



**TEGEMEO INSTITUTE OF AGRICULTURAL  
POLICY AND DEVELOPMENT**

**PROCEEDINGS OF A BREAKFAST MEETING ON  
ASSESSING COSTS OF MAIZE AND RICE PRODUCTION IN KENYA:  
IMPLICATIONS FOR FOOD SECURITY**

**HELD AT FAIRVIEW HOTEL, NAIROBI ON 5TH OCTOBER, 2017**

**OCTOBER, 2017**

## **INTRODUCTION**

Maize is the most important cereal in Kenya. It provides up to 65 percent of staple food calorie. The crop is planted on 40 percent of total crop area and is produced by majority of the smallholder farmers in the country. Kenya is a net importer of major cereals. As at July 2017, the country imported 80, 70 and 25 percent of its rice, wheat and maize demand, respectively. The structural deficit is due to challenges in production which include low productivity, declining soil quality, crop diseases, weak linkages between research, extension & farmers, low technology uptake, limited access to affordable credit, low market participation, declining land sizes, limited access to water for irrigation, climate change and high production costs.

To ensure food security and improve household incomes, it is important to continuously assess and monitor profitability and competitiveness of these staples. This will enable identification of opportunities for increased production as well as areas of policy intervention to ensure low food prices for consumers and sustainable margins for producers. For this reason, Tegemeo Institute annually assesses the food situation and cost of production (maize and rice) to monitor factors that drive costs, their trends over time and inform policy on areas of interventions to reduce cost. The findings for the assessment on the 2017/18 cropping year were shared with agricultural sector stakeholders in a breakfast meeting held on October 5<sup>th</sup>, 2017. Following are the proceedings and deliberations of the meeting.

## **PROCEEDINGS**

### ***SESSION ONE: INTRODUCTION AND WELCOMING REMARKS***

The moderator, Dr. Lillian Kirimi thanked guests for attendance and welcomed them to the meeting. She requested them to listen to the findings and actively participate in the deliberations on the way forward. She requested participants to introduce themselves by stating their names, institutions they represented and their roles/positions. She then invited the Director of Tegemeo Institute, Dr. Milton Ayieko, to give his welcoming remarks.

***Welcoming Remarks by Dr. Milton Ayieko - Director, Tegemeo Institute***

The director thanked the participants and welcomed them to the meeting. He said that the purpose of the invitation was to share findings on the food situation assessment and cost of production of maize and rice. He mentioned that Tegemeo has been at the forefront in conducting evidence based agricultural research in collaboration with the ministry of agriculture (MoALF) and other stakeholders to inform, stir up debate and generally shape the future of agriculture in Kenya. He indicated that the current food situation shows that the country cannot sustain itself on key staples. He wondered whether the country was prepared to find solutions to this problem, if it is efficient in production and whether it has enough resources to manage the production shocks.

He then invited Professor Kibor, the acting Deputy Vice Chancellor; research & extension division of Egerton University who was representing the Vice Chancellor (VC) to give his opening remarks.

***Welcoming Remarks: Professor Alfred Kibor - Ag. DVC, R&E Egerton University***

The professor conveyed the VC's apology, indicating that she was not able to attend due to administrative engagements at the University. He said that within the university structure, Tegemeo falls under the division of research and extension which he currently heads. He acknowledged the various stakeholders present including representatives of the agricultural ministries both at national and county levels and others in attendance. He said it was a privilege for Egerton University to have Tegemeo Institute because of the role it has played in agricultural development in the country through offering empirical policy advocacy. He noted with concern that Kenya is facing challenges in food production which made such a meeting important to chart the way forward. He said that the bottom line in the whole agriculture development agenda is to ensure farmers are empowered to produce, noting that just last year (2016) the food situation was dire. He said that there is sufficient expertise in the country as represented in the meeting and, therefore, participants should be able to come up with practical and implementable solutions to food security. He finally challenged the participants to not only listen but also identify action areas which they could undertake once back at their stations towards enhanced food security. He

said that the key point was how the information will be used noting that food insufficiency was the key concern of the meeting. He conveyed the VC's concern on insufficient food production saying that the VC had particularly asked: "Have we done enough to empower our farmers to produce enough food for their table and surplus to sell and earn some income?"

***Welcoming Remarks by Mr. Henry Mwangi – Deputy Director Agriculture, MoALF***

Mr. Mwangi welcomed participants to Nairobi adding that the national government was appreciative of Tegemeo's work on empirical policy research. He however challenged the Institute to inform the country specifically on: when it is appropriate to import and when the country should export food commodities; and specific issues to address to solve the problem of food insufficiency. He noted that some countries have solved food security by addressing specific key issues. He gave an example of India which focused on the blue, green and white economies and is now food secure. He said that some countries are feeding maize to livestock to produce milk and asked whether as a country we still need to depend on maize farming for food. He said that although the meeting would inform the country on what is important to lower cost of maize production, he wondered whether the country should keep equating maize to food security and whether maize should be grown everywhere in the country.

***Breakfast Meeting Objectives: Dr. Milton Ayieko - Director, Tegemeo Institute***

Dr. Ayieko began by referring to Tegemeo's vision which is "A people forever free from hunger" to demonstrate the Institute's conviction that there should be enough food for everyone and all people should have resources to access the food. He said that for this reason the Institute organized the meeting to share the findings and initiate debate on whether the country is ready to feed itself. He acknowledged the challenge by Mr. Mwangi that the Institute should inform the country on when it is appropriate to import or export food commodities. He said that Tegemeo has been doing that by providing evidence for learning and accountability. He recalled that last year (2016) there were pointers to shortage in harvest due to drought and disease incidences early in the growing period. He lamented that while the country should have acted early to ensure smooth supply of the key staples, the decision to allow imported maize took long as actors engaged in blame games while market prices sharply rose due to dwindling supply. Dr.

Ayieko raised several concerns pertaining to cereal production in the country, including the need to diversify consumption to other staples like rice and sorghum to reduce pressure on maize, and declining productivity in spite of increased input use, leading to increased food prices. He noted that the focus should be on the root problem and consequent mitigation measures. He requested participants to deliberate on key issues such as: the efficiency of production systems, whether the country has enough resources including the strategic food reserves to address food supply shocks and why the country always has to wait until there is a food crisis to act. He said that in addition to the evaluative research that the Tegemeo is known for, every year the Institute assesses the food situation and cost of production to help predict the food situation and advise policy makers on possible interventions to reduce the cost of production and ensure food security. In conclusion he invited the participants to the two presentations as below:

- i. Cost of maize and rice production in small- and large-scale systems by Dr. Timothy Njagi
- ii. Food situation assessment report by Mr. Kevin Omondi

## **SESSION TWO: PRESENTATIONS**

### ***Cost of Maize and Rice Production - Dr. Timothy Njagi- Tegemeo Institute***

Maize is a major food staple and source of income for a majority of households in Kenya. Therefore, any shortage of maize supply is commonly equated to food insecurity. The assessment of costs of production was based on individual maize farmer interviews, focus group discussions (FGDs) and key informant interviews (KII) carried out in six counties. The counties were purposively selected based on their importance in the production of maize and rice in the country and the concentration of pre-defined scale of production. The selected counties were Kakamega, Trans Nzoia, Uasin Gishu and Nakuru for maize and Kisumu and Kirinyaga for rice.

### ***Objectives of the Cost of Production Assessment***

- To establish the cost of maize and rice production in 2017 and explain the costs
- To find out the opportunities that exist for improving competitiveness and incomes for maize and rice producers
- To recommend policy options for the government.

## **Maize production cost**

### ***Large scale maize production***

A large-scale farmer was defined as one who had 50 acres and above under maize during the 2017 long rains season. From the findings, these farmers expected to harvest about twenty (20) 90-kg bags per acre on average. They expected to sell at about KES 2,500 per bag, translating to a total revenue of KES 50,000. Production costs were high in both Trans Nzoia and Uasin Gishu counties at KES 31,332 and 29,662 per acre, respectively. This was mainly pushed by land preparation, fertilizer and harvesting costs. Unlike Nakuru County, farmers in the two counties ploughed twice, applied two 50-kg bags of planting fertilizer and harvested manually. On the other hand, production costs were lower in Nakuru by about KES 10,000. This was because ploughing was done once, farmers used one and a half 50-kg bags of planting fertilizer and harvesting was fully mechanized through use of combine harvesters. When a 30 percent mark-up was added, production cost per bag averaged KES 1,790, which would require a yield of 11 90kg bags to break even. At the expected sale price of KES 2,500, largescale farmers would get a profit of KES 1,150 per bag. The three key drivers of cost were productivity, input costs and mechanization.

### ***Small- scale maize production***

A small-scale farmer was defined as one who had 10 acres or less under maize during the 2017 long rains season. The expected yield in Kakamega and Uasin Gishu was lower at 14 bags per acre compared to Trans Nzoia and Nakuru (17 and 20 bags/acre, respectively). Farmers expected to sell a bag of maize at KES 2,200 to get KES 35,000 per acre on average. Total cost of production per acre was highest in Trans Nzoia and Uasin Gishu at KES 28,176 and 26,515 respectively. This was caused by land preparation, planting fertilizer, harvesting and handling costs. Farmers in these two counties used two 50-kg bags of fertilizer per acre and ploughed twice during land preparation. Additionally, payment for harvesting labor was per bag of unshelled maize as opposed to per acre in Kakamega and Nakuru. Weeding costs were higher in Nakuru (KES 4,800 per acre) because of a high wage rate. Break even yield with a 30 percent

markup was 12 bags per acre. At the expected price of KES 2,200, farmers expected to make an average profit on KES 640 per bag.

Generally, production costs increased slightly from 2016 figures. This was due to decline in yields, and higher input (use of subsidized or commercial fertilizer) and labor costs (use of manual labor compared to mechanization). Other factors were low response to fertilizer application and costs incurred to control the unprecedented fall armyworm (FAW) attack. Small-scale production costs are still high making production of maize under the small-scale system uncompetitive.

### ***Policy Recommendations***

To reduce costs and improve competitiveness there is need to improve productivity and lower the cost of inputs through initiatives like the fertilizer cost reduction programme. Policy should encourage use of labor-saving technologies (mechanization). Fertilizer use should be guided by soil nutrient requirements based on soil testing. Integrated soil fertility management (ISFM) and good agricultural practices should be promoted through information on soil quality and required nutrients, and agronomic practices. Overall, revamping extension systems is key to ensure farmers have access to the right information and use it to increase productivity and reduce costs of production.

### **Rice production**

Assessment of cost of production for rice was done in Mwea irrigation scheme and among the non-scheme farmers commonly known as out-growers in Ahero, Kisumu. The main variety planted in Mwea was Basmati, while in Ahero, the IR variety was planted. In Ahero the main source of fertilizer was NAAIAP (i.e. fully subsidized), while in Mwea, farmers used commercial fertilizer (i.e. unsubsidized). Mwea farmers were more commercialized at 96 percent compared to Ahero at 93 percent.

### ***Production cost: Non-scheme farmers***

The non-scheme farmers expected to harvest about 1,400 kg of rice per acre, which they expected to sell at KES 40 per kg, equivalent to KES 57,600 per acre. The major costs were land

preparation at KES 10,900, harvesting (KES 7,200) and other labor cost which was mostly bird-scaring, at KES 4,000. Fertilizer and water were free but water access was not reliable. The production cost per acre was KES 36,000 (KES 25 per kilo), which translated to a profit of KES 15 per kg. Land in the non-scheme area had a shadow price of KES 10,000. Renting land would raise the cost of production to KES 32 per kg and reduce the profit to KES 8 per kg. Labor costs accounted for 66 percent of total cost of production followed by cost of hiring machinery at 23 percent.

***Production cost: Scheme farmers***

Scheme farmers expected to harvest about 2,200 kg of rice per acre and sell it at KES 60 per kg and hence realize a revenue of KES 135,000 per acre. The major costs were land preparation at KES 8,200, other labor (KES 9,250) which was mostly bird-scaring, harvesting (KES 7,200) and weeding (KES 6,250). Both planting and topdressing fertilizers were obtained from the scheme at a total cost of KES 7,770 per acre. Water was paid for at a subsidized rate of KES 3,000 per acre. The total production cost per acre was KES 57,000 or KES 26 per kg of rice, resulting in a profit of KES 34 per kg. Land within the scheme area had a shadow price of KES 50,000 which would raise the production cost to KES 48 per kg and reduce the profit to KES 12 per kilo. Labor cost accounted for 57 percent of total cost of production followed by cost of hiring machinery at 12 percent.

Generally, production systems and costs are different in the two study areas due differences in production technologies and access to input subsidy. In Mwea, there is a big difference between producer and consumer prices (KES 60<sup>1</sup> for a kg of paddy rice compared to KES 200 per kg of finished Pishori rice). Labor contributes the highest proportion of cost suggesting opportunities of saving costs through mechanization. Bird scaring is an expensive labor-intensive activity in rice production and interventions at County and/or national government level are recommended. Rice production is profitable even where land was hired despite the high land rates.

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<sup>1</sup> 1.4 kg of paddy is required to mill 1kg of rice. At the prevailing prices, 1.4 kg would cost KES 85.



### *Policy recommendations*

Rice demand is increasing amid high costs of production. There is need to enhance uptake of innovations that will reduce cost of rice production. These include use of nets for bird control as well as enhanced bird surveillance and control. The system of rice intensification (SRI)<sup>2</sup> should be promoted. To meet the rising rice demand there is need to increase rice production and productivity through expansion of area under irrigated rice, exploring opportunities for upland rice production and providing credit facilities for farmers/youth because rice has high capital requirement.

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<sup>2</sup> SRI is an agro-ecological methodology for increasing the productivity of irrigated rice by changing the management of plants, soil, water and nutrients. It promotes use of combined technologies from land preparation to harvesting intended to reduce costs and increase productivity. SRI is based on four main principles: early, quick and healthy plant establishment, reduced plant density, improved soil conditions through enrichment with organic matter, reduced and controlled water application. Benefits of SRI include: between 20-100 or more percent increase in yields, up to a 90 percent reduction in required seed and up to 50 percent savings in water.

## ***Food Situation Assessment - by Mr. Kevin O. Onyango, Tegemeo Institute***

### ***Introduction***

Food and nutrition security is critical to Kenya's economic and social well-being. The country is not able to meet the national food needs from own food production and the balance is met through imports. Kenya and neighboring countries in the region experienced a devastating drought in 2016 which led to loss of livestock in pastoralist and agro-pastoralist areas, low crop production and consequently food shortages and high commodity prices. The need for close and periodic monitoring of crop performance and assessment of food situation in the country to inform policy decisions in time to avoid food shortage and food prices crisis was a major lesson from the drought.

### ***Objectives of the assessment***

The assessment sought to establish the general food situation in the country with special focus on maize, rice, wheat, potatoes and other major staples.

Specifically, the study sought to:

- Evaluate crop performance in the 2017 long rains season
- Assess the condition of and prospects for short season crops
- Assess the impact of fall armyworm (FAW) and other pests and diseases on the performance of the long and short rains crop
- Establish the food security status of the country
- Draw lessons and policy recommendations

### ***Methodology***

The assessment was conducted in eight purposively selected counties, namely Kisumu, Kakamega, Trans Nzoia, Uasin Gishu, Nakuru, Narok, Kirinyaga and Meru. Data was collected through key informant interviews (KIIs), focus group discussions (FGDs) with county agriculture officers (CDAs, CCOs, CADOs, SCAOs, and WAOs), farmers and NCPB managers. Secondary data review and field observation augmented the primary data.

## ***Rainfall performance, 2017***

### ***i. March-April-May rains***

There was late onset and early cessation of rainfall during the March-April-May (MAM) period. March was characterized by sunny and dry days throughout, while April and early May received below normal rains which were poorly distributed in space and time. There was a severe dry spell in late May and June leading to late planting, poor crop establishment, and reduced crop acreage.

### ***ii. June-July-August rains***

Several parts of Western Kenya and Rift Valley received near normal June-July-August (JJA) rains but temperatures were generally higher than average. Moisture stress conditions during the June dry spell led to flower abortion in beans and forced some farmers to convert their crop to silage. Short period crops like potatoes were also severely affected by the drought. Enhanced rains in July contributed to the recovery of crops but also coincided with bean maturity/harvesting leading to losses.

## **Challenges during long rain season, 2017**

The long rain season of 2017 experienced several challenges, notably the fall armyworm infestation that was first detected in March 2017 in Western Kenya. The severe attack coincided with the May-June dry spell. It affected over 800,000 Ha of maize crop. Generally, there was late response to the attack. However, enhanced rains in July and August coupled with other interventions like use of pesticides helped to suppress the attack. Loss due to FAW infestation during the long rains harvest was estimated at 10% of total harvest. The FAW menace is still on because the infestation has been reported during short rains crop too. Maize head smut is an emerging challenge in Nyanza, Western and Rift Valley regions and there is need to guard against the observed buildup of the smut in some of these areas.

## ***Historical production of key staples***

There was a general drop in production of staples in 2016. Millet production dropped by 45 percent, sorghum by 38 percent, maize by 13 percent and beans by 5 percent. Average maize

production has been below the estimated national demand of 45-50 million 90-kg bags. Potato production increased by 33 percent between 2012 and 2015 but dropped by 35 percent between 2015 and 2016.

### ***Maize performance in the 2017 long rains season***

During the 2017 long rains, acreage under maize dropped from 1.8 million hectares to 1.5 million. This was mainly due to FAW infestation and late onset of rain, which meant that some farmers didn't plant, while others converted the affected maize to silage.

### ***Stocks and maize balance sheet***

The current food situation has improved in parts of the country such as Nyanza, Western, Central and parts of Rift Valley regions from the long rains harvest. However, food situation in most pastoral and agro-pastoral areas is alarming, given that more than 3.5 million people are acutely food insecure and in dire need of humanitarian support. National and regional wholesale and retail maize prices are declining due to the presence of long rains harvest in the market. The projected enhanced October-November-December (OND) rains are likely to enhance short rains yields.

The maize balance sheet was based on estimates from the MoALF food situation report. Three scenarios were developed to project the food situation expectations:

- i. Scenario 1 - Assuming harvests would be as projected by the MoALF
- ii. Scenario 2 - Assuming a 20 percent *decline* in short rain harvest like was the case for the long rains
- iii. Scenario 3 - Assuming a 20 percent *increase* from expected short rains harvest based on enhanced rains projections by the meteorological department.

The projected maize balance for the three scenarios as at March 31<sup>st</sup>, 2018 will be 3,789,893, 3,293,969 and 4,133,969, bags, respectively, which will last to around April 2018 at a national consumption rate of 3.39 million bags/month. The country, therefore, needs to plan for maize imports for May to July when the next harvest is expected. The post-harvest losses are high at 12

percent which is more than a month's national consumption of the commodity. Contribution of other staples like wheat, rice, potatoes and plantain to the national food supply is still significant.

### **Lessons and recommendations**

- Rain fed production system is uncertain and overwhelmed in Kenya and hence, there is need to:
  - Efficiently produce maize and other staples under irrigation
  - Conduct periodic monitoring of performance and effects on food security
  - Develop and strength early-warning-systems
- Reduction of post-harvest losses is critical for food security and can be achieved through:
  - Investment in on-farm and off-farm storage technologies
  - Better post-harvest handling and management
- Constant surveillance and concerted multidisciplinary efforts to identify and control field and storage pests and diseases to minimize losses. They include:
  - Investment in training of agricultural practitioners and farmers
  - Investment in agricultural research and emphasis on evidence based interventions
  - 'making extension function again'
  - Rapid response strategies in case of disease or pest attack/outbreak
- National food security is highly dependent on maize, and there is, therefore, need to:
  - Promote production and access to other food crops to enable Kenyans diversify consumption

### **SESSION THREE: PLENARY**

The moderator Dr. Kirimi invited participants to the plenary session. She requested them not only to ask questions but also give solutions on how to address the food situation challenges and the costs of production.

Questions, comments and suggestions were grouped by theme for purposes of articulation and follow up.

#### ***Clarifications on the presentations***

One participant observed that the seed rate for rice as presented was too high (100 & 75 kg/acre for scheme & non-scheme farmers, respectively). He also sought clarification on the pricing between the unprocessed (paddy) and processed rice, noting that the price difference was high.

Another participant observed that the reported cost of production for maize was lower than was the situation on the ground. He felt there were additional costs for chemicals due to MLND, FAW and head smut that had not been fully captured because in the areas where FAW was prevalent, severity was high and so was the cost.

On seed rate, Dr. Njagi said that it was a typo error which would be corrected to 10 and 7.5 kg/acre, respectively.

#### ***Extension***

On revamping extension, a participant suggested that the Institute should organize a forum with the governors to explain the importance of extension to agriculture since they are more likely to listen to an independent entity such as Tegemeo rather than the agriculture executives and experts from within county.

Dr. Njagi responded that Tegemeo has done some work on devolution and the information is on the Institute's website. Therefore, the Institute is ready to dialogue with the county governments on how best to support agriculture.

Another participant informed the meeting that in Machakos, FAW was more severe in the irrigation schemes which could result in more destruction than in the Rift valley and western

areas. He suggested that the MoALF should follow up on the recommendations from FAO and strategies agreed upon in other forums. He lamented that the ministry does not apply agreed or existing technologies in dealing with weather and environmental disasters like drought, MLND and the FAW.

Another participant emphasized that FAW was devastating and it needs a concerted effort within and between the counties. This is because FAW is migratory and can move to a county that has already take measures to eradicate the worm. She said there is need for an inter-county or national surveillance and communication strategy to enhance coordination in dealing with FAW.

She further observed that although Tegemeo did a survey on support to extension and recommended more resources for the same, a new challenge in the form of staff shortage had emerged. Hence county agriculture staff is not able meet farmer extension needs. She suggested that Tegemeo should do a quick assessment on extension staff at counties to inform the county governments. She concurred that county governments may listen more to independent authorities like Tegemeo.

On FAW, Mr. Onyango responded that it had a big impact on food security and encouraged county and national governments to collaborate on the problem to improve coordination.

### ***Challenges with estimates***

A participant wondered whether the per capita consumption and the total consumption of maize are known. He questioned the estimated per capita consumption of one, 90-kg bag since Kenyans consume other staples. He said there is need for other estimation techniques such as crop cut surveys to estimate total production.

A participant wanted to know the best method to estimate maize or food stocks at farmer level considering that farmer reports are usually biased. He added that the agriculture ministry is running a program to improve the estimates. He also reported that in a recent study, maize held by NCPB was found to have 150 times the minimum acceptable levels of aflatoxins. This cannot, therefore, be considered as food or feed in the maize stock estimates.

Another participant concurred with the challenges in yield estimation. He noted that Kakamega County had earlier attempted to improve estimation of production by doing crop cuts but the program has since come to an end. He informed the meeting that the ministry of agriculture in collaboration with One Acre Fund intended to develop a yield database for a crop insurance product. The yield estimate will be used to develop an index for compensating farmers. He suggested that the system should be up-scaled to national level to inform on more accurate crop yield.

Another participant commented that the county food balance estimates assume that what is within the county is consumed within the county which is not the case because the county cannot restrict maize flow out of the county. Hence the food balance estimates are inaccurate.

Dr. Njagi responded that crop cuts are a better way to estimate the production and productivity but the costs of the surveys are prohibitive. He said the Institute has noted estimation errors on other production variables like acreage and is currently using more efficient technology of measurement like GPS area measurement.

### ***Devolution***

A participant wanted Tegemeo Institute to comment on its input in the county policy domestication process now that counties are integrating the national policies into the CIDPs and other county blue prints.

Another participant noted that the agricultural priorities have changed since devolution. For example, Trans Nzoia County is promoting sugarcane over maize and so such crops are taking up area that was previously under maize. He also observed that the study findings were good and suggested that they should be incorporated into the second generation of CIDPs.

### ***Maize and food security***

Participants wanted to know the current food situation and whether food security is all about maize and suggested that the government needs to put in place proper infrastructure for maize to flow to deficit areas.



Another participant urged Tegemeo to do a survey in future on small-scale rice development initiative to inform on its potential to boost food security. He added that sometimes back, Busia emerged the most food secure county due to focus on drought tolerant crops and that there are efforts to promote these crops in sugar growing areas like Mumias.

Another participant said that food security should be in the context of other food crops and livestock because focusing on maize alone will not be very informative for policy. He, therefore, urged Tegemeo to include more crops and even livestock in future assessments.

One participant sought answers to the following questions: how does the cost of production in Kenya compare within the region?; should the maize flour subsidy by the government go on or should we let market forces determine flour price?; what price should government offer farmers for the long rains season maize?; and, when should be the right time for the country to import maize given that last year the importation was late leading to steep rise in prices?.

A participant alleged that maize prices have declined to KES 1,800 in Trans Nzoia<sup>3</sup> since the harvest began. He suggested that the government should buy maize from farmers to cushion them from low prices. Another participant sought to know the COP in Uganda wondering whether Kenya is better off growing maize for livestock and depend on the neighbors for food maize. He also wondered whether farmers were making practical margins by growing maize.

Mr. Onyango responded that based on a study by the Regional Network of Agricultural Policy Research Institutions (ReNAPRI), the cost of production in Kenya was higher than in other countries in the region like Uganda, Zambia and South Africa.

On the importance of maize in food security, he said that although consumption patterns are slowly changing as shown by other studies by Tegemeo, maize was still the main source of staple calorie in the country. He further commented that in future the Institute will consider adding other food crops in the assessment but for this year all crops were affected by drought. Therefore, including them would not change the overall food security prospect.

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<sup>3</sup> Ministry of Agriculture's market information shows prices are averaging KES 3,000 per bag

Dr. Njagi commented that its generally good economics to choose either the right or left-hand side to intervene. In Kenya, policy has intervened on inputs to reduce the cost of production and avail the produce at an affordable price. Government also intervenes on producer price. This year was unique necessitating an intervention on consumer prices. Food security is about both availability and access hence people should have sufficient income to buy maize from the market. He recommended that the government should utilize one of the objectives of the strategic food reserves (SFR) which is to stabilize prices and so buy sufficient quantities (increase reserves to 10 million bags or three months' supply) to last the country through a production cycle. This would allow time to seek markets and import in time and not as hurriedly as happened this year. Instead it needs to be informed by early warning systems. He expressed the Institute's willingness to work with the government to improve decision making.

### *Subsidy fertilizer*

A participant asked whether the fertilizer subsidy was sustainable and commented that the NCPB was too stringent, which was not supportive to the county government efforts to improve access to the subsidized fertilizer. He said that in spite of attempts to have NCPB release fertilizer to the farmers, including making telephone calls to NCPB offices, farmers were yet to receive the fertilizer.

Another participant recommended that use of cooperatives instead of NCPB depots can make fertilizer access easier for many small-scale farmers and these channels should be utilized more to reduce the cost of accessing fertilizer.

A participant urged the county governments to put more emphasis on soil testing since it is possible that some farmers are using the wrong fertilizers. He said, county governments should take advantage of the established fertilizer blending plants to ensure farmers get soil-crop specific fertilizer blends.

He also noted that poor performance of the 2017 crop was attributed to the late arrival of subsidized fertilizer and suggested that NCPB should consider involving other distributors to ensure timely delivery of the fertilizer.

Mr. Onyango observed that although fertilizer quantities were higher in 2017, delayed delivery to farmers affected crop performance because farmers continued waiting for fertilizer leading to late planting in some cases. There was also a concern that farmers are developing ‘a subsidy syndrome’ such that they cannot do without subsidized fertilizer and this hampers their farming operations and has a negative effect on production.

### ***Seed technology***

One participant from the seed traders association of Kenya (STAK) informed the meeting that together with KEPHIS and Kenya Market Trust (KMT), they are working on an innovation to have mandatory certification stickers with codes for verification on the seed packaging for purposes of countering production and sale of fake seeds.

### ***Mechanization***

A participant commended Tegemeo for the rich repository of empirical studies and findings which he said have been used over the years to communicate with government and other stakeholders. He then noted that one highlight of the findings and recommendations was mechanization. He suggested that policy should advocate for the formation of mechanization hubs across the country and close to farmers rather than the sparse and disjointed technologies centers.

He also noted that there is a lot of support from various initiatives and programs from USAID, the World Bank and FAO like the Kenya cereal enhancement program-climate resilient agricultural livelihoods (KCEP-CRAL) that county governments should be able to utilize to upscale climate smart agricultural practices to improve the livelihood of farmers. Another participant added that mechanization should take a climate smart approach.

A participant asked whether the assessment looked into cost of production in other government initiatives like the Galana-Kulalu to compare the cost of production and hence the advantage of largescale mechanization. In response, Dr. Dennis Otieno said that a previous study by Tegemeo found that although irrigated maize was more cost-efficient especially due to the possibility of more cropping seasons, irrigation water and land were underutilized in the scheme.

### ***Conservation agriculture and climate practices***

Another participant observed that the cost of land preparation was too high and wondered whether climate smart agriculture practices like minimum tillage should be recommended to farmers. This technology has been shown to reduce cost and conserve nutrients and moisture.

Another participant noted that in a comparative study between farmers using conventional and minimum tillage, there was a 10 bag difference in maize production between conventional tillage and the climate smart agriculture technologies and cost of production especially in land preparation was considerably reduced under minimum tillage.

### ***Knowledge management***

A participant said that most cost of production assessments focus on analyzing cost components but ignore knowledge management or the reason why farmers farm the way they do. As an example, he pointed out that the costs for the out grower/ non-scheme farmers in Ahero were high and wondered whether it was due to their knowledge level on seed storage, planting time or seed preparation. He suggested that COP findings should be discussed with farmers so that they can self-assess to establish ways of reducing cost of production and improve productivity.

A participant from Trans Nzoia noted that there was low fertilizer yield response despite increased use of fertilizer. He, however, pointed out that 2017 was a peculiar year and was not ideal for judging fertilizer productivity. He also indicated that the fertilizer yield response was visible for small-scale farmers.

He said that together with the meteorological department, climate information was being disseminated to farmers through the climate wiser program. This will help farmers take advantage of available moisture and other information to improve yields. He also noted that MoALF headquarters has promised to initiate a data forum to allow timely data access by farmers though this has not materialized. He emphasized the need to embrace data management to improve information flow to help farmers make timely decisions.

On indigenous knowledge, Mr. Onyango noted that farmers were using local knowledge to manage FAW. Some farmers used soap solutions, sand, ash and tobacco snuff to control the worms.

## **SUMMARY**

Inputs (fertilizer), labor and post-harvest handling were the biggest shares of total production cost. Therefore, efforts to reduce cost of production should focus on fertilizer cost reduction and promotion of labor-saving technologies (mechanization). Fertilizer use should be guided by soil nutrient requirements based on soil testing. Integrated soil fertility management (ISFM), good agricultural practices, conservation and climate smart agriculture should also be promoted.

Extension systems need to be revamped to ensure that farmers have access to the right information and are able to use it to increase productivity and reduce unit costs of production. County governments should be sensitized on the importance of extension to agriculture and be encouraged to build capacity of extension services at county level.

Overdependence on rain-fed farming increases production uncertainty. Policy should encourage production of maize and other staples under irrigation. Kenya's import dependency ratio for rice has been high and increasing. At the same time irrigation farming is still low. Therefore, there is an opportunity to increase rice production and productivity through expansion of area under irrigated rice. Production of upland rice should also be promoted. Credit facilities for farmers especially the youth should be enhanced to boost rice production since it is capital intensive.

Accurate policy formulation and monitoring of production performance requires better estimation techniques such as crop cut surveys. This will also enable development of accurate early warning systems for timely food security interventions. The country will have to diversify its staple calorie sources to reduce pressure on maize.

## **ANNEX1: LIST OF PARTICIPANTS**

	<b>NAME</b>	<b>TITLE</b>	<b>ORGANIZATION</b>
1	Alex Dietz	Commercial Manager	Cargill
2	Anthony Kariri	IT Support	Tegemeo
3	Benard K. Kimeto	CDA	MOALF-Narok
4	Benson Muriithi Mukongo	CDA	MOALF-Kirinyaga
5	Charles M. Waweru	County Crops Officer	MOALF
6	Christopher Mutisya	Business Development Manager	Cereal Growers Association
7	Colletah Sigila	Legal Council	Parliament
8	Dominic T. Otieno	County Crops Officer	MOALF
9	Dr. Dennis Otieno	Research Fellow	Tegemeo
10	Dr. Lilian Kirimi	Senior Research Fellow	Tegemeo
11	Dr. Mercy Kamau	Senior Research Fellow	Tegemeo
12	Dr. Milton Ayieko	Director	Tegemeo
13	Dr. Priscilla Wainana	Post-Doc	Tegemeo
14	Dr. Samwel Mburu	Research Fellow	Tegemeo
15	Dr. Timothy Njagi	Research Fellow	Tegemeo
16	Duncan Ochieng Onduu	Executive Officer	STAK/KEPSA
17	Dustan Kaburu Misheck	DCDA Crops	MOALF-Meru
18	Eric Kariuki	Research Officer	Parliament
19	Eric Mukundi Njue	Research Associate	Tegemeo
20	Ernest Muendo	D/CDA	MOALF-Narok
21	Eunice Nyango	Research Officer	NCPB
22	Eustace Muriuki	MD	MEA Ltd
23	Fredrick O. Owino	Crops Officer	MOALF-Nakuru
24	Fredrick Siele	MSM	NCPB
25	Githuku James	Research Associate	Tegemeo
26	Grace Kirui	CDA	MOALF
27	Henry G. Mwangi	Deputy Director	MOALF
28	Hillary Bii	Research Associate	Tegemeo
29	James M. Kariuki	CDA	MOALF-Machakos
30	John Njongoro	Rice Farmer	RFAK
31	Johnson Imbira	CDA	MOALF-Kakamega
32	Jonathan N. Munyao	County Crops Officer	MOALF
33	Joseph K. Cheboi	CDA	MOALF-Uasin Gishu
34	Joyce Makau	Research Associate	Tegemeo
35	Judy Kimani	COO	Tegemeo
36	Judy Oloo	Crops Officer	MOALF
37	Julius Kisingu	Programme Officer	UN-WFP

	<b>NAME</b>	<b>TITLE</b>	<b>ORGANIZATION</b>
38	Kenneth Kagai	CDA	MOALF-Trans Nzoia
39	Kevin Onyango	Research Associate	Tegemeo
40	Dr. Mathew Muma	Policy Analyst	KIPPRA
41	Moses J. Biketi	County Crops Officer	MOALF-Trans Nzoia
42	Mulinge Mukumbu	DCOP	USAID/KAVES
43	Nicholas Odhiambo	Research Associate	Tegemeo
44	Nicodemus Maluki	Clerk Assistant	KNA
45	Otundo Robert	Research Associate	Tegemeo
46	Paloma Fernandes	CEO	Cereal Millers Association
47	Prof. Alfred Kibor	Ag. DVC R&E	Egerton University
48	Prof. Rose Nyikal	Associate Professor	UON
49	Robert Rubhi	Programme Officer	EAFF
50	Rose Ngugi	ED	KIPPRA
51	Samson Nguta	Agriculture Officer	MOALF
52	Stephen Omondi	SCAO	MOALF-Narok
53	Susan Maina	KMT/KEPSA	Sector Lead
54	Sylvester Oketch	CDA	MOALF-Kisumu
55	Titus Kisangau	Programme Officer	EAGC
56	Titus Omengo	County Crops Officer	MOALF-Kakamega
57	Tom Chariga	Chairman	KCO
58	Walter E. A. Nganyi	AD	KMD
59	Z. K. Chebet	DMIS	Ministry of Agriculture