Subpart B1a
Southern
Rift Valley Province

Kajiado
County
This project was supported by the German Agency for Technical Cooperation (GTZ)
RIFT VALLEY PROVINCE
and its District Groups

- Provincial Headquarter
- International Boundary
- Provincial Boundary
- Boundary of District Groups

Described as:
- Northern Part
- Southern Part

Turkana is not included in the F.M. Handbook because there is no farming there.
Farm Management Handbook of Kenya

VOL. I  Labour Requirement, Availability and Costs of Mechanisation

VOL. II  Natural Conditions and Farm Management Information

Part II/A  WEST KENYA
Subpart A1  Western Province
Subpart A2  Nyanza Province

Part II/B  CENTRAL KENYA
Subparts B la/b  Rift Valley Province, Northern (except Turkana) and Southern Part
Subpart B2  Central Province

Part II/C  EAST KENYA
Subpart C1  Eastern Province, Middle and Southern Part
Subpart C2  Coast Province

VOL. III  Farm Management Information - Annual Publications were planned. The idea changed to Farm Management Guidelines, produced by the District Agricultural Offices annually and delivered to the Ministry in April every year.

VOL. IV  Production Techniques and Economics of Smallholder Livestock Production Systems

VOL. V  Horticultural Production Guidelines

Publisher: Ministry of Agriculture, Kenya, in Cooperation with the German Agency for Technical Cooperation (GTZ)

VOL. II is supplemented by CD-ROMs with the information and maps in a Geographical Information System. Additionally there will be wall maps of the Agro-Ecological Zones per district group (= the former large districts) for offices and schools.

Layout by Ruben Kempf and Mike Teucher, Trier, Germany.
Ministry of Agriculture

FARM MANAGEMENT HANDBOOK OF KENYA

VOL. II

Annex:

- Atlas of Agro - Ecological Zones, Soils and Fertilising
  by Group of Districts in Southern Rift Valley -

Subpart B1a

Kajiado

County

by

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Additional Contributions to the 2nd Edition by: Dr. J. Ahenda & P. M. Maluku, KEPHIS; G. Awinyo (GTZ) – assisting R. J. & digitizing of soil maps into GIS; Th. Buerel – support by analyzing remote sensing data; M. Fiebiger – rainfall data analysis; probability calculations, yield probabilities by simulation programs; B. Girkens – final computerized drawing of maps in GIS and other maps; Heike Hoeffer – project coordination in GTZ Nairobi; Ph. Karuri – assistance in the Farm Survey; Anna Kauhold – final computerized drawing of fertilizer maps; Ruben Kempl – typing and layout; Elizabeth Kimenyi & Anne Njoroge – coordination of farm survey; Z. Mairura, Ass. Dir. of Farm Business Subdivision; S. N. Maobe (KARI); N. M. Mawe (KARI); Susanne Meissner - water availability & requirement diagrams, typing; M. Mueller – calculation and diagrams of growing periods, ENSO influence; Dr. Anne W. Muruki & J.N. Qureshi – soil and fertilizer recommendation maps and information; Francis Muthami (GTZ); Dr. Dorothy Mutisya & Dr. J. Ochieng – crops and fodder list; Birgit Schmidt – basics for maintaining and regaining soil fertility; Joshua Shivachi & Ch. Wambongoro – analysing the Farm Survey data using SPSS software; M. Teicher - final computerized drawing of soil and fertilizer maps; Dr. Lusike Wasiuwa – horticult. part of the crop list; J. Wieczorek – computerization of maps in GIS; tables and diagrams.
PREFACE TO THE ATLAS
The internet and CD versions of the handbook have technically a reduction of details:
The most important information, the maps, are due to reduction of the 24 MB to the CD-size of 6 MB, not
well readable (esp. formulas of the AEZ Subzones and of the soils). Therefore we prepared additional Atlas-
CDs for each group of districts, containing the maps of Rainfall, Agro - Ecol. Zones and Subzones, Soils, and Fertilizer Recommendations together with the legends.
These maps are produced as pdf-files and can be zoomed for easy reading.

ACKNOWLEDGEMENT
for the Support to the First Edition
In compiling this Handbook, we have relied on the support of many officers from a variety of institutions
too numerous to mention, who made available their data and experience. We would like to thank them for
their invaluable assistance.
I would also like to thank my colleagues, the Research Officers, the District Land and Farm management
Officers, for their cooperation, and a special thank you to those who typed the draft edition.
Our particular thanks go to Prof. Dr. Ralph Jaetzold, University of Trier, for his selfless support in compiling
this handbook and for his assessment of the natural conditions including land and population. His deep
understanding of the needs of agricultural extension officers and farmers was a great asset. Our thanks also to
Dr. H. Kutsch, University of Trier, who computerized a large and complex amount of information involved
in establishing the AEZs.
Many thanks also to the staff of the Geographical Department of the University of Trier, Germany, for their
major effort in drawing up maps of outstanding quality, the centrepiece of the work.

Helmut Schmidt
Farm Management Research Officer
Nairobi, May 1982

ACKNOWLEDGEMENT
for the Support to the Second Edition
In revising this Handbook, various personalities and institutions were relied upon to provide the necessary
data required to update the previous data sets. In this regard, we would like to sincerely thank them for their
invaluable input in the exercise.
Special thanks go to the Ministry of Agriculture staff who undertook the Farm Surveys to elucidate on the
fundamental changes that have taken place in farming at the household level.
We are indeed very grateful to the people of Germany, who despite their limited financial resources, have
continued to support Kenya. Of importance here is the German Agency for Technical Cooperation (GTZ)
and the German scientists who have been working for Kenya over the years. Last but not least, thanks to Mr.
Reimund Hoffmann, the PSDA Coordinator, Nairobi, whose office ably managed the Handbook revision
project.

Prof. Dr. Chris Shisanya     Elizabeth Kimenyi
Professor of Agroclimatology     Assistant Director of Agriculture
Dept. of Geography     FMD, MOA
Kenyatta University, Nairobi     Kenya
Nairobi, January 2009     Nairobi, January 2009

We want to thank very much also Mr. Zachariah Mairura, Deputy Dir. of Agri-Business Dep., for his en-
gaged support of our inquiries in the districts 2009 and 2010.

Prof. em. Dr. Ralph Jaetzold     Prof. Dr. Berthold Hornetz
Retired Professor of Geography     Professor of Agricultural Geography
University of Trier, October 2010     University of Trier, October 2010
Institutional memory is of paramount importance for planning and development. For any research or agricultural extension to be successful, information on the natural farming potential is equally important.

In an effort to consolidate research - extension work of many years, the first edition of the Farm Management Handbook (FMHB) of Kenya Vol II (Natural conditions and farm management information), which described the conditions of the Kenyan farming community at that time, was produced in 1982/83. The handbook was in three parts i.e.:

A – for Western Kenya (Western and Nyanza provinces)
B – for Central Kenya (Central and Rift Valley provinces).
C – for Eastern Kenya (Eastern and Coast provinces)

For more than two decades, the handbook has proved very valuable to researchers, planners, extensionists, developers etc. This is a document that has been sought for enormously and hence the need to revise it in order to accommodate the changes that have taken place in our country since the production of the first edition. Some of these include: changes in the administrative boundaries, opening up of new farming areas due to population pressure, etc.

This second edition has been produced on the basis of Provincial administrative boundaries for the six Provinces i.e. Western, Nyanza, Rift Valley, Central, Eastern and Coast. The information will be availed in hard copies and in CD – ROMS to facilitate updating any future changes.

It is not possible to acknowledge the contribution of all the individuals who made this edition a reality but I need to mention the following individuals:

Thanks to the Ministry of Agriculture officers, especially the Farm Management Division officers at the headquarters (Mrs. E.W. Kimenyi, Mr. F.N. Nderitu, Mrs. H.W. Njoroge, Mrs. A.W. Njoroge, Mrs. A. W. Wanyama, Mr. P.T. Karuri and most engaged Mr. Z. Mairura), and the District staff, for their selfless contribution; Prof. Dr. Chris Shisanya, leader of the revision team, for his tireless efforts and guidance; Prof. em. Dr. Ralph Jaetzold for his enormous knowledge on the definition of the agroecological zones and his great contribution to their mapping; George Awinyo (German Technical Cooperation (GTZ) – Private Sector Development in Agriculture (PSDA)) for his expertise and contribution in the area of Geographical Information Systems (GIS).

I also wish to thank the GTZ who have facilitated the production of this edition both financially and by the use of their personnel, specifically the late Prof. Werner van der Ohe who supported the idea of the revision, and Mr. Reimund Hoffmann (GTZ – Team Leader Private Sector Development in Agriculture PSDA), for supporting and taking up the task to completion.

Dr. Wilson Songa, OGW
AGRICULTURAL SECRETARY
Nairobi, January 2009
KAJIADO GROUP 1

KAJIADO
Group of Districts 2010
= Kajiado County

Kajiado Central
Kajiado North
Loitokitok

District headquarters
District boundary

This map is not an authority for boundaries

KAJIADO NORTH

KAJIADO CENTRAL

LOITOKITOK

Ngong

Min. of Agr. and GIZ. R. Jeltzold 2011, GIS-Cartogr.: B. Girkens

0 20 40 60 80 100 km
3.6 KAJIADO GROUP OF DISTRICTS

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3.6.1 NATURAL POTENTIAL

INTRODUCTION

Kajiado group of districts consists almost entirely of ranching zones except for three very small strips near Ngong, Sultan Hamud and Namanga, and a larger one on the footslopes and footplains of Kilimanjaro in southeast Kajiado. The Chyulu Hills get also more rain than the plains but they are protected because of their precious nature.

In the Kenyan part of the agricultural belt around Kilimanjaro, LH 3 occurs as a very limited area in the northwestern footslope but wheat and fodder barley can still be extended there. The Upper Midland Zones start only with zone UM 3 i.e. the coffee zone. It is small, marginal and confined to an area around Loitokitok. In the Maize-Sunflower Zone UM 4, only early maturing varieties should be planted because the rains occur in two separate short seasons. This zone has developed to a real maize belt but it is in danger to be overused by monocropping, no rotation except with beans in the shorter first rainy season and maize in the second one which is a bit longer here.

The Lower Midland Zones start with zone 4 only, i.e. cotton is climatically marginal. In addition, the soils at the footplains of the Kamba Hills are often too stony for this crop and cannot retain enough moisture. Very early maturing maize is more profitable than cotton.

The Livestock-Millet Zone LM 5 is still almost uncultivated but early or very early maturing millet and sorghum varieties could be planted here. Some irrigation possibilities with waters coming from the Kilimanjaro or the Nguruman Escarpment have been taken up. The most successful one is in zone IL 6 west of Magadi.
KAJIAODO GROUP 4

KAJIAODO
Group of Districts

AVERAGE ANNUAL RAINFALL
in mm

Broken isolines are uncertain because of lack of rainfall records

9136

9137

9236

9237

District boundary
Seasonal river
River
Swamp

9136 = Grid number
13 = Station number in grid (see Table 1)

Rainfall station, having at least 15 years of records
(some are closed now)

Rainfall and temperature recording station
(No. 22 closed since 2004)

Min. of Agr. and GTZ: R. Jantzer 2010, GIS-Cartogr.: B. Girkens
<table>
<thead>
<tr>
<th>No. and altitude</th>
<th>Name of station</th>
<th>Agro-Ecol. Zone and Subzone</th>
<th>Annual rainfall mm</th>
<th>Monthly &amp; seasonal average rainfall in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>923602</td>
<td>Kajiado, Namanga District</td>
<td>UM 4 s/vs + fs</td>
<td>647</td>
<td>J 64 F 63 M 93 A 160 M 68 J 10 F 6</td>
</tr>
<tr>
<td>1371 m</td>
<td></td>
<td></td>
<td></td>
<td>A 6 3 J 2 A 3 O 6 N 22 D 88 89</td>
</tr>
<tr>
<td>9237004</td>
<td>Oloitokitok, District Office</td>
<td>UM 3 s + m/s</td>
<td>880</td>
<td>J 75 F 70 M 128 A 130 M 45 J 3 F 2</td>
</tr>
<tr>
<td>1761 m</td>
<td></td>
<td></td>
<td></td>
<td>M 1 4 J 75 A 245 M 146</td>
</tr>
<tr>
<td>9237007</td>
<td>Kajiado, Mashuru Dispensary</td>
<td>UM 5 vs/s + (vs/s)</td>
<td>505</td>
<td>J 38 F 36 M 63 A 129 M 64 J 9 F 4</td>
</tr>
<tr>
<td>1585 m</td>
<td></td>
<td></td>
<td></td>
<td>M 3 J 3 A 23 S 66 O 67</td>
</tr>
<tr>
<td>9136013</td>
<td>Ngong, District Office</td>
<td>LH 3 s/m + (s/vs)</td>
<td>812</td>
<td>J 42 F 53 M 91 A 190 M 144 J 37</td>
</tr>
<tr>
<td>2042 m</td>
<td></td>
<td></td>
<td></td>
<td>F 15 M 19 A 25 J 43 A 91 M 63</td>
</tr>
<tr>
<td>9237022</td>
<td>Outward Mtn. Sch.</td>
<td>UM 3 s + m/s</td>
<td>922</td>
<td>J 74 F 69 M 128 A 154 M 26 J 12</td>
</tr>
<tr>
<td>1870 m</td>
<td></td>
<td></td>
<td></td>
<td>F 2 4 J 7 A 45 M 233 A 147</td>
</tr>
<tr>
<td>9237031</td>
<td>Oltukai Amboseli HQS</td>
<td>LM 6 br</td>
<td>291</td>
<td>J 20 F 31 M 26 A 62 M 15 J 0</td>
</tr>
<tr>
<td>1216 m</td>
<td></td>
<td></td>
<td></td>
<td>F 0 M 0 A 1 J 15 M 71 A 50</td>
</tr>
<tr>
<td>9136039</td>
<td>Kajiado District Office</td>
<td>UM 6 br</td>
<td>480</td>
<td>J 40 F 26 M 62 A 120 M 56 A 12</td>
</tr>
<tr>
<td>1737 m</td>
<td></td>
<td></td>
<td></td>
<td>J 6 M 9 A 22 J 69 M 55</td>
</tr>
<tr>
<td>9237043</td>
<td>Lesoit Ranch Kajiado</td>
<td>LM 6 br</td>
<td>445</td>
<td>J 34 F 26 M 46 A 87 M 46 J 4</td>
</tr>
<tr>
<td>1115 m</td>
<td></td>
<td></td>
<td></td>
<td>F 2 M 3 A 11 J 27 M 92 A 68</td>
</tr>
<tr>
<td>9136163</td>
<td>Maasai Olorgesailic</td>
<td>LM 6 br</td>
<td>559</td>
<td>J 50 F 53 M 54 A 141 M 94 A 14</td>
</tr>
<tr>
<td>1143 m</td>
<td></td>
<td></td>
<td></td>
<td>J 8 M 4 A 22 M 22 A 53 M 45</td>
</tr>
<tr>
<td>9136167</td>
<td>Magadi Soda Works Lab</td>
<td>IL 6 br</td>
<td>427</td>
<td>J 49 F 43 M 64 A 104 M 56 A 8</td>
</tr>
<tr>
<td>612 m</td>
<td></td>
<td></td>
<td></td>
<td>F 3 M 3 A 6 J 16 M 37 A 47</td>
</tr>
<tr>
<td>9136185</td>
<td>Kajiado Maasai Rural Tr. Centre</td>
<td>UM 5 vs/s + vs</td>
<td>582</td>
<td>J 39 F 46 M 70 A 143 M 80 A 15</td>
</tr>
<tr>
<td>1737 m</td>
<td></td>
<td></td>
<td></td>
<td>J 6 M 6 A 11 M 28 A 77 M 62</td>
</tr>
<tr>
<td>9136190</td>
<td>Esampu Keke Kajiado</td>
<td>UM 6 br</td>
<td>466</td>
<td>J 42 F 42 M 55 A 103 M 42 A 42</td>
</tr>
<tr>
<td>1743 m</td>
<td></td>
<td></td>
<td></td>
<td>F 14 M 7 A 7 J 7 M 22 A 24</td>
</tr>
<tr>
<td>9136225</td>
<td>Olkiramatian</td>
<td>IL 6 br</td>
<td>455</td>
<td>J 85 F 38 M 71 A 105 M 42 A 7</td>
</tr>
<tr>
<td>747 m</td>
<td></td>
<td></td>
<td></td>
<td>F 10 M 3 A 10 M 7 J 35 A 22</td>
</tr>
</tbody>
</table>

1) Wet years, not typical, ca. 900 mm
KAJIADO Group of Districts

66% RELIABILITY OF RAINFALL IN AGROHUMID PERIODS OF FIRST RAINY SEASON
(End of Febr. - June or less)
Amounts in mm, surpassed in 10 out of 15 years

Broken isolines are uncertain because of lack of rainfall records

Min. of Agr. and GTZ: R. Jaetzold 2010, GIS-Cartogr.: B. Girkens
KAJIADO GROUP 7

KAJIADO Group of Districts

66% RELIABILITY OF RAINFALL IN AGROHUMID PERIODS OF SECOND RAINY SEASON
(End of Oct. - beg. of Febr. or less)
Amounts in mm, surpassed in 10 out of 15 years

Broken isolines are uncertain because of lack of rainfall records

1) Agrohumid periods of at least 50 days occur in less than 50% of the seasons (in areas > 1500m)

2) Agrohumid periods of at least 40 days occur in less than 50% of the seasons (in areas < 1500m)

Min. of Agr. and GTZ: R. Jaetzold 2010. GIS-Cartogr.: B. Gikens
## TABLE 2: CLIMATE IN THE AGRO-ECOLOGICAL ZONES

<table>
<thead>
<tr>
<th>Agro-Ecological Zone</th>
<th>Subzone</th>
<th>Altitude in m</th>
<th>Annual mean temp. in °C</th>
<th>Annual av. rainfall in mm</th>
<th>66% reliability of rainfall(^1)</th>
<th>60% reliability of cereal and legumes growing period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1st rainy season in mm</td>
<td>Middle rains &amp; 2nd season in mm</td>
</tr>
<tr>
<td>LH 2</td>
<td>s/m + m</td>
<td>1 850-2 000</td>
<td></td>
<td>Very small and National Park</td>
<td>200-250</td>
<td>220-250(^3)</td>
</tr>
<tr>
<td>LH 3 Wheat-Maize-Barley Zone</td>
<td>s or s/m + m/s</td>
<td>1 850-1 960</td>
<td>17.3-17.9</td>
<td>800-1 000</td>
<td>250-320</td>
<td>310-400</td>
</tr>
<tr>
<td>LH 3</td>
<td>s/m + s/vs</td>
<td>1 850-2 100</td>
<td>16.5-17.9</td>
<td>800-950</td>
<td>300-370</td>
<td>300-350</td>
</tr>
<tr>
<td>LH 4 Cattle-Sheep-Barley Zone</td>
<td>s + vs/s</td>
<td>1 850-2 025</td>
<td>16.9-17.9</td>
<td>720-800</td>
<td>250-300</td>
<td>230-280</td>
</tr>
<tr>
<td>LH 5 Lower Highland Ranching Zone</td>
<td>vs/s + vs</td>
<td>1 850-2 000</td>
<td>17.0-17.9</td>
<td>600-720</td>
<td>200-250</td>
<td>200-230</td>
</tr>
<tr>
<td>UM 3 Marginal Coffee Zone</td>
<td>s + m/s</td>
<td>1 800-1 850</td>
<td>18.0-18.3</td>
<td>900-1 000</td>
<td>280-330</td>
<td>300-350</td>
</tr>
<tr>
<td>UM 4 Maize-Sunflower Zone</td>
<td>fs + vs/s</td>
<td>1 790-1 850</td>
<td>18.0-18.4</td>
<td>720-800</td>
<td>250-300</td>
<td>250-300</td>
</tr>
<tr>
<td>UM 4</td>
<td>s/vs + fs</td>
<td>1 450-1 800</td>
<td>18.0-20.1</td>
<td>700-900</td>
<td>250-300</td>
<td>260-350</td>
</tr>
<tr>
<td>UM 4</td>
<td>s/vs + (vs/s)</td>
<td>1 790-1 850</td>
<td>18.0-18.4</td>
<td>700-800</td>
<td>250-290</td>
<td>200-250</td>
</tr>
<tr>
<td>UM 5 Livestock-Sorghum Zone</td>
<td>vs/s + vs/s</td>
<td>1 400-1 700</td>
<td>18.5-20.5</td>
<td>520-720</td>
<td>170-240</td>
<td>180-260</td>
</tr>
<tr>
<td>UM 6 Upper Midland Ranching Zone</td>
<td>b r</td>
<td>1 400-1 800</td>
<td>18.5-20.6</td>
<td>Agriculture only by irrigation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LM 4 Marginal Cotton Zone</td>
<td>s/vs + s/vs</td>
<td>1 000-1 440</td>
<td>20.1-22.8</td>
<td>650-850</td>
<td>200-250</td>
<td>250-330</td>
</tr>
<tr>
<td>LM 5 Lower Midland Livestock-Miller Zone</td>
<td>vs/s + vs/s vs/s + vs vs + vu</td>
<td>970-1 400</td>
<td>20.6-23.5</td>
<td>500-650</td>
<td>170-180</td>
<td>180-250</td>
</tr>
<tr>
<td>LM 5 Lower Midland Ranching Zone</td>
<td>b r</td>
<td>950-1 350</td>
<td>21.0-23.9</td>
<td>Agriculture only by irrigation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>IL 6 Inner Lowland Ranching Zone</td>
<td>b r</td>
<td>610-950</td>
<td>24.0-26.0</td>
<td>Agriculture only by irrigation</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

\(^1\) Amounts surpassed normally in 10 out of 15 years, falling during the agro-humid period which allows growing of most crops. Growing periods should be more reliable, therefore amounts surpassed normally in 6 out of 10 years.

\(^2\) Only added if rainfall continues at least for survival (r>0.25 PET) of most crops.

\(^3\) There is a weak continuation of rainfall from the second rainy season to the next first one.
KAJIA DO

Group of Districts

BELTS OF ZONES BY TEMPERATURE
LH = Lower Highland Zones
UM = Upper Midland Zones
LM = Lower Midland Zones

AGRO-HUMID (=GROWING) PERIODS
in First Rainy Season in Spatial Groups of Days which should be exceeded in 6 out of 10 years

1) UM 5 65 - 74
2) UM 4 75 - 84
3) LM 4 75 - 84
4) UM 4 75 - 84
5) LH 3 85 - 114
6) UM 3 85 - 104
7) LM 5 65 - 74
8) LM 5 < 45
9) LM 5 45 - 55
10) LM 5 45 - 55
11) LM 5 55 - 74
12) LM 5 45 - 74
13) UM 5 50 - 64

Min. of Agr. and GIZ: R. Jaetzold 2011, GIS-Cartogr.: B. Girkens
AGRO-ECOLOGICAL ZONES AND SUBZONES - Introduction

The yield potentials are calculated for the important annual crops with the programs WATBAL and MARCROP by B. Hornetz (see chapter 3.1 and Annex). The other crops are classified by estimates according to their temperature and water requirements. Not all suitable crops could be mentioned here because of limited space. More crops and the most suited varieties can be found in the crop list (Table X) and in IRACC: Small Holder Farming Handbook for Self Employment, Nairobi 1997, when comparing both sources with the climatic data of the AEZ and Subzones (Table 2) as well as considering the soil requirements (Table IV) and the soil map. The potentials require optimal fertilising and manuring as well as good crop husbandry to reach the given percentage, groups.

Recommended for checking in Table X are the following crops resp. varieties which have not been mentioned in the potentials: Many maize varieties, most of them commercial ones; more vegetables like french beans, carrots, leek, celery, spinach, beetroot, turnips and more fruits like grapefruit, mandarines, limes, lemons and tangerines. For fodder and forage many other plants than the mentioned ones are classified in Table XI by Agro-Ecological Zones. It must be kept in mind that the second rainy season is very sensitive to the El Niño-Southern Oscillation (ENSO) System. In an ENSO-season it gets 10% more rainfall and a 20% longer growing period than normal, 50% more rainfall and a 45% longer growing period than in an Anti-ENSO-season. This can be forecasted by the Met. Service already in July and is of vital importance for the selection of the right seeds and increasing or decreasing the stocking in time.

The tables beneath the diagrams of growing periods may differ from other calculations because they do not include the drier grass growing periods which can give a minimum supply of moisture to low demanding crops.

It must be realised that the potentials are ecological ones. What is economical depends on the present relations of costs-yield-prices and the marketing possibilities, of course.
AGRO-ECOLOGICAL ZONES AND SUBZONES  (Legend to the Map)

$LH$ = LOWER HIGHLAND ZONES

$LH 2$ = Wheat/Maize – Pyrethrum Zone

$LH 2$ = Wheat/Maize – Pyrethrum Zone with a short to medium and a medium cropping season

Very small and National Park (Chyulu Hills)

$LH 3$ = Wheat/Maize – Barley Zone

$LH 3$ = Wheat/Maize–Barley Zone with a short or short to medium cropping season and a medium to short one

Small, but nationally of some importance as a wheat area

Good yield potential
1st rainy season, start norm. mid March: E. mat. barley
2nd rainy season, start norm. mid O.: E. mat. wheat, e.mat. barley

Fair yield potential
In both rainy seasons e. mat. beans, kales, green onions

Pasture and forage
Livestock should be restricted to bouldery or slopy areas not suitable for cultivation. E. mat. barley and beans straw for add. feeding

$LH 3$ = Wheat/Maize–Barley Zone

$LH 3$ = Wheat/Maize–Barley Zone with a short to medium and a short to very short cropping season

Good yield potential
1st rainy season: E. mat. wheat, e. mat. barley, e. mat. maize; e. mat. peas and beans, e. mat. potatoes; m. mat. sunflower (lower places), vegetables
2nd rainy season, start norm. end of O.: V. e.mat. barley, vegetables
Whole year: Black wattle

Pasture and forage
0.8 - 1.6 ha/LU on secondary grassland, higher capacity on art. pasture of Nandi Setaria. Barley Amani and subterr. clover a. o. (Table X) for add. forage

$LH 3$ = Wheat/Maize–Barley Zone

$LH 3$ = Wheat/Maize–Barley Zone with a short to medium and a short to very short cropping season

Very small area around Ngong, already too densely populated for agriculture, or it is Forest Reserve

$LH 4$ = Cattle-Sheep–Barley Zone

$LH 4$ = Cattle-Sheep–Barley Zone with a short to medium cropping season

Very small and under pressure for building plots

$LH 4$ = Cattle-Sheep–Barley Zone

$LH 4$ = Cattle-Sheep–Barley Zone with a short and a (weak) very short to short cropping season

Fair yield potential
1st rainy season: V. e. mat. barley, e. mat. wheat; kales

Poor yield potential
2nd rainy season, start norm. b. of N. (to 1st r. s.): Late mat. maize (N. - June), e. mat. barley (N. - E.), v. e. mat. barley (N. - b. of J.)

Pasture and forage
1.3 ha/LU on open highland savanna with red oats grass predominant, about 0.8 ha/LU on art. pasture of Rhodes grass var. Elmba or Boma; suitable for grade cattle; e. mat. barley like
Amani and subterranean clover as add. forage (others see Table XI).

\[ LH_5 \]

\[ b r or \]

\[ vs/s + vs \]

Lower Highland Ranching Zone with bimodal rainfall or a very short to short growing season and a very short one

Small, south of Ngong Hills. The grass growing seasons might become cropping seasons due to global warming and new fast growing varieties (see Table X).

\[ UM \] = UPPER MIDLAND ZONES

\[ UM_3 \] = Marginal Coffee Zone

\[ UM_3 s + m/s \] = Marginal Coffee Zone with a short and a medium to short cropping season

Good yield potential
1st rainy season, start norm. end of March: Dryland comp. maize (~60 %), e. mat. sorghum; onions, e. mat. cabbages
2nd rainy season, start norm. mid O.: E. mat. maize, m. mat. sorghum, e. mat. finger millet; e. mat. beans, Dolichos beans; onions, cabbages, tomatoes, kales

Fair yield potential
1st rainy season: E. mat maize, e. mat. beans, sweet potatoes, pigeon peas; kales, tomatoes
2nd rainy season: M. mat. maize
Whole year: Arabica coffee (fair on higher places, poor on lower places, there add. irr. profitable), pawpaws, citrus

Pasture and forage
0.7–1.1 ha/LU on sec. high grass savannah of zebra grass (Hyparrhenia rufa), down to about 0.35 ha/LU feeding Napier and Bana grass plus legumes like siratro and leaves of horse tamarinds (Leucaena leucocephala)
UM 4  = Maize-Sunflower Zone

UM 4  = Maize-Sunflower Zone with a fully short cropping season and a (weak) very short to short one

Small area below Ngong (see Farm Survey), under pressure for building plots

UM 4  = Maize-Sunflower Zone with a short to very short cropping season and a fully short one

Good yield potential (on deep soils)
1st rainy season start norm. mid March: E. mat. sorghum (higher places); v. e. mat: sorghum (lower places); mwezi moja beans, e. mat. cowpeas (lower places); dwarf sunflower (lower places)
2nd rainy season, start norm. end of O.: Katumani maize (higher places), Dryland comp. maize (lower places); e. mat. sorghum (ratoon in following rainy season); mwezi moja beans, e. mat. cowpeas (lower places); e. mat sunflower (lower places, bird protection necessary)
Whole year: Sisal

Fair yield potential
1st rainy season: Dryland comp. maize; Dolichos beans, sweet potatoes; tomatoes, onions, e. mat. cabbages
2nd rainy season: E. mat. beans (higher places), Dolichos beans, sweet potatoes; tomatoes, onions, cabbages
Whole year: Pineapples, cassava, castor

Pasture and forage
1.2 - 2.5 ha/LU on undestroyed medium grass savanna, down to about 0.3 ha/LU feeding Bana grass, legumes (wetter places) or moth beans, leaves of horse tamarinds and salt bushes (Atriplex nummularia)

UM 4  = Maize-Sunflower Zone with a short to very short cropping season and a (weak) very short to short one

Potentials as above but crops in 2nd rainy season more poor than fair.

UM 4  = Maize-Sunflower Zone with two short to very short cropping seasons

One area on Chyulu Hills, National Park. Another but very hilly area is southwest of Sultan Hamud

UM 5  = Livestock - Sorghum Zone

UM 5  = Livestock - Sorghum Zone with two very short to short cropping seasons

No good yield potential

Fair yield potential
1st rainy season, start norm. mid March, or 2nd rainy season, start norm. end of O.: V. e. mat. sorghum, e. mat. foxtail and proso millet, chick peas (on heavy black soils in lower places) dwarf sunflower, rai (v. e. mat. oilseed Brassica juncea from Jodhpur, still experimental in Kenya)

Poor yield potential
Both rainy seasons: Dryland comp. (30-40%) and Katumani maize (20-30%); v. e. mat. beans

Pasture and forage
1.6 - 2.8 ha/LU on undestroyed medium grass savanna; more dense stocking if planting salt bushes, Mesquite or Algarrobo (Prosopis juliflora or chilensis) for browsing and Gao trees (Acacia albida) mainly for pods as add. forage, others see Table XI

UM 5  = Livestock - Sorghum Zone

UM 5  = Livestock - Sorghum Zone with a very short to short and a very short cropping season

Fair yield potential
1st rainy season, start norm. end of March: V. e. mat. sorghum, dwarf sorghum; green grams (lower places), chick peas (on heavy black soils in lower places); dwarf sunflower, rai (oilseed Brassica juncea from Jodhpur)
2nd rainy season, start norm. beg. of Nov.: Yields a bit less, sunflower poor
### DIAGRAM OF SHORTER GROWING PERIODS ON FERRALSOLS

#### Also showing the irregular start of the 1st and the changing end of the 2nd rainy season

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<td>Precipitation is cumulated during agro-humid period in mm</td>
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##### Subzones:

- (vav) = vav | br

#### Table

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#### First rainy season: Av. end of March - end of May

- Yeas of usable records: 27

#### Second rainy season: Av. end of Oct. - begin of January

- Yeas of usable records: 28

#### Changes for the right growing periods:

- KCB maize: 0 gr. p. of at least 110 days = 0 % of the seasons
- E.mat. sorghum: 1 gr. p. of at least 100 days = 4 % of all seasons
- E.mat. beans: 2 gr. p. of at least 90 days = 7 % of all seasons
- E.mat. cowpeas: 7 gr. p. of at least 80 days = 26 % of all seasons
- V.e.m.green grams: 13 gr. p. of at least 70 days = 48 % of all seasons

#### Existential risks:

- No cereal growing period in a year or more: 3 times = 10.7 % of the years
- 2 or more consecutive rainy seasons without the min. AHP 1) of 50 d.: 3 times in 28 years
- No grass growing period in a season: 6 times = 10.9 % of the seasons
- No grass growing period in a year or more: 0 times = 0 % of the years

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1) valid = no significant gaps in the records

2) AHP = Agro-humid period – growing period for cereals and legumes; GGP = grass growing period

3) Mean duration of growing periods (AHP) on Ferralsols is about 10 days shorter than on Vertisols; chances for crop cultivation are lower.

( ) figures in brackets means: no data at the beginning of the rainy season
### First rainy season: Av. end of March - end of May

- Av. end of March - end of May years of usable records: \(27^{1)}\)

### Second rainy season: Av. end of Oct. - begin of January

- Av. end of Oct. - begin of January years of usable records: \(28^{1)}\)

#### Chances for the right growing periods:

<table>
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<th>Cereal and legumes growing period</th>
<th>Dry conditions</th>
<th>Precipitation is cumulated</th>
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<td>V.e.m. gr. green</td>
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#### Existential risks:

- No cereal growing period in a year or more: 2 times = 7.2 % of the years
- No grass growing period in a year or more: 0 times = 0 % of the years

---

[1) valid = no significant gaps in the records](#)

[2) AHP = Agro-humid period – growing period for cereals and legumes; GGP = grass growing period](#)

[3) Mean duration of growing periods (AHP) on Vertisols is about 10 days longer than on Ferralsols; chances for crop cultivation are also higher.](#)

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**Note:** Figures in brackets mean: no data at the beginning of the rainy season.
**Poor yield potential**
1st rainy season: Dryland comp. (30-40%) and Katumani maize (20-30%); v. e. mat. beans

**Pasture and forage**
1.8 - 3 ha/LU on short grass savanna with red oats grass (Themeda triandra) predominant. No forage cultivation necessary on good grassland soils, on degraded pastures and stony soils saltbush (Atriplex numm.) and other fodder plants (see Table XI) advisable

**UM 6** = *Upper Midland Ranching Zone*

**UM 6** = *Upper Midland Ranching Zone with bimodal rainfall*

No rainfed agriculture advisable. Limited irrigation near Athi River

**Pasture and forage**
About 4 ha/LU on nearly treeless short grass savanna. Dominating black soils not suitable for fodder shrubs. Especially short rains are diminishing considerably west of hillsides

**LM** = *LOWER MIDLAND ZONES*

**LM 4** = *Marginal Cotton Zone*

**LM 4** = *Marginal Cotton Zone with two short to very short cropping seasons*

**Good yield potential**
1st rainy season, start norm. mid March, or 2nd rainy season, start norm. end of O.: Dryland comp. maize (on contour ridges), v. e. mat. sorghum (70 - 80%), e. mat. bulrush millet, e. mat. foxtail or proso millet (70 - 80%); dwarf sunflower; v. e. mat. cowpeas, black and green grams, chick pea (late planted on h. black soils); v. e. mat. pumpkins
Whole year, best pl. time end of O.: Sisal, *buffalo gourds* (on sandy soils, still experimental in Kenya), castor, jatropha

**Fair yield potential**
1st or 2nd rainy season: Katumani maize (on contour ridges), e. mat. sorghum; mwezi moja beans (50 - 60%), e. mat. soya beans, Dolichos beans, e. mat. bambara groundnuts (on light soils), sweet potatoes; e. mat. sunflower; onions, tomatoes; pigeon peas
Whole year: Cassava

**LM 5** = *Lower Midlands Livestock - Millet Zone*

**LM 5** = *Lower Midlands Livestock - Millet Zone with two very short to short cropping seasons*

**Good yield potential**
1st rainy season, start norm. mid March, or 2nd rainy season, start norm. end of O.: E. mat. foxtail and proso millet, v. e. mat. pumpkins
Whole year: Buffalo gourds and Marama beans

**Fair yield potential**
1st or 2nd rainy season: Dryland comp. maize (~40%), e. mat. bulrush millet, v. e. mat. sorghum; black and green grams, v. e. mat. cowpeas, v. e. mat. tepary beans, v. e. mat. moth beans, chick peas (on h. bl. soils late planted); dwarf sunflower, v. e. mat. bambara groundnuts (on light soils)
Whole year: Sisal, castor, Jatropha

**Pasture and forage**
3 - 4.5 ha/LU, down to about 0.8 ha/LU with silage of fodder sorghum and hay of moth bean vines,
Mesquite or Algarrobo (*Prosopis juliflora* or *chilensis*) and saltbush (*Atriplex nummularia*) for browsing, Gao trees (*Acacia albida*) for pods, Opuntia var. without prickles (also as vegetable and fruit).

**LM 5**

\[ f \text{ vs } + \text{ vs/s} \]

- **Lower Midlands Livestock - Millet Zone**
  - with a very short to short cropping seasons

Area on Chyulu Hills. National Park or shallow soils and lack of water

**LM 5**

\[ v/s + \text{ vs} \]

- **Lower Midlands Livestock - Millet Zone**
  - with a very short to short and a very short cropping season

Small, potential see Taita/Taveta

**LM 5**

\[ \text{ vs } + \text{ vs/s} \]

- **Lower Midlands Livestock - Millet Zone**
  - with a very short cropping season and a fully short 2nd one

Very small, potential the same as in the next subzone, 2nd season a bit better

**LM 5**

\[ \text{ vs } + \text{ vs} \]

- **Livestock - Millet Zone**
  - with two very short cropping seasons

**Good yield potential**

1st rainy season, start norm. end of March: V. e. mat. foxtail and hog millet

2nd rainy season, start norm. end of O.: The same

Whole year: Buffalo gourds, Marama beans

**Fair yield potential**

1st rainy season: E. mat. foxtail and proso millet, dwarf sorghum (~40%); green grams, v. e. mat. moth beans, v. e. mat. tepary beans (40 - 50%), v. e. mat. cowpeas (~40%), chick peas (on h. bl. soils late planted); dwarf sunflower, v. e. mat. bambara groundnuts (on light soils); v. e. mat. pumpkins

2nd rainy season: The same but less risky

Whole year: Sisal, castor, Jatropha, *Vigna lobatifolia*

**Pasture and forage**

3.5 - 5 ha/LU on undestroyed nat. pasture, more if soils are stony; improvable as in LM 5 vs/s + vs/s
LM 5  = Lower Midlands Livestock - Millet Zone
vs + (vu)  with a very short cropping season and a weak very uncertain one

Good yield potential
1st rainy season, start norm. end of March: V. e. mat. foxtail or hog millet
Whole year: Buffalo gourds (on sandy soils), Marama beans

Fair to poor yield potential
1st rainy season: V. e. mat. sorghum (~40%), e. mat. bulrush millet; green grams, moth beans, cowpeas
for spinach; dwarf sunflower, v. e. mat. bambara groundnuts (light soils)

Pasture and forage
4 - 5 ha/LU; forage see LM 5 vs/s + vs/s

LM 5  = Lower Midlands Livestock - Millet Zone
vu + vs  with a very uncertain 1st cropping season and a short one

Potential as above but in 2nd rainy season

LM 6  = Lower Midland Ranching Zone
br  with bimodal rainfall

No rainfed agriculture possible except with runoff-catching techniques (see Fig. 2). More than 4 ha/LU
on short grass savanna or light bushland

IL 6  = Inner Lowland Ranching Zone
br  with bimodal rainfall

No rainfed agriculture possible but irrigation near the Nguruman Escarpment. More than 5 ha/LU
on short grass savanna or dwarf shrub
KAJIADO GROUP 20

KAJIADO
Group of Districts

SOILS

KEY
- Road
- Towns and Villages
- Boundary of District Group
- River or smaller water course
- National Park

Groups of Special Soil Care Necessities
- Organic manuring etc. and protection against soil erosion esp. necessary
- Heavy organic manuring
- Heavy organic manuring and protection against denudation & erosion
- Organic manuring & mulching and protection against denudation
- Mulching with deep rooting bushes especially profitable
- Flood control & drainage, channeling and ridging
- Different technologies are necessary
- Unsuitable soil or topography for agriculture

Reasons
- Soils young and shallow, sloppy
- Senile deep soils
- Senile and shallow soils
- Young footslope soils
- Bedrock has many nutrients
- Seasonal inundations & waterlogging
- Complex soils, see legend

SOIL DISTRIBUTION, FERTILITY AND MAJOR CHARACTERISTICS

The physiography of the northern and western parts of Kajiado group of districts is dominated by the Rift Valley System with escarpments on both sides of the rift, large lava flows and outcrops on the valley bottom as well as on the escarpments and east of the Ngong Hills. Lake Magadi is situated in the lowest part of the southern rift near the Tanzanian border. Southeast of the Rift Valley around Kajiado Town, Namanga and Athi River the peneplain of the old basement system is stretching south into the Lake Amboseli Basin and east to the Machakos Hills.

Shallow, partly bouldery Cambisols from volcanic origin (LsB 1) are occupying the bottom of the Rift Valley; the lower parts along the luggas are seasonally waterlogged, partly saline and alkaline (Solonchaks and Vertisols, BV 1). The floodplains of the Ewaso Ngiro west of the Lake Magadi are covered by Fluvisols (AA 8), which are liable to waterlogging during the rainy season. The river is ending in a swampy area, north of Lake Natron, containing infertile Solonchaks (S 1).

Strongly weathered, less fertile Ferralsols (Pn U 1) and Luvisols (Um 25) are dominating on the peneplain, in some parts associated with less weathered Cambisols and Regosols on rock outcrops (HU 2); these soils are liable to soil erosion when the vegetation is destroyed. In the Lake Amboseli Basin Fluvisols and Vertisols (AA 4 + AA 5) as well as Luvisols (AA 6) are accompanying the river beds (e.g. near Ol Keju Adu); these soils are seasonally waterlogged and have to be drained for agricultural purpose.

The physiography of southeastern Kajiado Group consists of the volcanic ridges and uplands of Kilimajaro. In the northeast, the Chyulu Range has influenced the topography so that volcanic plains and lava flows occur. Piedmont plains extend east of Amboseli, with lacustrine plains around Lake Amboseli.

In the Chyulu Hills, moderately to highly fertile soils occur (HP 1) but the majority of these soils are not yet sufficiently weathered and have a low water retention capacity. Soils on volcanic footridges occupy the southwestern and southern part of the district (unit RBC) and are of moderate to high fertility. Soils of units Um U 5 and YPC are of the same fertility, found on the piedmont plains in the western region.

The dominating soils in the centre of the district are upland soils of low to moderate fertility (unit UBA). The northern region consists of soils on non-dissected erosional plains (map units PnU 1, PnU’1, Pn 21*). In general, they are of low to moderate fertility, apart from unit Pn 21* which is of high fertility.

On volcanic plains around the Chyulu Range, soils of unit RP 1 occur which could be of high fertility if the area was not so dry. Bottomlands with soils of variable fertility are found (unit BV 3) along the Loolturesh River. In the north of the district, soils of low fertility occur on the badlands.

As the soils are extremely shallow, likelihood of soil erosion and degradation is very high and the forests in the National Park of the Chyulu Hills must be kept at all costs.

LEGEND TO THE SOIL MAP OF KAJIADO GROUP OF DISTRICTS

1 Explanation of first character (physiography)

M Mountains and Major Scarps
H Hills and Minor Scarps
Hs Step faulted scarps of the Rift Valley
L Plateaus and high-level Structural Plains
Ls Step-faulted floor of the Rift Valley
R Volcanic Footridges
F Footslopes
FY Footslopes and piedmont plains undifferentiated
Y Piedmont plains
Uu Upper level uplands
KAJIADO GROUP 22

Uh   Upper middle-level uplands
Um   Lower middle-level uplands
Ul   Lower-level Uplands
Ux   Uplands, undifferentiated levels
Up   Upland/high-level plain transitional lands
Pn   Non-dissected erosional plains
Pd   Dissected erosional plains
Ps   Sedimentary Plains
Pv   Volcanic Plains
Pl   Lacustrine Plains
A    Floodplains
B    Bottomlands
D    Dunes or dune land
S    Swamps
V    Minor Valleys
W    Badlands

2   Explanation of second character (lithology):

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Recent Alluvial Sediments from various sources</td>
</tr>
<tr>
<td>B</td>
<td>Basic and Ultra-basic Igneous Rocks (basalts, nepheline phonolites; older basic tuffs included)</td>
</tr>
<tr>
<td>BP</td>
<td>- do - with influence of volcanic ash predominant</td>
</tr>
<tr>
<td>I</td>
<td>Intermediate Igneous Rocks (andesites, phonolites, syenites, etc.)</td>
</tr>
<tr>
<td>L</td>
<td>Limestones and Calcitic Mudstones</td>
</tr>
<tr>
<td>O</td>
<td>Plio-Pleistocene Bay sediments</td>
</tr>
<tr>
<td>P</td>
<td>Pyroclastic rocks</td>
</tr>
<tr>
<td>U</td>
<td>Undifferentiated Basement System Rocks (predominantly Gneisses)</td>
</tr>
<tr>
<td>V</td>
<td>Undifferentiated or Various igneous rocks</td>
</tr>
<tr>
<td>V+</td>
<td>-do - with volcanic ash admixture</td>
</tr>
<tr>
<td>X</td>
<td>Undifferentiated or Various Rocks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plant nutrients in parent material:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>BP</td>
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<tr>
<td>I</td>
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<tr>
<td>L</td>
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<tr>
<td>O</td>
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</tbody>
</table>

3   Soil descriptions

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 1</td>
<td>Somewhat excessively drained, shallow to moderately deep, brown to dark brown, firm and slightly smearable, strongly calcareous, stony to gravelly clay loam; in many places saline and/or sodic and with inclusions of lava fields: ando-calcic REGOSOLS, partly lithic phase</td>
</tr>
<tr>
<td>MV 4</td>
<td>Well drained, shallow to moderately deep, dark reddish brown, friable, humic, rocky and stony, clay loam: humic CAMBISOLS, rocky and partly lithic phase</td>
</tr>
<tr>
<td>MV 5</td>
<td>Well drained, shallow to moderately deep, dark reddish brown to dark brown, friable, rocky and bouldery, clay loam to clay; in places with a humic topsoil: nito-chromic CAMBISOLS; with haplic PHAEOZEMS, lithic phase, LITHOSOLS, eutric REGOSOLS and Rock Outcrops</td>
</tr>
<tr>
<td>MV 7</td>
<td>Well drained, shallow, dark brown, firm, rocky and stony, clay loam: eutric REGOSOLS, lithic phase; with Rock Outcrops</td>
</tr>
</tbody>
</table>
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MU 1  Somewhat excessively drained, shallow to moderately deep, reddish brown, friable, rocky and stony, sandy clay loam: eutric CAMBISOLS, partly lithic phase; with LITHOSOLS, eutric REGOSOLS and Rock Outcrops

MU 2  Well drained, moderately deep, reddish brown to brown, friable, stony sandy clay loam, with an acid humic topsoil: humic CAMBISOLS; with dystric REGOSOLS and Rock Outcrops

HB 1  Well drained, shallow, brown, firm, gravelly clay, with a stony to bouldery surface: chromic CAMBISOLS, lithic arid boulder-mantle phase

HL 1  Somewhat excessively drained, shallow, dark grey, firm, moderately calcareous, stony clay; on crystalline limestones: orthic RENDZINAS, lithic phase

HsV 1  Well drained, shallow, dark reddish brown, friable, strongly calcareous, rocky or stony, clay loam; in many places saline: LITHOSOLS; with Rock Outcrops and XEROSOLS, lithic, bouldery and saline phase

HU 2  Somewhat excessively drained, shallow, reddish brown, friable, rocky or stony, sandy clay loam: eutric REGOSOLS, lithic phase; with Rock Outcrops and calcic CAMBISOLS

HUC  Complex of: excessively drained to well drained, shallow, dark red to brown, friable, sandy clay loam to clay; in many places rocky, bouldery and stony and in places with an acid humic topsoil dystric REGOSOLS, lithic phase; with LITHOSOLS, humic CAMBISOLS, lithic phase and Rock Outcrops

HV 1  Well drained, shallow, dark reddish brown, friable, very calcareous, bouldery or stony, loam to clay loam; in many places saline: LITHOSOLS; with calcic XEROSOLS, lithic, bouldery and saline phase and Rock Outcrops

L 15  Imperfectly drained, moderately deep to deep, very dark grey to black, firm to very firm, slightly calcareous, cracking clay; in many places with a gravelly, calcareous deeper subsoil: pellic VERTISOLS and orthic RENDZINAS

L 17  Complex of: Moderately well drained, shallow, yellowish red to dark yellowish brown, friable, gravelly clay over petroplinthite or rock (50-70%): IRONSTONE SOILS; with LITHOSOLS and: poorly drained, deep to very deep, dark brown to very dark greyish brown, mottled, firm to very firm, cracking clay; in places moderately deep to very deep over petroplinthite: undifferentiated VERTISOLS and vertic GLEYSOLS

LB 4  Well drained, moderately deep to deep, dark brown, firm clay, with a thick humic topsoil: ortho-luvic PHAEOZEMS
LB 5  Moderately well drained, very deep, dark greyish brown, firm clay: verto-luvic PHAEOZEMS; with eutric PLANOSOLS

LB 9  Well drained, shallow to moderately deep, reddish brown, firm clay loam, with a humic topsoil: chromo-luvic PHAEOZEMS, partly lithic phase

LB 10 Well drained, shallow to moderately deep, dark reddish brown, firm, strongly calcareous clay loam, with a stony to bouldery surface; partly saline and/or sodic: calcic XEROSOLS, boulder-mantle and partly lithic and saline-sodic phase

LB 11 Imperfectly drained, deep, very dark greyish brown, very firm, cracking clay: chromic VERTISOLS

LB 12 Well drained, moderately deep to very deep, dusky red to dark brown, friable to firm, sandy clay loam to clay: ferric and nito-chromic LUVISOLS

LB 13 Well drained, deep to very deep, red to dark red, friable firm, sandy clay to clay, over pisocalcic material; on sheetwash and fluvialite sediments: ferric LUVISOLS

LI 1  Well drained, moderately deep to deep, yellowish red to strong brown, friable clay, over petroplinthite or rock; in places shallow over petroplinthite: orthic FERRALSOLS, partly petroferric phase; with IRONSTONE SOILS

LP 1  Well drained, moderately deep to very deep, dark brown, friable and slightly smeary, clay loam to clay: ando-luvic PHAEOZEMS

LsB 1  Well drained, moderately deep, dark reddish brown to reddish brown, friable to firm and slightly smeary, bouldery and stony, clay loam to clay; in places calcareous: ando-chromic CAMBISOLS, bouldery phase; with calcic XEROSOLS

RB 3  Well drained, extremely deep, dusky red to dark reddish brown, friable clay; with inclusions of well drained, moderately deep, dark red to dark reddish brown, friable clay over rock, pisoferric or petroferric material: eutric NITISOLS; with nito-chromic CAMBISOLS and chromic ACRISOLS, partly pisoferric or petroferric phase

RBC  Moderately well drained, shallow to moderately deep, dark brown, friable, strongly calcareous, sandy clay to clay loam, over petrocalcic material: calcic CAMBISOLS, petrocalcic phase

RP 1  Somewhat excessively drained, very deep, strong brown to dark yellowish brown, very friable and smeary, slightly sodic, gravelly sandy clay loam, with a humic topsoil: mollic ANDOSOLS, sodic phase

F15 Complex of: somewhat excessively drained to well drained, deep to very deep, dark red to brown, loose sandy loam to friable to firm, clay: undifferentiated ACRISOLS; with ARENOSOLS
FU 1  Well drained, very deep, yellowish red to dark reddish brown, loose, loamy coarse sand to friable
sandy clay loam:
chromic LUVISOLS; with rhodic FERRALSOLS and luvic/ferralic ARENOSOLS

FUC  Complex of:
well drained, deep to very deep, dark reddish brown to dark yellowish brown soils of varying
consistence and texture; in places gravelly and stratified:
ferralic ARENOSOLS; with ferralo-chromic/orthic LUVISOLS

FVC  Complex of:
well drained to moderately well drained, deep, reddish brown to very dark greyish brown,
firm, sandy clay loam to clay; in many places with a humic topsoil and/or cracking and/or
moderately calcareous:
undifferentiated LUVISOLS, luvic PHAEOZEMS and chromic VERTISOLS

FYL 1  Well drained, deep to very deep, dark brown, friable to firm, clay loam to sandy clay; in places
calcareous:
chromic LUVISOLS and haplic KASTANOZEMS

Y1  Complex of:
well drained, shallow to deep, greyish brown to black, very friable and smeary, rocky or
bouldery, gravelly, sandy clay loam to clay:
mollic ANDOSOLS, rocky phase and haplic CHERNOZEMS, stony and partly lithic phase

Y2  Well drained, deep to very deep, dark brown, firm clay; in places cracking and/or calcareous
and sodic:
vertic LUVISOLS; with calcic LUVISOLS, sodic phase and chromic VERTISOLS, sodic phase

Y6  Association of:
well drained, deep to very deep, dark reddish brown, friable to firm, sandy clay to clay; on
convex to straight slopes:
ferralo-ferric LUVISOLS
and:
moderately well drained, very deep, dark reddish brown to dark brown, firm, moderately
calcareous clay; with a saline and sodic deeper subsoil; on concave slopes:
vertic LUVISOLS, saline-sodic phase

Y8  Well drained, very deep, dark reddish brown to dark brown, loose sandy loam to friable to firm,
sandy clay:
orthic LUVISOLS; with luvic ARENOSOLS

UBA  Association of:
well drained, deep to very deep, dusky red to dark reddish brown, friable, stony, clay loam to
clay; on upper slopes:
chromic LUVISOLS, stony phase
and:
imperfectly drained, deep to very deep, dark brown to very dark greyish brown, firm, calcareous,
saline and sodic, stony, cracking clay; on lower slopes:
vertio-luvic PHAEOZEMS, stony and saline-sodic phase
ULB 1  Well drained, extremely deep, dusky red to dark reddish brown, friable clay:
eutric NITISOLS

Um 19  Well drained, moderately deep to very deep, dark reddish brown to dark yellowish brown, friable
to firm, sandy clay to clay; in many places with a topsoil of loamy sand to sandy loam:
ferralo-chromic / orthic/ferric ACRISOLS; with LUVISOLS and FERRALSOLS

Um 25  Complex of:
well drained, shallow to deep, reddish brown to brown, friable to firm, sandy clay loam to clay:
chromic LUVISOLS and dystric CAMBISOLS, lithic phase

UmU 5  Well drained, deep to very deep, dark brown, very friable, clay loam to gravelly clay loam:
eutric CAMBISOLS

UP 2  Well drained, moderately deep to deep, black, very friable and smeary, very gravelly loam, with a
humic topsoil:
mollic ANDOSOLS

Up 8  Association of:
well drained, deep to very deep, dark reddish brown, friable to firm, sandy clay loam to sandy
clay, with a calcareous deeper subsoil; on upper, convex slopes:
chromic LUVISOLS
and:
imperfectly drained, deep to very deep, dark grey to black, firm to very firm, clay, abruptly
underlying a topsoil of friable sandy clay loam; on lower, straight slopes:
eutric PLANOSOLS

UpB  A  Association of:
imperfectly drained, moderately deep, dark greyish brown to black, very firm, gravelly, cracking
clay; in places saline; on gentle slopes:
pellic VERTISOLS, partly saline phase
and:
imperfectly drained, moderately deep, dark greyish brown to black, very firm, gravelly clay,
buckently underlying a topsoil of gravelly sandy clay loam; on terrain tops:
eutric PLANOSOLS

UpY  A  Complex of:
well drained, shallow to moderately deep, reddish brown, friable, stony and gravelly clay loam,
with a humic topsoil:
chromo-luvic PHAEOZEMS, partly lithic phase
and:
imperfectly drained, moderately deep, very dark greyish brown to black, very firm, cracking clay:
chromic VERTISOLS

Uu 3  Well drained, shallow to moderately deep, dark greyish brown, friable to firm, calcareous, very
rocky and bouldery clay:
calcic CAMBISOLS, lithic and bouldery phase
KAJIADO GROUP 27

UUA  Association of:
well drained, moderately deep to deep, dark red to dark reddish brown, friable to firm, sandy clay to clay; on slopes:
chromic LUVISOLS
and:
well drained, very deep, light brown to strong brown, very friable clay; on flat interfluves:
orthic and xanthic FERRALSOLS

Ux 8  Association of:
well drained to imperfectly drained, moderately deep to very deep, dusky red to very dark greyish brown, friable to firm, clay loam to clay; in many places stony and bouldery and/or cracking; with severe gully erosion and many rock outcrops; in major upland area:
eutric NITISOLS; with chromic CAMBISOLS, bouldery phase, VERTISOLS and Rock Outcrops
and:
well drained to imperfectly drained, shallow, dark reddish brown, friable to firm, gravelly and bouldery clay loam; on volcanic cones:
chromic CAMBISOLS, lithic and bouldery phase

PdV 1  Well drained, shallow, dark reddish brown to dark brown, friable to firm, sandy clay loam to clay loam; in places rocky:
chromo-luvic PHAEOZEMS, lithic phase; with Rock Outcrops

PdXC  Complex of:
well drained, shallow, dark reddish brown to strong brown, non to moderately calcareous, firm, stony and gravelly loam to sandy clay loam, partly over petrocalcic material:
chromic CAMBISOLS to orthic LUVISOLS, lithic or paralithic phase; with calcic CAMBISOLS, petrocalcic phase

Pl 8  Poorly drained, very deep, black to very dark olive grey, mollled, very firm, strongly calcareous, strongly saline, strongly sodic clay; lower level of Amboseli:
gleyic SOLONCHAKS, sodic phase

Pl 10  Complex of:
moderately well drained to imperfectly drained, shallow to deep, strongly calcareous, strongly saline and strongly sodic soils of varying colour, consistence and texture; over pisocalcic or petrocalcic material; higher level of Amboseli:
orthic SOLONCHAKS and orthic SOLONETZ, petrocalcic phase

PlU 1  Imperfectly drained to poorly drained, very deep, dark greyish brown to dark brown, firm to very firm, slightly to moderately calcareous, slightly to moderately saline, moderately to strongly sodic, silt loam to clay; in many places, with a humic topsoil; Subrecent lake edges of the Central Rift Valley:
undifferentiated SOLONETZ, saline phase

Pn 17  Well drained to imperfectly drained, deep to very deep, dark reddish brown to very dark greyish brown, friable to firm, slightly calcareous clay; in many places cracking:
vertic LUVISOLS and chromic VERTISOLS
Pn 21  Imperfectly drained, very deep, very dark greyish brown, brown, very firm, moderately calcareous, slightly saline and moderately sodic, cracking clay: verto-juvic PHAEOZEMS, saline-sodic phase

PnB'1  Imperfectly drained, very deep, dark grey to black, firm to very firm, bouldery and stony, cracking clay; in places with a calcareous, slightly saline deeper subsoil: pellic VERTISOLS, stony phase and partly saline phase

PnU 1  Well drained, moderately deep to deep, dark red to strong brown, friable to firm, sandy clay loam to clay: ferric and chromic LUVISOLS

PnUP 1  Moderately well drained, very deep, dark reddish brown to dark brown, firm, strongly calcareous, slightly saline and moderately sodic, cracking clay: vertic LUVISOLS, saline-sodic phase

PsO 2  Imperfectly drained, moderately deep, dark brown, extremely firm, moderately calcareous, slightly saline, moderately sodic, clay loam to sandy clay, with a topsoil of strongly sealing sandy loam: luvo-orthic SOLONETZ, saline phase

PvB 1  Well drained, very deep, dark red, friable, stony and bouldery clay: chromic LUVISOLS, bouldery phase

PvP 1  Excessively drained to well drained, very deep, dark greyish brown to olive grey, stratified, calcareous, loose fine sand to very friable fine sandy loam or silt: ando-calcaric REGOSOLS

PvP 4  Imperfectly drained, very deep, yellowish brown to olive grey, friable, slightly saline, slightly sodic, sandy loam to silt loam, with a brittle and strongly sodic deeper subsoil: gleic SOLONETZ, saline and fragipan phase

AA 1  Well drained to imperfectly drained, very deep, brown to dark brown, friable, micaceous, slightly calcareous, sandy loam to clay loam; in places with a saline-sodic deeper subsoil: eutric FLUVISOLS

AA 5  Imperfectly drained to poorly drained, very deep, dark reddish brown to dark greyish brown, firm to very firm, cracking clay; in many places mottled and with a calcareous, saline and sodic deeper subsoil: chromic VERTISOLS, saline-sodic phase

AA 4 + AA 5  Complex of soils of units AA 4 and AA 5

AA 6  Imperfectly drained, very deep, dark brown, firm, strongly calcareous, moderately saline, strongly sodic clay, with a topsoil of sandy clay loam: calcic LUVISOLS, saline-sodic phase
AA 6 +
AA 7  Association of:
well drained, very deep, dark reddish brown to dark brown, friable to firm, calcareous, sandy clay loam, with a saline and sodic deeper subsoil; on higher parts:
calcic LUVisols, saline-sodic phase
and:
imperfectly drained, very deep, very dark grey, firm, moderately calcareous, moderately saline, moderately to strongly sodic, cracking clay; on lower parts:
pellic VERTISols, saline-sodic phase

AA 8  Well drained to moderately well drained, very deep, dark greyish brown to yellowish brown, friable, stratified, silty clay loam to clay; in places slightly to moderately saline and slightly to moderately sodic:
eutric FLUVISols, partly saline-sodic phase

AA 10 Well drained, moderately deep to very deep, dark brown, very friable, moderately calcareous, gravelly clay loam, with a slightly saline and sodic deeper subsoil; in places over petrocalcic material:
calcic CAMBISols, saline-sodic phase

BV 1  Imperfectly drained, deep, dark brown to olive grey, firm to very firm, clay soils of varying calcareousness, salinity and sodicity; in many places cracking:
VERTISols and SOLONCHAKS, undifferentiated

BV 3  Imperfectly drained, very deep, dark brown to dark grey, firm, slightly to moderately saline, moderately sodic, cracking clay; in many places calcareous:
chromic and pellic VERTISols, saline-sodic phase

D 3  Well drained, very deep, dark brown, friable or brittle, strongly calcareous, moderately saline sandy clay loam, with fragipans at various depths:
calcic CAMBISols, saline and fragipan phase

S 1  Poorly drained to very poorly drained, very deep, dark greyish brown to dark olive grey, firm to very firm, strongly calcareous, strongly saline, strongly sodic clay; in many places with fragipans at various depths:
gleyic SOLONCHAKS, sodic phase and partly fragipan phase

VXC  Complex of:
well drained to imperfectly drained, shallow to moderately deep, dark reddish brown to very dark greyish brown, firm, slightly to moderately calcareous, rocky stony, or gravelly clay

W  Excessively drained, reddish brown, firm, strongly calcareous, slightly to moderately saline, strongly sodic, silt loam to clay loam of varying depth; strongly eroding and in many places with a gravel or stone surface:
undiff. SOLONETZ; with calcic XEROSols, LITHOSols, etc.; stone-mantle phase
KAJIADO GROUP 31

FARM SURVEY AREAS in Regard to AEZ and Soils

- unsuitable steep slopes
- irrigation
- swamp
- AEZ boundaries
- AEZ broken boundaries, uncertain or transitional
- Subzone boundaries

No. and approx. area of Farm Survey 2004 (s. Table 22)

1110 Representative area of F.S. conclusions according to AEZ and soil unit (Agro-Ecol.-Unit)

110 Slightly different soil or climate

Min. of Agr. and GTZ: R. Jaetzold 2010, GIS-Cartogr.: B. Girkens
3.6.2 POPULATION AND LAND see main Volume Southern Rift Valley Province

3.6.3 AGRICULTURAL STATISTICS see main Volume Southern Rift Valley Province

3.6.4 FARM SURVEY IN KAJIADO GROUP OF DISTRICTS

During the 2004 Farm Survey, only one AEZ, UM 4 in Kajiado North, was selected to represent the agricultural areas of Kajiado group of districts (Table 16). The other ones are near Namanga and Loitokitok. The data collected during the 2004 FS on various agricultural aspects are presented in Table 17 while the cropping pattern results are presented in Table 18. The average total land size per household was 2.4ha, an indication that land availability per household is yet to become a problem in the cultivatable parts of Kajiado group of districts. The average land for annual crops, permanent crops, pasture & fodder crops is 0.77ha, 0.04ha and 0.29ha, respectively. The district group is predominantly semi-arid and majority of the inhabitants are pastoralists. The low average land for permanent pasture in the survey area near Ngong could be attributed to the coming land shortage there by increasing population around Nairobi but it might be misunderstood, meaning artificial pasture only. Most of the district group is falling under communal land that is commonly used for grazing.

There are two farming seasons in Kajiado North District in which the main crops grown are maize, beans, Irish potatoes, kales and tomatoes. These crops are grown on a higher acreage during the better first rainy season than during the second one (Table 17). Bananas are the only perennial crop mentioned, cultivated on a total of 1.4ha from the entire sample.

In AEZ UM 4, although it is not optimal, dairy farming is practiced due to the near marketing in Nairobi, with an average household keeping about four dairy animals. 70% of the cattle livestock is considered to be improved. Even though zebu animals were not reported here, they are kept in the major parts of the district group since the Maasai community is known for pastoralism. With high TLU values of 12.94/ha for dairy, pasture land is increasingly becoming overstretched. Milk goats can be an alternative for households who have little land only.

Inputs are rarely used in UM 4 and if any, indeed in very small ineffective quantities as illustrated by the low amount for nitrogen, insecticides and cultivated land under improved seed varieties. The reason might be lack of cash mainly in time of planting. Progressive is the high amount of manure used by the majority of farmers here.

Sustainable agriculture offers solutions to some of the challenges facing in Kajiado North, South and Loitokitok districts. These can be summarized as follows:

- **Improved soil fertility:** Conventional farming methods rely on artificial fertilizers to maintain fertility. Because the use of artificial fertilizer is limited in Kajiado group of districts anyway, farmers need to embrace sustainable agricultural techniques to maintain and improve soil fertility: organic fertilizers, mulching, cover crops, agro-forestry, crop rotation and multiple cropping.
- **Better pest control:** Conventional farming uses chemical pesticides to control pests. These are expensive and often result in the emergence of new pests or the resurgence of the very pests they are trying to control. Use of insecticides and fungicides is rare in Kajiado but farmers should be encouraged to adopt integrated pest management approaches: a combination of natural enemies, crop rotations and mixtures and biological control methods. These methods cost less than the pesticides, and do not result in pest resurgence.
- **Controlling erosion:** Sustainable agriculture includes a plethora of techniques to conserve precious topsoil and prevent it from being washed or blown away. These include using contour bunds, contour planting, check-dams, gully plugs, and maintaining cover crops or mulch to protect the soil from heavy rainfall.
- **Water conservation:** Water is scarce in much of Kenya, and drought is never far away. Sustainable agriculture conserves water in the soil through a variety of methods. Fortunately, many of these are the same as those used to control soil erosion. Because it conserves water and uses a variety of crops instead of just one, sustainable agriculture is less risky than conventional mono cropping as is the case in the agricultural AEZs of Kajiado group of districts: it is more likely to produce food for the farm family even during a drought.
- **Reliance on local inputs:** Farmers here start to realize the value of the inputs they have immediately to hand. They include manure from their or the pastoralists animals as well as vegetation like *Tithonia* from roadsides and the field boundaries (used as mulch or to make compost). Farmers need to be encouraged to use these local inputs as this will not only reduce the cost of production but also reduce the negative effects
of artificial inputs on the environment.

- **Indigenous knowledge**: An important local input normally is the people’s own knowledge. Local people are experts on the plants, animals, soils and ecosystems they are surrounded by and on which they depend. But here the pastoral Maasai have only recently taken up agriculture where it is possible, and the others are immigrants which can share their knowledge of sustainable agriculture with neighbouring Maasai. Sustainable agriculture draws on this wealth of knowledge, and encourages local people to use it, test it, and promote what works best.

- **Local organizations and initiative**: Equally important are the energy and capacity of local people to organize and cooperate to solve their own problems. Unlike conventional extension agencies, organizations that promote sustainable agriculture spend at least as much time in helping farmers to organize as they do in teaching farming technologies. Ironically, many sustainable agriculture approaches are very similar to the techniques traditionally used by farmers before the advent of “modern” farming. That does not mean, though, that sustainable agriculture turns its back on modern inputs or ideas. Many types of sustainable agriculture use modern high-yielding crop varieties and artificial fertilizers wherever appropriate.

### TABLE 15: FARM SURVEY SITES
(Representative of the Dominating Agro-Ecological Zones, Sub-zones and Units)

<table>
<thead>
<tr>
<th>District</th>
<th>No. in Kenya</th>
<th>Agro-Ecological Unit</th>
<th>Farm survey site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kajiado North</td>
<td>110</td>
<td>UM 4 s/vs + fs RBC</td>
<td>Ngong Division, Nkaimurunya Location, Kataka Lower Matasia Sub-location.</td>
</tr>
</tbody>
</table>

Tables 16: ASSETS, LAND USE, FARMING INTENSITY AND INPUTS see main Volume Southern Rift Valley Province

Tables 17: CROPPING PATTERN see main Volume Southern Rift Valley Province
3.6.5 INTRODUCTION TO THE ACTUAL LAND USE SYSTEMS AND POTENTIAL INTENSIFICATION BY BETTER FARM MANAGEMENT IN DOMINATING AGRO-ECOLOGICAL SUBZONES

In order to realize the main task of the farm management, a question targeting specifically the inputs used by farmers and resultant increase in yields was included in the Small Farm Survey questionnaire that was conducted. In each survey area the purposively sampled 30 farmers were divided into 3 groups: one group applying low inputs, a second one medium inputs, and a third one high inputs. The difference between these groups shows the amount of yields that can be realistically achieved by the farmers practicing better farm management. The column with the yield potential finally shows figures under optimal soil conditions, water supply, crop husbandry and pest control, which is the ultimate goal of any farmer.

More detailed information can be found together with calculations of profitability in the Farm management Guidelines of each district. The tables found here are not correlated with the relevant and most suited Agro-Ecological Units, which are necessary for the calculation of expected yields and the amount of inputs. The amount of fertiliser per soil unit is described in MURIUKI & QURESHI: Fertiliser Use Manual, KARI 2001. For more details, see Chapter 3.2.6.

In terms of aerial expanse, the dominant Zones in which field data were collected from in the Kericho Group of Districts are: LH 1, LH 2 and UM 2. An additional important reference material is "Small Holder Farming Handbook for Self-employment". First published in 1997 by Information Research and Communication Centre (IRACC) & Marketing Support Services Ltd, Nairobi.

KAJIADO NORTH DISTRICT

Subzone UM 4 s/vs + f(s) of the Maize-Sunflower Zone

This is the Upper Midland Marginal Maize-Sunflower Zone with a short to very short cropping season followed by a short cropping season found in Ngong Division, Nkaimurunya Location, Kataka Lower Matasia Sublocation. The dominant soil type is a complex of chromo-luvic PHAEZEMS and chromic VERTISOLS. The annual average rainfall amount is between 700 – 900 mm. The first rainy season can expect more than 180 – 200 mm in 10 out of 15 seasons; the middle rains and second rainy season > 260 – 380 mm. The 60% reliability of the growing periods during the 1st and 2nd seasons is 75-100 and 75 – 115 days, respectively.

A variety of crops are grown in this Subzone during the first rainy season. In order of importance are: maize pure stand, beans pure stand, kales, tomatoes and Irish potatoes. The same crop mix is repeated during the second rainy seasons. Banana growing was the main crop reported as being perennial in this subzone (see Table 18).

An examination of Table 17 shows that farmers in this Subzone apply minimal nitrogen fertiliser to the soil. The low nitrogen fertiliser application explains the low maize crop yields attained in this subzone. Additionally, there was no farmer who reported applying P₂O₅-based fertilisers Optimum agroecological unit potential for say maize cannot be realized under such 'marginal' crop husbandry as is presently the case. If farmers take up agricultural as a business, and concomitantly replenish the soils with the necessary fertiliser inputs, significant maize yields can easily be realized as shown in Table 19 under the dominant soil type complex of chromo-luvic PHAEZEMS and chromic VERTISOLS.
### TABLE 18: INCREASE OF YIELDS BY BETTER FARM MANAGEMENT IN AGRO-ECOLOGICAL UNIT\(^1\) UM 4 s/vs + fs, Ux 9

**Subzone: s/vs + fs, Soil Unit: RBC**  
Survey Area 110 (Matasia)

<table>
<thead>
<tr>
<th>Crop Yields(^3) and Inputs</th>
<th>Farmers in Prod. Level</th>
<th>Farmers in Prod. Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maize local monocropped</strong></td>
<td>I= low</td>
<td>II= med.(^4)</td>
</tr>
<tr>
<td>Yields(^3) kg/ha</td>
<td>2500</td>
<td>3500</td>
</tr>
<tr>
<td>N kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>P(_2)O(_5) kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>K(_2)O kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Manure t/ha</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td><strong>Hybrid maize</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yields(^3) kg/ha</td>
<td>3000</td>
<td>4000</td>
</tr>
<tr>
<td>N kg/ha</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>P(_2)O(_5) kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>K(_2)O kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Manure t/ha</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td><strong>Maize local intercropped</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with beans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yields(^3) kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fertiliser(^7)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>N kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>P(_2)O(_5) kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>K(_2)O kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Manure t/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Maize hybrid intercropped</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with beans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yields(^3) kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fertiliser(^7)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>N kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>P(_2)O(_5) kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>K(_2)O kg/ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Manure t/ha</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**NOTES:**

\(^1\)Source: Interview of 30 farmers (if possible 10 in each level) 2004 by Divisional and Field staff  
\(^2\)Figures of these cereals growing periods should be reached or surpassed in 6 out of 10 years; growing periods may be considered longer due to immediately following second rainy season by middle rains. Then the second growing period is shorter than the given figures  
\(^3\)Achieved average yields with average rainfall  
\(^4\)Farmers with medium inputs  
\(^5\)Farmers with high inputs of Fertiliser, insecticides, soil and water conservation  
\(^6\)Potential yield according to crop list and local climate of this Agro-Ecological Unit if soils are optimally fertilized, plus optimal crop management  
\(^7\)Fertiliser applications are averaged at 20 % of pure nutrient  
*Agroecological unit potential for local maize variety not yet established
There is no chapter of "Fertiliser and Manure Recommendations for Important Agro-Ecological Units" in the Kajiado Group of districts because at the time of the Fertiliser Use Recommendation Project of the GTZ (1986-90) agriculture was so limited to Ngong and Loitokitok, the soils were still fertile and manure was available everywhere, that it was not necessary to implement trial sites there. But in the meanwhile the situation has changed as mentioned in the final chapter.

3.6.6 FINAL STATEMENTS

These are here primarily a question of livestock keeping as in Narok group of districts and therefore not the task of a Farm Management Handbook, and basic needs and possible earnings of a Maasai family are separate questions which need special investigations.
Farming is done mainly by immigrants from other tribes. These invading farmers may not be careful enough with the soil if they don’t own it. Agrobusiness is their main aim. Therefore the statements are some recommendations only.
In the first rainy season around Loitokitok one large field of beans joins the other, in the second one it is the same monotonous view with maize because these are the cash crops now and in future. This is not a sustainable system. More cropping diversity and rotation is necessary and a mixture with livestock to get manure. The volcanic soil is still fertile now but not forever if agromining continues. The many necessary nutrients are not replaced by the common NPK fertilizers. Fodder cultivation for livestock must be included, and mulching with branches of deep rooting bushes like Tithonia too, to replace the loss of nutrients in the maize and beans fields as much as possible. Irrigation is also helpful, because it is not only the water itself but it brings the important micronutrients from the mountains, too.
For livestock keeping after the end of nomadic movements, rotational grazing in paddoks would be the normal way of management in years of average rainfall. But the now reduced possibilities to move to better places in case the local grazing is finished must be changed to a system of variable adapted numbers of animals to the seasonal carrying capacity. The negative fluctuation of prices in times of drought (Table 14) could partly be compensated by production of dried meat as it is usual in South Africa and Namibia (=biltong).