcde}$ | 1948$^{abc}$ | 863$^{cdefg}$ | 492$^{def}$ | 7559$^{cde}$ |
| 15. | Rivendel | 256$^{de}$ | 869$^{cdef}$ | 977$^{ef}$ | 1329$^{bcde}$ | 1660$^{bc}$ | 1017$^{bcdef}$ | 613$^{d}$ | 6720$^{e}$ |
| 16. | KTA 202 | - | - | - | 874$^{def}$ | 853$^{de}$ | 618$^{efg}$ | 217$^{ef}$ | 2562$^{f}$ |
| LSD (0.05) | | 153 | 703 | 504 | 754 | 638 | 716 | 361 | 2036 |

Suez and Amos produced a similar amount of DM (kg DM ha$^{-1}$) to Klondike, Haifa, Ladino, Rajah and Vendelin, but their total DM yield was higher than the rest of the cultivars. San Gabriel, KTA 202 and Palestine had the lowest total DM production.

**NOTES:**

## POSTER PRESENTATION: THE DRY MATTER PRODUCTION OF ANNUAL FORAGE LEGUMES

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In South Africa a large amount of cool season annual forage legume cultivars are available. The evaluation of these cultivars is important to determine the potential as fodder and also fodder flow for animal production. The trial was carried out as a small plot trial on an Estcourt soil type on the Outeniqua Research Farm near George (Altitude 201m, 33º 58' 38" South and 22º 25' 16" East, rainfall 728 mm per year) in the Western Cape of South Africa. Sprinkler irrigation was used with irrigation scheduling done according to tensiometer readings. The trial was planted on the 20th of May 2009 and consisted of 12 cultivars. The experimental design was a complete randomised block design. Results were compared over four cuttings.

**Table 1** The dry matter production (kg DM ha$^{-1}$) of annual winter growing forage legume cultivars evaluated at Outeniqua Research Farm. ($^{abcde}$ Means with no common superscript differ significantly (P<0.05); LSD = Least significant difference)

| Treatment | | Cut 1 | Cut 2 | Cut 3 | Cut 4 | Total |
|---|---|---|---|---|---|---|
| 1. | Zulu | 790$^{bcde}$ | 2272$^{b}$ | 833$^{b}$ | 978$^{bc}$ | 4874$^{b}$ |
| 2. | Paradana | 533$^{e}$ | 1698$^{bc}$ | 740$^{b}$ | 124$^{c}$ | 3094$^{defg}$ |
| 3. | Calipso | 994$^{abcd}$ | 3028$^{a}$ | 4315$^{a}$ | 2741$^{a}$ | 11078$^{a}$ |
| 4. | Casbah | 125$^{f}$ | 326$^{e}$ | . | . | 451$^{h}$ |
| 5. | Paraggio | 1085$^{abc}$ | 1306$^{cd}$ | . | . | 2391$^{fg}$ |
| 6. | Santiago | 1389$^{a}$ | 1407$^{cd}$ | . | . | 2796$^{efg}$ |
| 7. | Campeda | 616$^{de}$ | 1893$^{bc}$ | 1176$^{b}$ | 22$^{c}$ | 3707$^{cde}$ |
| 8. | Sharano | 730$^{cde}$ | 1325$^{cd}$ | . | . | 2055$^{g}$ |
| 9. | Woogenellup | 617$^{de}$ | 2299$^{ab}$ | 969$^{b}$ | 17$^{c}$ | 3902$^{bcd}$ |

| Treatment | | Cut 1 | Cut 2 | Cut 3 | Cut 4 | Total |
|---|---|---|---|---|---|---|
| 10. | Lazer | 632$^{de}$ | 783$^{de}$ | 1458$^{b}$ | 1458$^{b}$ | 4332$^{bc}$ |
| 11. | Emena | 1131$^{ab}$ | 1933$^{bc}$ | . | . | 3064$^{defg}$ |
| 12. | Max | 972$^{bcd}$ | 2225$^{b}$ | . | . | 3197$^{def}$ |
| LSD (0.05) | | 398 | 742 | 1069 | 1057 | 1062 |

Casbah, Paraggio, Santiago, Sharano, Emena and Max could only succeed in producing for the first two cuttings. Calipso had a higher than, or similar DM production to any of the other cultivars over four cuttings and in total.

**NOTES:**