



The Impact of Climate Change on Rainfed Chickpea Production in the Center of Badghis, Afghanistan

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ABSTRACT

Cultivation of drought tolerance crops like chickpea can secure food production in Badghis. Chickpea demonstrate resilience in the face of climate change, though to possess deep root systems and enhance ability to withstand water scarcity. The purpose of this study was to investigate the impact of climate change on chickpea production during the last ten years (2010 to 2019) in the center of Badghis, Afghanistan. The research involved 50 participants who were randomly selected from among the farmers and extension management personnel of Agriculture Department. The data were collected through questionnaires and analyzed using SPSS and Excel programs. The findings indicated that chickpea production in Badghis province's center peaked at 410 tons in 2012, while the lowest production was zero tons in 2018. Furthermore, the highest recorded rainfall in the area was 464 mm in 2015, whereas the lowest rainfall was 185 mm in 2018. The highest amount of snow in the center of Badghis province in 2010 and 2017 is 118 mm and the lowest amount of snow in 2018 is 21 mm. The correlation analysis indicates that decreased rainfall and snowfall resulting from climate change have negatively impacted chickpea production in Badghis province.

Keywords: Badghis, Chickpea, Climate Change, Production

INTRODUCTION

Climate change is a significant global phenomenon with far-reaching impacts on various sectors, including agriculture (Savage *et al.*, 2009). Rainfed chickpea production, a crucial source of food and income in the center of Badghis province. (Ghafouri, 2007). This crop is susceptible to the changing climate patterns observed over the past decade (2010-2019). Understanding the influence of climate change on rainfed chickpea production in this region is essential for developing effective strategies to mitigate potential losses and ensure sustainable agricultural practices (Gholami and Ramezani, 2017). This study aims to examine the specific impacts of climate change on chickpea yields during the specified period, focusing on key climatic variables such as temperature, precipitation, and extreme weather events. By analyzing long-term climate data and correlating it with chickpea production levels, this research will provide valuable insights into the vulnerability and adaptive capacity of rainfed chickpea systems in the face of climate change. The findings will contribute to evidence-based decision-making, enabling policymakers to implement targeted interventions and adaptations to safeguard chickpea production and achieve food security goals in this region. Understanding the complex interplay between climate change and rainfed chickpea production is crucial for developing resilient agricultural systems and ensuring sustainable livelihoods in the center of Badghis province.

The objective of this research is to investigate the impact of climatic changes on chickpea production in the center of Badghis province over the past decade (2010-2019).

MATERIALS AND METHODS

Study Area

A 2020 questionnaire based study at the center of Badghis province assessed the impact of climate change on rainfed chickpea yield from 2010 to 2019.

Samples Collection

First-hand data is the most reliable and timely information in any research, and these data were completed through interview with 50 farmers and extension management of the Department of Agriculture, Irrigation and

Livestock of Badghis Province, who were randomly selected. Secondary information is mostly collected from books and fresh related articles related to the subject and references to internet sites.

Statistical Analysis

The collected results were analyzed with SPSS statistical software and the corresponding figures were drawn by Excel program. Materials such as pen, camera and paper are used in this research.

RESULTS AND DISCUSSION

The findings of the research obtained from the extension management of the Department of Agriculture of Badghis province indicate that the highest amount of chickpea production was in the center of Badghis province in 2012 and the lowest amount of chickpea production was in 2018, so the chickpea production during the last ten years has been decreased due to the fact that the agricultural products of this province are all irrigated and depend on the amount of rainfall, the amount of rainfall during the last ten years has been very low, and the production of irrigated agricultural products, especially the irrigated chickpea crop has been decreased. (Figure 1).

The findings of the research according to figure (2) show that the amount of annual rain has decreased in the last ten years. Annual rainfall increased in the years 2011, 2015, and 2019. But it was decreased in 2012, 2013, 2014, 2016, 2017, and 2018. It is very clear that many changes have occurred between the years (2010 to 2019) and the highest amount of rain (468 mm) happened in 2015. In general, the amount of rain has decreased in the center of Badghis province in the last ten years.

According to the findings, the amount of snow has decreased in the last ten years (2010 to 2019) in the center of Badghis province. The amount of annual snow increased in the years 2011, 2015, and 2017. But the amount of snow decreased in the years 2012, 2013, 2014, 2016, 2018, and 2019. It is very clear that many changes have occurred also in snowfall between the years (2010 to 2019) and the highest amount of snow (118 mm) has happened in 2011 and 2017. In general, the amount of snow has decreased in the center of Badghis province during the last ten years (Figure 3).

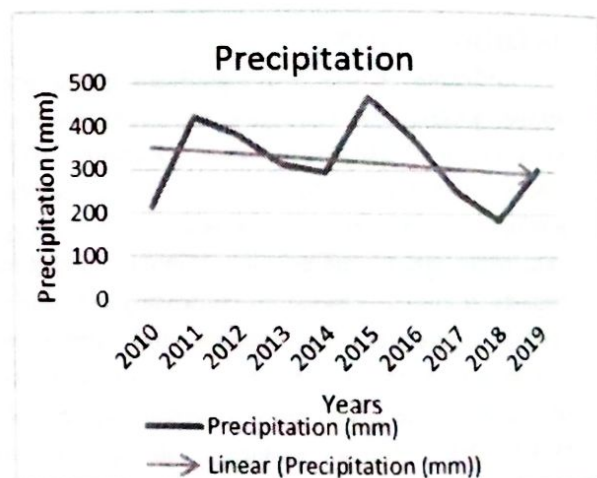
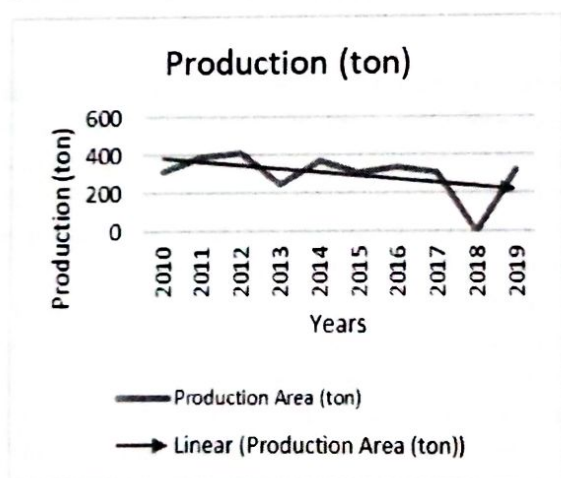


Figure 1. The production of rainfed chickpea in the center of Badghis Province (source: Badghis Agriculture Extension Management).

Figure (2): Annual rainfall in the center of Badghis Province (source: Badghis Agriculture Extension Management).

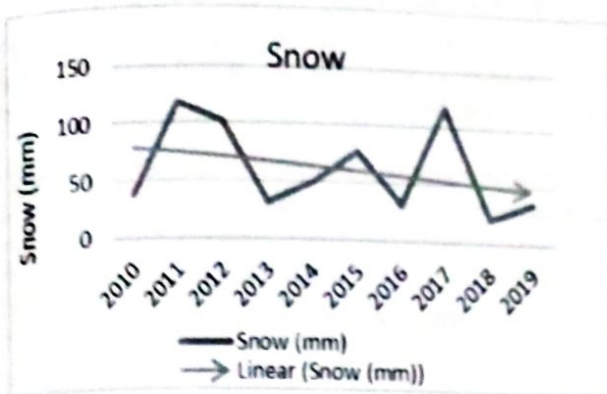


Figure 3: Annual snowfall in the center of Badghis Province (source: Badghis Agriculture Extension Management)

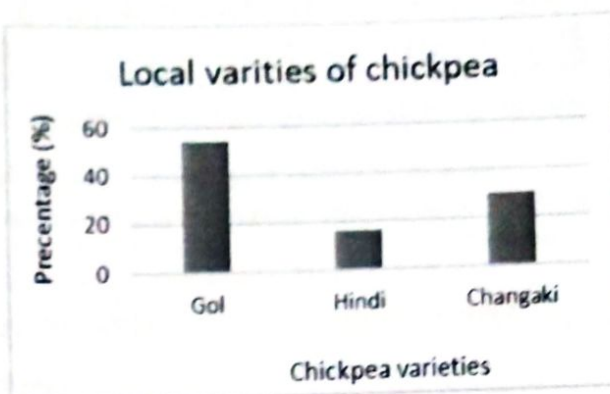


Figure 4: Different varieties of chickpea in the center of Badghis Province (source: Interview With the Farmers)

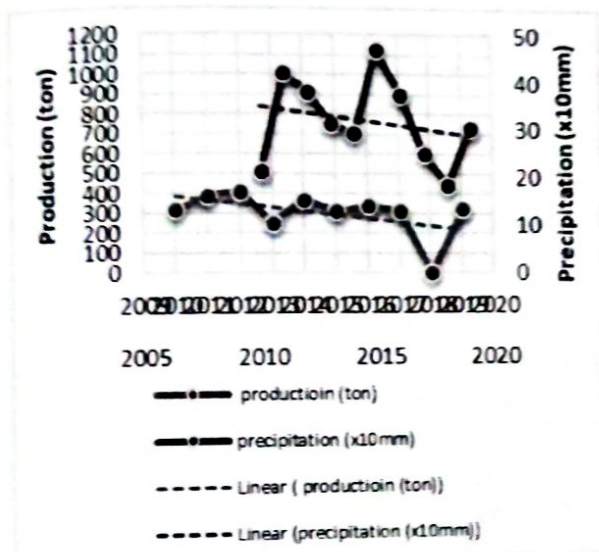


Figure (5): Comparison of production with rainfall in the center of Badghis province (source: extension management of Badghis Department of Agriculture).

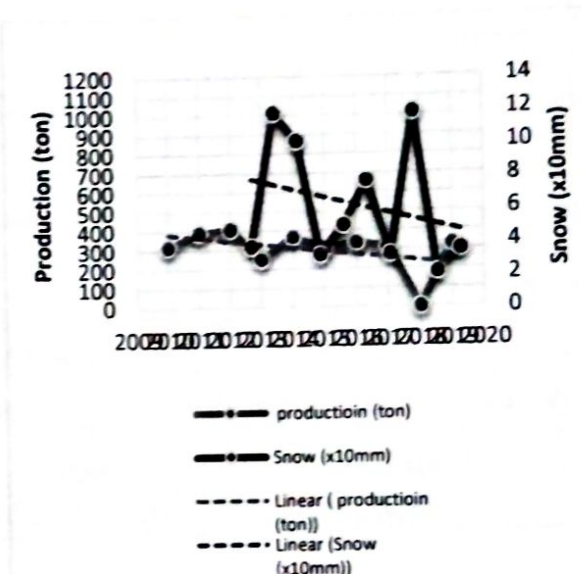


Figure (6): Comparison of production with snow in the center of Badghis Province (source: Extension Management of Badghis Agriculture Department).

From figure (4), we can conclude that the highest cultivated area of chickpea is related to the Gol variety and the lowest cultivated area is related to the Hindi variety during the last ten years (2010 to 2019) in the center of Badghis province. The use of Gol variety is mostly due to the high agreement of the product with the climatic conditions of the region. According to the findings of the research, the amount of annual rain has had an effect on the yield of chickpeas, as you can see in Figure (5), with the decrease in rainfall in the last ten years, the yield of chickpeas has also decreased.

From figure (6), we can conclude that the amount of snow during the last ten years in the center of Badghis province has had an effect on the yield of chickpeas, with the decrease in the amount of snow during the last ten years in the center of Badghis province, the yield of chickpeas has also decreased. Correlation results also show that the relationship between rain and yield is equal to 0.584 and the relationship between snow and yield is equal to 0.532 and this indicates a strong positive relationship between the variables, meaning that if the amount of rain increases by 0.584 units, the yield increases by one unit. Also, if the amount of snow increases by 0.532 units, the yield increases by one unit. According to the above correlation results, it can be concluded that rain and snow had a positive effect on yield (Table 1). The results of this research is parallel with the findings of Gholami, A., & Ramezanzpour, H. (2017) and Kiani, F., & Karimzadeh, H. (2015) who reported that the direct effect of rain and snow on plant growth can be the reason for increasing soil moisture and increasing

water supply for plants. Also, the indirect effect of these rains may be due to changes in the temperature and humidity conditions of the region, which can affect the growth and development of plants. Singh, S. P., & Singh, G. (2014) also positively evaluated the impact of snow and rain on the yield of agricultural products in the Western Himalayan region of India and showed that the increase in snow and rain caused an increase in the yield level. Plants, which is consistent with the findings of this research.

The above information concludes that the yield in the last ten years (2010-2019) in the center of Badghis province is 301.72 tons on average, and the average amount of rain and snow was 320.2 mm and 62.1 mm respectively.

Table 1: Relationship between precipitation, snow and production in the center of Badghis province

| | | Correlations | | |
|---------------|---------------------|---------------------|--------------------|-----------|
| | | Production (ton) | Precipitation (mm) | Snow (mm) |
| Production | Pearson Correlation | 1 | .584 | .532 |
| | Sig. (2-tailed) | | .077 | .114 |
| | N | 10 | 10 | 10 |
| Precipitation | Pearson Correlation | .584 | 1 | .443 |
| | Sig. (2-tailed) | .077 | | .200 |
| | N | 10 | 10 | 10 |
| Snow | Pearson Correlation | .532 | .443 | 1 |
| | Sig. (2-tailed) | .114 | .200 | |
| | N | 10 | 10 | 10 |

Table 2: Descriptive statistics of data for precipitation, snow and production

| Descriptive Statistics | | | |
|-------------------------------|----------|----------------|----|
| | Mean | Std. Deviation | N |
| Production | 301.7200 | 115.32402 | 10 |
| Precipitation | 320.2000 | 90.74115 | 10 |
| Snow | 62.1000 | 38.00132 | 10 |

CONCLUSION

In conclusion, the analysis of chickpea production data in the center of Badghis province over the past ten years revealed significant variations in production and climatic variables. The decline in rainfall and snowfall, attributed to climate change, has adversely affected on production of chickpea. This highlights the vulnerability of rainfed chickpea production in Badghis province. Adaptation strategies, such as improved water management and drought-tolerant cultivars are crucial to enhance chickpea production and mitigate the negative impacts of climate change in this region.

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