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# CAN IRRIGATION BE AN ANSWER TO KENYAS FOOD SECURITY PROBLEM?

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Policy Brief

## SUMMARY

Irrigation development is one strategy the government can use to improve food security in Kenya. Lessons from irrigated maize production studies show that it is profitable and that Galana Kulalu food security project has the potential to produce about half of the country's food requirement contributing significantly to food security and the GDP through the incomes earned. However, high costs due to inefficient use of fertilizer, water and land are the major cost factors that have caused doubts and low level engagement in irrigated maize production. It is thus recommended that efficient use of land, fertilizer and water under both intensive and extensive maize production under irrigation, would contribute to lowering the unit cost of production and lead to increased food production.

## BACKGROUND

Kenya has a population of about 43 million people with a growth rate of 2.7%, one of the highest in the world. This population has tripled in the last 35 years and is expected to be 64 million by the year 2030. About 80% of the population is rural and relies on agriculture as a source of employment. The country has an area of about 584,646 square kilometers of land of which only 17% is arable while 80% can be classified as ASAL. A high population increases pressure on the country's resources leaving an increasing number of people particularly the youths vulnerable to poverty. The poverty data shows that poverty levels are at 50% and 34% in rural and urban areas respectively. Nearly half of the country's population live below the poverty line (<1 US$ per day) and are food insecure. Food insecurity arises due to declining land area and maize productivity in high potential areas and increasing demand for food due to increasing population. The annual maize output in Kenya is about 39 million bags against a food consumption demand of 36 million bags currently. With increasing population more food is required in future. To increase food production, the government has adopted irrigation as a strategy and has increased funding to this sector from 11.5 billion to 13.5 billion in the 2014/15 financial year, developed irrigation policy and bills and carried out detailed design works. The government is also carried out implementation and rehabilitation of irrigation projects and schemes. Irrigation has the potential to increase food output by about 100-400%. In Kenya, there is about 3 million acres of irrigable land and only 10% is currently being utilized. It is against this background that Tegemeo institute of agricultural policy and development carried out a study seeking to answer if irrigation can be an answer to food production and food security in Kenya?

## Major cost elements

The overall cost of production for irrigated maize was KES 15,705 per 90kg bag for the 2014/15 crop season. This is about 20% higher than that for non-irrigated maize which is KES 13,100 per 90kg bag. Evidence shows that the major factors contributing to this high costs are fertilizer, water and land preparation contributing 28.1%, 19.6% and 15.9% respectively Figure 1. The intermediate factors (pesticides, herbicides, transport, gunny bags, storage chemicals and their handling charges) and seeds have a relatively lower cost of 10.7% and 8.6% respectively. These two factors were sourced through farmer groups which lowered their procurement costs considering that these are marginal areas. Poor road network and insecurity have made transport to be the most expensive factor in this category. Although the demand for labor was high, irrigated maize production experienced limited labor supply which contributed only 13.1% to the total cost. ASAL areas experience labor shortage due to the low population in these marginal areas. Labor scarcity raises the wage rates for labor in irrigated farms making them much higher than non-irrigated farms. This has resulted in most farmers using family labor in field activities resulting in the apparent low cost of labor Table 1 and Figure 1.

## Revenues

The profit margins per acre and per bag under irrigated maize of KES 8495 and KES 772 respectively, were higher than KES 5003 and KES 658 for non-irrigated maize. The breakeven point was however inversely related to price and directly related to the cost of production. Irrigated maize had a breakeven point of about 7 while non-irrigated maize had 5. Increasing maize price is associated with increased margin per bag. Irrigated maize also has an additional advantage in that output and profits can be increased by increasing the number of seasons. Table 1.

## Efficiency tests

The results from Table 2 and Table 3 were used to estimate the statistics for efficiency test. The results show that fertilizer, water and land were inefficiently used while there was near optimal use of seeds and labor. Optimal rates of application for fertilizer and water needs to be developed for different methods of water application. Water and land are significantly underutilized and this led to low output. The available option for increased production is to intensify the use of these factors on a small scale. The use of water saving technology and intensive land use would prevent excessive land and water wastage. Labor and seeds were well utilized.

## Conclusions and Policy Implications.

In conclusion, this study establishes that:

Irrigated maize is profitable and the most important factors of production are fertilizer, water (amounts and method of application), labor and preparation practices. Irrigated maize is beneficial since it returns a high margin of 29% more per bag than non-irrigated maize, has higher output levels and its profit margins are higher. It is important to note that a 1% price increase increases profit margins by 0.615 % and cost margin by 29%.

The production of irrigated maize is flexible and one can have more[1] than one crop in a year. This implies that high returns can be achieved if production is targeted at seasons when there is low supply of maize in the market.

The major cost limitations are the high cost of production due to high factor costs, small farm sizes, price fluctuations and limited labor. In terms of production, fertilizer, land and water have a significant effect on maize production though they are inefficiently used. Fertilizer is excessively used while land and water are underutilized.

## Policy insights

The high profits, income and low cost per bag for irrigated maize is a sign of a viable venture though it has challenges for Galana-Kulalu food security project.

1. The project has the potential to increase the country's maize output by about 5.5 million bags considering one seasons output and about half of the national food requirement i.e 16.5 million bags if they are to produce for three seasons. This is quite a substantial amount and can improve the food security situation and the GDP of the country.

However, there are challenges which needs to be addressed among them competing political interests in water use, human wildlife conflicts, insufficient water (Figure 5), high cost of irrigation investment (Figure 3, 4 and 5), land use rights and the value chains for the crops that are to be grown.

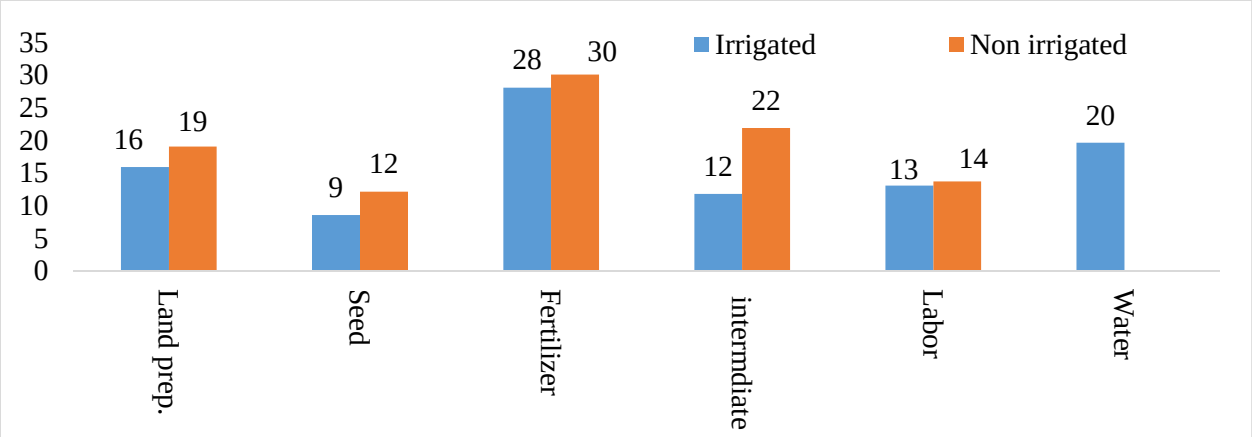


Figure 1 Factor cost proportion of total cost`

Table 1. Production cost structure of irrigated maize in Kenya for 2014/15 crop season.

| | *Irrigated* | *Non irrigated* | *Simulated* | *2 crops* |
|---|---|---|---|---|
| Maize yield (bags/acre) | 11 | 7.6 | 11 | 22 |
| Sale price per 90kg bag | 2,200 | 2382 | 2,382 | 2,382 |
| **Total revenue** | **24,200** | **18,103** | **26,202** | **52,404** |
| **Total production costs (TC)** | **15,705** | **13,100** | **15,705** | **31,410** |
| Total production costs (TC) with WC | 17,276 | 14,410 | 17,276 | 34,551 |
| **Cost per bag w/o WC** | **1,428** | **1,724** | **1,428** | **1,428** |
| **Cost per bag with WC** | **1,571** | **1,896** | **1,571** | **1,571** |
| Breakeven yield (90kg bags) | 7.14 | 5.5 | 6.59 | 13.19 |
| Margin per bag (Ksh) w/o WC | 772.3 | 658.3 | 954.3 | 954.3 |
| Margin per bag as % of cost w/o WC | 54% | 38% | 67% | 67% |

**Source:** Author 2015.

Table 2 Regression results for irrigated maize production

| | Coef. | Std. Err. | t | P>\|t\| |
|---|---|---|---|---|
| **Chemicals** | -0.079 | 0.089 | -0.89 | 0.378 |
| **Labor** | 0.116 | 0.040 | 2.85 | 0.006 |
| **Water** | -0.208 | 0.108 | -1.92 | 0.059 |
| **Seeds** | 0.604 | 0.092 | 6.56 | 0 |
| **Land** | -0.096 | 0.039 | -2.45 | 0.017 |
| **Fertilizer** | 0.092 | 0.021 | 4.39 | 0 |
| **_cons** | -617.78 | 361.14 | -1.71 | 0.092 |

**Source**; Author 2015.

Table 3: Efficiency test results

| | *Water* | *Labor* | *Land* | *Seed* | *Fert.* |
|---|---|---|---|---|---|
| **GM MVP** | 16,852 | 25.6 | 5,977 | 3,366 | 1,078 |
| **Price** | 4911 | 312.61 | 3000 | 3750 | 2400 |
| **Ratio** | 3.43 | 0.08 | 1.99 | 0.9 | 0.449 |
| **Decision** | Under | Excess | Under | Excess | Excess |
| **Policy direction** | Eff. | High rates | Intens. | Excess | under |
| **CV** | Sig. | Not sig. | Sig. | Not sig. | Sig. |

**Source**: Author 2015.

Figure 2 Irrigated maize in Perkerra irrigation scheme Baringo County.

Figure 3 Water flow in irrigation canal in Bunyala.

Figure 4 Cemented canals in Lower Kuja irrigation project

Effect of large output levels on consumer and producer price levels have to be addressed so as to maintain all stakeholders gainfully employed in maize business.

## What can be done to increase food production?

To improve on the plot and scheme level inefficiency associated with irrigated maize production and hence food production, the following actions are recommended.

Efficient use of water and water application methods since the factor is scarce, Figure 6 below.

Figure 5 River Galana inadequate water

Figure 6 Centre pivot a more efficient water application method.

With the cost for water being paid for as a lump sum, cost reduction can be achieved through efficient use of water and water application methods. This would lower the water wastage and ensure sufficient amounts is available for maize.

R & D to increase maize productivity through technical change in irrigation technology package that embodies limited wastage of fertilizer, intensive maize production of under irrigation that gives high yield increases and reduce the unit cost of production and breakeven point and profit margins.

Expansion of maize production areas to tap into the 87% of the available irrigable land can exploit economies of scale and lower the unit cost of production. This gives room for area expansion which will lead to high output levels and margins per bag.

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