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Effects of Rainfall Variability on Maize Production in Afgooye District, Lower Shebelle Region, Somalia

Abdisalam E. Ahmed [a++*]

[a] *Faculty of Agriculture and Environmental Science, Somali National University, Gaheyr Campus, Afgoi Road, Dharkenley District, Mogadishu, Somalia.*

Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

The research aim was effects of rainfall variability on Maize production in Afgooye, District, lower Shebelle. Somalia. This study adopted with a cross-sectional survey research design, and followed quantitative approach. The accessible population, the study selected 108 sample size represent the population by using Slovin formula with the maximum acceptable error of 5%. The variables used in this study included rainfall pattern, rainfall intensity and rainfall frequency. The data was analyzed with the package of statistical package for Social Science technique (SPSS 22.0). The results showed rainfall Variability effected maize production. This study showed that rainfall pattern, rainfall intensity and rainfall frequency have an effect with maize production.

Keywords: Rainfall variability; maize production; afgooye.

[++] *Head, Senior Lecturer;*
**Corresponding author: E-mail: elmi10@snu.edu.so;*

1. INTRODUCTION

Rainfall variability is one of the most important factors determining variability in agricultural production. This has serious consequences for individuals and societies, resulting in crop failures, livestock losses, income loss, and even famine. It also causes significant environmental degradation, especially when combined with inadequate management strategies.

“Globally rainfall variability is a global issue because it affects all countries of a world. Rainfall variability is an indicator of global rainfall change which has being brought about directly or in directly by human activities that alter the composition of the global atmosphere” [1].

“Currently, about 60 per cent of the world and 90 percent Sub-Saharan African staple food production are under direct rain fed agriculture Intergovernmental Panel on Climate Change” [2]. “Over the past years the frequency of the climate variation in terms of temperature and rainfall has been increasing” [3]. “Evidence is emerging that climate change is increasing rainfall variability and the frequency of extreme events such as drought, flood, and hurricanes Intergovernmental Panel on Climate Change” [4].

Afgooye had an annual mean rainfall of 584 mm. In 1977 it received a total of 800 mm of rainfall. “Rainfall variability is the degree to which rainfall amounts vary across an area or through time” [5]. But according to Cordis [6] “Rainfall variability is an indicator of global rainfall change which has being brought about directly or in directly by human activities that alter the composition of the global atmosphere”. Rainfall variability refers to the rainfall parameter of a region varying from its long-term mean [7]. In this study rainfall variability is defined degree to which rainfall amounts vary across an area or through time. There are various characteristic of rainfall variability. According to Wilhite et.al [8] rainfall is characterized into amount, intensity duration, frequency and pattern period. It is also characterized into regional annual rainfall totals rainfall seasonality and frequency of extreme weathers. Rainfall variability is characterized into soil moisture, plant moisture, drought, floods and rainfall patterns [9]. In this study rainfall variability was be operationalized into rainfall pattern, rainfall intensity and rainfall frequency. It is characterized by rainfall seasonality and distribution. “Rainfall intensity is defined as the ratio of the total amount of rain movement of a series over an extended period of time or it is the long-term change over a period of time” [10].

In the context of Somalia, it is considered one of the countries who are extremely susceptible to climate variations, even though the agriculture sector still remains the backbone of the Somali economy since it contributes to a GDP of a country’s total export earnings by approximately 75% and 93%, respectively” [11]. “More precisely, changes in temperature are associated with reducing soil moisture, causing evaporation, drier conditions, and rain failures. This would ultimately decrease water availability for irrigation which further causes crop yields to decline sharply” [12]. “Specifically, the lower Shebelle region which is the country’s principal maize production region experiences temperatures ranging from 26 to 28°C [13]. Consequently, the maize production decreases sharply in the times 85 of rainfall failures” [12].

However, the rainfall patterns has become intense and more frequently in this place. Rainfall patterns flood and other climatic events has also become constraint to the maize production. Therefore this study will focus on to examine the effect of rainfall variability among maize farmers in Afgooye District. This study was carried out in Afgooye District which was known its historic maize production in Somalia because of its crop productivity level compared to other regions in the country.

2. MATERIALS AND METHODS

2.1 Study Area

This study was conducted in Afgooye District, Somalia among farmers. Afgooye District is located in the Lower Shabelle region and is located 30km from Mogadisho, the capital city of Somalia.The communities of the district are farmers who rely on small scale farming as a source of livelihood.

2.2 Study Design

This study adopted with a cross-sectional survey research design, and followed a quantitative approach. Survey research is defined as "the collection of information from a sample of individuals through their responses to questions" [14]. Across sectional survey is the method of choice if you want to gather the data at one point

in time [15]. The main purpose of using a cross-sectional data was used to test causal questions in a number of ways because a cross-sectional study only happens once, you were able to analyze and act on your data immediately [16]. This were enable the researcher to present a picture of the rainfall variability on maize production in Afgooye District,Lower Shabele Somali.

2.3 Sample Size

Sample is a further subset of the target population which we would like to include in the study. Thus a sample is a portion, piece, or segment that is representative of a whole [17]. The sample size of the study was 108 farmer. Krejcie and Morgan recommended a sample size of 108 for population of 150 at 95% level of confidence, 0.5 level of significance and 5% margin of error.

2.4 Sampling Technique

This study was adapted to convenience sampling technique. This study population is undefined and infinite. Therefore, probability method could now work.

2.5 Data Collection Instrument

Survey research may use a variety of data collection methods with the most common being questionnaires and interviews. The data collection questionnaire was survey method. This study used questionnaires to collect data. The questionnaire is the main instrument for collecting data in survey research. Basically, questionnaires were employed in this study because it was less expensive and took a short time.

2.6 Data Analysis

Data analysis was done using SPSS 20.0 version and the results presented in charts and statistical significance was at p value of < 0.05.

3. RESULTS

Table 2 showed that 40.4% of the respondents were strongly agree,36.5% of the respondents were agree,11.2% of the respondents were neutral,7.5% were disagreed and 4.4% were strongly disagreed of Distribution of rainfall effects on maize yields in different places. Rainfall seasonality has caused retardation of maize growth that 31.3% of the respondents were strongly agreed, 43.5% of the respondents were agree, 9.4% of the respondents were neutral, 10.2% of the respondents were disagreed and 5.6% were strongly disagreed. 50.7% of the respondents were strongly agree agreed, 30.9% of the respondents were agree, 4.7% of the respondents were neutral, 11.8% were disagreed and 1.9% were strongly disagreed of early rainfall onset affects maize production . 46.8% of the respondents were strongly agree, 39.8% of the respondents were agree, 9.3% of the respondents were neutral, 2.8% were disagreed , 1.3% were strongly disagreed of late rainfall onset affects maize production.

In Table 3, indicates of 52.4% of the respondents were strongly agree, 37.4% of the respondents were agree ,3.7% of the respondents were neutral, 5.6% were disagreed and 0.9% were strongly disagreed of rainfall intensity increase amount of runoff causing soil erosion. 27.8% of the respondents were Strongly agree, 37% of the respondents were Agree, 18.5% of the respondents were neutral, 13.9% of the respondents were disagreed and 2.8% were strongly disagreed of rainfall intensity causes post-harvest loses. 32% of the respondents were strongly agree, 34.8% of the respondents were agree,10.2% of the respondents were neutral, 19.4% were disagreed and 3.6% strongly disagree of rainfall amount causes delay in the onset of planting. 35.9% of the respondents were Strongly agree 49.8 %of the respondents were agree 7.8 %of the respondents were Neutral ,3% of the respondents were disagree,3.7% were Strongly disagreed of rainfall variations has caused drought and flooding affecting maize production.

In Table 4 Indicates of 43% of the respondents were Strongly agre, 20.2% of the respondents were agree,22% of the respondents were neutral,12% were disagreed and 2.8% were strongly disagreed of rainfall frequency affects the quality maize produced. 28% of the respondents were Strongly agree 47% of the respondents were agree, 18% of the respondents were neutral, 10% of the responds were disagreed, 5% were strongly disagreed of Rainfall frequency has affected land preparation for planting. 42.% of the respondents were Strongly agree,38.7 of the

respondents were Agree, 6.7% of the respondents were neutral, 5.9% were disagreed, 6.5% were strongly disagreed of Rainfall frequency causes Late maturity. 36.3%of the respondents were Strongly agree, 44.1% of the respondents were Agree, 6.7% of the respondents were neutral, 8.9% were disagreed, 4.1% were strongly disagreed of rainfall frequency increases the chances of crop failure.

Table 1. Demographic data

Variables	Frequency	Percentage
Gender		
Male	94	87%
Female	14	13%
Total	**108**	**100**
Age		
25-35	15	14%
35-45	27	25%
45-55	64	59%
Above 55	2	2%
Total	**108**	**100**
Marital Status		
Single	23	21%
Married	71	66%
Divorced	14	13%
Total	**108**	**100%**
Education level		
None	73	61%
Primary	10	4%
Secondary	11	10%
University	14	17%
Total	**108**	**100**

Table 2. Rainfall pattern on maize production

		Level of agreement (%)					
No	**Statement**	**Strongly Agree**	**Agree**	**Neutral**	**Dis agree**	**Strongly Disagree**	**Total**
1.	Distribution of rainfall affects maize yields in different places	40.4	36.5	11.2	7.5	4.4	100
2.	Late rainfall onset affects maize production	46.8	39.8	9.3	2.8	1.3	100
3.	Early rainfall onset affects maize production	50.7	30.9	4.7	11.8	1.9	100
4.	Rainfall seasonality has caused retardation of maize growth	31.3	43.5	9.4	10.2	5.6	100

Table 3. Rainfall intensity on maize production

No	Statement	Level of agreement (%)					
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
1.	Rainfall intensity increase amount of runoff causing soil erosion	52.4	37.4	3.7	5.6	.9	100
2.	Rainfall intensity causes post-harvest loses	27.8	37.0	18.5	13.9	2.8	100
3.	Rainfall amount causes delay in the onset of planting	32.0	34.8	10.2	19.4	3.5	100
4	Rainfall variations has caused drought and flooding affecting maize production	35.9	49.8	7.6	3.0	3.7	100

Table 4. Rainfall frequency and maize production

No	Statement	Level of agreement (%)					
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
1.	Rainfall frequency affects the quality maize produced	43.0	20.2	20.2	12.0	2.8	100
2.	Rainfall frequency has affected land preparation for planting	28	47	18	10	5	100
3.	Rainfall frequency causes Late maturity	42.0	38.7	6.7	5.9	6.7	100
4.	Rainfall frequency increases the chances of crop failure	36.3	44.1	6.7	8.9	4.1	100

4. DISCUSSION

4.1 Demographic Characteristics of Respondents

Majority of the study was revealed that 87% of the respondents were male and 13 % of the respondents were female. This implies that the majority of the respondents were male. This is because these categories of people who work in maize are more men than women. The researcher was found out that 21% of the respondents were single,66% of the respondents were married whereas as the remained 13% are in divorced. About 73 (68%) of the respondents were none educated, 10 (9%) of the respondents were primary level,11 (10%) of them were secondary level and 14 (13%) of the respondence were University level .In addition 15 (14%) of the respondents were between 25-35 years, 27 (25%) of the respondents were between 35-45 years, 45-55 interval years are 64 (59%) respondents whereas the those above 55 are 2 (2%)years the age of the respondents.

4.2 Effect of Rainfall Pattern on Maize Production

The researcher was found out that 40.4% of the respondents were strongly agree, 36.5% of the respondents were agree,11.2% of the respondents were neutral,7.5% were disagreed and 4.4% were strongly disagreed, this implies that the majority of the respondents were strongly agreed with that statement. This is because the category of people was aware to this statement that rainfall pattern causes poor yield and the maize will failure. This implies that the majority of the respondents were strongly

agree with the statement so that This findings are supporting Cudjoe, Antwi-Agyei, and Gyampoh, (2021) [17], provided strong evidence about rainfall pattern and maize production.

4.3 Rainfall Intensity on Maize Production

The study was found that indicates of rainfall intensity increase amount of runoff causing soil erosion 52.4% of the respondents were strongly agreed, 37.4% of the respondents were agree ,3.7% of the respondents were neutral, 5.6% were disagreed and 0.9% were strongly disagreed. This implies that the majority of the respondents were agreed with the statement. This is because the category of people was aware to this declaration.This findings are supporting Cudjoe, Antwi-Agyei, and Gyampoh, [18] provided strong evidence about rainfall intensity and maize production. According to Adamgbe and Ujoh (2013) [19], explained variations in the annual rain days as well as the rainfall received play a key role in the amount of maize yields.

4.4 Rainfall Frequency and Maize Production

The study was indicated that rainfall frequency affects the quality maize produced, about 43% of the respondents were strongly agreed, 22% of the respondents were agree 20% of the respondents were neutral 12% were disagreed and 2.8% were strongly disagreed. These finding supported my findings of rainfall frequency and maize production Nicholson (2008) provided a support that rainfall duration and intensity of early and mid-season rain can have a dramatic effect on yield and Huho, and Kosonei, [20] explained 27 Understanding extreme climatic events for economic development in Kenyathe frequency of occurrence and severity of floods and droughts have been increasing over time causing massive crop failure where maize yields dropped from 2.5 to 0.5tones/Ha [21-23].

5. CONCLUSION

The first objective of this study was to assess the effect of rainfall patterns on maize production among farmers in Afgooye District, Somalia. Rainfall patterns were operationalized as Rainfall Seasonality Rainfall Distribution, that the rainfall variability is a cause of poor yield potential and crop failure, so that heavy precipitation and field flooding in agricultural systems delays spring planting, increases soil compaction, and causes crop losses through anoxia and root diseases; variation in precipitation is responsible for the majority of the crop losses. It was concluded that rainfall pattern affects yield of maize.Maize is mainly grown in rain-fed areas that receive heavy annual rainfall. That is why it is fundamentally maize is Gu season (July-August) Deyr season (December-January) in Afgooye Somalia. The study was summarized that rainfall pattern delays the onset of the planting season. The onset of rainfall can be described as the possible start of rainfall in a year. Finally climate change will cause an intensification of rainfall variability.

The second objective of this study was to assess the effect of rainfall intensity on maize production among farmers in Afgooye District, Somalia. Rainfall intensity was operationalized as duration and amount of Rainfall. It was used to analyze the relationship between the rainfall intensity and maize production of the farmers.

The final objective of this study was to determine the effect of rainfall frequency on maize production among farmers in Afgooye District, Somalia. Rainfall intensity was operationalized as number of rainy dates.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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