RESULTS FROM SWIFTSYND TRIALS ON IMPROVED AND NATIVE PASTURE AT DOUGLAS DALY, N.T.

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SUMMARY:

Pasture growth trials using a method called SWIFTSYND (Day and Philp, 1993) have been used on improved (Urochloa mosambicensis) and native (Heteropogon contortus dominated) pasture sites at Douglas Daly Research Farm (DDRF) in the Northern Territory. Data collected included vegetation cover, dry matter yields, soil moisture, and nutrient levels of plant material. This report describes the SWIFTSYND trials and presents the results of this study.

INTRODUCTION:

Cattle production is one of the most important land uses in the Australian Semi Arid Tropics (SAT). The region experiences distinct wet and dry seasons annually, with frequent high intensity rainstorms having the potential to cause significant damage to poorly managed lands. Land management practices and strategies therefore, can prove crucial to the sustainable productivity of the land.

To facilitate sustainable development and management of land resources, the dynamics and interactions of soil, plant, water, and climate need to be understood. Computer simulation models provide a tool to enable this. The Land Management Strategies for the Semi-Arid Tropics (LAMSAT) project in collaboration with Agricultural Production Systems Research Unit (APSRU) is developing such a computer simulation model called APSIM (Dilshad et al., 1993). One of the modules of the APSIM model will be a pasture productivity model called GRASP (McKeon et al., 1993) developed by Queensland Department of Primary Industries. The parameters required for GRASP are obtained from a pasture growth trial called SWIFTSYND (Day and Philp., 1993). This technical report presents the results from SWIFTSYND studies conducted at Douglas Daly in the Northern Territory.

DESCRIPTION OF EXPERIMENT:

Location:

The study area was situated at the Douglas Daly Research Farm (DDRF) 250 km south of Darwin at a latitude of 13°51' and longitude 131°12'. It consisted of eight sample areas on four catchments (fig. 1.).

The four catchments ranged in size from 4.1ha to 7.8ha, were delineated by narrow based soil conservation banks creating a cross-slope channel with a mean bed slope of 0.6% (Dilshad and Peel, 1994). Inter bank spacings were determined by the Northern Territory Conservation Commission Soil Conservation Design Manual (Anon., 1983) for a storm with an average recurrence interval of ten years.
Three of the catchments were sown with improved pasture (IP) Sabi-grass (*Urochloa mosambicensis*), and the fourth (fig. 1.) was left undisturbed as native bushland with a predominant understorey of black speargrass (*Heteropogon contortus*).

![Diagram showing layout of catchments](image)

**Fig. 1. Layout of the DDRF experimental site.**

**Rainfall, Evaporation and Runoff:**

The semi arid tropics of Northern Australia is characterised by distinct wet and dry seasons with historic mean annual rainfall for the research site being 1200mm (Lucas, 1984). More than 90% of the annual rainfall is recorded over the five month period from November to March (Williams et al., 1985). These are the only months when mean monthly rainfall exceeds mean monthly evaporation (Lucas, 1984).

On average, more than 90% of the surface runoff events in agricultural catchments at Douglas Daly occur during the months of December to February, inclusive (Dilshad and Jonauskas, 1990). For most of the wet season the intertropical convergence zone lies across the area and high rainfall intensity is common (Williams et al. 1985). For example, a storm with an intensity of 100mm/h over a duration of 20 minutes has an average recurrence interval of less than a year (Pattison et al., 1977).
Soils and Infiltration:

The catchments were located on the Red Earths great soils group as defined by Stace et al. (1968) and grouped into the Tippera family (Lucas et al., 1987). These soils would be classified as kandosols under the new classification of Australian soils by Isbell (1993).

Across the four catchments studied, soil was relatively uniform showing minor variation in the top 40cm. The textures ranged from clay loam at the top 10cm to light medium clay at 40cm. Between 40 and 150cm the soil texture ranged from light medium clay to heavy clay. Below this, bands of weathering sandstones were scattered throughout the profile.

These soils experience infiltration rates of around $1.8 \times 10^2$ mm/h on initial dry soils. After 20 minutes flooding, infiltration rates stabilise with final infiltration rates ranging between 9 and 18mm/h (Day, 1977).

Preparation Of Site:

Sampling area:

Each of the three IP catchments had two 20m x 20m fenced areas. Within each fenced area there was an 18m x 13.5m sampling area (fig. 2a.). At the beginning of the trial, vegetation in the 20m x 20m fenced areas was mown to approximately 3cm height. Any remaining litter was then removed by a light raking. This ensured the vegetation on the sites would have similar starting levels for cover and yield.

Each sampling area had nine 5m x 3.5m blocks that were pegged out with walkways between them to avoid trampling of the material to be harvested (fig. 2a.). Each of the nine blocks had sufficient area to lay out 6 individual 1m x 1m quadrats without overlapping (fig. 2b.).

Preparation of the sampling areas in the native pasture (NP) catchment was different from those in the IP catchments due to the presence of trees. An area of 30 x 30m was fenced, with vegetation within this area burnt. This larger sample area was required to provide the nine sampling blocks with preferably no trees.

Neutron moisture meter:

In each of the sampling areas there were three neutron moisture meter access tubes installed in the ground at blocks 2, 6, and 8 (fig. 2a.), using a hydraulic ram. A steel tube, 46mm in diameter, was used to bore a hole down to a depth of 1.8m. The aluminium access tube (50mm diameter) was then inserted into the hole and driven down to a depth of 1.8m. Any soil dislodged and trapped within the tube, was removed with an auger. The tube was sealed at the bottom end with a rubber bung, and fibreglass resin was poured into the tube to ensure a good seal. The top of the tube was sealed using a rubber bung with an inverted aluminium cap secured on top of it for added protection against cattle and rain, and to help mark the position of the tube.
Sampling Times:

Sampling times were determined by the pastures reaching critical stages in their growth cycle described hereunder.

Base reading:
The initial samples were collected in the last week of Sept. '92 on completion of site preparation. Samples were collected anywhere within the fenced areas but outside the sampling areas. Six samples were collected in each fenced area to define base line data for the experiment.

First reading:
The first flush of growth for the season occurs after receiving 50mm of rainfall cumulatively in a fortnight (Norman 1963). The first sample was aimed at measuring this initial stage of growth. Sampling took place in the second week of Nov. '92. The previous fortnight had experienced 95mm of rainfall, 50mm falling in one storm.

Second reading:
The aim of the second sampling was to capture data at the flowering and seeding stage of the IP. This was when the plant had produced enough leaf matter to enable it to take on the process of reproduction. This set of samples was taken in the second week of Dec. '92.
The native pasture experienced a much slower growth rate, although some annuals and weed species experienced good growth in this period. The NP attained a similar growth stage as the IP by the third reading. At the time of the second sampling, the catchments had experienced about 275mm of rainfall since the experiment had commenced.

*Third reading:*
The third sampling was taken towards the end of the growing season after the IP had gone through the process of seeding, and was utilising its energies towards growing more green material.

At this stage the NP was close to its peak in yield, and had full heads of seed. The sample was collected in the third week of Mar. '93.

*Fourth reading:*
It was originally proposed to collect another set of samples in May '93. As there was no significant growth observed due to lack of rainfall throughout April '93, the fourth sampling was abandoned.

*Fifth reading:*
The final set of samples was to be collected at approximately one year after the trial had commenced. This was to enable the measurement of the conversion of attached to litter over the non-growing season. This sample was collected in late Aug. '93, before the expected increase in daily temperature and humidity, which could accelerate the process of litter breakdown.

**METHODOLOGY OF SAMPLING:**

*Information Collected:*
In each of the nine sample blocks (fig. 2a.), a set of data described below, was collected within a 1m x 1m quadrat (fig. 2b.). Data collected included, ground cover, soil moisture, dry matter yield and chemical analysis of vegetative material. Rainfall data was collected from a number of stations (fig. 1.) located in and around the study area. Other relevant meteorological data was recorded at the DDRF weather station, nearly 2.5 km west of the catchments.

*Cover:*
A 1m x 1m quadrat was used to measure attached, weed, litter, bare ground and total plan cover (TPC). Attached cover was any plant cover which was attached to the main plant even if it was not green and was not classified as a weed. Weed was any plant that was not a grass or would not be expected to be found in the general regime of plants recognised for that site. For example, the IP blocks had *Urochloa mosambicensis* (sabi) planted in them but there were some weeds such as *Senna obtusifolia* (sicklepod), and *Cyperus rotundis* (nut
grass) amongst the pasture. Litter was any vegetative material that was not attached to any plant.

When visual estimates of cover were made special care was taken to make sure that the eye position was normal to the centre of the quadrat. Measurement of the cover levels were done with minimal disturbance to the sample blocks. The levels of cover were measured in a plan view. Each quadrat was photographed from the 'normal point' before the vegetation was harvested.

Yield:

Attached plant material, weeds, and litter were harvested from each quadrat. Attached and weeds were harvested using a set of shears to cut the plant as close to the ground as was possible without pulling the root system out of the ground. Litter was collected by hand with care taken not to pick up soil. The plants were harvested only if the base of the plant was within the quadrat, even if the stems and leaves continued outside the quadrat. The samples were placed in brown paper bags, labelled and dried at 78°C for forty-eight hours, and their weights recorded.

Attached:
Attached material in the IP catchments was a collection of the Sabi grass only. Attached in the native bushland included any of the grasses which were found in the area, Heteropogon contortus (black speargrass), Themeda triandra (kangaroo grass), Sehima nervosum, Chrysopogon fallax, and Mnesthia rotboellioides.

Weeds:
Weeds harvested in the IP sample areas included sida (Sida acuta), sicklepod (Senna obtusifolia) and nut grass (Cyperus rotundis). The native pasture weeds included any of the plants which were not grasses, which included some local annual herbs and forbs.

Litter:
Litter was collected after the attached material and weeds were harvested. This was done by gently gathering the remaining plant material together by hand. Care was taken not to pick up soil. A light shake of the sample before bagging helped release most of the soil.

Soil Moisture:

Gravimetric method:
Immediately after harvesting a quadrat, gravimetric soil moisture readings were taken for 0-10, 10-20, and 20-30cm depths. A 50mm diameter auger was used to collect samples from a location selected within each quadrat. The samples were oven dried at 104°C for 24hrs to obtain the gravimetric moisture content (%).
Neutron moisture meter method:
Neutron probe readings for each sample area coincided with the yield measurements for the sample area. Readings were taken starting at a depth of 40cm and then at 20cm intervals to a depth of 180cm.

The probe emits fast neutrons which travel up to 3 metres into the surrounding soil. Fast neutrons lose energy and are converted to slow neutrons through collisions with atoms of low atomic weight (Linsley, 1982). The hydrogen in water is normally the major atom of low atomic weight in the soil. When the neutron returns to the probe, it may have hit many water molecules and slowed down considerably. The speed with which the neutron returns to the probe is proportional to the moisture content in the surrounding soil (Goodspeed, 1981). At each depth, three 16 second counts were taken and an average of the three was used. Calibration equations were used to convert neutron probe readings into percentage volumetric soil moisture.

Chemical Analysis:

Sample preparation and analysis:
Chemical analysis was carried out on all plant materials collected for yield measurements. After the dry matter yield was measured, a sub-sample of the plant material representative of the whole sample was coarsely ground. This included seeds if the plants sampled were seeding at the time. NP litter included grass litter and any tree litter, including twigs and thin branches. The sub-sample was then further ground to obtain a very fine composition. It was placed in a small plastic sample container with a sealing lid, and stored in a cool dry place until analysed. The chemical analysis of the samples investigated levels of nitrogen, phosphorous, potassium and micronutrients. A peroxide sulphuric acid digestion was used to prepare the ground plant material for analysis of nitrogen levels. A nitric acid digestion was used to prepare the plant material for analysis of the remainder of the nutrients. Analysis was carried out by a machine using optical emission spectrometry.

RESULTS AND DISCUSSION:
The data collected from the IP catchments showed minor differences, between and within catchments. Thus the figures containing the results for IP, display the means and standard deviations of all the data for IP sample areas. However there were some differences between the two NP sample areas, thus the results of these sample areas are displayed separately.

Cover:

Improved pasture:
At the base reading (Sept. '92) TPC was 47%, which comprised of 25% litter cover, and 22% attached cover (fig. 3.).
In Nov. '92 visible litter cover levels decreased considerably to 3% (fig. 3.) which was not due to a real drop in litter cover but due to a sudden increase in attached cover to 59% (TPC 62%). Due to the rapid growth pattern of Sabi grass, determining total litter cover was difficult due to the canopy cover.

Between Sept. '92 and Nov. '92 the sabi grass leaves tended to grow long but in a horizontal fashion, thus yielding a high value for attached cover. At the Dec. '92 sampling the sabi grass leaves had grown further but tended to grow upright, thus the measured cover levels exhibited a drop in attached (53%) and TPC (59%), and an increase in litter cover (5%). Over this same period when attached cover decreased, the yield for attached doubled (fig. 5a.).

By March '93 TPC (93%) and attached (90%) had increased dramatically, whilst visible litter was only 1%. In Aug. '93 cover was still high (TPC = 98%, attached = 97%) due to the fact that the leaves were still connected to the tussock but had dropped due to water stress.

**Native pasture:**
The NP showed a much slower increase in cover levels (fig. 4.) compared to Sabi grass. TPC started at 26% (Sept. '92) but only sample area 1 (SA1) experienced an increase by Nov. '92 (fig. 4a.1.). By Dec. '92 SA1 increased to 53% and sample area 2 (SA2) had a significant increase to 47%, and increased further to 84 and 71% respectively (Mar. '93). No sample was available for Aug. '93 due to a major bushfire that swept through the catchment in late July '93.

The local speargrass species *Heteropogon contortus* grows from a small base with leaves tending to grow in a generally upright fashion, with plants growing to about 70cm high and producing seed by March to April. Grass basal area for SA1 was only 0.8%, whereas it was 2.6% for SA2. This plant did not generate a lot of cover, compared with Sabi, until later in the growing season (Mar. '93).

Litter cover stayed around 20% for SA1, but fluctuated between 8 and 23% for SA2 (fig. 4c.2.). The litter predominantly consisted of tree leaves, which showed a high resistance to breaking down as a result of which the cover levels remained reasonably steady.

Cover due to weeds increased moderately during the growing season. Weed cover for the two sample areas increased to similar levels for Nov. and Dec. '92, but by Mar. '93 SA1 had increased to 30% and SA2 had only increased to 17% (fig. 4d.). Weeds produced considerable cover early in the season in comparison to attached. The period from Nov. '92 to Dec. '92, weed increased from 6.3% to 14.6%, attached increased from 11.5% to 13.6%. A similar trend was experienced for yields for the same period.
Fig. 3. Cover levels (%) for the improved pasture sample areas.
Fig. 4. Cover levels (%) for the native pasture sample areas.
Yield:

Attached:
The IP catchments experienced an increase in attached dry matter yield during the growing season, and a slight decrease during the dry season (fig. 5). The yields doubled from an average of 1.2 t/ha in Nov. '92 to 2.39 t/ha in Dec. '92. Yields again increased considerably resulting in an average 4.37 t/ha from Dec. '92 to March '93. There was a decrease in yield over the dry season to 3.85 t/ha in Aug. '93.

Even though there was very little rain after Mar. '93, there was a net gain of total yield between Mar. '93 (5.28 t/ha) and Aug. '93 (6.35 t/ha). It appeared that there was an increase in attached yield between Mar. '93 and Aug. '93, however, by Aug. '93 sampling most of the increase had been counter-balanced with the conversion of attached to litter.

The NP yields increased at a much slower rate (fig. 6.). Its growth could have been hindered by a number of other factors such as competition with other small herbaceous and woody weeds, leaf litter affecting seed germination, and tree canopy cover affecting transpiration.

Attached yields doubled from 0.13 t/ha in Nov. '92 to 0.26 t/ha in Dec. '92; in comparison, weed yield for the same period doubled from 0.21 t/ha to 0.42 t/ha. Weeds being strong competitors, achieved faster growth than the surrounding native grasses. From Dec. '92 to Mar. '93 the attached yield increased from 0.26 t/ha to 1.48 t/ha. There was no August sample due to the fire in the catchment in late July '93.

Litter:
Litter yield for the IP remained relatively stable throughout the growing season. The average yield value for Sept. '92 was 0.94 t/ha, which decreased marginally to 0.87 t/ha in Nov. '92. The yield further decreased to 0.64 t/ha in Dec. '92, and increased to 0.75 t/ha in Mar. '93. Between Mar. '93 and Aug. '93 most of the IP sampling areas showed an increase in litter yield by a factor of 3 to 4, resulting in an average of 2.5 t/ha in Aug. '93. This degree of increase was to be expected due to heat stress and the plant shedding old leaves which it could not support.

The NP catchment had experienced a fire a few weeks before the Sept. '92 sample, thus no samples were collected. The increase in litter yield was attributable to leaves dropping from the surrounding trees due to the fire. The rest of the growing season saw a gradual decrease in litter yield due to breakdown of litter. From Nov. '92 to Mar. '93 the litter yield nearly halved. No sampling was possible in Aug. '93 due to the bushfire in July '93.
Fig. 5. Dry matter yields (t/ha) for the improved pasture sample areas.
CORRIGENDUM.

Fig. 6(b.2) on page 14 of this technical memorandum is incorrect and should be replaced with the figure below.

c.1. Weed sample area 1

![Graph showing weed sample area 1 data over time from Sep-92 to Sep-95.](image-url)
Fig. 6. Dry matter yields (t/ha) for the native pasture sample areas.
Chemical analysis:

**Improved Pasture: nitrogen**

Concentrations of N in attached material (fig. 7a.) were initially 2,900 ppm (Sept '92) and increased rapidly to 14,500 ppm (Nov. '92). A steady decrease in concentration from 7,200 ppm (Dec. '92) to 5,700 ppm (March '93) and a further decrease to 2,700 ppm (Aug. '93) was seen. Actual plant uptake of N however progressively increased throughout the growing season from 0.2 kg/ha (Sept. '92) to 17.5 kg/ha (Nov. and Dec. '92) and up to 25 kg/ha by March '93 (fig. 13a.). By August '93 (non-growing period) plant uptake had decreased to 10.5 kg/ha.

Concentrations of N in litter material remained fairly constant (6,500 ppm) for the growing season, decreasing to 3,800 ppm by Aug. '93 (fig. 8a.). Plant uptake of N remained at a level of 5 kg/ha (fig. 13b.) for the growing season. The August '93 sample experienced a slight increase (9.5 kg/ha) in N uptake, this was related to the increased yield for this period.

There was not enough weed material available to conduct N analysis for the Sept. '92 and Aug. '93 sample times (fig. 9a.). The concentration of N started at 18,000 ppm (Nov. '92), decreasing to 15,500 ppm (Dec '92), and further decreasing to 5,500 ppm (Mar. '93).

**Improved Pasture: phosphorous**

Concentrations of P (fig. 7b.) in attached material were initially 900 ppm (Sept. '92) and increased to 3,500 ppm (Nov. '92), but decreased slightly to 3,000 ppm (Dec. '92). The March '93 sample showed a large increase to 17,800 ppm, which could have been caused by the increased soil moisture which causes P to become more mobile (Thiagalingam, pers. comm.). Phosphorous levels returned to lower concentrations (1,600 ppm) by the end of the non-growing season, Aug. '93. The uptake of P exhibited the same trends in concentration levels, except between the period Nov. and Dec. '92 where there was an increase (fig. 13a.).

Concentrations of P in litter material (fig. 8b.) remained low for the early stages of the growing season (850 ppm) increased rapidly to 12,500 ppm (Mar. '93) but returned to 900 ppm by the end of the non-growing season (Aug. '93). Uptake of P followed the same trend (fig. 13b.).

Concentrations of P in weed material (fig. 9b) followed similar trends as experienced by the attached and litter material, starting at 2,800 ppm (Nov. '92), up to 4,100 ppm (Dec. '92), and a further increase to 11,100 ppm (Mar. '93).

**Improved Pasture: potassium**

Concentrations of K in attached material had an initial level of 11,500 ppm (Sept. '92), swiftly increasing to 46,500 ppm (Nov. '92), then decreased in Dec. '92 to 33,200 ppm and 34,800 ppm (figs. 7c.1. and fig. 7c.2.) (the second value given is due to outliers having been removed). At the end of the growing season K concentration further decreased to 2,300 ppm (Mar. '93) but increased to 14,800 ppm by Aug. '93. The uptake of K (fig. 13a.)
followed a similar pattern, except for an increase from 55.5 kg/ha (Nov. '92) to 79.3 kg/ha (Dec. '92), this trend was in contrast to that for the concentration levels.

Concentrations of K in litter material had an initial level of 5,400 ppm which decreased to 4,900 ppm (fig. 8c.1.) and 2,700 (fig. 8c.2. outliers removed). The Dec. '92 sample was steady at 4,200 ppm (3,400 ppm fig. 8c.2.) and decreased to 1,600 ppm (Mar. '93). A significant increase to 9,100 ppm was experienced for the August '93 sample. The shape of the graph for uptake of K (fig. 13b.) was the same as that for concentration.

Concentrations of K in weed material was similar to those for attached material (fig. 9c.). From an initial level of 52,300 ppm (Nov. '92), decreased to 30,700 (Dec. '92), and decreased further to 1,400 ppm (Mar. '93).

*Native Pasture: nitrogen*

Concentration of N in attached material from SA2 had an initial level of 4,200 ppm (fig. 10a.2.). SA1 did not have enough material to be analysed. Both sample areas experienced a high concentration of N for Nov. '92 (fig. 10a.1. & 10a.2.) of 12,900 and 11,000 ppm respectively. The Dec. '92 sample exhibited a decrease for both areas to approximately 8,000 ppm, but only SA1 sustained a further decrease to 5,900 ppm (Mar. '93). SA2 declined marginally to 7,400 ppm. No sample was collected in Aug. '93 due to the fire. However the uptake of N rose continuously throughout the growing season (fig. 14a.) for both SA’s, reaching a peak of 9.8 kg/ha (Mar. '93).

Concentrations of N in litter material for both SA1 and SA2 were very similar (fig. 11a.1. & 11a.2.). An initial reading of 5,700 ppm (Sept. '92) held steady until the Nov. '92 sampling, but actual uptake increased from 7.2 kg/ha to 10.4 kg/ha (fig. 13b.). SA1 increased to 7,900 ppm (Dec. '92), whilst SA2 increased to 7,000 ppm, with both sample areas ending the growing season at approximately 7,000 ppm (Mar. '93).

There was not enough weed material available to have N analysis conducted for three of the five sample times, thus the graphs (fig. 12a.1. & 12a.2.) depict a trend similar to the attached material for the sample periods Dec. '92 and Mar. '93.

*Native Pasture: phosphorous*

Concentration of P in attached material at initial sampling was 300 ppm (Sept. '92) for SA2 only. Both sample areas experienced a small increase (figs. 10b.1. & 10b.2.) to 1,200 ppm (Nov. '92), but sustained a slight decline to 1,000 ppm (Dec. '92). The March '93 sample showed considerable increases for both sample areas, 8,200 ppm (SA1) and 11,000 (SA2). This increase could be attributed to the wet conditions causing phosphorous to become more mobile, as discussed previously for the improved pasture. Plant uptake followed a similar trend (fig. 14a.).

Concentrations of P in litter material were found to be near identical for both sample areas (fig. 11b.1. & 11b.2.). Concentrations started at 500 ppm (Sept. '92), rose slightly to 600 ppm (Nov. '92), and increased further to 900 ppm (Dec. '92), with a final reading of 9,000 ppm (Mar. '93).
Fig. 7. Nutrient levels (ppm) of attached material in improved pasture sample areas.
Fig. 8. Nutrient levels (ppm) of litter material in improved pasture sample areas.
Fig. 9. Nutrient levels (ppm) of weed material in improved pasture sample areas.
The analysis of P concentration in weed material was limited by the lack of samples collected, as previously outlined. Both sample areas had a concentration of 1,300 ppm in Dec. '92 (figs. 12b.1. & 12b.2.) but SA1 increased to 14,000 ppm (Mar. '93), whereas SA2 only rose to 6,100 ppm for the same period. This could be attributed to the type of litter (tree or grass) which was predominant in the area.

**Native Pasture: potassium**

Concentration of K in attached material was initially 5,700 ppm (Sept. '92) for SA2. SA1 did not have enough sample for analysis. Both sample areas were high in K in Nov. '92; 20,700 ppm (figs. 8c.1. & 8c.2.), and both sustained identical decreases to 17,200 ppm (Dec. '92) and a further reduction to 700 ppm (Mar. '93). Plant uptake (fig. 14a.) however, experienced an increase from 2.7 kg/ha (Nov. '92) to 4.4 kg/ha (Dec. '92) but declined to 1.1 kg/ha (Mar. '93).

Concentrations of K in litter material for both sample areas were very similar (figs. 11c.1. & 11c.2.), with an initial reading of approximately 5,500 ppm (Sept. '92). The concentration then decreased to 2,900 ppm (Nov. '92), and further decreased to 1,500 ppm in SA1 and 2,300 ppm in SA2 (Dec. '92). The final reading for both sample areas was 800 ppm (Mar. '93). In contrast, plant uptake (fig. 14b.) was initially 7.0 kg/ha (Sept. '92), but increased to 8.0 kg/ha (Nov. '92), with a further rise to 12.6 kg/ha (Dec. '93). Plant uptake decreased to 0.9 kg/ha (Mar. '93).

Concentration of K in weed material (figs. 12c.1. & 12c.2.) starting with approximately 20,000 ppm (Dec. '92) followed by a rapid reduction to 1,500 ppm (Mar. '93).

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**Soil Moisture:**

**Improved pasture:**

Volumetric moisture content (vmc) for IP showed minor variation throughout the trial for depths of 50cm to 180cm, ranging from 22% to 28% vmc (figs. 15a.1. to 15c.2.). Depths of 0 to 50cm experienced the greatest variation in vmc chiefly due to climatic conditions and vegetative growth. The lowest vmc recorded was 6% in Aug. '93 at 5cm depth, and the highest was 29% in Dec. '92 at 50cm depth.

**Native pasture:**

Native pasture vmc experienced similar trends to the IP, with vmc from 50cm to 180cm showing minor fluctuations ranging from 25% to 31%. The top 50cm experienced fluctuations similar to the IP during the trial. The lowest vmc measured was 5% (Sept. '92) at a 5cm depth, and the highest was 30% (Nov. '92) at a 50cm depth.
Fig. 10. Nutrient levels (ppm) of attached material in native pasture sample areas.
Fig. 11. Nutrient levels (ppm) of litter material in native pasture sample areas.
Fig. 12. Nutrient levels (ppm) of weed material in native pasture sample areas.
Fig. 13. Mean uptake of nutrients (kg/ha) for the improved pasture sample areas.

Fig. 14. Mean uptake of nutrients (kg/ha) for the native pasture sample areas.
Fig. 15. Mean soil moisture readings (vmc) for each sample area.
CONCLUSION:

The SWIFTSYND trial has identified patterns of pasture growth, chemical movement, and water use over a complete growth cycle for native and improved pasture in the Douglas Daly region of the Northern Territory. This high quality data can now be used to develop parameter files for the GRASP model.

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