reported and distributed as follows: 185 species in Caesalpinioideae, 48 species in Mimosoideae and 77 in Papilionoideae growing in different locations in Cameroon and belonging to different habitat. The results are listed and discussed in the light of legume taxonomy

Establishment and population dynamics of indigenous N_2-fixing legumes for soil fertility restoration in resource-constrained farming systems

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Addressing soil fertility challenges for smallholder farmers of Southern Africa require new technical innovations drawing more from indigenous knowledge and resources. Establishment and population dynamics of indigenous legume fallows were studied under low (450 - 650 mm yr^{-1}) to high (> 800 mm yr^{-1}) rainfall areas of Zimbabwe in the 2004/05 and 2005/06 rainfall seasons. Twelve species, mostly of the genera *Crotalaria*, *Indigofera* and *Tephrosia* were broadcasted in mixtures at 120 seeds m^{-2} $species^{-1}$ on disturbed soil. *Eriosema ellipticum, Crotalaria ochreleuca* and *C. laburnifolia* had the highest emergence above 57 % compared with lowest values of 15 - 20 % for *Tephrosia radicans* and *Indigofera astragalina* respectively. About 50 % of the sown species successfully established on undisturbed soil in the second season. Within a growth period of six months, *Crotalaria ochreleuca* and *C. laburnifolia* attained maximum biomass of about 5 and 9 t ha^{-1} (dry weight) respectively. Some species such as *Crotalaria cylindrostachys* yielded about 0.5 t ha^{-1} of biomass over periods as short as three months. Cumulatively, *C. laburnifolia* produced ~ 10 t ha^{-1} over two seasons due to its superior regenerative capacity. Biennials such as *Neonotonia wightii* and *E. ellipticum* only reached their maximum biomass in the second season with seasonal yields not exceeding 2 t ha^{-1}. Non-legume species diversity decreased in the second season apparently associted with increased N availability. Phosphorus application influenced the magnitude of biomass with little effect on species composition and establishment patterns. This current understanding of population dynamics could contribute to the development of management options involving indigenous legumes for fertility restoration of degraded soils in most parts of Zimbabwe and similar agro-ecologies in Sub-Saharan Africa.

Investigating nitrogen fixation in the *Medicago-Sinorhizobium* symbiosis

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A well documented and intractable problem with the symbiotic medics is their aggressive nodulation by inefficient strains of S*inorhizobium* spp. This often leads to lower levels of fixed nitrogen and reduced benefit in rotational cereals. At present, we have little understanding of the mechanisms resulting in this sub-optimal fixation of nitrogen in medic root nodules. Possible explanations range from incomplete nodule development through to inefficient transport of fixation products from the bacteroid to the plant host. To gain an insight into the phenomenon, we have compared fixation ability of the sequenced strain *S. meliloti* 1021 (Sm1021) and the model legume *Medicago truncatula* with a number of other strains and *Medicago* hosts. From these comparisons, Sm1021 on *M. truncatula* shows a number of marked differences including: decreased plant top dry weights, decreased nitrogen in plant tops, delayed nodule development, increased nodule number, different nodule colouration and morphology. These differences are indicative of an inefficient symbiosis. Further work will attempt to explain these differences by exploring early signalling differences between Sm1021 in association with *M. truncatula* and *M. sativa* using a microarray approach and to evaluate whether exopolysaccharide production is involved in sub-optimal nitrogen fixation in medics.

Biogeochemistry of batch denitrification using sawdust as a carbon source

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Batch denitrification experiments were performed on groundwater and soil from Marydale a town in the Northern Cape Province of South Africa using sawdust as a carbon source. Parameters monitored at set times during the various experiments included pH, electrical conductivity, total alkalinity, nitrate, nitrite, ammonia, sulphate, potassium, and chloride. Soil from two different depths was used for the purpose of comparison. Different C:N ratios were used to evaluate the best C:N ratio to effect denitrification and to evaluate the ratio yielding the least undesirable by-products, while providing sufficient denitrification to lower the nitrate concentration of groundwater to comply with drinking water standards. The heterotrophic plate count was monitored throughout the experiment to establish the various growth phases of bacteria within the time series selected for the experiment. The biogeochemical changes during the time series, were evaluated against the drinking water standards of South Africa while taking the nitrate hazard in the country into account. Results showed that dissolved organic carbon is directly proportional to the amount of carbon source added for each treatment and that nitrite is produced for most of the treatments throughout a 28 day experiment, however increasing the incubation period and carbon ratio lead to successful removal of both nitrate and nitrite. It was concluded that the nitrate concentration can be reduced to acceptable levels. From the results it was evident that the reaction was carbon limited due to the slow release of assimilable carbon from sawdust for lower C:N ratios.