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Exploring inconsistencies, trends and forecasting of wheat production in Bangladesh: a statistical analysis approach

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ABSTRACT

After rice, wheat is the another most imperative source of staple foods in Bangladesh. Wheat production plays a crucial role in ensuring food security. However, persistent inconsistencies between wheat production and cultivated area pose challenges to national food security. This study investigates the trends, variability, and forecasting of wheat production in Bangladesh from 1971 to 2023. Secondary data were collected from the Bangladesh Bureau of Statistics and the Department of Agricultural Extension. The entire period was divided into two periods: 1971–2000 and 2001–2023. A semi-log model was used to estimate the growth rate, while a linear regression model examined the dependency of wheat production on cultivated area. The coefficient of variation (CV) was applied to assess variability, and the Autoregressive Integrated Moving Average (ARIMA) model was employed for forecasting wheat production. A steady decline in the area of wheat cultivation and fluctuations in wheat production was visible throughout the study period. A moderate positive correlation between area and production was observed, which indicates that area under cultivation has an influence on production of wheat in Bangladesh. While the growth rate was unstable throughout the study period with significant variability. The underlying patterns in wheat production was successfully identified by the ARIMA (1,1,0) model providing meaningful forecasts. This paper forecast the wheat production for upcoming 5 years. A consistent trend was detected emphasizing key stages of increase and decrease of wheat production in Bangladesh. To wrap up, though wheat production in Bangladesh has made some improvement, the country deals with a continuous struggle to meet the demand. Strategies to ensure more stable and increased wheat production must be prioritized by the policymakers.

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Introduction

Agriculture has been serving as a core component of Bangladesh's economy from its inception, even though modern economies typically rely on industrialisation. According to World Bank (2022) report, about 11.22% of the GDP of Bangladesh is represented by agriculture. As Bangladesh relies on an agrarian economy, food security has become the primary concern for this country due to high population density. Agriculture is playing a key role in the country's path to achieving enduring growth and advancement (Rahman, 2017). Despite several environmental or institutional challenges, Bangladesh has experienced a doubling in its population over the last 30 years (Karim, 2025). Increased population leads to farmland loss and urbanization. Ultimately, it reduces crop productivity and creates food insecurity (Ali, 2007). Effective and strategic planning to meet the future demand and increase production of cereal crops is crucial, as domestic rice production is inadequate to meet the nation's needs (Hossain & Teixeira da Silva, 2013). Typically, considering financial terms, Boro (winter) rice is most beneficial for farmers in irrigated areas, while in non-irrigated zones, wheat can bring more returns (Morris *et al*., 1996). In Bangladesh, wheat holds the position of the second most significant crop, serving as a crucial winter crop playing a key role in the nation's food security, agricultural economy, and trade dynamics. It has the ability to adapt in diverse conditions as well as high yield potential has made it valuable (Shewry, 2009). Rice by itself is no longer capable of supplying a proper, nutritious, and balanced diet for humans, livestock, or poultry (FAO, 2004). Wheat is recognized as a valuable source of B-group vitamins, fibers, and essential minerals and is also rich in protein (Shewry & Hey, 2015). Wheat actually serves versatile purposes; beyond foods, it can be used as animal feed to make wheat straw composites, Cosmetics, ethanol production and so on (Kumar *et al.*, 2011). It provides both human food and animal feed. Vital Wheat gluten has been a significant commodity in world trade and plays a key role in the food industry. Gluten and its modified forms are also used as a substitute for calf milk (Day *et al.*, 2006). Due to rapid urbanization and industrialization, wheat consumption in Bangladesh is rising, as it has various uses in bakery industries (Karim *et al.*, 2010).

Over the last few decades, the dietary habits of Bangladeshi people have gone through significant changes and wheat meeting 13.6% of the country's cereal demand (BBS, 2023). The market price of wheat is stable, thus which has become an important part of the diet in Bangladesh as well as a reliable crop for the farmers (Karim *et al.*, 2010). However, production of wheat has declined to 1.19 MMT in the 2023-24 season (BBS 2023). Wheat consumption in Bangladesh is increasing though production has declined over the years. The wheat sector in Bangladesh faces several challenges, including vulnerability to diseases like wheat blast, representing the first instance of this disease in Asia, which affected approximately 3.5% of wheat fields in 2016 (Islam *et al.*, 2019). Although the immediate economic impact was limited due to the small proportion of wheat in total cereal consumption, the potential for greater losses exists if the disease spreads to major wheat-producing areas. Bangladesh is a major wheat consumer, and domestic production only meets a fraction of the demand. To bridge the gap between domestic production and consumption, Bangladesh relies heavily on wheat imports. To address the demands of a growing population and ensure food security, the Bangladeshi government significantly raised wheat imports between 2008 and 2011, exceeding the amounts imported in previous years (Hossain & Teixeira da Silva, 2013). Thus, to improve the nutritional status Bangladesh, it is mandatory to ensure adequate supply and production of wheat (Wadud *et al.*, 2001). In the 2020/21 marketing year, wheat import requirements were estimated at 6.1 MMT, reflecting a steady increase since 2012/13 (BBS 2024). This dependency underscores the importance of international trade relations and the need for stable import channels to ensure food security. A primary objective of the Sustainable Development Goals (SDGs) is to promote sustainable agriculture in order to achieve food security (United Nations, 2015). Karim *et al*. (2010) state that regional variations exist in Bangladesh's wheat output trends. Wheat production of Bangladesh is affected by a number of variables, such as a lack of arable land, weeds and pests, a slow deterioration in soil quality, a slow uptake of improved varieties, and insufficient irrigation systems (Rahman and Hasan, 2011). As a result, the government is unable to meet domestic demand and has to depend on wheat imports. Thus it is necessary to ensure accurate forecasting as well as analyzing the production trends to enable the government to detect shortcomings, predict potential challenges and implement timely and effective policies. Besides, a clear understanding of the stability of different crop cultivations is important for farmers to make informed and strategic production and investment decisions. In addition, it will be also helpful for the financial institutions to evaluate farmers repaying capacity and their risk bearing ability by evaluating the consistency and stability of yield (Das *et al*., 2016). Hence, it is also important to assess the inconsistency between the area under cultivation and the production of wheat in Bangladesh, which can provide insights into the productivity trends and efficiency of wheat over time ensuring informed decisions by policymakers as well as farmers. Karim *et al*. (2010) used ARIMA models to forecast the trends of wheat production in various regions of Bangladesh including Rangpur and Dinajpur. Faruq and Hossain (2015) used ARIMA (0,2,1) model to estimate the Production trends of wheat in Kushtia district, Bangladesh and they found the model was highly effective. While their study discussed some specific regions, this study aims to focus on the national-level data to examine the trends of wheat production across the country.

Methodology

Data Analysis

Secondary sources are used to collect data on the area and production of wheat for 53 years. The whole-time span was segmented into two periods to compare. Period I covering the years 1971 to 2000, while period II counted from 2001-2023 to examine the area, production, and wheat yield in Bangladesh. These secondary sources include the yearbook of Bangladesh Bureau of Statistics (BBS), which is known as the Statistical Yearbook of Bangladesh, and the Department of Agricultural Extension (DAE). Different descriptive analysis techniques, including mean, standard deviation, correlation coefficient, coefficient of variation, semi-log growth model, and simple linear regression model, were used to measure the behaviour of change, growth rate, relation among area, production, and yield of wheat and to measure the dependency of production of wheat on the cultivated area. Those tools were suggested by Das et al. (2016), Chowdhury et al. (2014), and Hasan et al. (2023) to achieve a more accurate evaluation for change and instability measure; they brought to attention that fluctuations, variations, and growth-related challenges can influence the area and production of various crops, such as pulses, oil seeds, wheat, and maize, in Bangladesh. To analyse the secondary data, we took help from SPSS 21.0.

Measurement of Growth Rate

To forecast wheat production in Bangladesh, Karim et al. (2010) employed various statistical models, including linear, logarithmic, quadratic, cubic, exponential, and compound models. According to Mamun *et al.* (2021), The exponential or compound growth model is widely used to measure the growth of crops. To assess the growth rate a semi-log model is fitted,

$$logy = \alpha + \beta t$$

Where, y denotes the area (in hectare), production of wheat (in metric ton) and yield of wheat (in metric ton/acre) and t represents the period (in year).

Correlation and Regression Analysis

Shahrier *et al.* (2025) applied time series analysis to see the impact of climate change on Boro rice production and Khatun *at el.* (2022) applied correlation and regression analysis on chili in Bangladesh. In this study, the correlation coefficient (r) to determine the level of interdependence between area and production is estimated, the formula we used to calculate r:

$$r = \frac{\Sigma xy - \frac{\Sigma x \Sigma y}{n}}{\sqrt{(x-\bar{x})(y-\bar{y})}}$$

where two variables, area and production, are demonstrated as X and Y.

A simple linear regression model is applied to examine the dependency of production on area, stated as:

$$\text{Production} = \alpha + \beta^* \text{ area} + e$$

Where e with a mean zero and variance σ^2 follows a normal distribution. The production of wheat used in metric tons, the area is in acres, α signifies the intercept, and the regression coefficient of the model is represented by β.

Measurement of Instability

The instability index was determined to measure fluctuations in the area and production of wheat in Bangladesh. The coefficient of variation (CV) is widely used to estimate variability, but it can't properly explain the trend component present in time series data. The coefficient of variation based on the trend was determined following the guidance of Cuddy and Della (1978), to address the limitation. To calculate the indices for area, production, and yield for the period from 1971 to 2023, the linear trend model was used. After examining the trend coefficient, significance is also tested. If the coefficient is significant, the instability index, represented by the coefficient of variation around the trend, is given by the formula: $CV_t = (CV)\sqrt{(1-R^2)}$,

where, $CV = \frac{\bar{x}}{s} \times 100$, $\bar{x}$ is the mean and s is the standard deviation and R^2 is the coefficient of determination.

Forecasting of Time Series Data

Time series data were analyzed and forecasted using the ARIMA model. This model is commonly used in forecasting applications

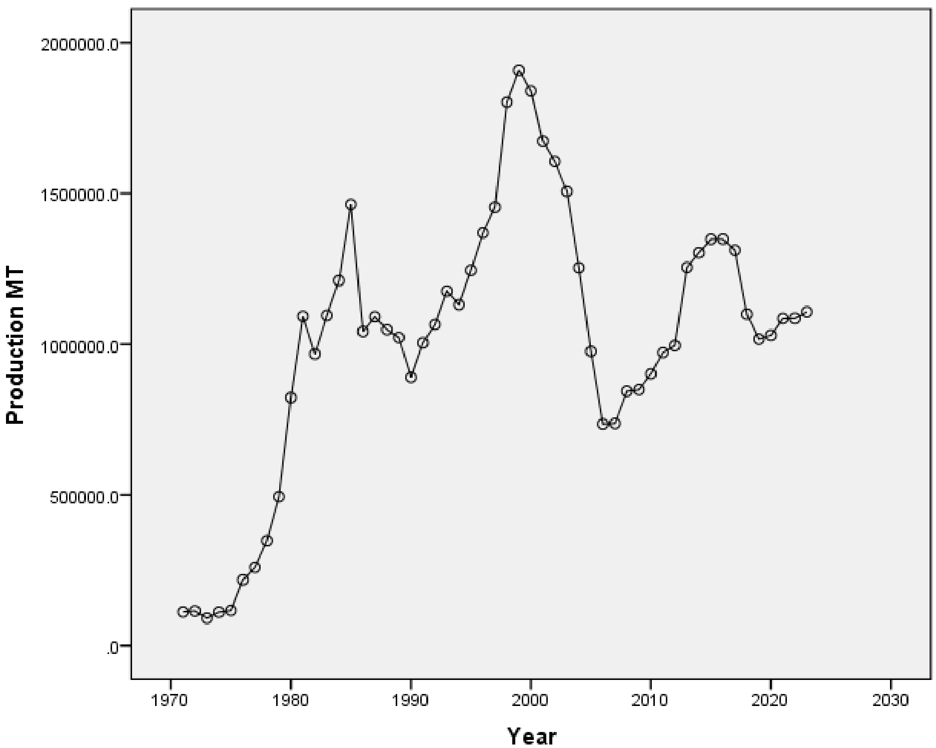

Fig. 1. Time series Plot of wheat production.

Table 1. Shift in area, production and yield of wheat in Bangladesh

Field of Measurement	Mean Value 1st period (1971-2000)	2nd period (2001-2023)	Standard deviation 1st period	Standard deviation 2nd period	t-value	P(T<t) Two tail
Area (in hectares)	484461	448223	239516	139058	-3.6**	0.002
Production (in tons)	920186	1130104	544016	258538	-0.605	0.552
Yield (ton/ ha)	1.731	2.630	.437	.592	-10.105**	0.000

** and * represents significant at 1% and 5% level of significance

and is especially effective in capturing linear dependencies in temporal information. There are three parameters that define the ARIMA model: **p** (autoregressive order), **d** (degree of differencing), and **q** (moving average order). The modeling process involved some key steps, including the maximum likelihood estimation (MLE) approach was used to evaluate the parameters. To find the coefficients that best suit the observed series, statistical software was used to train the model on the historical data. Additionally, the best model was chosen using performance metrics including standard error, Bayesian information criterion (BIC), and Akaike information criterion (AIC). Future values were predicted using the verified ARIMA model. Some metrics were used to evaluate forecast accuracy. Additionally, residual dependency was investigated using the first-order autocorrelation coefficient. We

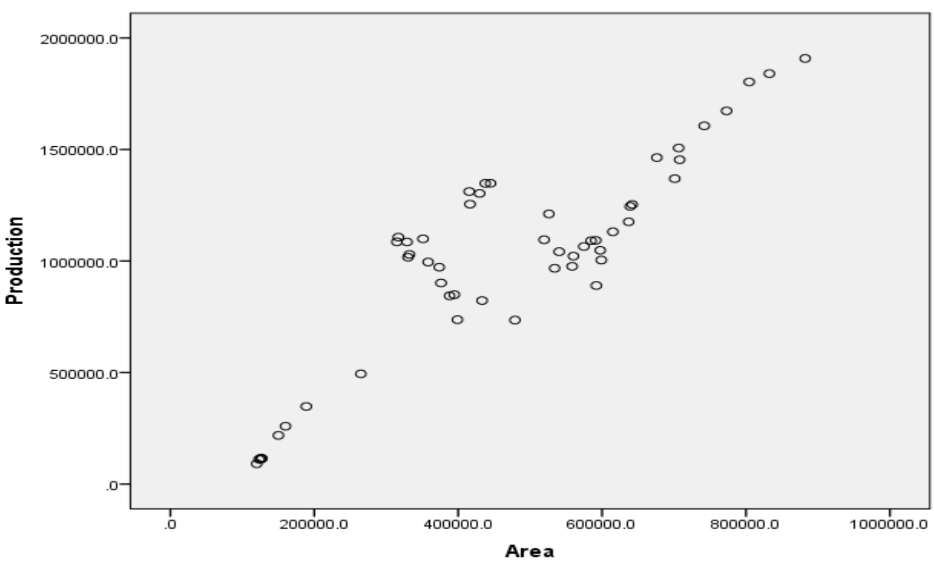

Fig. 2. Scatter plot of area and production of wheat in Bangladesh

used the R Studio auto,arima package for forecasting analysis. This package compares multiple models and declares which one is the most suitable for given data.

Result and Discussion

Figure 1 represents the line graph demonstrates the trend of production value (in metric tons) of a period of 53 years (1971-2023). It is visible that, initially, there was a steady rise in the production from 1970s to the late 1980s. Production reached its peak level in early 2000s, which eventually met a dramatic fall after that. Yet, there is a consistent growth, experiencing overall upward movement in recent years.

This figure represents that there is a linear relationship between the area and production of wheat.

Change in Area, production and yield

The total study period is divided into two periods: in period I, we cover the years 1971 to 2000 (30 years), while in period II, we cover the years 2001 to 2023 (23 years). Table 1, underscores a significant decline in the cultivated area for wheat, However, the duration of Periods I and II are not equal, as Period I consists of 30 years while Period II consists of 23 years, and we must acknowledge this fact. Besides, wheat production faces land use pressure from other rabi crops like Boro rice, potato, and maize (WRC, 2009). The production should decrease as like area, which was observed by Das *et al.* (2016) in the case of pulse in Bangladesh. Wheat production in Bangladesh continued to increase during in period II years due to the adoption of improved varieties, better irrigation facilities, and policy support aimed at ensuring food security.

According to Karim *et al*. (2010), there was a rapid fall in wheat production in 1971-1974. In 1971-72, wheat production in Bangladesh was only 0.11 million tons, while after 34 years, in 2005, it had increased significantly to 0.98 million tons. Wheat was not largely recognized as a crop in Bangladesh before 1975-76, and wheat cultivation was irregular (Banglapedia, 2006). Continuous efforts have been made to develop high-yield wheat varieties over the years, ultimately leading to the release of multiple improved varieties, which has changed the scenario of wheat production in Bangladesh over time. BARI Gom 19” and “BARI Gom 20” from 1998, “BARI Gom

Table 2. Relationship between area and production of wheat in Bangladesh

	Time Period	Correlation Coefficient (r)	p(T<t) two tail
Area vs. production	Whole Period	0.875**	0.000
	1st Period	0.983**	0.000
	2nd Period	0.665**	0.001

**. Correlation is significant at the 0.01 level (2-tailed).

21" from 2000, and "BARI Gom 22," "BARI Gom 23," and "BARI Gom 24" from 2005 are noteworthy examples of these (Pandit et al., 2011). BARI Gom 25' and 'BARI Gom 26' were later released in 2010 (BARI, 2012), and 'BARI Gom 27' and 'BARI Gom 28' were subsequently released in 2012 to further enhance yield potential and disease resistance.

In addition, t-values and p-values were also presented which indicates that the area, production, and yield have faced insignificant changes.

Relationship between Area and Production

Correlation coefficient is frequently used to gauge the evolving patterns of area and production for a crop. It is known that only linear relationships are examined by simple correlation analysis and a scatter diagram is an important graphical tool to measure such a relationship (Das *et al.*, 2016). The linear connection between the area of cultivation and production for the entire time span has been demonstrated by the scatter diagram (Figure 2). From table 2, we can see the association between the area and production of wheat in Bangladesh over three different time periods. The correlation coefficient for the whole period was 0.875, which indicates a strong positive association, having a highly significant p-value of 0.000. In period I the correlation was 0.983, which indicates stronger positive association and highly significant. However, in period II, the correlation decreased to 0.665 which indicates a moderate correlation. Yet, it was statistically significant with a p-value of 0.001. Though still statistically significant suggest that production growth is now less dependent on area expansion and more influenced by improvements in yield, technology adoption, and better input use. This shift highlights a transition from extensive to intensive growth in Bangladesh's wheat sector.

Regression Analysis

A simple linear regression models were applied to assess the production of wheat on area. From

Table 3 represents the wheat production that has increased by 1.966 times for every

Table 3. Investigating the dependency of production on area of wheat in Bangladesh

Period	Constant Value	Regression Coefficient	R-square	Adjusted R-square	95% Confidence Interval for Reg. Coefficient		t-value	p value
					Lower	Upper		
Whole period	90776.966	1.966**	0.765	0.760	1.659	2.272	12.885	0.000
1st Period	-161259.495	2.232**	0.966	0.965	2.070	2.395	28.168	0.000
2nd Period	577630	1.237**	0.443	0.416	0.607	1.867	4.084	0.001

** and * represents significant at 1% and 5% level of significance

Table 4. Growth rate of area and production of wheat in Bangladesh

Field of Measurement	Period	Growth Rate (%)	t value	P value
Area	Whole period	0.005*	2.507	0.015
	1st Period	0.030**	10.314	0.000
	2nd Period	-0.015**	-7.197	0.000
Production	Whole period	0.013**	5.522	0.000
	1st Period	0.041**	9.123	0.000
	2nd Period	-0.001	-0.425	0.675

** and * represents significant at 1% and 5% level of significance

one-unit increase in area, with a high R-squared value of 0.765. R-squared value of 0.765 indicates strong relationship. With a regression coefficient of 2.232 in Period I, wheat production increased by 2.232 units for every unit increase in planted area. The model fit was excellent, as indicated by the R^2 value of 0.966. The R^2 value decreased to 0.443 in Period II, indicating a reasonable match, while the regression coefficient decreased to 1.237, indicating that production rose by just 1.237 units per additional unit of area. All results are statistically significant, highlighting a consistent dependence of wheat production on cultivated area, though the strength of this relationship declined over time.

Growth rate

According to Table 4, the negative and significant growth in wheat area during Period II indicates a consistent contraction in land devoted to wheat cultivation, likely due to land-use competition, profitability concerns, and climate-related challenges. Although wheat production also showed a negative growth rate, it was not statistically significant, suggesting that yield improvements have partly compensated for the loss of area. Yet, in the case of period II, the growth rate for production was insignificant at both the 1% and 5% levels. It is mandatory to address production instability to ensure sustainable agricultural development. High instability values suggest unpredictable production patterns, with the Cuddy Della Valle index offering more accurate insights than the coefficient of variation for time series data. Furthermore, Durbin and Watson introduced a method, which is widely used. (Durbin & Watson, 1971). The Durbin-Watson (D-W) statistic is used to measure autocorrelation, and when its value is close to 2, there is no autocorrelation. Fluctuations in agricultural production are largely driven by various factors, including natural calamities such as floods and droughts in Bangladesh. These factors significantly influence the observed variations.

Instability

Instability is identified as a crucial parameter of judgement in development studies while

Table 5. Instability in area, production and yield of wheat in Bangladesh

Field of Measurement	Measurement Statistics	Whole Period (1971-2023)	1st Period (1971-2000)	2nd Period (2001-2023)
Area	CV	42.940	49.439	31.020
	R-Square	0.029	0.865	0.662
	t value	1.229	13.369	-6.477
	P value	0.225	0.000**	0.000**
	D-W	0.086	0.532	0.191
	Cuddy Della Valle Instability Index	39.212	18.171	19.220
Production	CV	44.690	59.120	22.880
	R-Square	0.280	0.824	0.034
	t value	4.452	11.468	-0.854
	P value	0.000**	0.000**	0.403
	D-W	0.145	0.421	0.250
	Cuddy Della Valle Instability Index	35.720	24.800	22.420
Yield	CV	31.880	25.256	22.530
	R-Square	0.753	0.525	0.828
	t value	12.480	5.563	10.045
	P value	0.000**	0.000**	0.000**
	D-W	0.228	0.303	0.400
	Cuddy Della Valle Instability Index	19.490	17.410	13.000

** and * represents significant at 1% and 5% level of significance

dealing with agricultural production. The instability in the area, production and yield of wheat in Bangladesh is presented in Table 5. It is visible that, during the period I, there was highest instability played by the area of wheat with a CV of 49.439 and a significant t-value. Even in period II area of wheat also showed significant fluctuations. But in case of whole period there was significant fluctuations. For production, the highest fluctuations were found in period I, with significant instability. But in period II, production fluctuations were not significant. Yield of wheat remain unstable during the whole study period, with significant fluctuations in both period I and period II, while period I had a bigger instability index compared to period II. which indicates a declining trend in the yield fluctuations of wheat. The R square value is considerable in period II for area production and yield. Evidence of autocorrelation is indicated by the Durbin-Watson statistics.In the following Table 5, we include CV values for area, production, and yield of wheat, showing fluctuations across the whole period, Period I, and Period II. Based on the analysis, we can conclude that wheat demonstrated significant instability throughout the time span. Das *et al.* (2016) observed similar fluctuations in agricultural variables, emphasizing the significance of such trends in determining production stability While studying about pulse in Bangladesh.

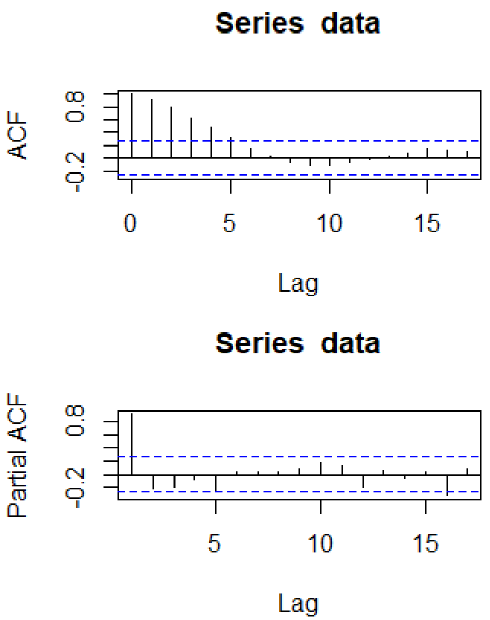

Fig. 3. Autocorrelation ACF (Autocorrelation Function) plot Partial ACF (Autocorrelation Function) plot

The ACF plot shows strong positive autocorrelation with a slow decay across lags, indicating the series is non-stationary and likely requires first differencing before modeling. The PACF plot shows a strong spike at lag 1 and cuts off afterward, indicating an Auto Regressive (1) process once the series is differenced.

Prediction of Time Series Data

Eleven ARIMA model was fitted in the study for forecasting wheat production. ARIMA (2,1,2) with drift, ARIMA (0,1,0) with drift, ARIMA (1,1,0) with drift, ARIMA (0,1,1) with drift, ARIMA (0,1,0), ARIMA (2,1,0) with drift, ARIMA (1,1,1) with drift, ARIMA (2,1,1) with drift, ARIMA (1,1,0), ARIMA (2,1,0), ARIMA (1,1,1), ARIMA (0,1,1) and ARIMA (2,1,1). By using "auto. arima" function in "forecast" package in R Programming Language, ARIMA (1,1,0) has been determined as the best-fitting model. This function is an updated version of the Hyndman-Khandakar method in R programming language, used to find the suitable model (Hyndman and Khandakar, 2008). The attributes of the model ARIMA (1,1,0) includes A Partial Autocorrelation Function (PACF) of 1, a differencing of 1, and Autocorrelation Function (ACF) of 0. ARIMA (1,1,0) was declared as the significant one

Table 6. Alternative models presented with AICc values

Model	AICc
ARIMA(2,1,2) with drift	1389.302
ARIMA(0,1,0) with drift	1388.451
ARIMA(1,1,0)with drift	1386.148
ARIMA(0,1,1) with drift	1387.350
ARIMA(0,1,0)	1387.173
ARIMA(2,1,0)with drift	1387.672
ARIMA(1,1,1) with drift	1387.867
ARIMA(2,1,1) with drift	1388.372
ARIMA(1,1,0)	1384.382
ARIMA(2,1,0)	1385.696
ARIMA(1,1,1)	1385.887
ARIMA(0,1,1)	1385.744
ARIMA(2,1,1)	1386.308

Best model: ARIMA (1,1,0)

Table 7. Parameter estimation of ARIMA (1,1,0) model

Parameter	Estimate	St. Error	Z value	Pr(>|z|)
AR1	0.298	0.130	2.286	0.022

Table 8. Performance values of ARIMA (1,1,0) model

Criteria	ARIMA(1,1,0)	Criteria	ARIMA (1,1,0)
Log likelihood	-690.070	RMSE	138855.510
Sigma ^{2}	2.0004e+10	MAE	98939.142
AIC	1384.140	MPE	2.284
AICc	1384.382	MAPE	11.177
BIC	1388.044	MASE	0.912
ME	13293.582	ACFI	-0.044

among all the eleven models, which performs better with the lowest AICc value. For the ARIMA (1, 1, 0) model, the AIC and BIC values are 1384.14 and 1388.04 respectively which is lowest. The AR (1) coefficient (0.298) has a p-value of 0.0222, So the estimated value is statistically significant at the 5% level. Here MASE value (0.912) is less than 1 and also MAPE value (11.177) seems satisfactory. Also ACF1 value (-0.044) is well off from 1. Therefore, the fitted model, ARIMA (1,1,0) demonstrates strong reliability. Based on their empirical research, Das *et al*. (2023) employed time series data of 60 years (1961-2000) to model and forecast the spinach production in Bangladesh. Using the "auto.arima" function in R programming language ARIMA (1,1,0) with drift model was the most appropriate to predict spinach production in Bangladesh. In another study, Akhi *et al.* (2021) predicted the production process of some winter vegetables in Bangladesh including Bean, Cabbage and Cauliflower. To estimate the production behavior the Box Jenkins ARIMA methodology was popular which provided that (0, 2, 1), (1, 2, 3), and (0, 2, 1) model were fit for Bean, Cabbage, and Cauliflower production forecasting, respectively. Das *et al.* (2022) utilized time series data from 1976 to 2020 applying six trend models. In this study, compound trend model was founded to be the most suitable to forecast tea production. In study of Hossain & Abdullah (2016) declared ARIMA (0,2,1) model as the suitable one to forecast Potato production in Bangladesh. They examined the time series data from 1971 to 2013. In our study, ARIMA (1,1,0) model

Table 9. Forecasted value of wheat production using ARIMA model (1,1,0)

Year	Forecasted production (MT)
2024	1124711
2025	1143270
2026	1162142
2027	1181104
2028	1200091

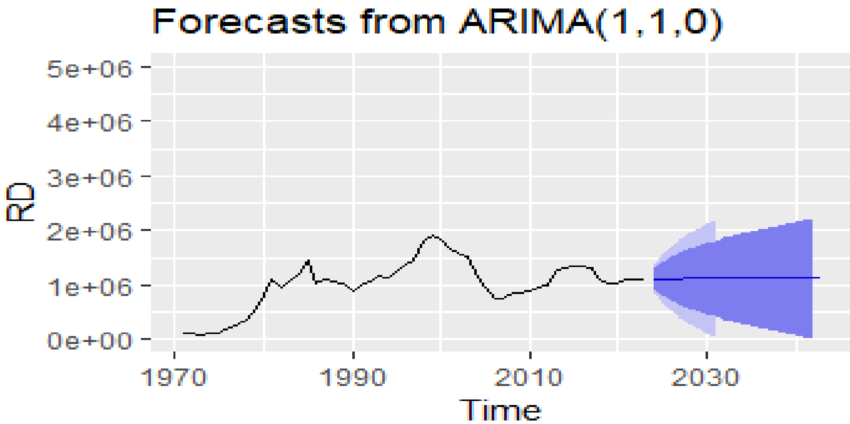

Fig. 4. Forecasting wheat production

was utilized and we utilized the "auto.arima" function to select the model. The forecast suggests a steady increase in production over the next five years. Policymakers may use this pattern to better distribute seeds and fertilizer, plan agricultural resources, and efficiently control irrigation. Additionally, it facilitates distribution and storage planning, guaranteeing that the increased output reaches customers. All things considered, these realizations help to stabilize the country's wheat supply and improve food security.

Conclusion

This study examined the inconsistencies between wheat production and area in Bangladesh from 1971 to 2023. The analysis used a semi-log model for growth rate estimation, linear regression to evaluate the relationship between area and production, the coefficient of variation (CV) for variability, and the ARIMA (1,1,0) model for forecasting. The results showed notable fluctuations in wheat production and a steady decline in cultivated area over time. A moderate positive correlation between area and production indicates that land use remains a critical factor for wheat output. ARIMA model forecasts, along with important insights into future production trends, highlight the need for policymakers to develop targeted strategies to support stable and increased wheat production. This includes funding for agricultural technologies, improved irrigation, easier access to inputs, and support for wheat marketing. Accurate forecasts can also assist in timely decisions regarding import-export policies, storage, and post-harvest loss reduction. However, socioeconomic or regional differences in wheat cultivation are not considered here. Future research should incorporate farm-level data, climate modeling, machine learning, and market dynamics to gain a more comprehensive understanding of the challenges and solutions for wheat production in Bangladesh.

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