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KENYA SOIL SURVEY PROJECT

"SUITABILITY AS SPORTS GROUNDS OF SOME SITES ON THE TERRAINS OF THE KIAMBU INSTITUTE OF SCIENCE AND TECHNOLOGY"

By

J.J. Vleeshouwer and J.M. Kibe

SITE EVALUATION

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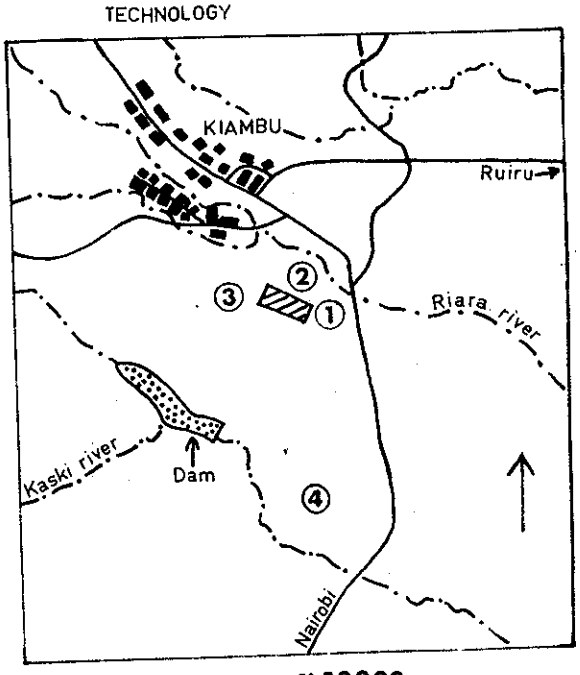

SUITABILITY FOR SPORTS GROUNDS OF SOME SITES ON THE TERRAINS OF THE KIAMBU INSTITUTE OF SCIENCE AND TECHNOLOGY

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J.J. Vleeshouwer and J.M. Kibe

1. Introduction

A request was received from the Project Director of the Kiambu Institute of Science and Technology to advise on the suitability of some sites for the establishmet of a number of sports grounds. The running costs for the above Institute, which is situated on Riara coffee farm, south of Kiambu, will be partly covered by profits from the farm. Therefore in the first instance four non-coffee covered parts are under consideration by the Institute for sports grounds (see fig. 1). Only if the limitations of these fields would prove to be too strong, or the necessary land improvement works too expensive, present coffee tree covered areas would be considered as alternatives.

On July 12, 1973 the sites were visited, the soil conditions studied and where necessary some infiltration measurements carried out. Some soil samples were collected for analysis in the laboratory.

2. Requirements for a good sports ground

Good sports grounds should meet the following requirements:

a After heavy rain, pools should disappear within 8 hours and the field should be ready for use (not muddy) within 24 hours. These conditions can only be achieved when:

1. Excess rain water is stored in and/or removed from the soil, which is only possible in soils with a high permeability and a deep ground water table.
2. Excess water of the area and its surroundings is removed to a major drainage way or to a low place with sufficient storage capacity.

b In the dry season the topsoil should not become very hard. Very hard surfaces may cause injuries when players fall.

c Throughout the year the fields should have a good grass cover. Good grass results in:

1. a softer surface in dry conditions (less injuries)
2. a less slippery field in wet conditions
3. intensive rooting of the topsoil and a higher biological activity in the topsoil, consequently the permeability and the water storage will increase (sooner dry after rains)
4. it should be non-stony and almost level

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3. Proposed area 1

3.1. Soil conditions

This small area is situated in the bottom of the Riara river valley, close to the road from Kiambu to Nairobi (see fig. 1). It has a rather irregular topography and is imperfectly drained.

Soils on the site are very deep (more than 200 cm) and consists of sandy clay, deposited by the Riara ("Alluvial Soils"). From 20 cm onwards many black manganese and brown iron mottles are present, indicating that in the wet season the ground water table may rise till 20 cm below the surface. Beginning at appr. 90 cm depth the sandy clay is saturated with water and is soft ("half ripened"), which indicates that the groundwater table only occasionally occurs deeper than 90 cm below the surface.

3.2. Works to be carried out and the suitability

a the terrain should be levelled and ant nests, stones and major roots should be removed

b the terrain should be ploughed in order to get a friable topsoil of at least 15 cm thick, which is suitable for planting grass

c grass planting

d when the soil is settled and the surface becomes uneven, the low places should be filled up with weed-free soil from other areas along the Riara river (not red soil).

After works mentioned above are carried out properly, the area would be only fairly well suitable for sports grounds, because in periods with high water levels in the Riara river the area will have a high ground water table. Consequently in such periods the field will be too wet to play on.

4. Proposed area 2

4.1. Soil conditions

This area, which is also rather small, is situated on the slope of the Riara river valley, between the dormitories and the river (see fig. 1). Soils are well drained have a moderately high permeability and consist in general of more than 180 cm red clay ("Kikuyu Red Loam"). However, locally soft rock (tuff) may occur at less depth.

4.2. Works to be carried out and the suitability

The same works as mentioned under 3.2. have to be carried out, but for topping up only red soil should be used.

It should be noted that the cost of levelling will be considerable.

After the necessary works are carried out properly, the area would be well suitable for sports grounds.

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5. Proposed area 3

5.1. Soil conditions

Area 3 is a relatively small site situated immediately south of the coffee drying beds (see fig. 1).
Like area 2, well drained, moderately permeable, red clay soils are found ("Kikuyu Red Loam"). However the topography is more favourable and soils are even deeper (more than 200 cm).

5.2. Works to be carried out and the suitability

Same as mentioned under 3.2. and 4.2. For topping up of low places only red soil should be used. Cost of levelling will be less than for area 2.

After the necessary works are carried out properly, the area would be well suitable for sports grounds.

6. Proposed area 4

6.1. Soil conditions

The biggest area proposed is situated appr. 1200 m south of the Institute's lecture rooms and staff houses (see fig. 1). It is a 3 ha depression without a natural out let. The site is rather flat as whole, but many 50-150 cm wide and 10-30 cm deep depressions are found. In the western part a swampy patch with a high ground water table (10-40 cm below the surface) is present.

These mostly very deep (more than 200 cm) soils have a 10 to 30 cm thick, rooted topsoil of light clay with a fine angular blocky structure. The topsoil which in general is thinest in the small depressions, has a low infiltration rate; the clay under the topsoil, specially the layer from 50 to 100 cm depth, is very slowly permeable (see table 1). In wet conditions the subsoil may become almost completely impermeable.

Table 1 Results of some permeability measurements on proposed area 4

time in minutes, needed for 10 cm of water to penetrate the soil

	cylinder 1	cylinder 2	cylinder 3	cylinder 4
dry topsoil	5.2	5.0	1.5	8.0
moist topsoil	16.0	13.3	5.4	42.6
dry subsoil	6.6	150*)	160*)	
moist subsoil	25.3	)**	)**	

*) calculated
)** after two hours less than 2 mm water had penetrated

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Fig. 2 Profile of ditch, to be filled with murram

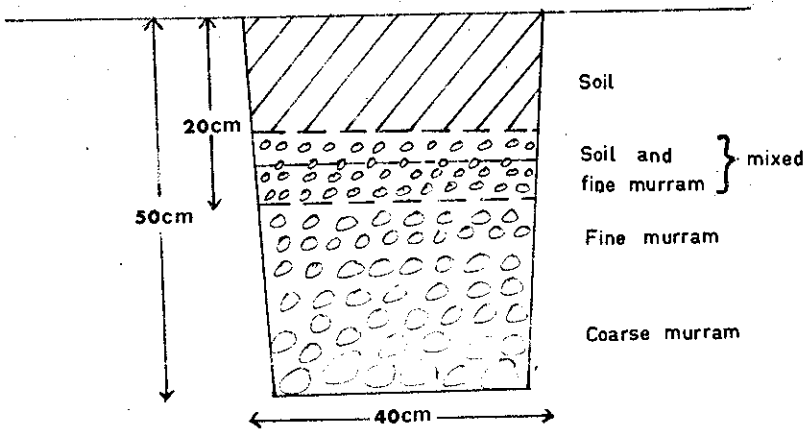


Fig. 3 Profile of open furrow

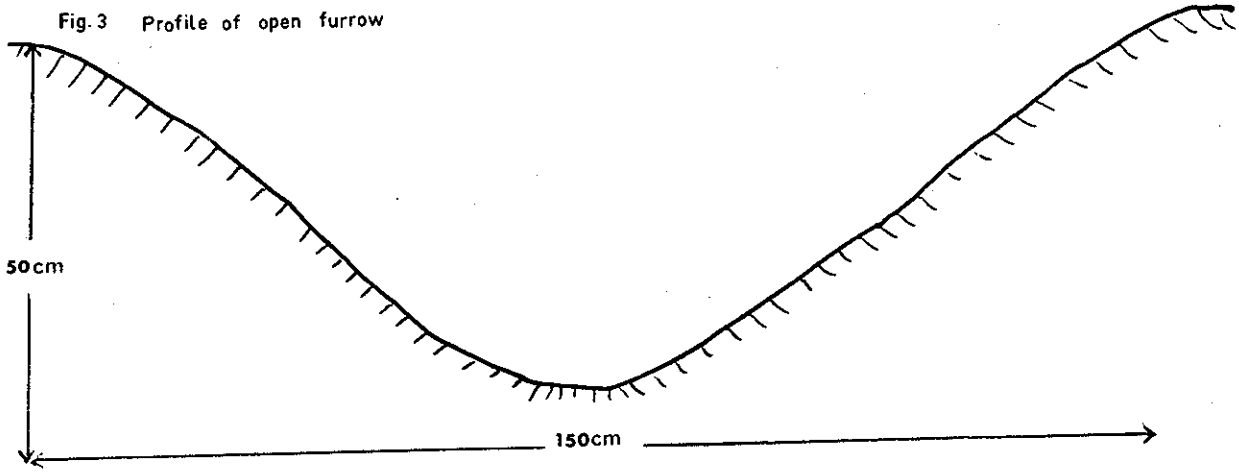
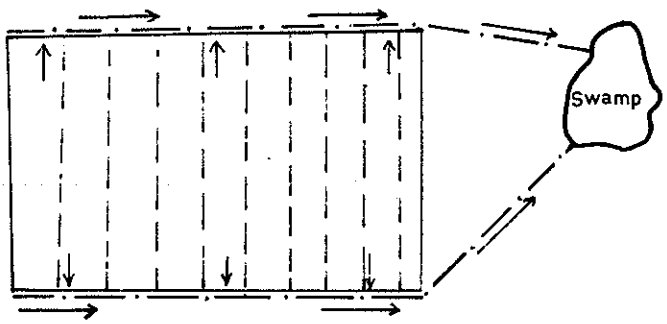


Fig 4 Layout of ditches and trenches



ditch filled with murram

open furrow

direction of waterflow

- The swampy area is 30 to 40 cm lower than the rest of the depressions. Till 140 to 150 cm depth the soils consist of rather soft ("nearly ripened") clay, which is saturated with water. This indicates that most of the year the groundwater table is very high. The reason is probable that not only water from the whole depression but also (subsurface) seepage water from the surrounding area with red soils, accumulates in the swamp.

6.2. Works to be carried out

1. Rotavate the topsoil till maximal 10 cm in order to destroy the existing grass sod.
2. Remove all ant nests, roots and stones
3. Dig ditches (see fig. 2) at not more than 10 m interval and connect these with an open furrow (see fig. 3), which can lead drainage water to the lowest (swampy) area (see fig. 4). The ditches should be filled up with murram, which is coarsest at the bottom and becomes finer to the top. The top 15 to 10 cm of the fill up should consist of soil (red soil or local topsoil from the area). At the transition this topsoil and the murram should be mixed in order to avoid a sharp transition.
4. Fill up the lower parts of the field in order to get a level field. The area should not be levelled with machinery because then the existing topsoil will locally be removed and the subsoil of heavy clay will become exposed. This clay has not only a very low permeability, but is also very hard when dry (injuries) and is moreover little suitable for growing of grass.
5. Grass planting.
6. Dig out the swampy area in order to increase the waterstorage capacity.
7. When the soil is settled and the surface of the field becomes uneven, the low places should be filled up again with weed free red soil.

6.3. Suitability

After the works mentioned under 6.3 are carried out properly, the area would be only marginally suitable. The reason is that in the rainy season the fields probably cannot be used during considerable periods, because they will be too wet, due to the following factors:

a the area has no natural drainage outlet and the soils have a very low permeability. Excess water therefore has to be stored within the area. Storage possibilities are however small, because the lowest (swampy) part receives very likely also water from the surrounding, higher areas by seepage. Increasing the storage

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capacity by deepening out the swamp is likely to be of limited use for storage of water to be drained from the proposed fields, because such seepage from the higher areas would continue to occupy substantial storage space.

b permeability of the soils is very low. Therefore excess water on the surface of the fields will not or almost not disappear through the soil. Gullies filled up with murram will only partly solve this problem.

Moreover, measures taken to make the area level and to drain excess water will result in a heterogenous soil pattern. As a result drying-up of the field and grass growth will be heterogenous as well.

6.4. Laboratory data

Laboratory analyses of some horizons of a profile in area 4 gave the following results:

Depth cm.	5-15	50-100	150-200
Texture:			
Sand %	24	24	16
Silt %	32	8	12
Clay %	44	68	72
Class	light clay	heavy clay	heavy clay
1:1 Suspension:			
pH - H_2O	5.2	6.7	7.3
EC (mmhos/cm)	0.13	0.45	0.30
C %	1.38		
N %	0.15		
Cat. exch. Cap. (m.e.%)	21.8	32.4	30.0
Exchangeable cations:			
Ca (m.e.%)	4.6	10.2	10.2
Mg "	6.2	6.8	6.6
K "	0.2	0.6	1.5
Na "	0.7	3.9	3.5
Sum "	11.7	21.5	21.8
Base Sat. %	53.7	66.4	72.7
E.S.P. %	5	12.0	11.7
P ppm	32		

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7. Suggestions for the application of fertilizers in area 4

At the request of the Institute some suggestions for the application of fertilizers are given. From the laboratory data mentioned under 6.4 oan be concluded that the phosphorus status of the soils in area 4 is good. Therefore it is advisable to apply only Nitrogen fertilizer, preferably A.S.N., in the following quantities:

First year: 100 kg of A.S.N. per ha at planting
100 kg of A.S.N. per ha after one month (end of rains)
300 kg of A.S.N. per ha after six months.

Then yearly 2 x application of 300 kg of A.S.N. per ha, just after rains.

8. Summary and conclusions

The Kiambu Institute of Science and Technology sought advise on the suitability for sports grounds of four sites (see fig. 1) on the Institutes terrains.

Area 1 is only fairly well sutable, because in periods with a high water table in the Riara river, the ground water table of the field will be high as well.
During these periods the field will be too wet to use as sports-grounds.

Area 2 is well suitable. Initial cost for levelling will be relatively high.

Area 3 is well suitable

Area 4 is only marginally suitable because it is too wet during considerable periods, due to

a absence of a natural water outlet
b very low permeability of the soils
c small storage capacity of the area for excess water

Moreover the initial costs (for drainage and leveling) are high.

The decision to develop all or some of the presently proposed fields for sportsgrounds, or alternatively to root-up coffee trees, depends on the costs of the improvement works to be carried out, the evaluation of the limitations still prevalent, and the loss of income from the coffee farm. To estimate this falls outside the scope of this investigation.