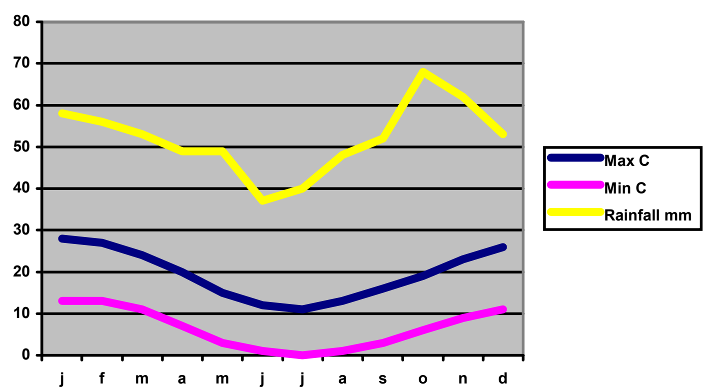
NUTRITION FOR RENOVATION

An awful lot has been written about general turf nutrition but very little specific information has been focused on regional issues in relation to this. Canberra and the surrounding area have a relatively unique climate and consequently the turf types present differ markedly from those found in the majority of NSW. This directly influences the nutritional regime adopted and is one of a number of factors that should be considered when developing a fertilizer programme in the ACT.

Graph showing mean annual max and mean temperature together with mean rainfall for the ACT



The ratio that nutrients are removed by the plant and found in leaf tissue falls in an NPK range from 3:0.25:2 to 8:1:5 (Salisbury, 1995 Street, 1998) although the actual requirements vary depending on turf species and the physical form of the fertiliser.

Handreck and Black (1994) proposed that annual NPK applications fall in the following range.

Table 1 Maximum and minimum proposed NPK ranges for optimal turf growth

NUTRIENT	MINIMAL ANNUAL NUTRIENT APPLICATION LEVELS THAT SUSTAIN TURF GROWTH kg/Ha	MAXIMUM ANNUAL NUTRIENT APPLICATION LEVELS THAT SUSTAIN TURF GROWTH. Kg/Ha
NITROGEN	160	400
PHOSPHORUS	30	50
POTASSIUM	80	240

Grass species

Not all grasses are the same and hence have differing nutrient requirements. The choice falls down to either warm or cool season grasses depending on the situation of the site.

Cool season grasses include bent grass; perennial ryegrass and fescue grasses and these have differing nutrient and pH demands in contrast to the warm season grasses such as couch grass or kikuyu.

Table 2. Characteristics of common Australian turf grass species

SPECIES	SALT TOLERANCE	SHADE TOLERANCE	SOIL pH	NITROGEN REQUIRED
COUCH	Medium	Poor	5.5-7.5	Medium
QUEENSLAND BLUE COUCH	Very good	Poor	5.5-6.5	Medium
BUFFALO	Medium	Poor	6.5-7.5	Low
KIKUYU	Very good	Poor	6.0-7.0	Low
BENTGRASS	Poor	Excellent	5.5-6.5	Low
PERENNIAL RYEGRASS	Moderate	Medium	6.5-7.0	Medium

This can be further demonstrated by looking at the actual N requirements per 100m2/growing month although this will also vary depending on time of year etc.

Table 3. Warm season grasses. N requirements g per 100m2/growing month (Carrow et al, 2001)

SPECIES	GENERAL TURF	RECREATIONAL TURF
COUCH-COMMON	98-195	195-342
COUCH-HYBRID	195-293	293-732
BUFFALO	0-146	146-195
KIKUYU	98-146	146-293
BUFFALO	146-244	195-293
ZOYSIA (COMMON)	49-146	146-244
ZOYSIA (HYBRID)	98-146	146-293

Table 4. Cool season grasses. N requirements g per 100m2/growing month (Carrow et al, 2001)

SPECIES	GENERAL TURF	RECREATIONAL TURF
COLONIAL BENTGRASS	146-244	195-390
CREEPING BENTGRASS	146-293	146-488
FINE FESCUES	98-195	146-244
KENTUCKY BLUEGRASS (COMMON)	49-146	98-293
KENTUCKY BLUEGRASS (IMPROVED)	146-195	195-390
PERENNIAL RYEGRASS	98-195	195-342
TALL FESCUE	98-195	146-342
POA ANNUA	146-244	195-390

These differences extend beyond nitrogen. For example perennial ryegrass has a much greater requirement for phosphate than browntop bent or fine leaved fescues. (STRI,1996) and Kentucky Bluegrass has a much greater requirement than perennial ryegrass (Rutgers University).

The role of pH also plays an important role. Different species prefer different pH levels and in conjunction with this different fertilisers have differing effects on soil pH.

Table 5. Optimal pH ranges for common Australian turf grass species

TURFGRASS	MAIN pH RANGE FOR SUITABLE GROWTH
BROWNTOP BENTGRASS	5.0 - 6.0
CREEPING BENTGRASS	5.5 -6.5
ANNUAL MEADOW GRASS	5.5 - 7.5
PERENNIAL RYEGRASS	6.0 - 7.0
KENTUCKY BLUEGRASS	6.0 - 7.0
COUCH GRASS	6.5-7.5
TALL FESCUE	5.5-6.0

These effects can be exaggerated on for example pure sand constructed areas that possess a low buffering capacity.

In Table 6 a minus sign indicates that the material tends to acidify the soil and a positive sign indicates that the material is basic and use will increase soil pH over time.

Table 6. Liming/acidifying properties of common fertilisers

MATERIAL	NITROGEN %	CACO3 EQUIVALENT PER 9KG OF NITROGEN
UREA	45	-16.4
AMMONIUM NITRATE (NITRAM)	33.5	-16.4
AMMONIUM SULPHATE	20.5	-16.4
C.A.N	20.5	0
MAP	11	-48.6
DAP	18-21	-32.3
POTASSIUM NITRATE	14	+16.4
MAP	48	-9.5
DAP	46-54	-12.7
POTASSIUM CHLORIDE	60-62	Neutral
POTASSIUM SULPHATE	50-53	Neutral
POTASSIUM NITRATE	44-46	+5

The other point worth noting is that cool and warm season grasses achieve optimal growth under differing temperature conditions. Cool season grasses achieve optimal growth within the range of 16-24°C and are severely restricted by periods of prolonged or severe high temperature or drought.

Warm season grasses grow optimally at 27-35°C and are restricted by prolonged or severe periods of cool weather becoming dormant when temperatures fall below 10°C.

Nature of the rooting medium

Sandy soils have very little in the way of inherent nutrient reserves. The very nature of the AGCSA specification for greens construction is that it drains extremely well and contains a minimal amount of organic matter.

This characteristic further means that they are actually unable to retain soluble nutrients derived from fertilisers. The high rate of leaching means that nitrates, potassium and ammonium tend to pass through the profile into the underlying drainage water.

In contrast to this heavier loam soils tend to retain nutrients much better and so make nutrients available to the grass for much longer.

Soil nutrient status

Regularly soil tests are carried out in order to determine the nutrient status of soils. Often these test results come back with a figure for nitrogen, phosphorus etc and an interpretation of these results.
Some nutrients are easier to test than others and amongst the former can be included potassium, phosphorus, magnesium and trace elements such as copper, zinc etc. However results for nitrogen are often misleading as there is currently no reliable analytical test available for predicting plant available nitrogen in outdoor soils. Often by the time the test results are returned the figure in the report is irrelevant.

The reason as to why this figure is unreliable is that a number of factors control the amount of plant available nitrogen and in particular the rate at which soil organic matter is mineralised. The conclusion to this is save your money when it comes to nitrogen testing in these situations.

Timing of fertiliser applications

This is crucial and has a huge influence on the programme to adopt. Basically the considerations can be divided into pre and post establishment and this is in turn is influenced by location within Australia.

Establishment

Once an area has been satisfactorily prepared the nutritional regime must be aimed at establishing a strong, vigorous sward as quickly as possible. How this is achieved is due to a careful balance of nutrition and irrigation.

In the case of constructions with a high percentage of sand the initial problem is one of moisture retention. In order to overcome this organic amendments are often added such as peat moss or poultry manure. Problems exist with both of these.

Peat moss is acidic possessing a pH of 4.5 and takes a considerable time to breakdown. Consequently if this is not incorporated thoroughly throughout the profile it can lead to a build up of a highly moisture retentive layer at depth and so encourage anaerobic soil conditions to develop.

An analysis of poultry manure shows that it does in fact contain low levels of organic matter and also can contain sodium in worrying levels depending on the source of manure. Preferable to both of these options is dried seaweed, composted sewage sludge or humic acid derivatives.

In relation to nutritional benefits from these amendments it is unlikely that these alone will lead to optimal growth of the respective grass species. To achieve this additional nutrients have to be added. Zontek (1990) showed that new sand based constructions required 500gN/100m2 in a soluble form and 500g N/100m2 in a slow release form to achieve optimal growth.

On high sand containing areas slow release forms of nitrogen are preferable as Nelson 1987 showed that most of the nitrogen applied in a soluble form had gone within 72 hours of application with 50% having gone within the first 24 hours.

Bentgrass

Typically cool season turf grasses are best established when planted in late summer/early fall and warm season turfgrasses are better suited for establishment during the hot months of late spring/summer. The ideal temperature range for seeding bentgrass is between 16° to 30°C, while temperatures, in the range of 24° to 35°C are required for the successful establishment of hybrid bermudagrass. Improper timing of planting may produce bare patches and may allow for the intrusion of weeds, disease and pests.

Use soil test results as a guide to determine how much starter fertilizer to incorporate into the seedbed. A rule of thumb used with success by many superintendents is to incorporate a 1-2-1 ratio starter-type fertilizer at a rate of approximately 450-500gN/100m2 of turf into the upper root zone just prior to seeding. Remember too try and use fertilisers which are safe to germinating seeds and have a low salt index. (Vavrek, B, 1999)

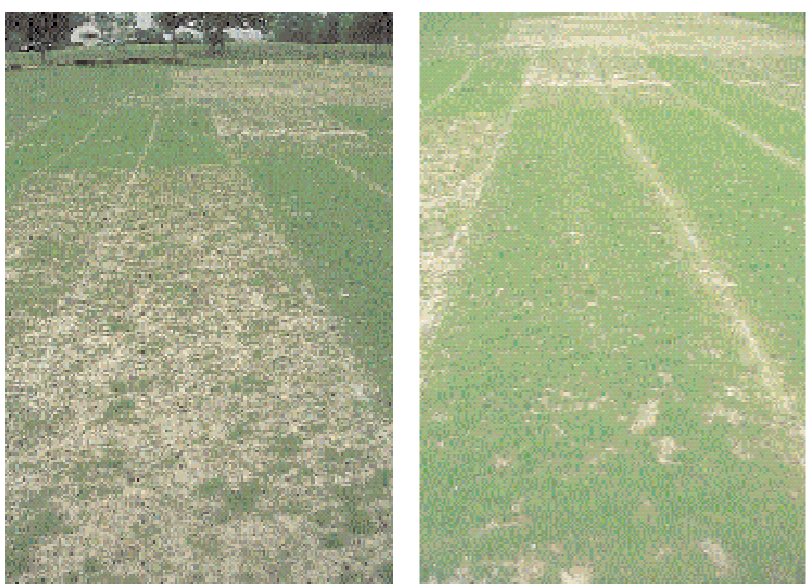
Couch grass

With couch the aim is to gain as rapid establishment as possible following sprigging. Sufficient water is critical as to is adequate nutrition. Being a warm season grass this has a high nitrogen requirement and thus two approaches can be used for establishment.

The first is applying nitrogen at a rate of 500g of N/100m2/week until it is grown in after around 6 to 10 weeks, after which time the rates are dramatically reduced to around 125g of N/100m2/week.

Alternatively research using soluble fertilisers has successfully shown that a progressive approach to growing in greens is possible i.e. 100gN for 2 weeks, 200gN for 2 weeks, 300gN for 2 weeks and 450gN for two weeks ((Miller, McCarthy and Rodriguez, 2000)

Unlike nitrogen and potassium, phosphorus is considered relatively immobile in most soils, although exceptions can occur in sandy soils. Phosphorus deficiencies commonly result from limited rooting during establishment. As phosphorus is less soluble and less movable by water, roots must grow to available concentrations of the nutrient. This is why most starter fertilizers contain ample phosphorus and are often incorporated throughout the root zone before planting.



An absence of phosphorus during TifEagle grow-in (left, from a 1:0:2 N:P:K fertilizer) is quite evident after six weeks, compared with grow-in with a phosphorus-containing fertilizer (right, 1:1:1).

So how much nitrogen, phosphorous and potassium fertilizer should be applied to sprigged bermudagrass?

The construction of new USGA research greens at the University of Florida and Clemson University provided opportunities to examine combinations of fertilizers to aid in the establishment of dwarf-type couch. The objective was to evaluate five different N:P:K fertilizer ratios for the establishment of FloraDwarf, Tifdwarf, and TifEagle bermudagrasses (*Cynodon* species).

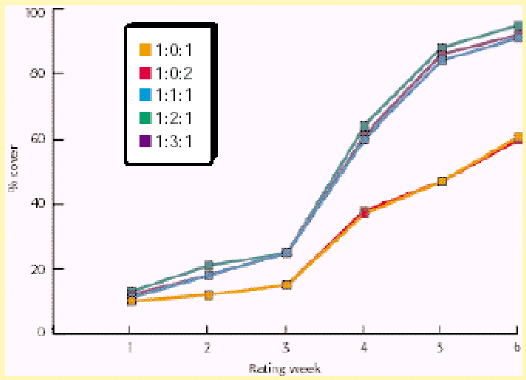
Five N:P:K fertilizer ratios were applied as treatments. Rates consisted of N:P2O5:K2O ratios of 1:0:1, 1:0:2, 1:1:1, 1:2:1, and 1:3:1. All treatment ratios were based on a nitrogen rate of 500g square metre per week. Preliminary soil tests indicated insufficient amounts of N, P and K for quality bermudagrass growth. To quantify the effects of the treatments, data collected included weekly ratings for percent cover, final shoot weights and final root weights.

Conclusions

This study indicates the need for more than just nitrogen fertilizers during the establishment of bermudagrasses on nutrient-poor soils such as sand-based greens. In the case of phophorus, it was apparent that simply increasing the amount applied will not necessarily increase growth. The 1:2:1 and 1:3:1 ratios in both studies were either the same or inferior in terms of growth compared with the 1:1:1 fertilizer treatment. This indicates that excessive rates of phosphorus are not beneficial once adequate amounts have been applied.

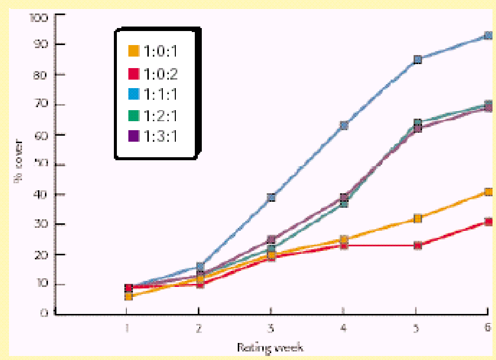
Complete fertilizer provided at least a two-week advantage at 50 % total coverage in both studies. The comparatively poor responses to 1:0:1 and 1:0:2 ratios in both studies indicate that nitrogen and potassium are unable to substitute for a balance of nitrogen, phosphorus and potassium.

TifEagle establishment



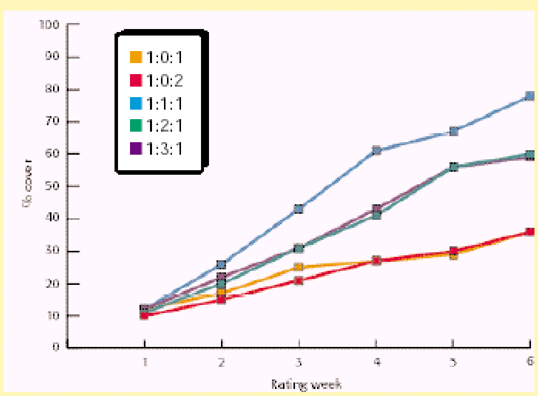
Percent cover for TifEagle bermudagrass under five fertilizer treatments during establishment in Clemson, S.C.

FloraDwarf establishment



Percent cover for FloraDwarf bermudagrass under five fertilizer treatments during establishment in Gainesville, Fla.

Tifdwarf establishment



Percent cover for Tifdwarf bermudagrass under five fertilizer treatments during establishment in Gainesville, Fla.

These studies indicate the need for balanced nitrogen, phosphorus and potassium nutrition when establishing couch on deficient soils.

Applications of all three nutrients in the right combination for a particular soil can ensure the desirable rapid grow-in and best rooting when establishing bermudagrass from sprigs.

Nutrient applications

Table 7. Recommended annual phosphate (P) applications (Bray P1- Extractable

SOIL TEST G/M2	GENERAL TURF KG/100M2	HIGH MAINTENANCE TURF KG/100M2
VERY LOW <0.74	1.5	2
LOW 0.79-1.22	1.0	1.5
MEDIUM 1.27-1.97	0.5	1
HIGH 2.01-3.45	0	0.5
VERY HIGH >3.45	0	0

Based on figures supplied by Michigan State University Soil testing Lab

Table 8. Recommended annual potassium (K) applications

SOIL TEST G/M2	GENERAL TURF KG/100M2	HIGH MAINTENANCE TURF KG/100M2
VERY LOW <1.4	2.0	2.5
LOW 1.4-9.4	1.5	2
MEDIUM 9.4-16.3	1	1.5
HIGH 16.3-23	0.5	1
VERY HIGH >23	0	0.5