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AN INVESTIGATION OF SELECTED SOIL PROPERTIES
INFLUENCING THE MANAGEMENT AND PLAYABILITY OF
NEW ZEALAND CRICKET PITCHES

A thesis presented in partial fulfilment of
the requirements for the degree of
Master of Horticultural Science in Soil Science
Massey University

Stuart Paul Cameron-Lee

1988

INTRODUCTORY SUMMARY

The 1980's has been a period of growth for New Zealand cricket. The advent of the one day game plus international success has developed spectator interest and support to an unprecedented level.

Cricket is certainly one game where player performance is very much dependent on the surface provided. It is perhaps fair to say that the standard of many New Zealand first class pitches has not allowed the development of entertaining cricket. As a result, pitches have been the target of increasing criticism from spectators, administrators, and players alike.

Cricket pitch preparation has been said to be an 'art'. But the groundsman has limited scope to practice the art if the suitability of the soil used for pitch preparation is wanting.

In an attempt to gain an understanding of the contribution of soil properties to good pitch preparation, the New Zealand Cricket Council and Soil Bureau of the Department of Scientific and Industrial Research (DSIR) provided funding for a research programme. It was hoped that improved playability and pitch performance could be achieved by combining the 'art' of pitch preparation with sound scientific principles.

The objectives of the research programme were:

1. To develop and standardise a set of laboratory procedures aimed at selecting soils and characterizing their suitability for cricket pitches.
2. To establish a comprehensive inventory of physical and chemical soil properties for a number of current pitch soils which can be used as a reference for selection of new pitch soils.
3. To relate sound scientific principles to field management techniques and pitch performance in an attempt to assist the groundsman with pitch preparation.

4. To investigate the contributions of management factors to pitch playability, and their interactions with soil properties.
5. To elucidate the value of the nuclear moisture-density method for in situ measurement of pitch soil water content and bulk density.
6. To develop and implement a soil monitoring system for groundsmen who can then use it to evaluate changes in soil properties during pitch preparation. This would allow the development of specific management programmes for individual venues.
7. To suggest areas for future research.

To meet these objectives a preliminary study (Cameron-Lee, 1984) was carried out to identify three soil parameters, namely clay content, clay type, and pitch soil profile, which affect pitch performance. An expansion of the findings of the preliminary study form the basis of this research programme.

This investigation incorporated a field trial using four soils commonly known as the Palmerston North¹, St John, Ward, and Kakanui. The soils have different chemical and physical properties. They are all currently in use throughout New Zealand on first class pitches. In addition, three pitch soils, namely the Marton, Redhill and Naike were evaluated, along with the field trial soils in the laboratory to provide a greater comparative analysis of pitch soil properties.

¹ A mixture of the Marton soil and unidentified local fine sandy loam.

The soils studied can be described as follows:

Pitch Soil

Soil Classification

1. Palmerston North¹

2. Marton

A central yellow grey earth described by Campbell (1979).

3. Kakanui

Known as the Waiareka clay, this soil is a southern brown granular clay (an intergrade between rendzina - like soil and brown granular clay) described by N.Z. Soil Bulletin 26 (3), (1968).

4. Ward

A central yellow grey earth described by N.Z. Soil Bureau Bulletin 27 (1968).

5. St John

No classification available.

6. Naike

A brown granular loam described by Bruce (1978).

7. Redhill

A Whatitiri clay loam (Red loam) hill soil described in N.Z. Soil Bureau Bulletin 5 (1954).

¹ A mixture of the Marton soil and a local soil (unclassified).

The broad conclusions that can be drawn from this study are:

1. The interaction between clay type and clay content has a major influence on pitch performance.
2. For the preparation programmes used, swelling clay soils were found to be more difficult to manage and produced inferior playability results when compared to non swelling soils.
3. The performance ranking (from best to worst) of the trial soils used was consistently Palmerston North, St John, Ward and Kakanui.
4. The nature of the pitch profile construction was found to influence performance. For example, a shallow clay soil layer over a sand base produced significantly faster drying within the surface 75 mm.
5. Subsurface (25-75 mm) water content was the single most important factor that influenced pitch playability. Complex interactions, however, occur between water content, soil chemical and physical properties, and management factors (e.g. the ability of the grass plant to remove water from depth) and these contribute to the performance of the pitch soil.
6. Soil properties characterize the potential of a pitch soil but pitch management determines the development of that potential.
7. Soil binding strength which is commonly used as a guide to pitch soil selection may not necessarily be a reliable index of soil performance. A standardised testing procedure was developed for pitch soil selection.
8. In order to guide groundsmen during pitch preparation, standard monitoring techniques have been developed.

The study identified areas for future research. These include:

1. A study of the influence of different levels of soil compaction (bulk density) on the water retention characteristics (field capacity; stress point; permanent wilting point) of pitch soils.
2. A more comprehensive study of plant-soil interactions to quantitatively determine the role of the grass plant in pitch soil drying and performance of the cricket pitch.
3. An investigation of different mowing management programmes on the rate and extent of pitch soil water loss.
4. A study of the use and effects of different physical treatments during pitch renovation.
5. A study of the modification of swelling soils with compatible non swelling types to moderate undesirable soil properties and improve management and playability.
6. An investigation of the design of pitch soil irrigation systems for different levels of cricket.
7. An investigation of the feasibility for greenhouse structures at Test venues.
8. An evaluation and calibration of the Clegg impact hammer for replacement of the bounce test as the objective method of playability assessment for New Zealand pitch soils.
9. The development of a standardized soil monitoring kit for use by groundsmen at venues throughout New Zealand.
10. Ongoing investigation and evaluation of potential pitch soils for improvement of existing soils and pitches.

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