

INTERANNUAL VARIATIONS OF RAINFALL AND CORN YIELDS IN NORTHEAST BRAZIL

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Abstract

Interannual variations of corn yields in northeast Brazil are connected to the variations in Southern Oscillation (SO). In three of the nine states the correlation coefficient between the two is significant. In all the nine states the correlation coefficient is negative showing that El Niño years are prone to low corn yields.

1. Introduction

Northeast (NE) Brazil experiences large interannual variations of rainfall. These variations can cause severe impact on human activities of this region. Based on the annual cycle of rainfall, NE Brazil can be broadly divided into three regions, viz, Northern NE Brazil, Eastern NE Brazil and Southern NE Brazil. The rainy season in northern NE Brazil is rather short and occurs in March, April and May (MAM) (Strang, 1972). In the eastern coastal NE Brazil the rainy season is April-May-June-July (AMJJ) (Rao et al., 1993) and in the southern NE Brazil the principal rainy season is November-December (ND) (Chu, 1983). Interannual variations of rainfall in one region are not well correlated with variations in the other two regions. However, intense droughts such as the one in 1983 seem to occur over entire NE Brazil.

During the period 1979-1983 NE Brazil has been under the sway of a dry spell, except for some relief in March 1981 (Rao et al., 1986). The drought in 1983 was wide spread. During the rainy season of 1984 and 1985 many stations in NE Brazil received twice the normal rainfall. The damage due to floods of 1985 was rather severe and by the end of April 1984 more than a million people were rendered homeless. After 1985 rainfall over NE Brazil decreased and in 1993 NE Brazil experienced a severe drought (Rao et al., 1995). Figure 1 shows these variations.

The climatic variability in the tropics as revealed by rainfall affects the crop yields. Gasques (1988) discussed the effects of climatic variability on agricultural production area yields in NE Brazil using data from 1960 through 1984. In the present study we extend his study including the data from 1948 up to 1991.

2. Data sources

Rainfall data were obtained from Instituto Nacional de Meteorologia of Brazil. Corn yields for the period 1948-1991 were obtained from Anuário Estatístico do Brasil, Instituto Brasileiro de Geografia e Estatística, IBGE.

3. Results and discussion

The variations of corn yields in the nine states do not exhibit an upward trend, unlike in the case of crops in some other regions. If at all, some states show a clear downward trend. The variations of corn yields are due to factors other than the application of modern technology. Table 1 gives some statistics regarding the corn yields. Since there is no clear trend we ventured to calculate mean and standard deviations. In same table skewness and yields of 1983, 1984, 1985, 1987, and 1990 are also given.

During the year 1983, the corn yields in 3 states were the lowest (marked by *) in the period considered and in 2 more states they are 2nd lowest. In the state of Bahia it is interesting to note that the corn yield was the lowest in 1984. Anomalies of 1984 over NE Brazil show that Bahia recorded much lower rainfall although other states recorded much above normal rainfall during MAM of 1984. During the heavy rainfall year 1985 corn yields were much higher in all the states. Again during the El Niño years 1987 and 1990, corn yields reduced. Maranhão recorded the lowest in the period considered during the year 1987.

Table 2 shows the linear correlation coefficient (c.c) between the corn yields and the SO index (Darwin sea level pressure). It can be seen that all the c.c show negative values. Thus years of higher Darwin pressure or El Niño years are associated with generally lower corn yields. The c.c values for the states of Ceará, Rio Grande do Norte, Paraíba e Pernambuco are higher (significant at 90% level). This shows at least in some states there is a significant link between the SO index and corn yields. Although c.c values are less in some states, El Niño years are associated with very low values of corn yield. Second column in Table 2 shows the correlation between rainfall and corn yields. At least in 3 states (Pernambuco, Paraíba e Ceará) the c.c are significant at 90% level.

References

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Table 1: Corn yields in northeast Brazil. * Lowest in the period 1948-1991. ** Second lowest in the period 1948-1991.

State	Mean	S.D.	Skewness	1983	1984	1985	1987	1990
Maranh.	617	155	-2.33	238	579	348	219*	281
Piauí	676	235	-2.01	121*	601	713	320	230
Ceará	617	244	-0.94	120*	610	372	260	348
R.G.N.	425	176	-1.67	71**	527	355	107	190
Paraíba	602	226	-2.23	127**	666	560	209	240
Pernam.	653	187	-2.66	156*	830	651	249	390
Alagoas	540	165	0.53	383	496	463	265	441
Sergipe	708	177	-1.05	514	884	958	653	625
Bahia	738	226	-1.78	311	190*	869	235	320

Table 2: Correlation coefficient between corn yields and SO index and rainfall.

State	c.c between Darwin pressure and corn yield 1948-1984	c.c between rainfall and corn yield
Maranh.	-0.15	0.07
Piauí	-0.10	0.11
Ceará	-0.26	0.25
R.G.N.	-0.28	0.16
Paraíba	-0.21	0.24
Pernamb.	-0.32	0.36
Alagoas	-0.06	-0.08
Sergipe	-0.08	-0.01
Bahia	-0.10	-0.03