

EGERTON UNIVERSITY



TEGEMEO INSTITUTE OF AGRICULTURAL  
POLICY AND DEVELOPMENT

# SMALLHOLDER MAIZE PRODUCTION EFFICIENCY IN KENYA

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Smallholder Maize Production  
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# Outline

- Introduction
- Efficiency in maize production
  - Trends in maize production and yield
  - Kenya and other countries' maize yield compared
  - Technical efficiency in Kenya's smallholder maize production
- How to improve smallholder efficiency

# Introduction

- Agriculture in Kenya undoubtedly important
  - Food source
  - Employment; >70% of rural & 18% of formal employment
  - Income; a large majority of rural households
- Performance of sector has a great bearing on both food security and overall economic growth
- Four main challenges in the sector:
  - **Low productivity**
  - Low value addition
  - Under-developed and inefficient markets (inputs and output)
  - Inefficient land use

# Introduction (cont)

- Sector development strategy:
  - Increasing productivity, commercialization and competitiveness
  - Developing and managing key factors of production
- Small-scale farming pre-dominates:
  - 75% of total agricultural output
  - 70% of marketed output
- Increasing efficiency of smallholder key to achieving sector's development goals

# EFFICIENCY IN MAIZE PRODUCTION

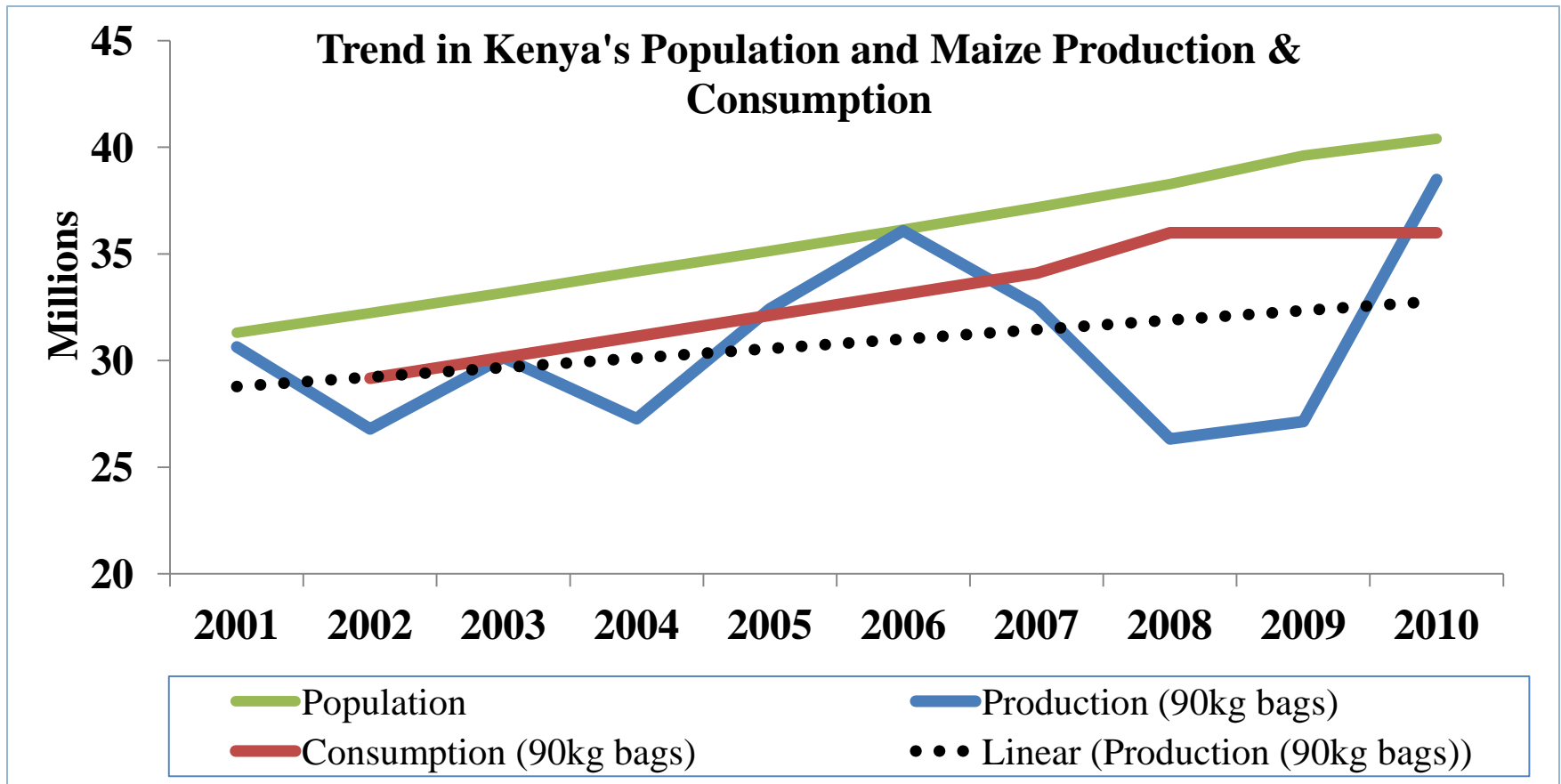


# Trends in Maize Production and Yield

- Maize is a staple food to a large proportion of people in Kenya
  - Nearly all agricultural households plant maize
- Small-scale production dominates
  - 70% of total production
- There has, however, been evidence of stagnation in maize production and productivity
  - Increasing gap between production and consumption
  - Increasing frequency of supply shortages

# Trends in Maize Production and Yield (cont)

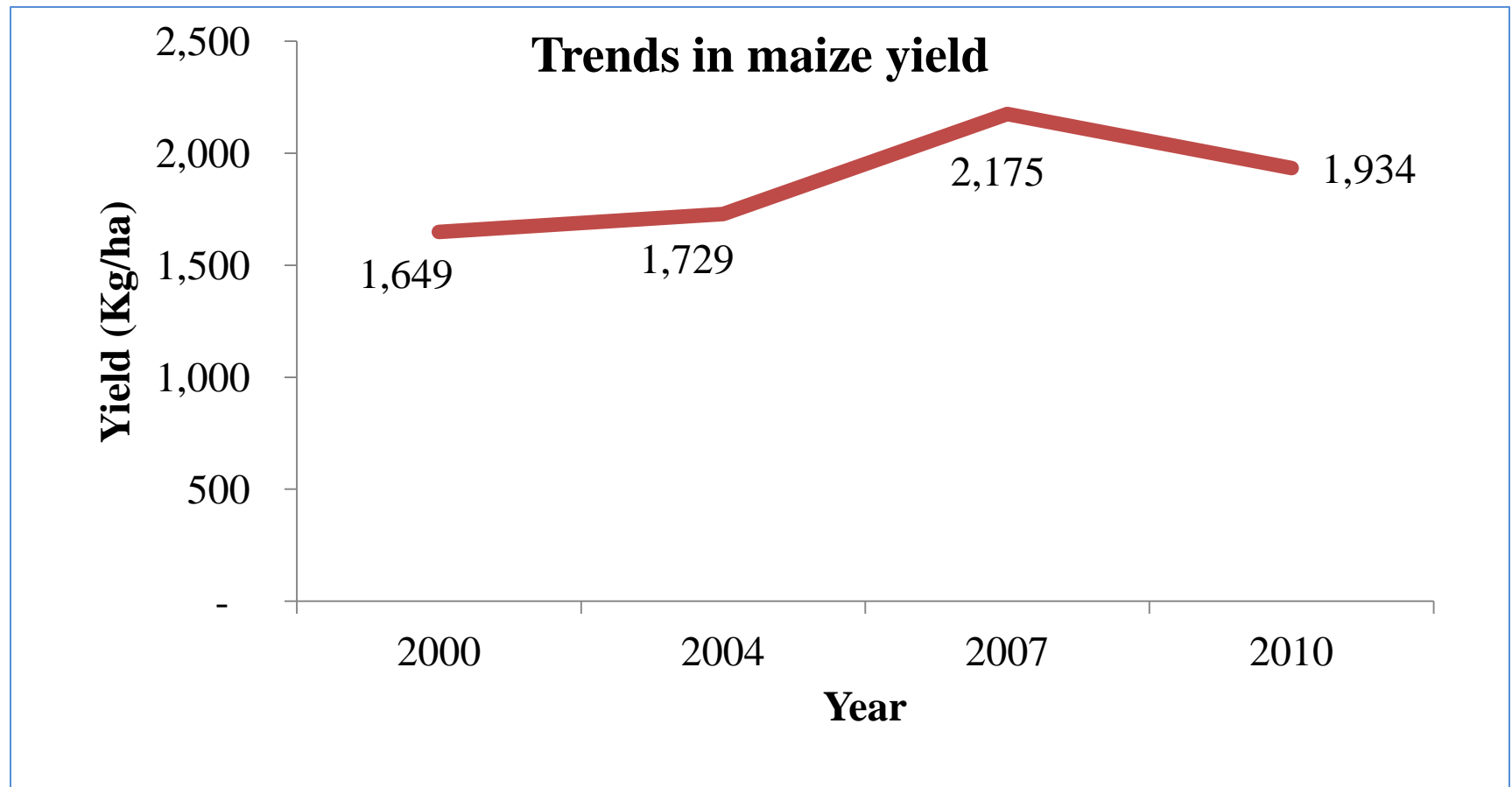
- Widening gap between maize production and consumption in the last decade



Data source: Ministry of Agriculture: Economic Review of Agriculture – Various Issues

# Trends in Maize Production and Yield (cont)

- Smallholder maize yield increased by 285kg/ha (17.3%) between 2000 and 2010



Data source: Tegemeo Institute Household Panel Survey, 2000-2010



# Comparison of Kenya's Maize Yield (Kg/ha) to other countries'

Kenya	Comparison countries ( FAOSTAT data 2009)
	South Africa - 4,964
Tegemeo Panel (2009/10) - 1,934	Malawi – 2,227
FAOSTAT (2009) – 1,294	Zambia – 2,069
	Uganda – 1,434
	Tanzania – 1,123

# Efficiency of Smallholder Maize Production

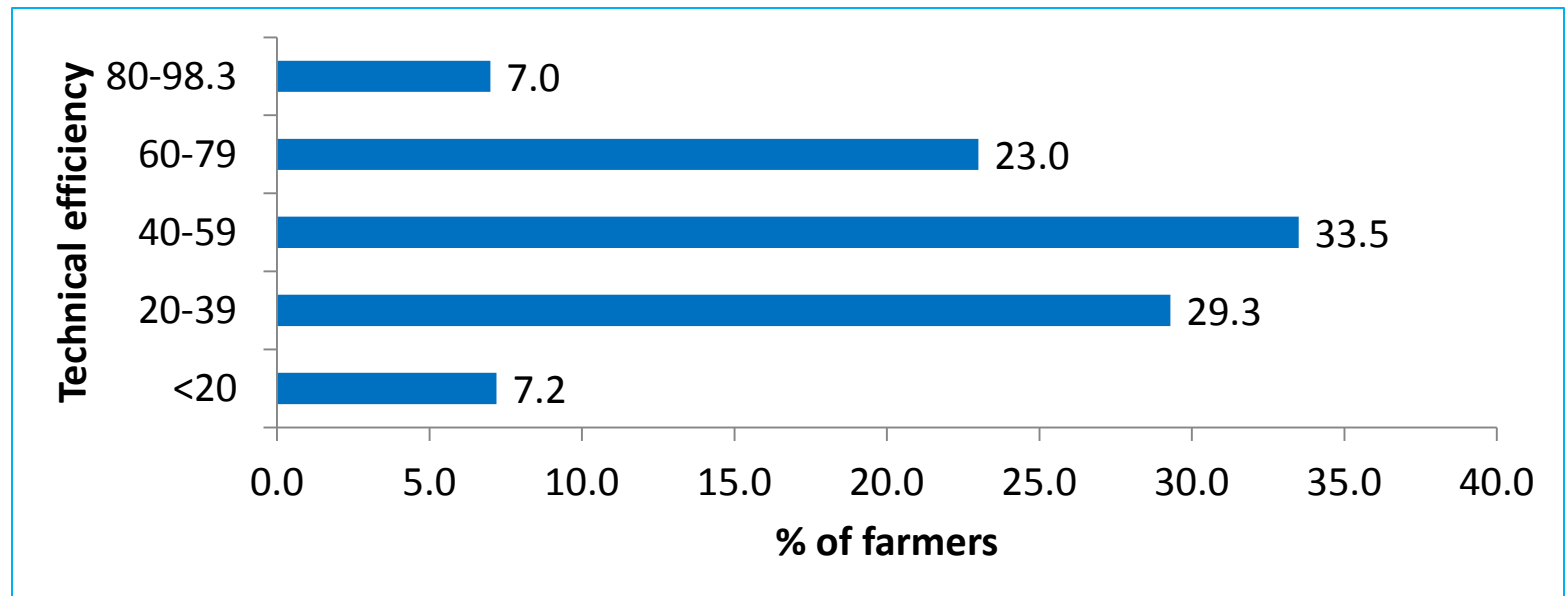
- A policy challenge in the maize subsector is how to improve efficiency through:
  - reduction of production and marketing costs
  - and appropriate use of appropriate inputs
- The strategy should ensure:
  - acceptable profitability for the producers and lower food prices for the consumers; and
  - improvement in competitiveness in maize production
- One pathway toward improving productivity is to improve efficiency - technical and allocative

# Efficiency of Smallholder Maize Production (cont)

- Technical efficiency involves maximization of output from a given quantity of inputs
  - *the ratio of the observed output to the corresponding frontier output, conditioned on the level of inputs used*
- Allocative efficiency reflects the optimal choice of input levels and proportions
  - *using an input at the level where its marginal physical product equals its input/output price ratio*
- Technical and allocative efficiency can be combined into a measure of total economic efficiency, referred to as cost efficiency

# Efficiency of Smallholder Maize Production (cont)

- Smallholder technical efficiency ranges from 7.2% to 98.3%, with a mean of 49%
  - There is scope of increasing maize production by 51% through adopting technologies and techniques used by best maize farmers
- Over 36% of maize farmers operate below the mean technical efficiency level; only 30% are at least 60% technically efficient



**Source: Kibaara (2005)**

# Efficiency of Smallholder Maize Production (cont)

- Technical efficiency ranges wide across zones; efficiency lowest in low potential and highest in high potential zone
  - Efficiency of 59% of farmers in low potential zone is less than 40%
  - Efficiency of 62% of farmers in high potential zone is at least 60%

Range of TE in Percent	Agro-regional zone			
	Low <sup>a</sup>	Medium <sup>b</sup>	High <sup>c</sup>	Overall
	-----% of farmers-----			
<20	13.1	7.2	1.7	7.2
20-39	45.9	32.3	9.3	29.3
40-59	31.0	39.4	27.1	33.5
60-79	10.0	20.1	39.3	23.0
80-98.3	0.0	1.0	22.5	7.0
Total	100.0	100.0	100.0	100.0

<sup>a</sup> Low potential =Coastal, Eastern and Western lowlands and Marginal rain shadow

<sup>b</sup> Medium potential =Central and Western highlands and Western Transitional

<sup>c</sup> High potential =High potential maize zone

**Source: Kibaara (2005)**

# Efficiency of Smallholder Maize Production (cont)

- Wide differences in maize yield across technical efficiency ranges
- Yield lowest in low potential and highest in high potential zone

Range of TE in Percent	Agro-regional zone			
	Low <sup>a</sup>	Medium <sup>b</sup>	High <sup>c</sup>	Overall
	-----maize yield (bags/acre)-----			
<20	1.3	1.8	1.7	1.5
20-39	2.8	3.9	5.0	3.5
40-59	5.4	7.8	9.0	7.5
60-79	11.8	13.7	14.1	13.7
80-98.3	-	16.4	21.6	21.3
Total	4.3	7.4	13.3	8.3

<sup>a</sup> Low potential =Coastal, Eastern and Western lowlands and Marginal rain shadow

<sup>b</sup> Medium potential =Central and Western highlands and Western Transitional

<sup>c</sup> High potential =High potential maize zone

**Source: Kibaara (2005)**

# Efficiency of Smallholder Maize Production (cont)

- Factors that increase efficiency in maize production (Kibaara, 2005)
  - Use of improved maize varieties
  - Use of fertilizer
  - Use of credit – provides resources for acquisition of inputs
  - Being in high potential areas (high rainfall areas)
  - Increased level of education (management ability)
  - Being younger

# HOW TO IMPROVE EFFICIENCY IN SMALLHOLDER MAIZE PRODUCTION





# How to improve efficiency in maize production

Potential priority areas:

1. More widespread and intensive use of modern farming technologies
  - Fertilizer
  - Seed
2. Improved extension effort
3. Well-functioning input and output markets
4. Irrigation

# 1. More widespread and intensive use of modern farming technologies

## Fertilizer

Agro-regional zone	1997	2000	2004	2007
	% of households using fertilizer on maize			
Coastal Lowlands	0	3	4	14
Eastern Lowlands	27	25	47	43
Western Lowlands	1	5	5	13
Western Transitional	41	70	71	81
High-Pot. Maize Zone	84	90	87	91
Western Highlands	75	91	91	95
Central Highlands	90	90	91	93
Marginal Rain Shadow	6	12	11	16
<b>Total Sample</b>	<b>58</b>	<b>64</b>	<b>66</b>	<b>70</b>

*Source: Tegemeo Institute, Household Surveys (1997-2007)*

- Increased number of households using fertilizer overtime; positive impact on maize productivity growth

# 1. More widespread and intensive use of modern farming technologies (cont)

## Fertilizer

<b>Agro-regional zone</b>	1997	2000	2004	2007
Dose rate (kgs/acre) on fertilized maize fields				
Coastal Lowlands	11	5	3	7
Eastern Lowlands	10	18	15	16
Western Lowlands	24	14	10	12
Western Transitional	54	48	62	71
High-Pot. Maize Zone	65	67	74	75
Western Highlands	31	36	46	47
Central Highlands	68	64	64	58
Marginal Rain Shadow	12	15	43	43
<b>National sample</b>	<b>56</b>	<b>55</b>	<b>60</b>	<b>59</b>

Source: Tegemeo Institute, Household Surveys (1997-2007)

- But application rate has stagnated overtime; affordability and knowledge on application rate are a concern

# 1. More widespread and intensive use of modern farming technologies (cont)

## Fertilizer

	1997	2007	2010
Did not Use fertilizer (% of hh)	36.6	24.1	30.3
<b>Reasons for not using (% of hh)</b>			
<b>Unaffordable</b>	<b>47.6</b>	<b>44.8</b>	<b>51.5</b>
Unavailable	-	-	0.8
<b>No need to use</b>	<b>10.6</b>	<b>21.0</b>	<b>32.8</b>
Uses organic fertilizer	21.3	24.7	11.9
Others reasons	20.5	9.6	3.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Source: Tegemeo Institute, Household Surveys (1997-2010)*

- Affordability most important reason for not using fertilizer
- Lack of information may be a hindrance to use

# 1. More widespread and intensive use of modern farming technologies (cont)

## Fertilizer

- Need for fertilizer cost reducing measures – KV 2030
  - Infrastructure improvement - reduce transportation cost
    - Rail transport
    - Rural feeder roads
  - Local manufacturing – feasibility study on
- Government support to poor and vulnerable
  - Targeted subsidy (E.g NAAIAP)
    - Need for complementary extension advice
    - Emphasize farmer empowerment to sustain input use beyond subsidy regime

# 1. More widespread and intensive use of modern farming technologies (cont)

## Seed

	1997	2000	2004	2007
% of hhs planting high yielding maize varieties	70	69	69	74
% of hhs using fertilizer plus hybrid maize seed	51	55	57	61
Distance to seller of hybrid maize	N/A	5.6	3.9	3.4

*Source: Tegemeo Institute, Household Surveys (1997-2007)*

- Increased number of households planted improved maize varieties
- Proximity to certified maize seed sellers improved
- But the average age of maize hybrids grown in Kenya is old (about 18 years overall in 2010), although the numbers planted increased

## 2. Improved extension effort

- Extension key to absorption and proper use of modern technologies
- But public and private extension generally not adequate
- Public extension
  - Inadequate staffing
  - Demand-driven approach; access to information an issue among many farmers
- Private extension
  - generally skewed towards high potential regions
  - high-value crops
  - scope limited
- Government need to work more in serving disadvantaged regions
- Partnership option (as in the NASEP)

### 3. Well-functioning input and output markets

- Without well-functioning markets, productivity growth unlikely
  - Input markets - timely availability and affordability of quality inputs
  - Output markets – certainty in accessing market outlets and obtaining rewarding prices
- Greater support to NARIs for generating improved varieties and breeds, and crop management techniques
- Invest in rural feeder road infrastructure and rehabilitate railway system
- Support programs that work with farmers to improve their crop husbandry, access to information and marketing skills
- Invest in market physical infrastructure



## 4. Irrigation

- Increasing episodes of depressed rainfall affecting maize yield and production
- Investment in irrigation
  - More land under irrigation
  - Water harvesting and storage

Thank You



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