

## Principles and practice of pitch preparation

*Produced under the auspices of the United Cricket Board of South Africa  
Prepared by NM Tainton, JR Klug, D Edmondson & RK Campbell (University of Natal) and P  
W van Deventer & M J de Beer (Potchefstroom University).*

### **Foreword**

*It is a fundamental principle that you cannot play good cricket on poor wickets. The United Cricket Board of South Africa has decided that it should play a leading role in upgrading the knowledge available to groundsmen for the preparation of turf wickets throughout South Africa.*

*To this end it has been most fortunate to secure the services of a team comprising members from the Universities of Natal and Potchefstroom to help it with this substantial and important task.*

*The publication of this book on the preparation and construction of turf pitches is a very welcome step in the process and the United Cricket Board is most grateful for the high quality work and energy that these universities have put into both the preparation of this book and the assistance that they have given those groundsmen responsible for preparing cricket pitches in South Africa.*

*We want this book to be regarded as a living document so that future editions will incorporate the increased experience and knowledge currently being generated, as well as the results of the research programme to which the United Cricket Board has committed itself.*

*We are very grateful to Professor Neil Tainton and his team from Natal University, and Piet van Deventer of Potchefstroom University for their great efforts in making this publication possible.*

**R C WHITE**

*Vice President: United Cricket Board of South Africa*

# Contents

1. INTRODUCTION
2. WHAT DO WE SEE AS BEING A GOOD PITCH?

For a four or five day game  
For a one day limited-overs game  
For one and two day club games

3. FACTORS DETERMINING PITCH PERFORMANCE

- (i) The bulli
- (ii) Pitch preparation - what to aim at
- (iii) The type of turf to use
- (iv) Cracking
- (v) Powdering and crumbling
- (vi) Do pitches deteriorate with age

4. GENERAL MANAGEMENT FACTORS

- (i) Overcoming layering
- (ii) Drainage
- (iii) Topdressing
- (iv) Incursion of grass from the outfield
- (vi) Maintenance of footholes

5. FERTILISING
6. PESTS, DISEASE AND WEED PROBLEMS
7. THE USE OF HESSIAN OR BIDUM
8. TESTING PROCEDURES

- (i) Physical tests on bulli
- (ii) Motty or Adams/Stewart Soil Binding test (ASSB)
- (iii) Chemical tests on bulli
- (iv) Chemical tests on irrigation water
- (v) Sampling procedures.
- (vi) Testing pitch performance

9. PITCH CONSTRUCTION
10. OTHER EXAMPLES OF PITCH PROFILES
11. RELAYING A PITCH
12. WINTER OPERATIONS
13. PITCH PREPARATION

Hints which may assist in choosing the right techniques  
Personal Guidelines

## REFERENCES

ABBREVIATED CONSTRUCTION RECOMMENDATIONS FOR SCHOOL AND CLUB  
CRICKET PITCHES

## 1. INTRODUCTION

A recent survey undertaken by the above team has shown that the quality of Provincial pitches varies considerably. Their pace, after preparation for four day matches, varied from medium to very slow, their bounce from medium to low and their consistency from reasonably consistent to very inconsistent. The same pattern is likely to be found among club and school pitches.

To overcome this problem the UCB has decided to put a help-line in place to assist groundsmen with their problems. Two teams (one at Potchefstroom University for the inland pitches and one at Natal University, Pietermaritzburg, for the coastal pitches, have been nominated to do this). It is hoped that these two teams will be able to assist in the following ways:

- give a series of seminars to groundsmen;
- visit each of the Provincial groundsmen for discussions on any problems they may have;
- search for a source of good quality bulli for each of the Provinces; and
- provide the Provincial groundsmen with the necessary equipment to measure the bounce and pace of their pitches and to correctly sample their pitches for any laboratory tests which they would like undertaken. Clubs might be able to negotiate with the Provincial groundsmen for the use of this testing equipment.

Any groundsmen would be free to contact either of the teams for advice, but any costs associated with any such action (beyond those listed above) would need to be borne by the Province or the clubs involved. Addresses are given at the back of this document.

It needs to be said at the start that, in pitch preparation, there may be any number of ways of reaching a particular goal. All groundsmen are likely to have developed their own particular procedures with which they may be entirely satisfied. Indeed, if the testing procedures which will be referred to later in this document show that they are consistently producing pitches which meet their particular goals, then there is presumably no need for them to change the procedures they are using. What we intend to do in this seminar, however, is to stimulate discussion among the groundsmen and to encourage groundsmen to think about what they are doing by providing them with the basic principles governing pitch behaviour. An understanding of the principles behind a good pitch will, we are sure, add a great deal of job satisfaction to the task of preparing a good cricket wicket. We hope you all find the seminar helpful and, above all, stimulating and we hope that you will all involve yourselves fully in our discussions.

## 2. WHAT DO WE SEE AS BEING A GOOD PITCH?

We may all have different ideas on how an ideal pitch should behave (depending perhaps on the bowling strengths of our side at any time) and the ideal pitch will vary according to the duration of the intended game. We need to define what we want before we can set down our procedures. For the purposes of this seminar, we define an ideal pitch as follows:

### **For a four or five day game**

#### *Day 1:*

The pitch should be quite moist, with some green grass on the surface (not all will agree with this, as in the Australian examples which will be discussed later). A green

surface will allow the ball to seam around a bit (later we will explain why greenness promotes this movement). The pitch should have consistent pace and bounce.

*Days 2 & 3:*

The pitch will have dried out and should become more bouncy and it should quicken up (provided it does not crack badly by becoming too dry too quickly). It will have lost its greenness and so should not seam around much. The ball should come nicely onto the bat and the pitch should now be ideal for batting.

*Day 4:*

The surface should start to powder and the cracks will start to open up. This will slow the pitch down. It will become less bouncy, the bounce will become more inconsistent and it will start to take spin.

*[Day 5:*

The above pattern will be accentuated as the pitch wears further.]

### **For a one day limited-overs game**

The general requirement here is for a pitch which will favour the batsmen. The ideal would be to produce a pitch equivalent to that on the second or third day of a five day game (described above) but of course without the wear. This suggests that water should be withheld for one to two days longer than for a five day game to allow it to dry out for a day or two longer.

### **For one and two day club games**

Since such games are seldom limited overs games and do not have a contrived result, the pitch here would need to have more life than that for a one day limited overs game. This could be achieved in a number of ways, such as by deliberately producing a green-top or a spinners wicket (hopefully not by having to resort to sprinkling bulli dust over the pitch to promote this). We hope to explain how such pitches can be produced later during this seminar.

## **3. FACTORS DETERMINING PITCH PERFORMANCE**

There are four main elements to a good pitch:

- (i) the nature of the bulli;
- (ii) the way in which the pitch is prepared;
- (iii) the way the water content of the bulli is controlled; and
- (iii) the type of turf used.

### **(i) The bulli**

#### *(a) bulli composition*

The nature of the bulli determines the maximum pace and bounce that can be achieved. The South African and Australian pattern is to use bulli with strong swell/shrink characteristics i.e. bulli which swells when it is wetted and shrinks when it dries, and which is able to provide a pacey bouncy pitch. This characteristic is brought about by a high content of what is known as 2:1 swelling clays. These clay soils have a high binding strength (which is closely correlated with bounce and pace - the greater the binding strength the greater the pace and the higher the bounce). Organic matter in the bulli will have a dampening effect of both pace and bounce.

Alternatively, a high sand content in the bulli will help to provide grip to the ball when it comes into contact with the pitch. This will slow the pace of the ball but will allow for greater turn.

Published reports suggest that ideal bulli should comprise the following fractions:

Clay: pitches	50 - 60% (Note that English and New Zealand have much lower levels than this - down to 30%)
Coarse sand:	< 10%
Calcium carbonate: our	< 5% (this is often found as whitish nodules in heavy clay soils, so avoid such soils). No visible reaction should take place when hydrochloric acid (10% dilution) is added to dry soil
Sodium: high in can is not content, when	< 5% (sodium levels are, unfortunately, rather high in the coastal pitches but there is nothing much that can be done about it except to make sure the problem is not accentuated by using bulli with a high sodium content, or regularly watering during the heat of the day when evaporation rates are high)
Linear shrinkage: pitch will	0.08 to 0.15 (the higher this is the more the pitch will crack)
Organic matter: strength	< 5% (organic matter in the soil reduces binding strength and so reduces pace and bounce)

If the clay content of the bulli is too high, cracking becomes a major problem. Cracking is not only dependent on the clay content but also to a large extent on the type of clay mineral dominant in the bulli. It seems also that cracks can become permanent in that they may not close up even on watering if a thick stone drainage layer exists under the bulli. This complicates pitch preparation and it is probably impossible to consistently produce a good pitch with such bulli. Note also that clay percentages can be lower than the above for club and school pitches which do not need to last for four to five days of continuous play.

The bulli should contain no gypsum or any other salts, since this promotes crumbling. Finely divided limestone in the bulli will also cause crumbling, as will a high salinity.

#### *(b) bulli depth*

Recommendations for the depth of bulli required are that it should be sufficiently deep to create a hard bound surface but not so deep that drying becomes difficult. Recommended

depths range from as little as 70 mm to 150 and even 300 mm. The longer the pitch has to last, the deeper must the bulli be and for Provincial pitches we suggest that it should not be less than about 150 mm. One means of reducing the amount of bulli used during construction is to increasingly dilute the bulli with sand with increasing depth down the profile, but the upper 100 mm or so should always comprise pure bulli.

## **(ii) Pitch preparation - what to aim at**

### *(a) The condition of the turf*

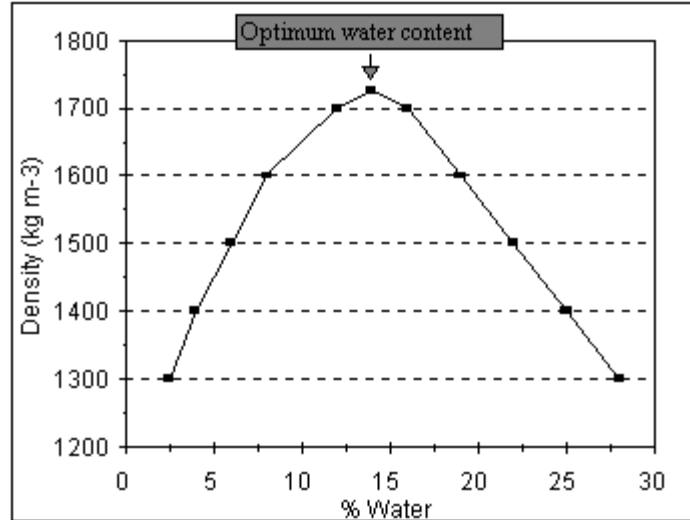
We suggest that our aim should be a pitch well covered with grass and with some green grass on the surface when play starts (although not all would agree with the need for surface green grass). The evenness of the grass turf is particularly important since patchy grass will cause patchy drying and areas which are not occupied by grass will crack excessively at the surface but remain moist at depth (because there are no roots to pump out the water).

Of interest here is the reason for the apparent gain in pace of the ball when it strikes a greentop and the very definite deviation which can be achieved. The former results because the ball loses very little pace when it comes into contact with the 'lubricated' surface produced by the green leaf material and, because it tends to keep lower than on a non-greentop, it reaches the batsman sooner than it would have had it bounced higher (note that it is physically impossible for the ball to actually gain in pace on pitching). The ball seams more readily because the difference in the friction between the seam and the playing surface and the non-seam and the playing surface is higher on a greentop than a non-greentop. We assume here that the seam still bites into the pitch whereas the non-seam portion of the ball will slide through with little resistance from the succulent grassy surface. The ball will therefore seam in the direction of the seam.

### *(b) Moisture content of bulli*

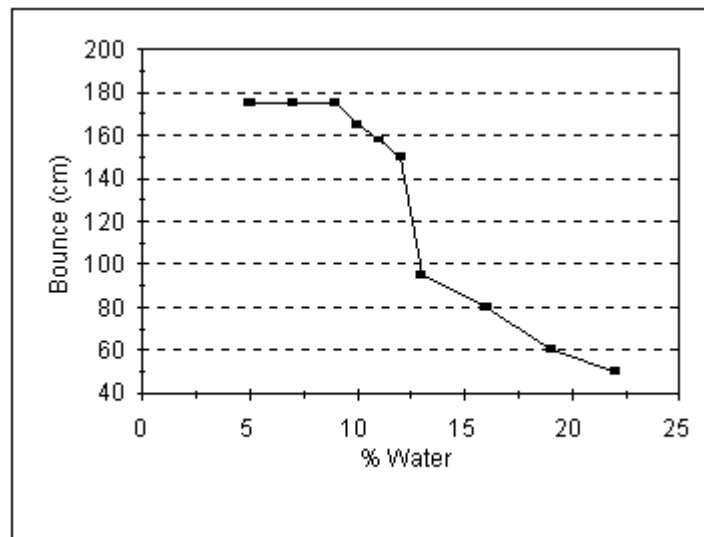
The ideal water content for maximum compaction is known as the optimum water content (Hillel, 1980) (Figure 1). Determining the optimum water content is time consuming, but once known for a specific bulli, it can be used to assist in achieving a range of compaction options.

The pitch should preferably have an even moisture content down to at least 75 mm and deeper since the nature of the bulli throughout this depth will affect the pace of the pitch. This can be achieved only at the start of play and then only provided there is a sufficiently well developed root system and enough active grass leaf to dry out the subsurface layers. During preparation it may be necessary to reduce moisture loss from the surface by covering the pitch with hessian or shade cloth (or by spreading grass cuttings over areas which are not well grassed - more of this later). Alternatively, the pitch can be syringed (wetted with a fine spray) at intervals during the day or in the evening before the covers go on to moisten the surface. Syringing in the evening is probably preferable as it allows time for the water to soak into the surface layers of the pitch. Please note that slow and deep drying is preferable to rapid and surface-only drying.



**Figure 1.** Typical water content - density curve indicating the maximum density at the optimum water content for a particular compaction effort.

The pace of the pitch will increase as it dries from some very wet state to some intermediate moisture content, when it will then slow down as it dries further (see Figure 2).

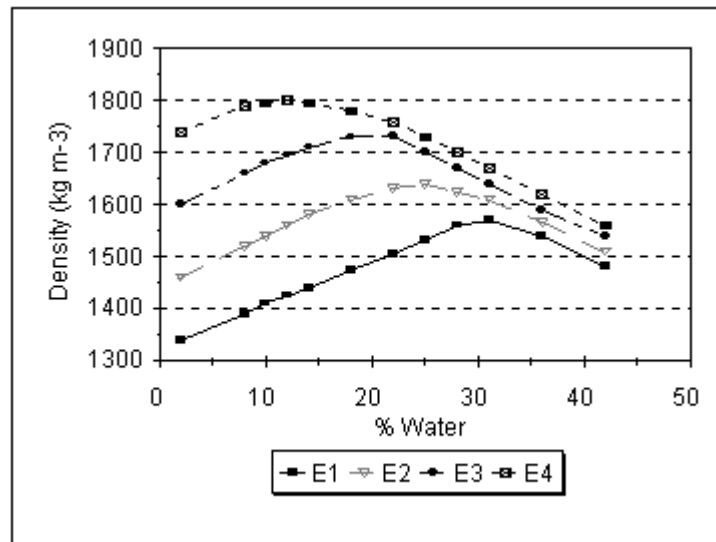


**Figure 2.** Relationship between water content and bounce on a clay sample over a twenty day period under laboratory controlled conditions.

The moisture content at which the change takes place varies with the nature of the ball. For four and five day games, the pitch at the start of play should normally be at a moisture content greater than that which will give maximum pace so that it initially speeds up with further drying. For a one day limited-overs game, the pitch should be near that moisture content which will give maximum pace.

*(c) Compaction*

The greater the compaction, the higher the bounce and the faster the pitch. To maximise these two, compaction down to a depth of 100 mm should be at least 80% of the maximum potential of the bulli to compact (measured as the bulk density of the bulli i.e. the weight of bulli per unit volume). Such compaction is best achieved by rolling with a roller of appropriate weight when the bulli is at an appropriate moisture content. The marrying of these two is difficult for any groundsman. It is possible to establish this relationship through research (it will vary from bulli to bulli) but the problem is in applying this information in practice. Some results of the different densities achieved when different energy levels are applied are shown in Figure 3. It is clear that when a light roller is used, the optimum water content is higher than would be the case when using a heavier roller, although one would then not achieve the same density.



**Figure 3.** Hypothetical example of different energy levels ( $E1 > E2 > E3 > E4$ ) producing different densities at different water contents. (Optimum water content differs at different energies).

Clearly, however, one has to start with uniform deep wetting of the pitch. Since the infiltration rate of bulli is extremely slow, it is preferable to apply water slowly and over a long period, and if possible at night since rapid evaporation during the day can lead to salt accumulation at the surface. Even where a pitch is badly cracked, the water which penetrates through the cracks still has to soak into the solid blocks of bulli between the cracks, and this takes time. Watering **must** be uniform or the resulting pitch will play inconsistently.

Compaction is then achieved by rolling regularly as the pitch dries. A frequent recommendation is to start with a light roller and to then increase the weight of the roller as rolling proceeds. The reason given for this is that it will create a surface seal. We are not convinced that this is necessarily a good idea. It is possible, though, that this seal will slow the rate of drying at the surface and, provided there is sufficient grass to ensure that water continues to be extracted from sub-surface layers, it may cause a more even drying of the soil profile. We must add, though, that our investigations of coastal pitches lead us to conclude that there was no need for a light roller, but we are prepared to be convinced that it has a role to play. Quite clearly, a heavy roller is needed to compact at depth and it should therefore be used before the deeper layers dry out too much. It must be appreciated that it is the weight of each single roller in a multi-drum roller that is important, and not the combined weight of all the drums.

A good pre-season heavy rolling should help the groundsman to achieve the required compaction more easily than if the pitch is not rolled with a heavy roller at this time.

Rolling on a dry surface, or the use of a vibrating roller, are not generally recommended. Both promote horizontal cleavage in the bulli and may severely damage the root system of the turf grasses.

*(d) Thatch*

Thatch results from the build-up of organic matter at the surface. (Interestingly, dung used to be sprayed onto pitches in England in the early days to deliberately produce lifeless pitches - no doubt spurred on by the great WG). Thatch build-up should be avoided at all costs. Whether it lies on the surface or within the profile, it acts to cushion the impact of the ball and will slow the pace of the pitch (although it will increase the bounce of moderate to slow paced pitches). When buried in the profile (where it forms an organic matter sandwich) it gives rise to independent layers of bulli. This has a severely negative impact on the pace and bounce of the pitch and is considered to be the main cause of low and uneven bounce on otherwise well prepared pitches. Thatch accumulation is therefore to be avoided at all costs. Dead material should be removed at regular intervals through the season (preferably by verticutting, but if a verticutter is not available, then scarifying and heavy brushing) and particularly before any top-dressing material is applied. All the dead material which is loosened must be removed and care needs to be taken not to sweep this material into cracks. This would prevent the bulli from binding when wetted.

A well known method of stabilizing a degraded pitch is to put some fresh grass clippings on the area to be stabilized and to roll the clippings into the surface of the clay while it is still fairly wet. There are questions as to when and how much of the clippings to put on and what the long term effect of this practice is on the pitch? Figures 4 & 5 provide a summary of some work done in this regard.

Figure 4 shows the effect of adding clippings to the bounce which is achieved. Since moisture content declined steadily with the number of days after compaction that readings were taken, this graph also shows the effect of declining moisture content on bounce.

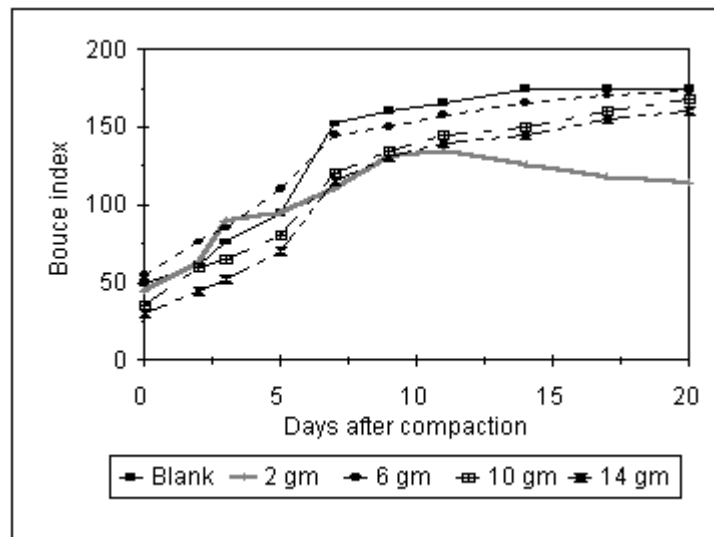


Figure 4. Qualitative contribution of rolled-in clippings to bounce over a period of twenty days under Laboratory controlled conditions.

Figure 5 shows the negative effect of adding organic matter to bulli on the modules of rupture (crust strength) of the bulli. The lower this is, the sooner will the pitch begin to crumble. Adding clippings will therefore promote the early break-up of a pitch.

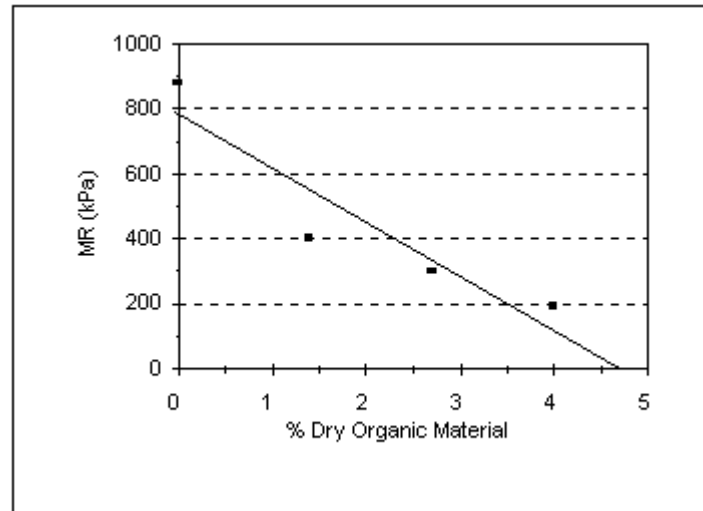


Figure 5. The influence of dry organic matter on the modules of rupture (MR) - a measure of soil strength. ( $MR = 764.54 - 162 \times \%OM$  ( $r = -0.93$ ))

The danger of layering caused by dead material is the main reason why we do not recommend the use of grass cuttings on pitches since once rolled into the pitch, this material is often difficult to remove completely.

Note that any organic material, including dead and living roots in the profile, will reduce soil strength and therefore the pace and bounce of the pitch, although living roots in particular should

help hold the pitch together and prevent the cracks from opening up too much as it dries. However, there is not a lot we can do about this. We can, however, prevent thatch build-up at the surface and, by correct mowing practices, reduce root die-back.

#### *(e) The use of variable top-dressing*

Topdressing with material which has very different swell/shrink characteristics from the existing material will also cause layering since the different materials will not bind together well. Such layering is then often exaggerated when grass roots follow the horizontal cracks between the layers of different material. It is important, therefore, to use top-dressing which has similar swell/shrink characteristics to the pitch bulli.

#### *(f) Mowing*

Not more than 30 to 40% of the leaf material should ever be removed at a single mowing. More intense mowing than this would severely retard the development of the root system and cause some of the roots to die - further adding organic matter to the pitch. Therefore, it

is often recommended that the cutting height be gradually reduced during preparation. This also means that a greater amount of leaf will remain on the pitch during the preparation period, allowing the grass to more effectively dry out the sub-surface soil.

#### *(g) Layering*

All pitches should be free of horizontal layering since this deadens the pitch (and so reduces bounce and pace), promotes shallow rooting (since roots will penetrate to the layer and then grow horizontally instead of proceeding into the next layer) and results in uneven moisture distribution through the pitch profile. Layering is caused by the incorporation of organic matter into the profile, as when topdressing is applied on a pitch which has a quantity of plant material on the surface (to form an organic matter sandwich); when different types of bulli are laid on top of each other; and when a pitch is rolled when its surface is dry but the bulli below the surface is moist. Layering can also be caused by using a vibrating roller, particularly when the pitch is relatively dry.

#### *(h) Irrigation*

- Irrigation is best done by using sprinklers which give a fine mist spray. Large droplets are likely to cause 'potholes' on the pitch.
- Avoid pools of water lying on the pitch surface. Water penetrates bulli very slowly.
- After irrigation, grass cuttings often collect at certain points on the surface. These cuttings must be brushed off the pitch.
- A hessian or bidum cover on the pitch in hot, dry, windy weather ensures good moisture retention by the pitch.

#### *(i) Aeration*

Grasses, being dependent upon an adequate supply of oxygen, respond favourably to aeration. Aeration is achieved by a soil-slitting machine, or by forking the surface at close spacing. A day after aerating, roll the pitch in a moist state with a light roller. Aeration practices assist in the penetration of irrigation water and of applied fertiliser.

#### **(iii) The type of turf to use**

In temperate countries, ryegrass is generally the chosen grass to use on pitches. In the tropical and sub-tropical regions, however, varieties of Bermuda (Cynodon, couch, kweek) are used almost exclusively for cricket pitches. Bayview Bermuda and Skaapplaas are now widely used, having replaced the Magennis which was used in the earlier days.

The characteristics of the grass which are important are as follows:

- (a) the grass must obviously grow well in a heavy clay soil and under the local climatic conditions
- (b) it should be able to tolerate wear well (so it should have a good underground root system)
- (c) it should preferably also have a strong rhizome (underground stem) system since these rhizomes can play an extremely important role in binding the pitch together and in preventing cracks from opening out too wide (provided the pitch is evenly grassed).

#### **(iv) Cracking**

As a pitch dries, the bulli shrinks and so cracks develop. These should disappear when the pitch is again wetted.

The impact of cracking is to reduce bounce and pace, and increase variability. It should also increase the amount of spin that a pitch will take, but turn in badly cracked pitches is likely to be inconsistent.

The cracking pattern will influence the behaviour of a pitch. It would clearly be undesirable for cracking to become so severe that the blocks of bulli between the cracks become unstable. This is likely to occur if the pitch is layered close to the surface. We believe, however, that a pattern of many fine cracks is preferable to only a few large cracks.

As mentioned earlier, a strongly rhizomatous grass is preferable to a surface grower as the rhizomes can be extremely effective in holding the pitch together.

#### **(v) Powdering and crumbling**

When a pitch powders or crumbles as it dries, the surface roughens. This allows the ball to grip when it pitches and so it will turn. The lower the clay content of the bulli, the greater will be its tendency to powder and crumble as it dries, and so the greater the tendency for the pitch to take spin.

#### **(vi) Do pitches deteriorate with age**

Three things are likely to happen to a pitch as it ages:

- (a) it will develop layers, either because layers of dead leaf material are incorporated into the pitch or because different types of bulli are used as topdressing,
- (b) organic matter will accumulate from dead roots, making the pitch spongy, and
- (c) salts, derived from either fertiliser or from irrigation water, may accumulate at the surface.

Careful management will control the build-up of thatch and the accumulation of salts at the surface, but there is nothing much that can be done about the build-up of root organic matter.

### **4. GENERAL MANAGEMENT FACTORS**

#### **(i) Overcoming layering**

Layering can be partially alleviated by hollow-tining or drilling the pitch and filling the hollows with new bulli. However, the only way to fully regenerate a layered pitch is to re-lay it completely.

#### **(ii) Drainage**

Most drainage problems in cricket pitches result from water penetrating under the table from the surrounding areas since water infiltrates only slowly into the bulli itself. In most situations

a gravel bed under the whole table is not considered essential, but the square must be surrounded by a ring drain. This should be close enough to the surface to allow a fork to be used to get rid of surface water. The ring-drain should lead into a sump connected to a drain which will lead the water from the field. Where waterlogging is a potential problem, a firm foundation should be produced from angular 6 - 10 mm diameter gravel. Bulli/sand mixtures can be used to ease the transition from the gravel to the pure bulli.

On the pitch itself, surface runoff should be the main mechanism of getting rid of excess water. Pitches should be level between stumps but always have a crossfall of between 1 and 2% (i.e. a minimum of 3cm per pitch).

The saddleback problem arising from frequent top-dressing of the ends of the pitch (to repair bowlers foot marks etc.) must be avoided or water will concentrate at the centre of the pitch.

### **(iii) Topdressing**

As mentioned earlier, topdressing material should always have similar swell/shrink characteristics to the underlying soil and it should never be spread over a layer of thatch. Also, the pitch surface, if smooth, should always be scored until rough to allow for good bonding between the topdressing and the underlying soil.

### **(iv) Incursion of grass from the outfield**

The first control step should be taken when the pitch is first constructed. It is a wise precaution to insert, all round the wicket area, a perimeter barrier such as plastic sheeting to a depth of 25cm. While it is easiest to install this barrier at the time of pitch construction, it can be done at any stage.

A second valuable precautionary measure is to have a perimeter buffer, 1m wide, around the pitch. This area should be planted to the same grass as that used for the pitch itself. Outfield grasses can be readily controlled in such a buffer zone before they invade the actual pitch.

### **(v) Bare patches on the pitch**

The appearance of bare patches on the pitch is not uncommon. The areas most exposed to damage are the footmarks caused by the batsmen and bowlers. Provided these footmark areas are nursed by sweeping, lightky forking, light top-dressing, and adequate irrigation and resting, there is every chance of the under-surface stem system sending up new shoots. However, by the end of the season, footmark damage can be so serious as to necessitate replanting these areas.

A second possible cause of bare patches is localised fungal infection, leaving areas where the grass has either been killed or is badly discoloured. If there is no revival after 2-3 weeks, such patches will require replanting or patching with grass sods, provided identical bulli sods are available.

Also possible is damage by fertiliser burn. This may occur if there are slightly hollow areas on the pitch surface into which fertiliser, applied to the pitch surface, is concentrated during irrigation. Replanting may then be necessary, paying particular attention to building up all hollows with top-dressing.

## **(vi) Maintenance of footholes**

In wet weather, the Umpires should ensure that the holes made by bowlers and batsmen are cleaned out and dried whenever necessary to facilitate play. In matches of two or more days duration, the Umpires should allow, if necessary, the reurfing of footholes made by the bowlers in their delivery stride, or the use of quick-setting fillings for the same purpose. The 'underpinning' method is recommended for this. Grass clippings may also be used to temporarily solve the problem.

## **5. FERTILISING**

Phosphorus, potash, calcium, magnesium and sulphur should be applied according to soil test (note that there should always be less magnesium than calcium in the bulli and that superphosphate should not be applied too liberally because the sulphur it contains will promote crumbling).

Nitrogen is applied according to demand. It should be applied regularly through the season - the smaller and more often the dressings are applied, the better. Nitrogen stimulates growth, darkens the green colour of the grass and promotes succulence. As a general rule, no more than about 6 g N/m<sup>2</sup>/month should be applied and around 3 to 4 g/m<sup>2</sup>/month should be sufficient (this translates to 15 to 20 g Ammonium sulphate or 11 to 14 g LAN). If too much is applied, the grass will become too soft and will wear poorly.

Nitrogen is generally applied as LAN, but Ammonium sulphate can be applied if sulphur is in short supply. A slow release form of nitrogen fertiliser can be useful in that it provides the grass with a more regular supply of nitrogen.

If the pH level is above 7, uptake of micronutrients (Copper, Manganese, Zinc, Boron and Molybdenum) will be inhibited. To reduce the pH of bulli is almost impossible, so in these circumstances, one should rather make use of foliar feeds such as Supafeed to provide the necessary nutrients and to spray it directly onto the turf with a knapsack sprayer at least twice in the season.

Note:

(i) Phosphorus promotes root growth. It normally needs to be applied only once a year, in early spring. Where wintergrass is a potential problem, it should not be applied in the autumn as application at this time will promote the growth of this weed.

(ii) Potash promotes hardness and so is important for increasing the 'wearability' of the turf. It should be applied regularly through the season (perhaps in three applications - early spring, mid-summer and in autumn, remembering that excessive levels of potash will reduce the strength of the bulli).

(iii) nitrogen promotes growth and succulence. Excessive amounts decrease the tolerance of the grass to wear and disease, and if applied too late in the summer and autumn can increase wintergrass problems where this weed is a potential problem.

It is important to note that the proper way to manage fertilising is to have the soil analysed each year. The analyses should then be interpreted and an appropriate fertiliser programme, based on these analyses, worked out.

## 6. PESTS, DISEASE AND WEED PROBLEMS

Insect pests do not seem to create any major problems with the turf of cricket pitches, while in general diseases are likewise not seen as a major problem. Fungal diseases can, however, affect the growth of the turf grasses in some areas and here the appropriate fungicides need to be applied at regular intervals to eliminate this problem. Where fungal diseases are encountered, turf from infected areas should be sent to a plant pathological laboratory (most Universities can provide a diagnostic service) for identification of the organism involved. The fungus can then be treated with the appropriate fungicide.

Reports have been received of the development of algae on the surface of cricket pitches. This would generally seem to result from poor drainage, with the affected areas remaining moist for extended periods.

The two most important weeds of cricket turf in South Africa are wintergrass (*Poa annua*) and watergrass (species of sedge). The former can readily be controlled using pre-emergence herbicides applied regularly during autumn and winter (perhaps three applications in March, May and June, with an additional application in August if there are signs of germination of the wintergrass). Sedges need to be controlled by applying appropriate selective herbicides when they are actively growing in spring and summer.

Groundsmen are advised to refer to persons dealing with agricultural chemicals for advice on appropriate herbicides and fungicides for their particular situations.

## 7. THE USE OF HESSIAN OR BIDUM

The use of hessian or bidum as an aid in the maintenance and preparation of cricket pitches deserves special mention. In the warm, dry, and often windy conditions experienced in the South African summers, hessian or bidum is an essential item in the groundsman's kit.

### (i) During pitch preparation

Where it is necessary for the roller to be used to prepare, for play, a pitch which is wetter than optimum, there is a danger of the roller picking up the bulli and so spoiling the pitch surface. Such damage can be avoided by laying a hessian cover over the pitch and rolling first with a light roller. In so doing, excess moisture is absorbed by the hessian and the pitch is protected. Light rolling for a short period assists in bringing the pitch surface to a suitable state for a heavy roller to be used. Hessian can, with advantage, also be used when the first rollings are given with a heavy roller. If the pitch is very wet, and unfit for rolling, hessian or bidum can be used to mop up excess moisture and any pools of water. Special importance is attached to the use of hessian or bidum in the preparation of practice nets, where the practice pitches have to be prepared three or four times a week with copious watering after each period of use.

### (ii) To preserve moisture in the pitch

It is considered an advantage that at the start of play the prepared pitch should contain some moisture rather than be too dry. In our climate, and specially on hot, windy days, bulli dries out very rapidly. The drying process can be retarded by ensuring that the work of the heavy roller is stopped just before the pitch is too dry, that is, before the colour of the bulli changes from black to grey. If the rolled pitch is then covered with hessian, the final stages of drying out will be retarded so that the pitch is in prime condition at the start of play.

### (iii) In pitch maintenance

Apart from the fact that the turf cover on cricket pitches is expected to survive the harsh treatment of constant close cutting with a mower, and the bruising effects of rolling, the natural ability of the grass to grow is still further hindered by the long periods that the pitch is dried out. Pitch soil, being black in colour, absorbs heat and becomes so hot that new growth of grass tends to be scorched. In addition, there is the pounding effect of the cricket ball and the effect of sharp studs now in common use on boots. It is indeed remarkable that the grass cover of a turf pitch can possibly survive such rough treatment, and it is not surprising that, from time to time, bare patches tend to develop, apart from those areas which are torn up by footmarks of the players.

It is in the treatment of worn areas that the groundsman can look to hessian or bidum to help.

By laying hessian or bidum over the worn areas of a pitch, soil moisture, so vital to allow for the recovery of the grass, can be maintained without any danger of stress arising from the soil becoming too dry. Secondly, the pitch soil is kept cool and protected from the wind and hot sun, thus giving optimum conditions for the grass to survive.

Sufficient light for growth gets through the hessian. Thus, with a good soil moisture level, cool temperatures, protection from wind and very hot sun, and sufficient light, there is set up an environment for growth which is of the utmost value in preserving the turf cover of the pitch.

The use of hessian or bidum for these purposes has been tested many times, and almost invariably with remarkably successful results. Even in cases where the grass seems to have been permanently destroyed, the hessian treatment has allowed for renewal of root growth and the re-appearance of the grass cover.

## 8. TESTING PROCEDURES

The following procedures can provide useful information to groundsmen.

### (i) Physical tests on bulli

Information on the physical nature of the bulli (clay percentage, swell/shrink characteristics etc.) will provide groundsmen with information on the suitability of any sample of bulli for use in constructing a pitch, or for use as topdressing. This information can also be used as a guide to the best rolling procedures to use but more work will need to be done on this aspect to allow groundsmen to use these procedures.

*Required sample size: **About 500 grams.** Provincial offices will have current delivery instructions and costs, as well as a supply of sample boxes and Soil Testing Submission forms. Please use these when submitting bulli for tests.*

### (ii) Motty or Adams/Stewart Soil Binding test (ASSB)

This test provides data which have been shown to correlate well with rebound height when a ball is dropped vertically using a bounce meter (which in turn has been found to correlate well with the amount of bounce and the pace of a pitch). It is a test which does not need sophisticated equipment and can be undertaken in one's office.

*Procedure:*

- (a) Transfer half a cupful of finely rubbed down soil (less than 2 mm) under test to a clean plate. To a second plate add a similar amount of a dry soil of which a large reserve is available. This second soil will serve as a standard for comparison with the test soil.
- (b) Moisten the two samples with distilled water if available (otherwise with tap water) until they can be moulded by hand. Water must be added slowly to ensure that the soil does not become too sloppy to mould (just as one would mix a cake batter).
- (c) Mould vigorously by hand over a period of 5 minutes to destroy all aggregates. Add more water if necessary.
- (d) Roll the soil into a ball and place it on a clean plate. Cover the soil with a wet cloth (wrung out by hand) and leave standing for 2 hrs.
- (e) Remould the soil by hand, making sure that it is plastic but not sloppy. It should have the consistency of putty and have little tendency to stick to the hands. It should also readily mould into a ball without forming cracks. Adjust moisture state if necessary by allowing it to dry further or by adding small amounts of water.
- (f) Roll the soil into a worm approximately 12.5 mm (0.5 inch) in diameter on a plate and cut into cylinders 25 mm (1 inch) long.
- (g) Carefully mould each cylinder into a ball and then roll between the palms of the hands.
- (h) Place the two sets of balls onto clean plates and allow to air dry in a cupboard for 5 days.
- (i) Place each dried ball in turn on a metal plate placed on a zeroed bathroom scale and break by slowly increasing foot pressure on a small flat metal plate placed on top of the ball. Note the reading on the scale when the ball breaks.
- (j) Discount the lowest value in each set and obtain the mean value of the rest.
- (k) Readings between 50 and 125 kg (110 to 275 lbs) have been shown to be optimum for British soils. We will need to do some work on our local soils, but would guess that our values could be much higher than this.

**(iii) Chemical tests on bulli**

These tests are needed to establish the fertiliser requirements of a pitch. These tests should normally include tests for phosphate (P), potash (K), calcium (Ca), magnesium (Mg), acidity (pH), salinity and, if possible, sulphur (S).

*Required sample size: **About 500 grams.** Provincial offices will have current delivery instructions and costs, as well as a supply of sample boxes and Soil Testing Submission forms. Please use these when submitting bulli for tests.*

**(iv) Chemical tests on irrigation water**

If there is any suggestion that the water may be unsuitable for use (because, for example, of its high salt content), it should be tested before use.

#### **(v) Sampling procedures.**

Great care needs to be taken to ensure that a representative sample is submitted to the laboratory for testing. When sampling loose bulli, therefore, a number of grab samples should be taken from different batches and thoroughly mixed. A sub-sample can then be taken from this mixture for submission to the laboratory for testing. Where an existing pitch is to be tested, a number of cores (about 15) should be taken to a depth of 100 mm, thoroughly mixed, and if necessary sub-sampled.

#### **(vi) Testing pitch performance**

A number of different procedures have been developed to test the performance of a pitch. These include, for example, the 'Clegg impact soil tester' but we have found the very simple and easy-to-use 'vertical bounce meter' to be an extremely useful instrument to test pitch performance. This instrument is used to measure the vertical bounce of a ball when dropped from a standard height (3.5 metres in our model but 4.9 metres in the instrument most commonly used - we found the latter to be extremely cumbersome to use). The bounce recorded using this meter has been found to correlate well with both the bounce that would be extracted by a bowler, and the pace of the pitch. Also, by taking a number of readings down the length of the pitch, one is able to determine an index of the inconsistency of the pitch. This very simple instrument, therefore, provides an indication of the bounce, pace and consistency of a pitch. It cannot provide an indication of the turn that could be extracted from a pitch. This is dependent on the roughness of the surface of the pitch. The rougher it is, the more the ball would grip when it pitches, and so the more it will turn. Theoretically, however, it would be possible to produce an instrument to measure this.

Instructions on use of bounce meter.

(i) Readings must be taken only from the danger area. A seamless hockey ball which weighs the same as a cricket ball (156g) is used, thus eliminating the variation in bounce height depending on whether the cricket ball lands on the seam or otherwise.

(ii) Always start at the same position, and record which end this is e.g. North, Duck Pond, Pavilion etc.

(iii) When taking readings, two people are required, one to hold the staff and the other to observe and record the height of bounce.

(iv) The staff-bearer must keep the pole perfectly vertical. If not, the ball will often hit the staff-bearers hands or the pole on its way down, or it will bounce too far from the pole for an accurate reading to be taken. If any of these things happen, the reading needs to be repeated.

(v) The observer should crouch at a convenient distance from the staff where he is not too close, nor too far to read the scale (usually about 1.5 to 2 metres). Readings (to the nearest cm) must be taken consistently. We suggest that these readings should be taken from the top of the ball (to standardise over all grounds).

(vi) For each test, take at least 20 readings, 10 along each side and finishing where one started. Please note where in the data set the change in direction took place. A convenient procedure is for the staff-bearer to take a step sideways along the length of the pitch after each bounce, with the observer crouching on the opposite edge of the pitch and viewing across it. An alternative method is for the staff-bearer to walk up the centre of the pitch, dropping the ball from first his left and then his right down the length of the pitch.

(vii) Blank recording sheets and an example of processed results are included at the back of this text. If bounce height readings are faxed to John Klug at 0331-2605708, they will be processed and returned in the format shown.

Some useful information has been gathered using a "Clegg hammer", and it has proved to be an effective way of measuring the actual hardness of a pitch. Unfortunately this is an expensive piece of equipment and is therefore not readily available to clubs and schools.

## **9. PITCH CONSTRUCTION**

Suggestions for a correctly constructed pitch

(a) Carefully assess the drainage requirements. Unless there is a danger of a perched water table developing, a perimeter drain surrounding the table should be sufficient to drain surface water and reduce lateral uptake of water by the table if a plastic lining is not present.

(b) Avoid elaborate (and unnecessary) combinations of a range of materials under the bulli. Medium crusher-run stone should be sufficient.

(c) Ensure that only good quality clay which has been analysed and passed as suitable is used.

(d) Consult widely and make certain that each stage of construction has been carefully researched and planned. Do not allow a hurried operation to justify short cuts.

(e) Be absolutely sure that adequate compaction occurs at every possible stage.

Summary: Recommended procedures for constructing tables vary considerably. Consult local Cricket Union groundsmen and follow proven specifications for your area.

A few examples are given here of recommendations which have been published (our additions are in italics).

Construction specifications will refer to the following factors:

(a) Base conditions and base layers. The general specification is medium crusher run stone.

(b) Each layer of material must be bonded or keyed into the layer below.

(c) The quality of clay must meet standard specifications. Refer to your Union groundsmen before deciding to purchase bulli.

(d) Good compaction must be achieved at each level and sub-level.

(e) Ten examples of pitch construction revealed that, on average, the total depth of excavation was some 450mm, of which the clay soil depth was 240 - 250mm (54%). Our information suggests that senior games lasting four or five days demand greater depth of clay for adequate preparation and strength. Shallow bulli must be avoided.

(f) Less than 100mm bulli is not recommended. Bulli of this depth should be compacted onto a stone layer and not onto loam or sand.

(g) Insert plastic sheeting between the table and the outfield to prevent encroachment of invader grass species.

*Example No 1.*

(i) Excavate table to 280 mm.

(ii) Lay strips of plastic down the edges of the excavation to prevent grass from entering the pitch area from the surrounds.

(iii) Add crushed stone to a depth of 150 mm. Compact the stone and then score the surface.

(iv) Apply 40 mm fine to medium gravel. Wet and compact. Score the surface.

(v) Complete filling with 90 mm of bulli, firming the material while filling. *(Fertiliser, and particularly phosphate, could be mixed in with the bulli at filling to promote root growth. The amount needed can be determined from analysis).*

(vi) If necessary, apply potash on the surface.

(vii) Plant sprigs 40 mm apart or spread sprigs over the area after watering, cover with a thin (5 mm) layer of finely crushed bulli and roll with a light roller.

(viii) Once established, topdress to level three or four times.

(ix) Fertilise monthly, irrigating the fertiliser in. Apply, in alternate months, 60 grams of 3.1.5 and 30 grams sulphate of ammonia per square metre.

(x) Roll in all directions - across, diagonally and in line with the pitch. Repeat this often after flooding.

(xi) Cut regularly to a height of 20 mm.

*Example No. 2.*

(i) Excavate to 300 mm. Slope base gently towards a sump, filled with stones, at one end. Compact base of excavation.

(ii) Line the vertical sides of the excavation with polythene/plastic.

(iii) Place 120 mm of 13 mm crushed stone into the excavation and compact. Mix in sand to assist with compaction.

- (iv) Add 80 mm of a loam soil and mix in 50 g supers and 50 g 2.3.2 fertiliser per square metre. Level, water and compact.
- (v) Add 100 mm bulli and compact.
- (vi) Wash grass sods to remove all soil and tease sprigs apart. Lay sprigs on bulli surface. Add a thin layer of sieved bulli to a depth of not more than 15 mm (sieve apertures 10 mm or smaller) over the grass and smooth.
- (vii) Apply 3.1.5 at 50g per square metre and water.
- (viii) Water lightly twice daily with a fine nozzle spray until grass shown signs of sprouting.
- (ix) Continue to water once daily until grass has covered.
- (x) Apply Ammonium sulphate or 4.1.1 fertiliser (50g per square metre) monthly and water.
- (xi) Once the grass is well established, topdress.
- (xii) Cut to 15 mm.
- (xiii) Rub in sieved (1.25 mm gauge screen) bulli, making sure that the grass tips protrude above the bulli.
- (xiv) Lightly water twice daily until grass shoots push through.
- (xv) Repeat (xiii) and (xiv) until the final level is reached which should be slightly above the level of the outfield.
- (xvi) Roll for half an hour with a hand roller in a dry state.
- (xvii) Once established, cut as short as possible and apply 3.1.5 and supers (25g/m<sup>2</sup> of each) and flood.
- (xviii) Commence normal preparation.

## **10. OTHER EXAMPLES OF PITCH PROFILES**

*Note: the layers referred to here are listed from the top to the bottom of the profile.*

### *Example No. 3*

This comprised the following layers:

Layer 1: 150 to 300 mm fumigated bulli (around 60% clay), the depth increasing the longer the expected duration of the games

Layer 2: a blend of the bulli with a sandy loam

Layer 3: 150 mm fumigated sandy loam

Layer 4: drainage (gravel) if required.

*Example No. 4.*

Layer 1: 80 mm of bulli

Layer 2: 40 mm of a 70:30 mixture of bulli and sand

Layer 3: 40 mm of a 50:50 mixture of bulli and sand

Layer 4: 130 mm of a fine/medium sand

Layer 5: 50 mm of coarse sand

Layer 6: 120 mm of 6 to 9 mm gravel

All this is surrounded, side and bottom, with a plastic membrane.

*Example No. 5*

(i) 150 - 200 mm bulli

(ii) 100 mm loose sand

(iii) 100 mm coarse sand

(iv) natural soil into which drains are cut.

*Example No.6 (Jack Manning):*

80 mm bulli; 40 mm gravel; 100 mm crushed stone

*Example No. 7 (Wanderers - old)*

300 mm bulli; 150 mm crushed stone

*Example No. 8 (Adelaide)*

300 mm bulli; straight onto a strong base

*Example No. 9 (Newlands - new)*

150 mm bulli; 300 mm laterite; 300 mm dune sand

*Example No. 10 (Maritzburg)*

250 - 350 mm bulli; 150 mm crusher run

**11. RELAYING A PITCH**

The need to relay a pitch is usually due to a sub-standard clay having been used initially or because the pitch has layered and is sheared horizontally, resulting in poor playing conditions. Bear in mind that both these factors are controllable, and that this state of affairs has expensive consequences considering that some 12 cubic metres of good quality bulli has to be procured and compacted into the pitch for re-establishment.

(i) Anyone planning to relay a pitch should follow the previous proposals, and consult and plan the operation to avoid preventable pitfalls.

(ii) Take into account those factors which resulted in the necessity to relay the pitch and ensure that previous mistakes are not repeated. Make certain that you are using the best quality clay possible.

(iii) If clay quality was not the problem, it is probable that the previous pitch had layered with organic matter and had sheared horizontally with habitual cracking.

(iv) Assuming that the pitch has adequate drainage and was well laid in the first place, it may be necessary to remove only the upper 150mm of bulli. The surface must be scoured and prepared to ensure proper bonding with the fresh material which is likely to have different characteristics.

(v) Ensure correct levels and reinstate barriers to prevent encroachment of invader grass species.

(vi) When establishing grass, be careful not to introduce a foreign growing medium into the pitch. Grass grown in bulli is suggested. An alternative method is to soften the final surface and rake before flooding and planting to a certified grass. Use washed grass sprigs (these can be washed with a high pressure hose to ensure that all the previous growing medium is removed). The sods are then teased apart. The washed grass sprigs are then spread on the surface, covered with sheeting and cross rolled a number of times. The sheeting can be left in place for a while (5 days) to keep the surface moist and water can be applied as necessary. Within one week the grass should have started to grow.

(vii) The whole operation should take six men about 10 hours.

Note: The pitch should not be played on during the first season to allow for good root development.

## **12. WINTER OPERATIONS**

Very little has been written about winter operations. Many cricket grounds are used for winter sports as well, and groundsmen are often frustrated by this.

### *(i) Post-season maintenance*

- Do not allow winter-sport activity to prevent essential attention being paid to the pitch.
- Repair damaged areas, remove all loose material and thatch.
- Remove invader grass and clean the surface.
- Replant bare areas using bulli plugs. Be sure the same bulli as in the pitch is used.
- Apply fertiliser.

- Apply a light dressing of bulli and level.
- Mow to 15 - 20 mm and water.

*(ii) Winter*

It is suggested that pitches should not be left unattended during this period. Thatch and foreign material should not be allowed to fall into the cracks, and grass growth should be encouraged as much as temperatures will allow. Drilling and decompaction can be undertaken during mid to late winter or early spring as dictated by climate. There is evidence that a follow-up pre-season compaction programme assists in setting up the table for better pitch preparation early in the season. Timing is a key factor as heavy duty operations which are left late can bring about serious problems if they have to be hurried for the start of the season.

Early spring is a vital period for root growth, and over-rolling and disruption may suppress this.

For Highveld conditions it is important to irrigate the pitch during winter (3 - 5mm every two weeks). The aim of this practice is not to lift the grass out of dormancy but to limit cracking and so damage to the root system.

The Highveld and Free State are faced with another problem that is not experienced in any other cricket playing country in the world. Due to very dry windless nights between May and August, severe frosts may completely kill the grass on cricket pitches. This reduces summer tolerance of the grass. Because frosts persist deep into August and even into September, the grass only starts growing in late spring. When the cricket season starts, the grass is still in a recovery phase and shows poor tolerance to wear and tear. The result is that the grass is damaged in such a way that it loses its ability to recover during the rest of the season due to the often very busy match programme. If one can simulate more favourable conditions during the winter on a micro scale to minimise frost damage, these problems could be eliminated.

Various hi-technology materials are currently being tested to overcome the frost problem. All have one common goal: they provide grass with a warmer day-time environment and warm air is retained close to the soil surface at night. Eight products are being tested and the initial results are very promising. The distribution agents of these products are most willing to assist in the planning and construction of frames and covers. They will be easily removable from the pitch and will look very similar to the rain-covers currently used in the U.K. These frames can be used in winter for frost protection, while in summer they are easily converted into very effective rain covers.

*(iii) Pre-season preparations*

If your ground was being used for winter sports, lay down fixed deadlines and season limits.

- Mow in stages. Never mow to remove more than 40% of the grass at any one mowing and always wait 3-4 days between mowings. Preferably, don't let the grass get too long in the first place.
- Verticut only when the surface is dry. Do not confuse this with scarifying. Verticut in both directions with the machine set to cut to just below the level of the bulli. This operation is vital for the spring flush of growth as it severs the surface runners (stolons) and thickens up the turf. Runners grow at their tips, and by cutting the

runners into sections, growth is promoted from each section. The cutting process also loosens up the thatch, thins out the mat, and breaks up the organic layer on the surface.

- Brush up all the uncut sections to ensure removal of the thatch.
- It is now essential to remove **all** loose material. A number of passes with the pitch cylinder mower will pick up much of this material. A rotary mower, set high, will progressively blow material aside. It may be advisable to use a knapsack type motorised blower to remove all the dust and thatch (NB. If you do not do this job correctly, you will have added to your layering problem).
- Flood the table, spike with a spiked roller or hollow-tine, and then apply fertilizer (particularly phosphate which promotes new root growth and must be placed in the root zone).
- Allow the grass to recover for a few days before applying a topdressing of sieved bulli. Do not use powdered bulli as this will crust and cake. Do not allow the grass to grow to the extent that the bulli dressing cannot be adequately screeded and levelled. Do not apply more bulli than is required for it to be rubbed into the grass, allowing most of the grass to show above the bulli layer. Apply bulli in minimal quantities at any one time.
- Spread bulli on low spots first (these should have been identified when the table was flooded). Then spread lightly from a spade in a sweeping action over the balance of the table. A light, low-bed trailer with old covers spread to collect spillage is preferable to wheelbarrows.
- Spread and level using a multi-bar metal frame, about the size of a dining room table, and constructed from 50mm flatbar with four dividers running lengthwise. On the front (long) edge are two welded hooks to which are attached ropes for two men to pull. The ropes must be at least 5m long so that the frame is not lifted when being pulled. The frame may be angled to help move cascading bulli from high spots to hollows. Alternatively, use a long straight-edge.
- Water lightly once or twice a day.
- After a week or less, rub in the bulli again using a frame.
- When the grass is through, dry roll both ways with a light roller to assist in breaking down the bulli and settling it.
- Highveld Spring treatment: When the turf comes out of dormancy it is important to remove all dead material from the pitch. This can be done by scarifying (pin-type) followed by a good brushing. Fertiliser should then be applied in the correct quantities and only then should topdressing be applied.

### 13. PITCH PREPARATION

It seems that there are two, or perhaps three, schools of thought on pitch preparation. There are those who follow a relatively complicated procedure and those who undertake a comparatively simple procedure. It seems that those who follow a complicated system may have poor quality clay to manage compared with those who have good quality bulli and who seem to produce good pitches with relative ease. The third group, who may be the elite, have good material and still follow a complicated system. They seem to be in the minority.

The first group do not find it necessary to use hessian to initiate rolling but use grass cuttings. It may be a coincidence that their pitches also suffer from layering, with habitual cracking, and find that cracks do not come together on watering so that permanent cracks develop. Also, this group usually commences rolling with a light roller to form a crust upon which to rely to give some pace and bounce.

The second group use hessian, commence rolling with a relatively heavy roller, roll for less time, and produce better pace and bounce.

The following provide an **indication** of the procedures which have been proposed for pitch preparation. We do not necessarily agree with all the procedures recommended but we provide these examples to provoke thought and to stimulate discussion between groundsmen.

*Pitch No. 1 (the Adelaide oval - the way to produce a white, glassy wicket)*

#### *DAY 1*

- (i) Double-cut to 10 mm
- (ii) Slowly and uniformly soak the pitch, preferably during the evening

#### *DAY 2*

- (i) If grass cuttings are to be used (to stop the bulli from sticking to the roller; to help retain moisture and promote even drying; and to camouflage bare areas), these should now be spread on the bald patches. Remember that grass cuttings can cause layering and that hessian is generally preferred anyway to prevent the bulli from sticking to the roller.
- (ii) Start rolling with a light roller (25 to 50 kg). Cross roll 2 to 3 times, **never** pushing a wave of water ahead of the roller.
- (iii) As the pitch dries (perhaps one half to an hour later), increase the weight of the roller - cross roll 2 to 3 times with a 100 kg roller. Repeat twice 2 and 4 hours later with a 400 kg roller, by which time the grass should have been pushed into the turf. A 1.5 to 2 ton roller should then be used, rolling up and down in low gear. If this roller does not crease the soil and push the grass even further into the turf, stop and rewater by hand before proceeding. On a normal day two more rollings can be given, the last in top gear.

#### *DAY 3*

- (i) Lower the cutting height to 6 mm. Double cut.
- (ii) If creases are still visible, use the heavy roller. Roll 3 more times for 20 to 30 minutes.
- (iii) Cut again to 6 mm and water.

#### *FINAL WEEK*

Continue cutting and rolling as before.

#### *DAY OF MATCH*

Double cut to 4 mm and roll with a heavy roller for 20 to 30 minutes.

#### *COMPLETION OF MATCH*

Clean off all grass cuttings and begin soaking slowly as soon as possible.

*Pitch No. 2. (a general Australian recommendation - the result is a white wicket)*

- (i) Mow to 10 mm. The mowing height should be reduced slowly as preparation proceeds.
- (ii) Irrigate the top few cm almost to saturation.
- (iii) As soon as the surface is sufficiently dry, roll with a 250 kg roller. This binds the soil and presses the grass into the soil surface.
- (iv) Sprinkle clippings on the surface (*generally **not** recommended*).
- (v) Use a heavy roller (1 ton or so). This will squeeze the mud over the grass, killing it. Further rolling compacts the mud/grass mixture into what is called a white wicket. At rolling, the surface should be sufficiently dry so that it will not flow, but the roller must still be able to squeeze water from the deeper layers into the drier surface. The moisture content is about right when the thumb, pressed into the surface, will leave a small indentation.
- (vi) A roller (1.5 to 2 ton) is now used in short bursts, each burst continuing until moisture is drawn to the surface. A heavy roller should not be over-used when the pitch is too dry. It will promote surface crumbling and horizontal shearing.
- (vii) The final roll is designed to give a glazed surface. A light roller is used after water has been sprinkled onto the surface so that it becomes slightly pugged. More clippings may then be applied to cover bare patches.

*Pitch No. 3 - a two-day club game using a single 1 500 kg roller*

### **Monday**

- Sweep off loose material and fill worn areas such as creases with fine bulli using a spike to prick out bonding holes to allow the new Bulli to key in.
- Irrigate the whole table thoroughly.

### **Tuesday**

- Rest the table and attend to outfield. Mow both ways in the afternoon or the following morning.

### **Wednesday**

- Apply water with a fine even spray.
- Using the thumb test, place hessian and undertake the first roll when the water only just shows under the thumb and smudges nicely when the thumb is turned or moved on the surface.
- Roll a few times and stop when the hessian has picked up surface water.
- Remove hessian by pulling back. It should not pick up Bulli.
- Commence rolling when it is judged that the consistency of the Bulli is ready to take the weight of the roller. Use a small knife blade inserted to judge this condition. As the bulli dries it 'clings' more to the blade, and it is this degree of clinging that is used

- to judge when rolling should begin. Obviously this technique relies solely on the individual developing the right sense of 'feel', but it is worth the effort.
- Only if necessary apply grass cuttings to bald patches (*again, **not** recommended*).
  - Stop rolling when the drum dries out.
  - After a period of thirty minutes roll again for approximately 20 minutes.
  - Repeat this pattern, extending the delay periods to cater for the prevailing weather conditions.
  - Cover.

### **Thursday**

- Remove covers and roll in the sweated moisture until the drum is dry.
- Roll for two spells of 20 minutes every 30 minutes.
- Cover.

### **Friday**

- Remove covers and roll in the sweated moisture as above.
- Limit rolling depending on climatic conditions.
- Mow if necessary.

### **Saturday & Sunday**

- Roll in moisture.
- Mow if necessary.
- Mark.
- Sweep off loose material.
- Roll in moisture.
- Mark.

### **After Play**

- Cover.

Each clay soil will ultimately require a separate preparation package for best results. It is essential that the clay material meets quality standards to afford the groundsman a reasonable opportunity of producing a good pitch.

Thereafter the process requires attention to detail without taking short cuts. The basics of a level surface, even grass cover, even application of water and the correct use of the roller can produce very satisfying results.

The process of preparing a cricket pitch involves Natural Science. The combination of nature and science needs to be understood and fully exploited to achieve the best results. Experience gained from a process which has a scientific base as the foundation will benefit any progress in all endeavors relating to these activities.

### **Hints which may assist in choosing the right techniques**

- A suitable clay soil should have a low infiltration rate, and hence the profile will take time to wet. Apply water in the early evening and at a slow rate.

- Grass serves to pump water from the profile. Therefore only cut low as late as possible. (Double cut)
- Slow drying allows thorough compaction, so promote this whenever possible.
- Devise tests to judge when to commence rolling e.g. the thumb test.
- Is rewatering advisable? Does its need indicate poor quality bulli? Examine this in your own situation.
- Is moisture from covers a good or bad thing? Experiment with different procedures and note the effects.
- Should rolling stop when the roller dries off? Examine in your situation.
- Do multiple size rollers give better results? Don't be afraid to try various combinations, especially in nets and outer pitches.
- What should the pattern of heavy rolling be dictated by? Satisfy yourself of this.
- Slow rolling as opposed to fast rolling. Slow when damp, and faster when drier. Slow in the morning and fast in the afternoon? Do these 'rules' apply to your pitches?
- Is it necessary to slow the drying process by covering with shade-cloth or hessian in your situation?
- Should the winner of the toss have an advantage? If you think so, then prepare the pitch accordingly.
- Groundsmen should aim for perfection - no matter who uses his pitch.

"A groundsman needs to do what he has to do and must understand what needs to be done. He must have the knowledge and facts to understand what his strengths and weaknesses are. Otherwise he will flounder and be misled. He will probably be inflexible and uncertain, lacking in real confidence."

### **Personal Guidelines**

- Establish clear objectives.
- Work to checklists.
- Investigate pace and bounce. They are related.
- Know your Bulli. Investigate its strengths and weaknesses.
- Avoid deductions based on doubtful arguments.
- Work on reasons and avoid excuses.
- Do your homework.
- Knowledge and advice is only a telephone call away.

### **Note:**

A survey undertaken in the USA involving Agronomists serving some 1700 golf courses gave the number one problem as "Communication" with both The Management committees and players. This indicated that greenkeepers needed to motivate and communicate the facts to these people. This requires a higher level of professionalism.

### **REFERENCES**

- Adams WA & Gibbs RJ 1994. Natural turf for sport and amenity: Science and Practice. CAB International, Wallingford, UK.
- Anon. 1981. Turf Cricket Wickets, a corator's handbook. New South Wales Cricket Association
- Burdett L 1994. Letter to Andy Atkinson.
- Manning JD 1982. Cricket pitches. Construction, maintenance and preparation. Guidelines for groundsmen, WP Cricket Union.

- Handreck KA & Black ND 1989. Growing media for ornamental plants and turf. New South Wales University Press, Australia.
- Hillel 1982. Introduction to soil physics. Academic Press, New York
- Walton N & Maclean A 1995. Construction - Senior Pitch. Specs for St Georges Park.
- McAuliffe KW & Tuohy MP 1987. Cricket wicket research carried out by Massey University during 1986/87 season. Soil Science Department, Massey University, New Zealand.

## ADDRESSES

Natal Team: Correspondence: University of Natal  
Private Bag X01  
Scottsville  
3209

Professor Neil Tainton	Phone: 0331-64794	Fax: 0331-2605708
John Klug	Phone: 0331-2605442	Fax: 0331-2605708
Dave Edmondson	Phone: 0331-2605935	Fax: 0331-62262
Rob Campbell	Phone: 0331-2605189	Fax: 0331-62262

Potchefstroom Team: Correspondence: Potchefstroom University  
Private Bag X6001  
Potchefstroom  
2520

Piet van Deventer	Phone: 0148-2992495	Fax: 0148-2992503
Marinus de Beer	Phone: 0148-2992519	Fax: 0148-2992503

---

## ABBREVIATED CONSTRUCTION RECOMMENDATIONS FOR SCHOOL AND CLUB CRICKET PITCHES

### Introduction

The quality and properties of a pitch used only for a limited overs match are vastly different to those for a five day test with respect to the thickness of the bulli, the drainage requirements, and the method of preparation.

The purpose of this section is to present an abbreviated summary of the more important guidelines to inexperienced administrators on how to build cricket pitches for schools and clubs for use in limited over matches.

### Length of pitch

The minimum length of established strips should be 24m. A slightly longer pitch (26m) has advantages but the sometimes recommended practice of shifting the crease along the length from match to match to avoid playing on the same deteriorated areas all the time often leads to unacceptable inconsistency in bounce and pace between the two ends of a pitch.

### Width of a pitch

Each individual strip should be 3.05m wide.

## **Directon of pitch**

Pitch length should be orientated to lie true north to south.

## **Slope of oval**

Ideally, the oval should fall in all directions from the centre, but failing this, should have a single phase slope of 1% in any convenient direction. In the latter case, the pitch should be slightly raised to avoid problems of water draining onto or under the bulli. If the oval is on a very well drained soil no slope is required.

## **Slope of pitch**

The slope of the pitch should not exceed 1% and it should follow the slope pattern of the oval. If the oval is centre sloped, the pitch square should also slope from the centre. The amount of fall should therefore not exceed 30mm across a 3.05m strip or 200mm along its length, being as flat as possible at the centre.

## **Height of pitch above outfield**

The pitch square should be about 75mm above the level of the outfield to allow for surface drainage off the pitch.

## **Drainage**

The material underlying the pitch should allow for good drainage and artificial drains might need to be installed to ensure that any water entering the sub-base will be able to drain away freely. If evapotranspiration is the only way in which water is lost from the pitch area, salts will accumulate in the bulli layer. Amongst other undesirable effects, this will promote crumbling of the pitch surface.

It is preferable to include at least one gravel layer as a sub-base, even if the underlying material allows for free drainage. An artificial drainage system (e.g. pipes) is recommended if there is any indication of poor drainage. These drain pipes should be installed at a slope of 1 : 100 to quickly remove all the water from the sub-base of the pitch and the outfield.

## **Controlling invasion**

To prevent grass from the outfield invading the pitch, 40cm wide black plastic strips should be laid vertically at the edges of the excavation before filling. The plastic will also assist in preventing water entering the pitch area from its surrounds.

## **Excavation**

Excavate to the desired size and depth. Decide on the number of layers to be included and their depths, and from this total subtract 75mm to allow the finished pitch to lie slightly above the outfield level. Generally, pitches for five-day matches need to be excavated to a depth of 550mm (including gravel layers) below final height; 475mm for three-day matches (again including gravel layers); and for one-day matches 400mm ( where gravel is being used) or 225mm (with no gravel layers). These depths are the minimum depth at the upper-slope

edge of the pitch area, and if a layer of clay loam is to be used, the depth of this layer must be added to the above values.

### **Base Construction**

Irrespective of the drainage capacity of the underlying material, the excavated base should be inclined in the direction of natural drainage. A ring drain should be constructed on the perimeter of the excavation to remove all excess water from the pitch area. In well drained soils a coarse gravel drain will suffice, but in poorly drained soils drainage pipes may be required and a more sophisticated system of lateral pipe-drains designed to drain the entire base.

1. Excavate the trenches for the drain pipes, making sure of a fall of at least 1 : 100, and line the trenches with geotextile (e.g. Bidum). Drain pipes with a diameter of 50mm are laid on a thin layer of coarse sand and the trenches are backfilled with the same sand. **CRUSHED GRANITE SHOULD NEVER BE USED** for this as it forms a hard layer which severely restricts water movement.
2. Coarse gravel (about 65% of the material should be between 4 and 9mm in diameter and 35% between 9 and 12mm) is then laid and its surface levelled. This layer should be about 100mm thick after having been compacted with a vibrator. **AGAIN, CRUSHED GRANITE SHOULD NOT BE USED.**
3. Above this there may be an intermediate fine gravel layer approximately 100mm thick. About 90% of this gravel should be between 1 and 4mm in diameter.

### **The bulli**

1. The selected bulli should be dry and the finer it is, the better. The best mixture is one which contains 40% of aggregates less than 2mm in diameter, with about 60% less than 5mm. It must be free of stones, root material and other impurities.

For a five-day test pitch, the bulli layer must be between 250 and 300mm thick. This can be reduced to 200mm for three-day pitches and to between 150 and 200mm for one-day games.

2. Where moles are likely to pose a problem, a 50mm layer of crushed glass can be laid immediately below the bulli.

In an effort to reduce the expense of buying bulli, a clay loam or sandy clay layer of 100mm is sometimes laid between the gravel and the glass, and the depth of bulli reduced to less than 100mm. This practice is certainly not recommended, but if absolutely necessary, the material should be well fertilized; especially with bonemeal and/or phosphate. The actual fertilizer need should be determined by soil analysis. Do not add compost. Compact it in the dry state with a roller to a thickness of 100mm. Score the surface after compaction to ensure proper binding between this layer and the bulli layer. Remember to mix in the fertilizer before compaction.

### **NB**

For one day pitches, e.g. school fields, the coarse gravel layer and the clay loam layer may not be necessary if the underlying material is well drained and the clay content less than 25%.

3. Before laying the bulli, it should be air-dried and rolled on a hard surface (e.g. a car park) to ensure a degree of uniformity in particle size. This also allows an opportunity to remove stones, roots and other unwanted debris. Do not sieve the bulli.
4. Add 100mm of appropriately fertilised bulli and compact in a dry condition with a roller or vibrator. Score the surface.
5. The construction can then be completed by infilling to the surface with layers of bulli, each not more than 100mm thick. On each occasion the bulli must be compacted and its surface scored before any additional material is added.

#### **NB**

It is highly recommended that the first fertilizer application, especially that of bonemeal and phosphate, be mixed with the bulli before filling. No fertilizer program can be given here, because the recommendations need to be based on soil test results.

#### **Grass establishment**

1. Soak the total area before planting. All hollows and sagged areas should be filled. The grass should be planted only when the surface is dry enough to walk on without having clay stick to ones shoes.
2. The grass (Skaaplaas or Bayview) can be planted in one of two ways:

(a) Grass sods are washed and torn apart to separate all the sprigs. The sprigs are then laid on the scored bulli surface and the entire sprig-covered area thoroughly wetted. A thin (10mm) layer of fine bulli is then spread carefully over the sprigs.

(b) Grass plugs can be planted in hollow-tine holes with the bulli slightly moist. Plugs should be spaced about 75mm apart.

The planted area should be watered at least once a day with a fine nozzle sprayer until there are signs of sprouting. Daily watering should continue until the grass has covered at least 75% of the area. A light dressing of dry bulli can then be spread over the pitch and levelled with a straight edge.

#### **Post-construction maintenance**

The grass should initially be allowed to grow out (to about 30mm) so that it can develop a good root system. Once it has reached full cover, its height can be reduced to 15mm.

- Once the pitch is covered and the grass is well established, the watering can be adjusted according to the weather conditions.
- The grass should be allowed at least 4 months of growth to encourage it to develop a good root system before the pitch is rolled.
- The grass should be kept to a height of about 15mm. A grass box should always be used on the mower so that cuttings can be removed.
- If the pitch surface is uneven, a light dressing of bulli can be rubbed into low lying areas. The grass must never be covered entirely and the final level should never be exceeded.
- A light hand roller can be used after each dressing to create a firm level surface.
- The grass should be cut down to 3mm only when pitch preparation starts.

