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Econometric Trend and Forecasting Production, Area, and Yield of Cereals in Eswatini: 1961-2018

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Abstract
Cereals constitute more than 60% of total food production and caloric intake of a typical household in Eswatini. A key agenda of the country within the context of her Vision 2030 agenda is to raise the productivity and livelihood of the nation's smallholder farmers. This study therefore examined the historical trend in the production, area, and yields of cereals in the country between 1961 and 2018 and forecast the variables up to 2030. The forecast methods employed include mean, naïve, exponential smoothing, and autoregressive integrated moving average (ARIMA). Based on various forecast accuracy techniques, ARIMA model outperformed the other alternatives for all the crops. Based on the estimates of the ARIMA models, the production, area, and yield of most of the crops are expected to decline by 2030. The forecast shows that the production of maize will decline by 2.73% in 2030 when compared with its 2018 value of 91247 tons. The 2018 maize area of 78535 hectares is predicted to decrease by 9.06% in 2030. Maize yield in 2022 is predicted to be 1.16 tons/hectare. This is still far below the national target of 2 tons/hectare by 2030. The forecast indicates that the area allocated to sorghum production will decline by about 36%, but the production will remain largely unchanged due to slight increase in yield. Rice production and yield are predicted to remain unchanged. It is interesting to note that the yield of rice in the country is more than 2 tons per hectare.

Keywords: Forecast, Production, Area, Yield, ARIMA, Eswatini

Introduction

Globally, cereals are staple food grown in large quantities as sources of vitamins, minerals, proteins, carbohydrate, fat and oil (FAO, 2011, https://www.fao.org/news/story/en/item/92544/icode/). In 2021, the global production of cereals was about 3.07 billion tons and the yield was estimated to be 4.15 tons/hectare (FAO, 2021). Currently in Africa, cereals are grown in over 123.4 million hectares of the arable land and the production is about 216 million tons per year (FAO, 2021). In order of importance, maize is the mostly grown cereal crop in Africa with consumption rates being the highest in eastern and southern Africa (ESA). Sorghum is the second most important with 22% of total cereal area, followed by millets with 19%. Rice has also become a highly strategic and priority commodity for food security in Africa. Its consumption is growing faster than that of any other major staple on the continent because of high population growth, rapid urbanization and changes in eating habits (Seck *et al.*, 2013). Though, a major imported commodity, wheat is also widely grown in the continent. About 9.6 million hectares is devoted to its cultivation (FAO, 2021). Within the South African Development Community (SADC), Agriculture supports the livelihood of more than 50% of the population, but the yield of cereals in 2017 was far less than the world average in most of the countries apart from South Africa and Mauritius. Data presented shows that the yield was as low as 0.40 ton/hectare in Botswana and 0.44 in Namibia (Figure 1) and in Eswatini, the yield was 1.14 tons/hectare in 2017. Major cereals grown in the kingdom of Eswatini include maize, sorghum, rice, and wheat. However, maize is the most important staple food crop grown by smallholder farmers in the country. Cereals in the country are grown mainly by farmers in the rural areas using communal Swazi National Land (SNL). Their harvest constitutes about 95% of the cereal production in the country (Mbonane and Makhura, 2018; Sibonginkosi *et al.*, 2019). Maize yield vary across the nation's agroecological zones (AEZ) from 1.55-4.90t/ha in the High Veld to between 1.21-4.20t/ha in the moist Middleveld (Dlamini, 2017; Mbonane and Makhura, 2018; Mncube *et al*., 2017). Several efforts have been made by the governments of Eswatini to improve the productivity of the cereals over the years and these are documented in the framework of her national agricultural policies (Government of Swaziland, 2005). In order to guide the development of agriculture in the country within the national development strategy termed vision 2022, the Government of Eswatini (GoE) has developed several policies that have meaningful implication for crop growth such as Poverty Reduction Strategy and Action Programme (PRSAP), Comprehensive Agriculture Sector Development Programme (CASP), and National Food Security Policy. Since the main target of CASP is to reduce poverty to zero by 2022, most of the policies have been geared towards increasing productivity of smallholder farmers on the SNL. As earlier noted, smallholder farmers are noted predominantly for the growth of cereals (i.e. maize, sorghum, rice and wheat).

The GoE have developed several policies and programme approaches that were undertaken towards the development of agriculture especially smallholder agriculture on SNL areas since its independence in 1968 (Dlamini & Masuku, 2011; Dlamini *et al*., 2012; Masuku *et al*., 2001). The Agricultural Policy promulgated in 1968 provides a framework for strategies aimed at achieving food self-sufficiency through increased production of maize by farmers on SNL areas (Oxford Policy Management, 1998; UNCTAD, 2000). In 1970s, the government created the Rural Development Area (RDA) through the help of many donors (FA0, 2011) and of late, there are 18 RDAs in the country. The main objective of Rural Development Area Programme (RDAP) is to achieve food self-sufficiency and bring SNL farmers to commercial or semi-commercial level using yield increasing inputs and extension services. It was reported that the RDAP could not achieve the goal of food self-sufficiency because of inadequate supply of modern technologies and labour (FAO, 2005). Hence, a policy shift from food self-sufficiency to food security was inevitable after the realization that sufficiency did not necessarily mean a guarantee against hunger and malnutrition. The National Development Strategy (NDS) of the 1990s reflected that policy shift. Its major thrust was assisting farmers to achieve basic food security and increased crop productivity through diversification and commercialization (Government of Swaziland, 1997). Two of the major achievements of the NDS were the establishment of the National Maize Cooperation (NMC) which was for the development and production of maize and other cereals. National Maize Corporation (NMC) is a fully state-owned enterprise established in 1985 in accordance with the Companies Act of 1912 to enhance increased production and national food security through improved stakeholder relationships, creating strategic partnerships, farmer support, vigorous marketing and supply of high-quality maize, cereals and other grains. Secondly, the NDS helped in the development of the Smallholder Agricultural Development Project for irrigation development (SADP), which was to assist the most disadvantaged agricultural producers in the SNL. In 1993 a loan was approved by the International Fund for Agricultural Development (IFAD) to develop 185 ha of new small-scale irrigation and the consolidation of another 257 ha of existing schemes to promote farmers' management of irrigation schemes. Within this framework, another irrigation schemes projects that were initiated by the government were the construction of the Komati Downstream Development Project (KDDP) under the Swaziland Agricultural Development (SWADE). The main aim is to develop 6,000 ha of new irrigation schemes along the Komati basin in collaboration with smallholder farmers using water from the Maguga dam. The Lower Usuthu Smallholder Irrigation Project (LUSIP) is another irrigation scheme that was developed by the government under SWADE. It involves the construction of three dams to form an off-river storage reservoir to impound water that will be diverted from wet season flood flows on the lower Usuthu River. The project is in two phases and aims to develop a net of 11,500 ha for irrigation. It is being financed through agreed loans from several organizations including the African Development Bank, the Development Bank of Southern Africa, the Arabic Bank for Economic Development in Africa, the International Fund for Agricultural Development, and the European Investment Bank. All these programmes and project initiated by the GoE are supposed to aid the agricultural development in the country, particularly increase in crop productivity per hectare (i.e. cereals). However, the agricultural sector is still largely rainfed with low levels of capital inputs and technology use (Central bank of Swaziland, 2011, https://www.centralbank.org.sz/wp-content/uploads/2021/03/2010-11-optimized-copy.pdf). To date, farming on the SNL remains vulnerable to negative impacts of climate change and poor investments on crop production and land management (Central Bank of Swaziland, 2014, https://www.centralbank.org.sz/wp-content/uploads/2021/03/2014-2015-optimized.pdf). Therefore, the main objective of this paper is to assess the current level of production, area, and yield of major crops (i.e. cereals) and forecast the growth of cereal by the year 2030 in the country.

In summary, despite laudable efforts of the Eswatini Government to enhance cereals production, the country is still a net importer of cereals. As at the end of 2021 fiscal year, Figure 2 shows that the government spent about USD85.68 million on cereals' importation Given the economic meltdown in Eswatini due to covid-19 pandemic and global financial crisis, the country may need to cut down on food importation, especially cereals, since the land area is suitable for their production. Using historical series, this study therefore forecast the yield up to 2030.

Methodology

This study covers the yield of cereals in Eswatini. Eswatini (formerly called Swaziland) is one of the middle-income countries in Southern Africa. The country shares its border with Mozambique in the Eastern part while other areas of the nation are surrounded by South Africa (Figure 3) with an estimated population of about 1.2 million and of which 70% (or 840,000) rely on agriculture as a mean of livelihood (Mbonane and Makhura, 2018). Several researchers in other parts of the world (i.e. Nigeria, India, Kenya etc) have predicted the future yield of cereals using several forecasting techniques (Belete & Shoko, 2018; Darekar & Reddy, 2017; Esther & Magdaline, 2017; Jimoh *et al*., 2016; Panasa *et al*., 2017; Sharma *et al*., 2013; Verma, 2018). Most common methods include mean, naïve, exponential smoothing and autoregressive moving average. However, the Autoregressive Integrated Moving Average (ARIMA) (Box and Jenkins, 1968; Box *et al*., 1974) is about the most popular and frequently used stochastic time series models. The purpose of the model was to identify, estimate and diagnose a time-series model, where time is the main explanatory variable (McCleary *et al*., 1980). Most of the time, the use of this model is limited to forecasting long-time series of high frequency (Kostić *et al*., 2016). In this study, four common forecasting techniques were estimated in the process of generating a meaningful forecast model of the area, production and yield of the cereals in Eswatini. The methods used are: naïve, exponential smoothing and auto-regressive integrated moving average (ARIMA) models because of their ability to generate precise forecast (Ajetomobi and Olaleye, 2019; de Oliveira and Oliveira, 2018; Kriechbaumer *et al*., 2014; Maria and Eva, 2011). The forecast performance of the models was based on the following measures of accuracy – MAPE, RMSE, and MAE. All the models and measures of accuracy were estimated with the use of forecast package in R software while the tables and graphs were drawn with the use of summaytools and ggplot2 packages. The mathematical formulation for each of the forecasting techniques is as follows:

Naïve Method

The naïve approach is based on the assumption that the area, production and yield of crop j in year t+1 is equivalent to its immediate area, production and yield in year t

$$Y_{jt+1} = Y_{jt}$$

Where;

Y_{jt+1} is the forecast area, production or yield of crop j in year t and Y_{jt} is the actual area, production or yield of crop j in year t

Exponential Smoothing

Exponential smoothing is a process of decomposing a time series into two components, namely, a level and a residual component (Ghysels and Marcellino, 2018). When the level at the end of the estimation sample, say Y_T^L, is reached, it can be used to forecast Y_{T+h} with $h > 1$. If the time series y_t is independent and identically distributed with a non-zero mean, Y_T^L can be estimated as the sample mean of y. In case y_t is persistent, then more weight should be ascribed to the more recent observations such that

$$Y_T^L = \sum_{t-1}^{T-1} \alpha(1-\alpha)^t Y_{T-t}$$

Where, α represents the smoothing parameter. Generally, $0 < \alpha < 1$ and $Y_{T+h} = Y_T^L$ since

$$(1-\alpha)Y_T^L = \sum_{t=1}^{T-1} \alpha(1-\alpha)^{t+1} Y_{T-t-1}$$

The equation becomes, $Y_T^L = \alpha Y_T + (1-\alpha)Y_{T-1}^L$

The starting condition is $Y_1^L = Y_1$ the larger the α, weight given to the most recent observations. In the limiting case of $\alpha = 1, Y_T^L = Y_T$

A more elaborate extension of the simple exponential smoothing is the Holt-Winters procedure where

$$Y_i^L = \alpha Y_t + (1-\alpha)(Y_{t-1}^L + T_{t-1})$$
$$T_t = c(Y_t^L - Y_{t-1}^L) + (1-c)T_{t-1}$$

With a condition that $0 < \alpha < 1$ the starting condition $T_2 = Y_1 - Y_1$ and $Y_2^L = Y_2$ and $Y_{T+h} = Y_T^L + hT_t$

The coefficients α and c are the parameters to control the smoothness of Y_T^L. The smaller the coefficients, the smoother the Y_T^L. In this study, Y_T^L is the area, production or yield of the cereals while Y_{T+h} is the forecast value of each of them. The state space framework for automatic forecasting with exponential smoothing in forecast package in R software (Hyndman *et al*., 2002) was implemented in this study.

ARIMA Model

A univariate economic time series such as Y_t contains a data generating process which belongs to the category of Autoregressive Integrated Moving Average (ARIMA) models. An ARIMA model is generally specified by three order parameters, termed, *p,d,q*. The autoregressive part of the model uses historic values to predict the observed values. The autoregressive parameter, *p*, refers to the number of lags allowed in the model.

For example, ARIMA (n, 0, 0) is represented by;

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \cdots + \alpha_n Y_{t-n} + \varepsilon_t \;\ldots\ldots (1)$$

where α_0 to α_n are the model parameters.

The *d* component of the model indicates the degree of differencing (*I(d)*) in the integrated component. The moving average component of the model, *q* indicates the residual of the model as a function of previous residual terms.

$$Y_t = \beta_0 + \beta_1 \varepsilon_{t-1} + \beta_2 \varepsilon_{t-2} + \cdots + \beta_n \varepsilon_{t-n} + e_t \;\ldots\ldots (2)$$

When the three components are combined, the ARIMA model, which can be written in linear form as:

$$Y_t = c + \alpha_1 Y_{dt-1} + \alpha_2 Y_{dt-2} + \cdots + \alpha_n Y_{dt-n} + \beta_0 + \beta_1 \varepsilon_{t-1} + \beta_2 \varepsilon_{t-2} + \cdots + \beta_n \varepsilon_{t-q} + e_t$$

There are two alternative process of setting up an ARIMA model (Box and Jenkin 1976). The first procedure involves the following steps:

- i. Plotting the data and checking for outliers, stationarity and/or the need for variable transformation
- ii. Differencing until the variable is stationary.
- iii. Using differenced series to find appropriate p and q ARIMA parameters.
- iv. Fitting the appropriate ARIMA (p, d, q) to the original data
- v. Verifying that the best available model has been estimated.
- vi. Forecast

The routes to be taken in respect of the second alternative include:

- i. The use of an iterative automated algorithm with as many different models as possible and later identifies the best model with appropriate information criteria.
- ii. Fitting the ARIMA (p, d, q) to the original data
- iii. Verifying that the best available model has been estimated.
- iv. Forecast

The second approach is followed in this paper using the automated algorithm in forecast package in R software.

Measures of Accuracy

Let Y_t to be *tth* observation and ht the forecast, where t= 1,2,.......,n the following measures of accuracy were used to assess the forecast performance of the models used in this study:

$$\text{MAE} = n^{-1}\sum_{t=1}^{n}|Y_t - h_t|$$

$$\text{MAPE} = 100n^{-1}\sum_{t=1}^{n}(|Y_t - h_t|/|Y_t|$$

$$\text{RMSE} = \sqrt{n^{-1}\sum_{t=1}^{n}(|Y_t - h_t|)^2}$$

Where *MAE* is the mean absolute error, *MAPE* the mean absolute percentage error and *RMSE* the Root Mean Square Error.

Results and Discussion

Descriptive Statistics

The summary statistics of the area, yield and production of cereals in Eswatini between 1961 and 2018 are shown in Table 1. Four main cereals in the country include maize, rice, sorghum and wheat. On the average, Maize alone constitutes about 95% of the total cereals' area and production in the country. It is the most popular marketable cereal in the country under the regulatory framework of the National Maize Corporation (NMC). Currently, the amount of maize produced in the country is still less than the quantity of the commodity imported mainly from neighboring South Africa. Next to Maize in terms of average production is rice. Rice is produced mainly in the northeastern part of Ewatini. The average production of rice is relatively low; it falls from almost 8000 tons in 1969 immediately after independence to about 80 tons in 2018. The production of sorghum and wheat are very minimal in the country.

The evolution of the production of the crops over the analysis period is shown in Figure 4. The entire crops exhibit more downward trend in production in the last decade than in previous decade. Maize showed an upward trend between 1961 and 1990 but declined from then. The change in maize production might be attributed to low availability and inefficient use of productivity increasing inputs such as fertilizer, land ownership issues with Eswatini National Land (ENL) where bulk of maize is produced and low agricultural extension-farmer ratio (Masuku and Belete, 2014). Over the years, the production of rice and sorghum has dwindled to almost an insignificant level. This might be due to lack of interest in the growth of the crops by farmers in the country or a poorly developed supply and value chain for the crops. Wheat production attained its peak in early 1980s and then declined. Generally, there is noticeable fluctuation in the production of wheat in the country over the analysis period. A major policy issue is that the production of cereals in Eswatini since independence has not been able to meet the nation's domestic requirement. The country has persistently relied on cereal imports from South Africa to meet local demands.

The trend of the area planted to different cereal crops in Eswatini is shown in Figure 5. More than 90% of the total land areas for cereals in Eswatini were allocated to maize production. Next to maize was the land area cultivated to Sorghum. The land area for rice and wheat was consistently minimal despite the potentials for the crops to thrive in the country. A major reason for such a trend for rice and wheat may be the lack of appropriate varieties (FAO, 2017). Another key issue may be the fact that Eswatini is a net-importer of the commodities from neighboring South Africa and the exchange rate is one to one. Figure 6 shows the trend of the yield of each of the cereals. The yield of maize shows an upward trend from 1961 to 1990 but decreased thereafter through to 2018. The decline may be traced to prevalence of extreme weather events due to climate change in recent time and low utilization of productivity increasing inputs (fertilizer, hybrid seeds, and pesticides) by the farmers due to poverty.

Forecasting Performance of the Models

Table 2 Shows that ARIMA model outperformed the other three alternatives for all the crops because it has the lowest forecast error. This implies that ARIMA model is the best forecaster of the production, area and yield of each of the three cereal crops finally selected for prediction up to 2022.

Arima Modelling and Forecasting

The best ARIMA models for the variables and their associated MAE, RMSE and MAPE are shown in Table 3. The table shows that the best ARIMA (p, d, q) for maize production, area and yield are 0-1-2, 1-0-0 and 0-1-1 respectively. The models vary from 0-1-1 to 0-2-2 in case of sorghum and for rice; they are 0-1-0, 1-1-0 and 0-1-0 respectively. The R^2 varies between 38% and 95%. This indicates that the lag of the dependent variables (production, area or yield of each of the cereals) and/or lag of their error terms explain changes in the dependent variables reasonably well in all cases.

The forecast plots are shown in Figure 7, and the actual forecast values are shown in Table 4. Based on the estimates of the ARIMA models, the production, area and yield of most of the crops are expected to decline by 2022. The forecast shows that the production of maize will decline by 2.73% in 2022 when compared with its 2018 value of 91247 tons. The 2018 maize area of 78535 hectares is predicted to decrease by 7.82% in 2022. Maize yield in 2022 is predicted to be 1.16 tons/hectare. This is still far below the national target of 2 tons/hectare by 2022. The forecast indicates that the area allocated to sorghum production will decline by about 12% but the production will remain unchanged due to slight increase in yield. Rice production and area are predicted to remain unchanged. It is interesting to note that the yield of rice in the country is more than 2 tons per hectare.

Conclusion

The main objective of this study is to forecast the production, area, and yield of cereals in Eswatini. Based on the importance of the cereals in the country, the analysis is limited to maize, sorghum and rice. Based on the forecast accuracy measures (MAE, RMSE and RMSE), ARIMA model outperformed the other three alternatives (mean, naïve and exponential smoothing methods). Data for the study were obtained from FAO statistical database and covered 1961 to 2018. The ARIMA model was used to forecast the production, area and yield of the crops from 2019 to 2022. The results for all the crops indicate that the production, area, and yield of all the crops will not improve significantly by 2022. The results therefore call for policies aimed at availability of high yielding varieties of the crops to be made available to the farmers at affordable prices. The farmers should be properly advised on best management practices such as efficient application of fertilizer, pesticides and irrigation facilities. The government should review the import policies on the crops to promote local production and processing.

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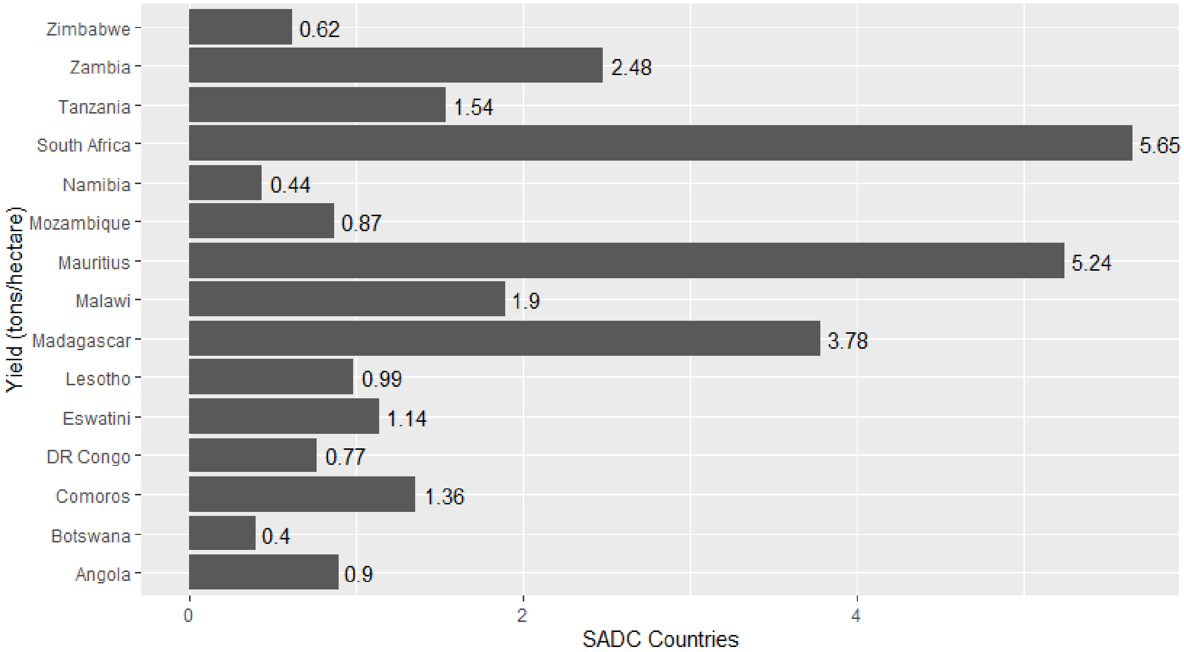
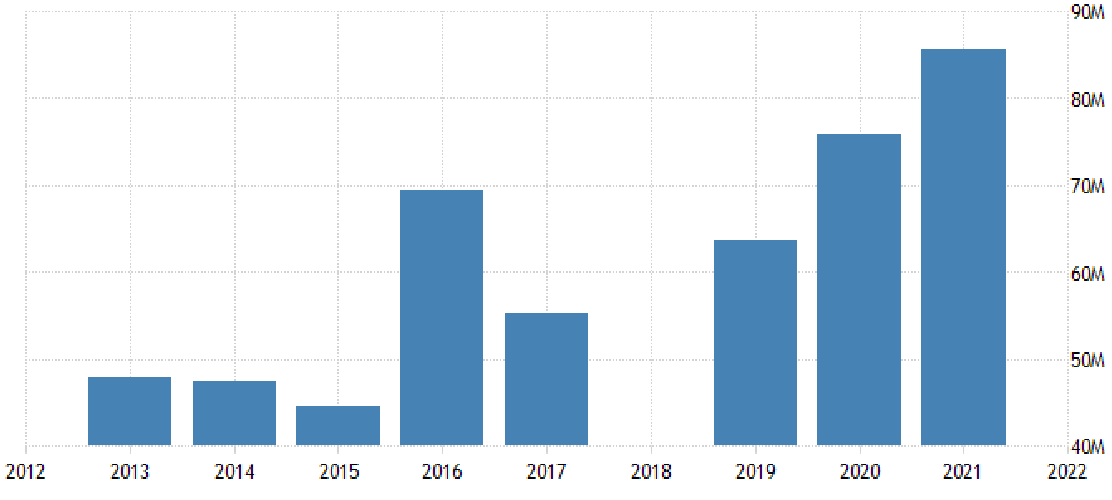


Figure 1: Yield of Maize Across SADC Countries



COMTRADE | TRADINGECONOMICS.COM

Figure 2: Cereals Imports in Eswatini
Source: COMTRADE tradingeconomic.com

Figure 3: Map of Eswatini Showing the Regions and Major Cities

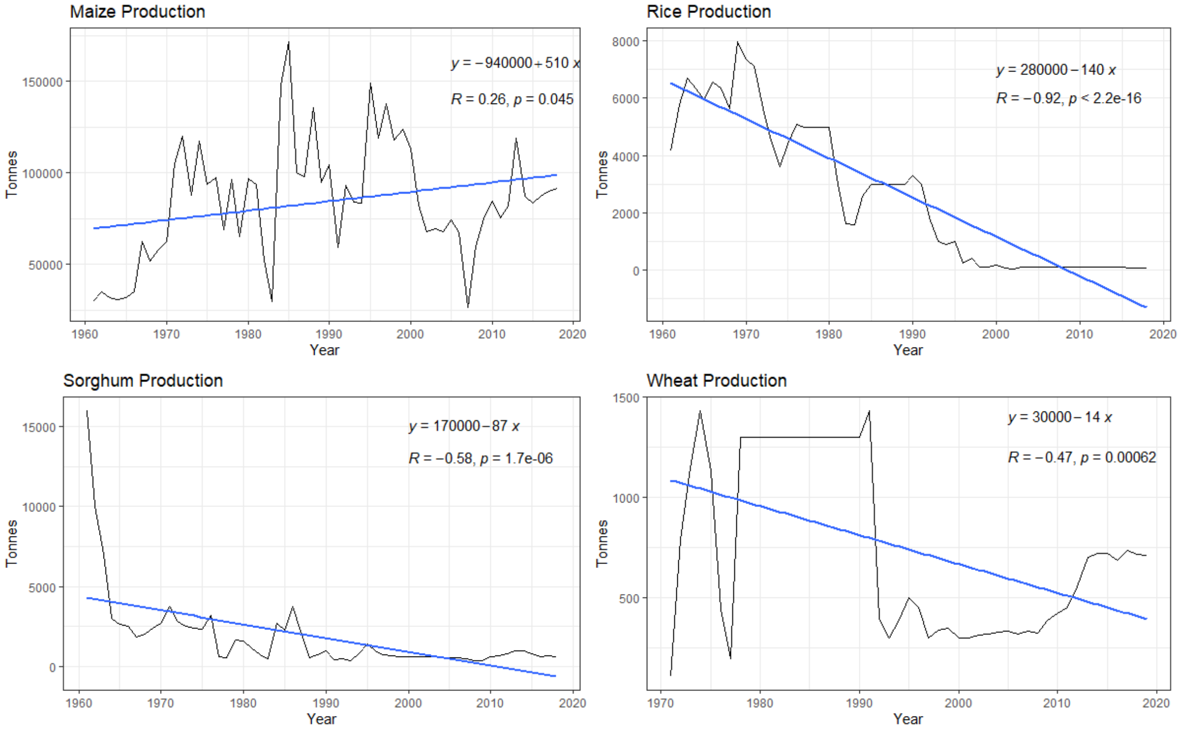


Figure 4: Production Trend of Cereals in Eswatini: 1961-2018

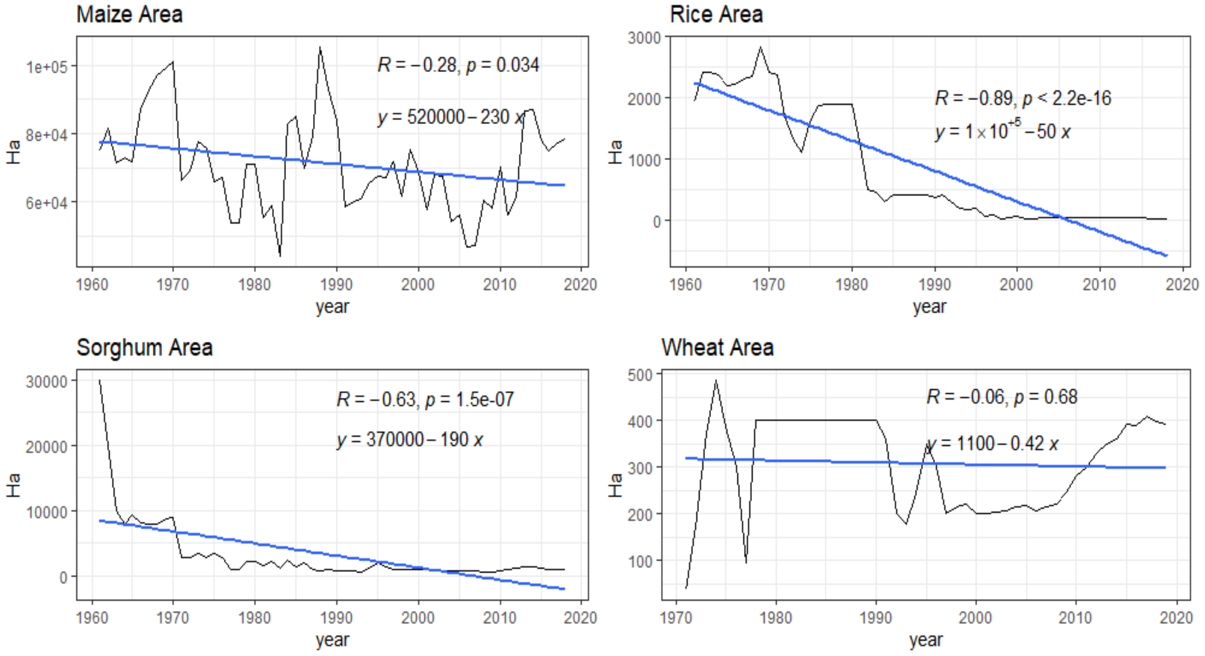


Figure 5: Trend of Cereals' Area in Eswatini: 1961-2018

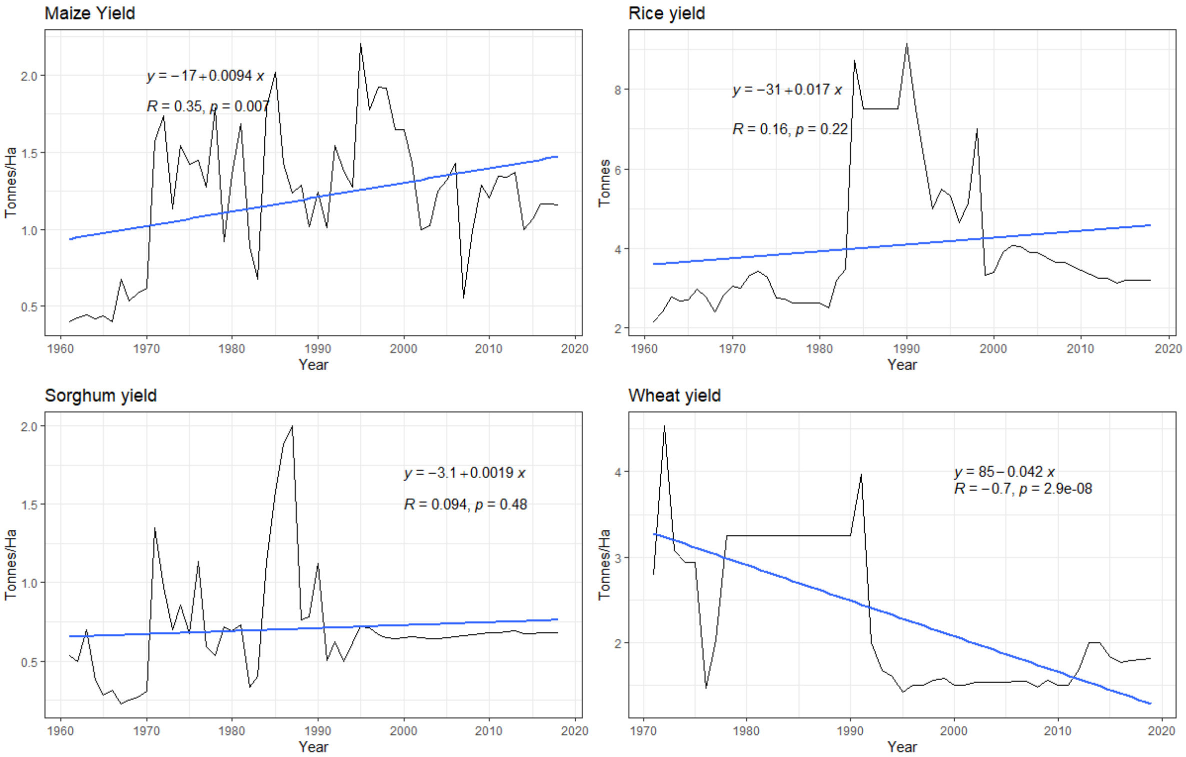


Figure 6: Trend of the Yield of Cereals in Eswatini:1961-2018

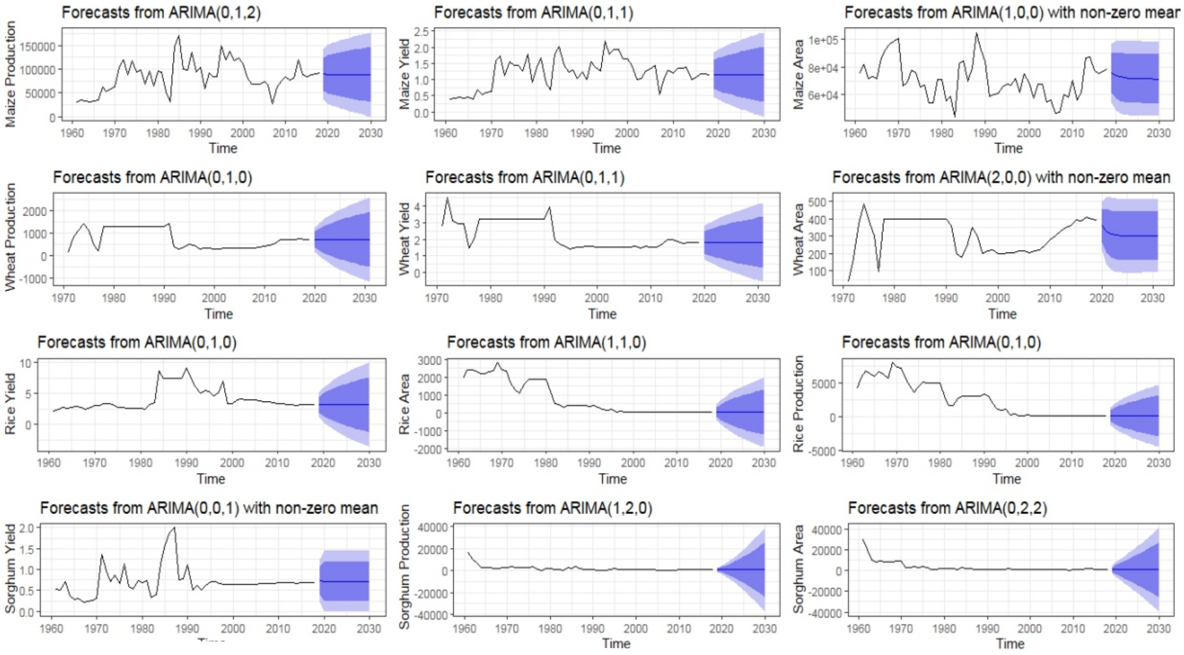


Figure 7: Forecast of Production, Area, and Yield of Cereals in Eswatini:2019-2030

Table 1: Descriptive Statistics of Cereals in Eswatini (1961-2018)

Production	**Mean**	**Std.Dev**	**Min**	**Median**	**Max**	**Observation**
Cereals,Total	89112	31861	27101	85855	178426	58
Maize	84071	32803	26170	84250	171867	58
Rice, paddy	2603	2529	53	2207	7983	58
Sorghum	1813	2515	350	794	16000	58
Wheat	741	437	106	689	1435	49
Area	**Mean**	**Std.Dev**	**Min**	**Median**	**Max**	**Observation**
Cereals,Total	75409	16543	46126	72881	112262	58
Maize	71116	13817	44143	70137	105296	58
Rice, paddy	825	947	13	381	2829	58
Sorghum	3208	5004	520	1144	30000	58
Wheat	307	101	38	350	487	49
Yield	**Mean**	**Std.Dev**	**Min**	**Median**	**Max**	**Observation**
Cereals,Total	1.22	0.44	0.45	1.28	2.17	58
Maize	1.20	0.45	0.40	1.26	2.21	58
Rice, paddy	4.08	1.79	2.15	3.34	9.15	58
Sorghum	0.71	0.34	0.23	0.67	2.00	58
Wheat	2.28	0.85	1.43	1.81	4.53	49

Source: Authors' Calculation 2022

Table 2: Forecast Accuracy for Cereals in Eswatini

Variable	**Mean**	**Naïve**	**Exponential Smoothing**	**ARIMA**
Maize Production				
MAE	25345.67	20982.56	19150.21	19029.29
RMSE	32519.44	29711.87	27373.62	26689.48
MAPE	42.60	26.13	25.33	24.66
Maize Area				
MAE	10792.43	8562.40	8711.15	8093.28
RMSE	13697.20	12048.95	11749.14	10762.87
MAPE	15.81	12.42	12.60	11.89
Maize Yield				
MAE	0.36	0.26	0.24	0.24
RMSE	0.45	0.38	0.35	0.35
MAPE	43.90	23.15	20.66	20.63
Sorghum Production				
MAE	1431.24	618.36	926.41	672.12
RMSE	2492.85	1238.65	1702.61	1070.02
MAPE	136.55	39.80	60.33	54.75
Sorghum Area				
MAE	3023.00	857.02	1024.03	918.21
RMSE	4960.20	2136.00	2422.66	1735.89
MAPE	169.98	29.04	32.01	37.88
Sorghum Yield				
MAE	0.20	0.16	0.15	0.19
RMSE	0.34	0.30	0.29	0.26
MAPE	35.14	22.53	21.32	29.23
Rice Production				
MAE	2227.87	389.82	411.56	383.17
RMSE	2506.99	675.77	714.86	669.92
MAPE	939.22	26.95	30.05	26.49
Rice Area				
MAE	857.84	108.70	124.49	105.59
RMSE	939.06	217.34	257.98	206.58
MAPE	1140.93	30.34	32.28	32.15
Rice Yield				
MAE	1.39	0.46	0.45	0.45
RMSE	1.78	1.01	1.00	1.00
MAPE	34.04	9.54	9.46	9.38

Table 3: Summary of ARIMA Model for the Selected Cereals

Crop	Variable	Arima Model	R-Squared	MAE	RMSE	MAPE
Maize	Production	ARIMA(0,1,2)	0.38	19029.29	2668.89	24.66
	Area	ARIMA(1,0,0)	0.38	8093.29	10762.87	11.89
	Yield	ARIMA(0,1,1)	0.45	0.24	0.35	20.64
Sorghum	Production	ARIMA(1,2,0)	0.83	672.13	1070.02	54.75
	Area	ARIMA(0,2,2)	0.89	918.21	1735.90	37.88
	Yield	ARIMA(0,0,1)	0.40	0.19	0.26	29.23
Rice	Production	ARIMA(0,1,0)	0.93	383.18	889.93	26.49
	Area	ARIMA(1,1,0)	0.95	105.59	206.58	32.15
	Yield	ARIMA(0,1,0)	0.71	0.45	0.99	9.38

Table 4: Forecast Values for Production, Area and Yield of Cereals in Eswatini

Variable	2018	2030	Difference	% Difference
Maize Production (Tonnes)	91247	88759.7	(2487.3)	(2.7259)
Maize Area (Hectares)	78535	71423.55	(7111.45)	(9.05513)
Maize Yield (Tonnes/Ha)	1.16	1.157298	(0.00457)	(0.39299)
Rice Production (Tonnes)	83.00	83	0	0
Rice Area (Hectares)	26.00	27	1	3.846154
Rice Yield (Tonnes/Ha)	3.19	3.192308	0	0
Sorghum Production (Tonnes)	633.00	633.1353	0.1353	0.021374
Sorghum Area (Hectares)	926.00	601.3867	(324.613)	(35.0554)
Sorghum Yield (Tonnes/Ha)	0.68	0.71141	0.027824	4.070363
Wheat Production (Tonnes)	713.00	713	0	0
Wheat Area (Hectares)	393.00	301.3221	(91.6779)	(23.3277)
Wheat Yield (Tonnes/Ha)	1.81	1.809565	(0.00468)	(0.25818)