Journal of Agricultural Science and Engineering
Vol. 1, No. 4, 2015, pp. 163-167
http://www.aiscience.org/journal/jase

Growth and Instability in Area and Production of Pulse in Bangladesh

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Abstract

Pulses are a good source of protein, minerals and energy in a human diet. This study is an attempt to measure the change and instability in area, production and yield of cereal crop pulse in Bangladesh based on secondary data during the period 1986 to 2009 collected from Bangladesh Bureau of Statistics. Different statistical tools have been used to perform the analysis. The analysis reveals that the area and production of pulse has not increased satisfactorily. Though the yield of pulse has increased but it is not sufficient to meet the demand of the country. The analysis also reveals that the area, production and yield of pulse are not stable during the study period. Therefore, researchers, policy makers, and farmers should give proper attention to develop technology to increase the production of pulse that improves the food security in Bangladesh.

Keywords

Instability, Production, Area, Pulse and Growth Rate

Received: August 9, 2015 / Accepted: August 15, 2015 / Published online: August 26, 2015

1. Introduction

Agriculture continues to be the most important sector of Bangladesh economy accounting 23 percent of the country's Gross Domestic Product (GPD) and the livelihood of the more than 75 percent of the population (BSGDMA, 2007). Bangladesh has the highest population density of the world with about 1088 per kilometer square. The food self sufficiency, thereby food security at nutritional level has become the crying need of the time. The cultivable land is decreasing giving space for development and housing of the increased population. The increase in the coastal belts is again threatened by increase salinity and possible inundation due to global worming and rising sea level. The north-western part of the country has started facing acute shortage of water thereby increase in drought-proneness. The temperature regime has started changing the long patterns. The rivers, river basins, the beels and haors are drying up much faster than before. Due to high and indiscriminate use of both surface and sub-surface water in Boro rice cultivation, having low possibility of appropriate recharging of the aquifers, our crop productions are being threatened to the maximum level (Rahman and Zilani, 2009).

Pulses are one of the good sources of high quality oils, proteins, minerals and energy in human diet. They provide the major cheap source of vegetable proteins. They also contain the amino acid lysine; which is generally deficient in food grains. Though pulses are excellent sources of proteins, but they are treated as minor crops and receive little attention from farmers and policymakers. With the development of irrigation facilities, the area of production of cereal crops has improved significantly, while pulses have been pushed to secondary lands of low yield. The area under pulse production has decreased continuously for the last few years

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in Bangladesh (Shahjan, 2002). The excellent nutrition value of pulses is highly complementary to a cereals-based diet in developing countries. Pulses are a cheaper source of proteins than animal foods (Singh and Jambunathan, 1989). In Bangladesh, a large number of people are suffering from malnutrition. For alleviating human malnutrition for the poorest segment of the country's population, pulses have been identified as crops with exceptional potential.

Bangladesh has suitable agro-ecological conditions for production of a number of pulses and oilseeds crop species. However, since independence of Bangladesh (1971) to current date there is continuous decline in both acreage and total production of both oilseeds and pulses except some exceptional years. With removal or reduction of the yield gaps of different crop species and with emphasis on the increase production of nutrient-rich crops like more pulses and oilseeds can increase the income level of the income poor farmers, and thus, can ensure reduction of poverty at grass root-level with increase nutritional food security at local levels (Rahman and Zilani, 2009).

Pulses occupy about 4 percent of the total cropped area and contribute about 2 percent to the total grain production of Bangladesh. To halt the declining trend, in 1988 the GOB approved the Crop Diversification Project, of which pulses were a major component. The projects emphasized the development of various pulses through regional and multi-location yield trials with new varieties and through farmers' field trials to create awareness about pulse cultivation. (Shahjahan, 2002)

In recent year department of agricultural extension (DAE) and ministry of agriculture have considered pulses and oilseed as a high priority sub-sector and have taken a plan titled "Pulses and Oil Crops Research and Development Vision: 2030" to increase the oilseed and pulse production. To fulfill the increasing demand of the country, it is necessary to increase the production of these two important cereal crops: pulses as well as oil seeds. The rate of increase in area, production, and yield of oil seeds and pulse should be increased and stable. But there is a lack of sufficient research in this field. Therefore, the present study aims to know the pattern of change and relationships among area, production and yield of pulse in Bangladesh.

2. Materials and Methods

Secondary sample data on area, production, and yields of cereal crop pulses for 24 years from 1986 to 2009were collected from different issues of the Statistical Yearbook of Bangladesh. The whole period was divided into two period's viz., period I from 1986 to 1997 and period II from 1998 to 2009 to compare in area, production and yield between the two periods. To examine the nature of change, instability and degree of relationships in area, production and yields of pulses in Bangladesh, various descriptive statistical tools, such as mean, correlation co-efficient and co-efficient of variation were used. The t-test, Simple linear regression technique and as semi log growth model were also used to analyze the data. The statistical data analyses were performed by using SPSS program.

3. Regression Analysis

To estimate the parameters, simple linear regression models were fitted to examine the change of production by the change of area. The model can be expressed as:

$$y = \alpha + \beta x + e$$

where, $e \sim N(0, \sigma^2)$, y is the production (in ton), x is the area (in acre), α is the intercept and β is the regression coefficient of the model.

4. Measurement of Growth Rate

The growth rates of area, production and yield of oil seed and pulse were worked out by fitting a semi-log function of the type: $\log y = \alpha + \beta t$, where, y is the area (in acre) or production (in ton) or yield (ton/acre) and t is the time period (in year).

5. Measurement of Instability

An index of instability was computed for examining the nature and degree of instability in area, production, and yield of pulse in Bangladesh. The co-efficient of variation (CV) was worked out for area, production, and yield to measure of variability. However, simple CV does not explain properly the trend component inherent in the time series data. Alternatively, the Coefficient of variation around the trend (CV_t) rather than co-efficient of variation around the mean (CV) was suggested by Cuddy and Della (1978) as a better measure of variability.

A linear trend $y = \alpha + \beta t + e$ was fitted to the indices of area, production and yield for the study period and trend co-efficient 'β' was tested for significance. Whenever the trend co-efficient was found significant, the index of instability was constructed as follows:

$$cv_t = (cv) \times \sqrt{1 - R^2}$$

where, $cv = \frac{s}{\bar{x}} \times 100$, $\bar{x}$ and s are the mean and standard deviation of the sample period.

In words, co-efficient of variation (cv_t) around the mean was multiplied by the square root of the proportion of the variation, which was unexplained by the trend equation, $y = \alpha + \beta t + e$.

6. Results and Discussion

6.1. Change in Area, Production and Yield

Due to urbanization, the cultivable area of agricultural crop has been reduced. As a result, the production of crops has been decreased. The amount of cultivable area of pulse has decreased by approximately 1.5 times during the last two decades and the production of pulse has decreased significantly in the same period. However, though the cultivable area of pulse has decreased, the yields of pulse have increased significantly. From the analysis, it is evident that there is a significant change in area, production and yield of pulse in Bangladesh (Table 1).

6.2. Correlation Analysis

From the correlation analysis, it is observed that the production of pulse is strongly positively correlated (r = 0.988) with its area for the whole period. The relationship between production and area of pulse is also highly significant which implies that the increment of area strongly affects the production of pulse to increase. Similarly, the area and production of pulse for the period I and II are also significantly correlated (Table 2).

6.3. Regression Analysis

The simple linear regression models were fitted for estimating the response of production of pulse due to the change of their respective area. Results show that the estimated coefficients of production on area are significant during the all periods (whole period, period I and period II). It implies that the production of pulse has increased by 0.274, 0.335 and 0.262 times during the whole period, period I and period II respectively. Therefore, the production of pulse has not been increased from the period I to period II (Table 3).

6.4. Growth Rate of Area, Production and Yield

The growth rate of area, production and yield provides a good measure of change in past and acceptable indication of change in future. The exponential model is used to measure the growth rate. It is found from the analysis that the area of pulse for the whole period has not increased significantly. It indicates that either we are losing cultivable land or farmers are not having interest in cultivating the crop pulse. Similarly the production of pulse has decreased significantly from period I to period II. It has decreased -2.5% and -6.4% in whole period and period II respectively except the period I. In period I, the production of pulse is increased 5.6 times. However the yields of pulse have increased significantly in the whole period and period II. It is observed that the growth in yield of pulse slightly improved in period II than period I. Therefore it is clear that the yield of pulses has increased though the cultivable area is reduced (Table 4).

6.5. Instability of Area, Production and Yield

Due to natural calamities, instability always exists in agricultural production in Bangladesh. The whole agriculture production is affected throughout the country by various factors such as floods, droughts, cyclones etc. Our analyses also support this claim. The area, production and yield of pulses showed the significant variation during the whole period. The production and yield of pulses has also showed significant fluctuation during the period I and period II (Table 5). Therefore it is clear from the analysis that pulses showed instability during the study period. While studying the change and instability of wheat and maize, Hasan et al. (2008) found that the production of maize was more unstable than wheat.

7. Conclusions

Pulse is one of the *major cereal crops* in *Bangladesh*. The overall production of pluses in Bangladesh is not satisfactory during the study period, as the average area and production of pulses have decreased from period I to period II though the yield has increased. The growth rate of area and production of pulse has also showed evidence in favour of the above statement. Thus, agricultural scientists should come forward to develop good variety of pulses in adverse (unfavourable) weather to meet the increasing demand. If we fail to provide farmers weather suitable and high yielding variety, the production of pulse can not be increased. So this study may be helpful for the policy makers, researchers and farmers to deal the problems of production of pulses in Bangladesh.

Appendix

Table 1. Change in area, production and yield of pulse in Bangladesh.

Field of Measurement	Mean Value		t-Value	Sig. (two tailed)
	Period-I (1986-98)	Period-II (1999-2009)		
Area (in acre)	1494000	931917***	5.31	0.000
Production (in ton)	442167	303000***	4.45	0.000
Yield (ton/acre)	0.294	0.331***	-4.91	0.000

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

Criteria	Value of Correlation (r)		Sig. (two tailed)
Area Vs production	Whole Period	0.988	0.000
	Period-I	0.995	0.000
	Period-II	0.997	0.000

Table 3. Testing dependency of production on area of Pulse in Bangladesh.

Period	Constant Value	Reg. Coefficient	t- Value	Sig. (two tailed)
Whole Period	40565.03	0.274	30.641	0.000
Period-I	-58619.06	0.335	33.028	0.000
Period-II	58564.17	0.262	37.89	0.000

Table 4. Growth rate of area, production and yield of pulse in Bangladesh.

Field of Measurement	Measurement Statistics	Growth Rate (%)	Sig. (two tailed)
Area	Whole Period	-3.5	0.000
	Period-I	4.7	0.001
	Period-II	-8.1	0.000
Production	Whole Period	-2.5	0.003
	Period-I	5.6	0.000
	Period-II	-6.4	0.000
Yield	Whole Period	1.0	0.000
	Period-I	0.9	0.000
	Period-II	1.7	0.000

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

Field of Measurement	Measurement Statistics	Whole Period (1987-2010)	Period-I (1987-1998)	Period-II (1999-2010)
Area	CV	32.55	19.06	27.93
	R-square	0.407	0.68	0.94
	Sig. (two tailed)	0.000	0.001	0.000
	D-W	0.3	1.131	1.36
	CV around trend line	25.06	11.16	6.55
Production	CV	29.34	22.31	22.61
	R-square	0.273	0.74	0.92
	Sig. (two tailed)	0.009	0.000	0.000
	D-W	0.292	1.24	1.34
	CV around trend line	25.02	11.29	6.24
Yield	CV	8.14	3.54	6.96
	R-square	0.85	0.88	0.84
	Sig. (two tailed)	0.000	0.000	0.000
	D-W	0.876	1.38	1.67
	CV around trend line	3.06	1.24	2.78

Acknowledgement

We like to thanks the Bangladesh Bureau of Statistics to provide us their collected data.

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