IMPACT OF CLIMATE ON CEREAL CROP PRODUCTION IN TURKMENISTAN

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Abstract
Climate determines, to a larger extent, the growth, production and yield level of any crop. Turkmenistan which lies in warm-arid continental climatic zone, extends from north-west to south-east, having some distinguished climatic types. Being a downstream state dependent mainly upon Amu Darya for irrigation, the steps towards neutralizing the impact of climate, especially temperature and rainfall, did not yield too much, so for cereal crop production in the study region is concerned. In this paper an attempt has been made to see how and to what extent the weather variables, particularly, rainfall and temperature, have influenced the production and yield level of cereal crops in Turkmenistan.

Keywords
Climatic Zones, Production Levels, Downstream, Water Deficient, Continental, *Velayat,* Cereals, Yield, Turkmenistan, Climate, Rainfall, Temperature, Weather, Irrigation, Regional Variation.

Introduction

Being located in dry continental climatic zone, Turkmenistan can be divided into well demarcated four climatic sub-zones, i.e. a) Lower Amu Darya; b) Northern Karakum; c) Southern Karakum and d) South-east Karakum. The weather parameters of these climatic zones differ which effect the agricultural land use and production of crops. The Lower Amu Darya climatic zone is coldest plain part of Turkmenistan. The Northern Karakum covers the northern part of the Amu Darya valley – habitat of cold air masses. The Southern Karakum zone forms the warmest part of Amu Darya basin which is characterised by a high mean temperature and relatively warm winters. While the South-east Karakum encompasses both warm as well as cold seasons with strong winds (Table-I).

Table-I
Regional Climatic Parameters of Turkmenistan

Parameter	Lower Amu Darya	Northern Karakum	Southern Karakum	Southest Karakum
Mid annual air temperature (^{0}C)	12	12.3	15.8	16.8
Average temperature of the coldest month (^{0}C)	-6	-5.2	-0.2	+20
Average temperature of the warmest month (^{0}C)	+27	+28	+31	+31
Temperature fluctuations (^{0}C)	-	-	31	29
Frost free days	187-200	200	230	230
Days with temperature above 10^0 C	196	210	-	250
Annual precipitation (mm/ year)	76-90	100	134	204
Evaporation (mm)	-	1700	2248	2155
Maximum temperature (^{0}C)	-36	+32	-25	-31
Snow cover days / year	-	10-15	10-13	15

Source: Amangul Ovezberdyyeva, Sustainable Water Management in Turkmenistan: Challenges and Solutions, Arndi University, Greifswald, p. 17.

The northern region experiences severe winters, low temperatures with snow while in east and south-east, cyclones with precipitation peak (December to April) can be observed. The western region experiences maximum precipitation from October to May while in plain region of Turkmenistan summers are dry and the maximum precipitation falls in winter and spring.

Spatio-temporal Variation in Cereal Production and Yield

The analysed weather regime directly influences the production and productivity in Turkmenistan. Here, the impact of climate is observed more intense because of the higher continentality nature of the country combined with the lesser neutralizing forces like irrigation and its technology. The regional temperature and rainfall, ofcourse, in combination with the geo-economic determinants, has regulated the production pattern of cereal and their yield level (Table-II).

Table-II
Production and Yield of Cereal Crops in Turkmenistan (1990-2010)

Province	Year	Production of Cereal Crops (000 tons)	Yield of Cereal Crops (tons/ha)	Percentage Growth	
				Production	Yield
Ahal	1990	112	2.39	-	-
	1995	300	1.12	167.85	-113
	2000	355	1.62	18.33	44.64
	2005	560	2.03	57.76	25.30
	2010	410	1.57	-26.78	-44.61
Balkan	1990	20	2.04	-	-
	1995	28	1.71	40.0	-16.17
	2000	48	1.45	71.42	-15.20
	2005	70	1.87	45.83	28.97
	2010	80	1.33	14.28	-28.87
Dashoguz	1990	57	1.83	-	-
	1995	170	1.70	198.24	-7.10
	2000	182	1.29	7.05	-24.11
	2005	239	1.29	31.31	0.00
	2010	208	1.28	-7.94	-0.78
Lebap	1990	98	2.45	-	-
	1995	238	1.82	142.85	-25.71
	2000	245	1.36	2.94	-25.27
	2005	351	1.70	43.26	25.00
	2010	271	1.38	-22.79	-18.82
Mary	1990	121	2.49	-	-
	1995	312	1.90	157.85	-23.70
	2000	405	1.80	29.80	-5.26
	2005	583	2.11	43.95	17.22
	2010	439	1.65	-24.69	-21.80

Source: Compiled and computed on the basis of data from FAO, IMF, World Bank, Worldfact Book, and Statistical Yearbooks of Turkmenistan.

If we examine the percentage growth of area, production and yield of different Velayats of Turkmenistan from 1990 to 2010, the following picture of comparisons emerge, leading to various area-specific treatments for achieving the targets (Table-III).

Table-III
Cereals: Growth in Area, Production and Yield (1990-2010)

Velayat	% age Growth		
	Area	Production	Yield
Ahal	15.34	13.61	1.76
Balkan	23.64	27.99	2.91
Dashoguz	25.81	11.72	8.23
Lebap	22.70	30.04	6.17
Mary	12.59	10.03	2.18

Source: Complied and computed on the basis of data from FAO, IMF, World Bank and Statistical Yearbooks, Turkmenistan.

After superimposing the data of various relevant tables, the results of growth and yield level of cereal crops have been produced in Table-IV.

Table-IV
Categorization of Growth and Yield Levels of Cereals

Category	Growth Level		Yield Level	
	% Area	% Production	% Area	% Production
A	70.91	70.41	19.7	18.32
B	18.5	8.46	61.35	60.55
C	10.14	21.13	18.95	21.13

Source: Based upon the relevant tables.

The preceding analysis of facts and figures enables the author to regionalize the *Veyalats* of Turkmenistan into different developmental levels so far its productivity of cereal is concerned (Tavle-V).

Table-V
Cereal Crop Yield Indices in Provinces of Turkmenistan

2005			2010		
Index Range	Level	Name of Province	Index Range	Level	Name of Province
High	>127	Mary	High	>106	Mary
Medium	111-127	Ahal, Balkan, Lebap	Medium	85-106	Ahal, Lebap
Low	< 111	Dashoguz	Low	< 85	Balkan, Dashoguz

S*ource: Based upon tables II to IV.*

Conclusion

The aforementioned analysis leads to some of the inferences which follow. Firstly, Turkmenistan has a dry continental climate and, simultaneously, belongs to downstream sub-region and in both situations demand irrigation with improved technology just to neutralise its locational disadvantage, so far the production and productivity of cereals in relation to climate is concerned. Secondly, to its benefit, it is bordered by Amu Darya on its north-east and by Caspian, on its north-west. In former case, it utilizes and has the potential of diverting more water from Amu Darya for its irrigation purposes while in case of latter, being a coastal country of Caspian, it harnesses the resources of the water body and in future, its scope of utilizing Caspian resources seems bright. Thirdly, the recent investments on irrigation infrastructure by initiating mega-water projects and canals, has started yielding results whereby more irrigable acreage is being brought under cultivation and already irrigated land is being intensified with the required irrigation at required time. Fourthly, the production of cereal crops and their yield level has also responded positively with additional irrigation facilities which is evident from the rising figures prepared in different preceding tables. Fifthly, although climate, particularly, temperature and rainfall still controls the agricultural scenario of Turkmenistan but the improved irrigation and its technology as well as diversification-cum-rotation of crops with high-yielding, early-maturing and water-efficient varieties of cereals, has to some extent neutralized the influence of climate on food crops.

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