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# IMPACT OF DROUGHT ON AGRICULTURE IN RAJASTHAN

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**Abstract**

*Drought conditions are fairly typical for the state of Rajasthan, and drought studies are crucial in the context of Rajasthan due to their impact on the state's society and economy. Making an effort in this stream of thought will undoubtedly aid understanding. the drought's natural course of action for future efforts. Rajasthan seems to be connected with drought. In contrast to other natural risks, drought is a destructive natural occurrence. A drought is considered to have occurred over a region when the annual rainfall is less than 75% of the normal, and a severe drought occurs when the annual rainfall is less than 50% of the normal. Rajasthan's drought-affected regions are falling behind in both agricultural and general economic growth. They feature significant annual swings in agricultural output and revenue, as well as a comparatively high prevalence of poverty. Drought in Rajasthan causes people and animals to relocate to nearby states in search of food and water, upsetting the state's economic balance. In this essay, we attempt to assess how Rajasthan's agricultural industry has fared in the face of drought.*

***keywords:*** *Drought , Agriculture*

**Introduction**

Because even locations with high average rainfall frequently experience acute water scarcity, the traditional perspective on a drought as a phenomena of arid and semi-arid areas is shifting. Cheerapunji, the region with the most rainfall in the world, is experiencing acute water shortages. With an average rainfall of 1100 mm, Orissa's drought startled many. In the Himalayan area, a water shortage is also not unusual. This demonstrates that drought is more closely tied to water resource management than it is to scarcity or a lack of rainfall (or mismanagement). Since 1901, Rajasthan has seen 48 drought years of varying severity (last 102 years). A more thorough research finds that just 9 out of 102 years had no droughts affect any of the districts in the State. The number of years without a drought will be significantly lower at the village level. As a result, drought affects some portions of Rajasthan each year. Despite this, the State views drought as a passing occurrence that can be resolved with short-term remedial measures. This study looks at a variety of drought management challenges in the State with the goal of identifying gaps and outlining suitable solutions to lessen the effects of future droughts. The study is being conducted as a part of the regional drought assessment and mitigation initiative in southwest Asia, which is concentrated on Afghanistan, southern Pakistan, and west India. Rajasthan has been chosen as a main target region in India for this larger initiative. The goals of this particular study are more specifically:

- Examine the impact of drought on production, employment, wages and farms income
- Analyze drought relief expenditure and its' impact on the State Budget
- Examine existing drought management policies and institutions in the State
- Examine issues associated with drought declaration

The analysis is based on secondary data released by several State and Central Government line departments, a review of related publications and research articles, as well as the author's direct encounters with residents in both rural and urban regions. There are eight chapters in the paper, including this one. The second chapter examines the pattern of rainfall and the prevalence of drought in various Rajasthani areas. There is also discussion of issues related to perceptions, responses, and the definition of a drought. The next chapter examines the challenges of drought susceptibility and tries to emphasise the necessity for accurate target area and population identification for effective planning of drought relief activities in the state. The current initiatives are largely based on conventional notions, such as that the only vulnerable groups are those who live below the poverty line (BPL) and those who belong to particular castes, and that the Western portion of the State is the most vulnerable. The following chapter discusses the State's declaration of a drought. The chapters that follow discuss the many effects of droughts, financial management, the effect of drought on state budgets, and governmental responses to the management of droughts. The study's results are outlined in the last chapter.

**Categories of Drought**

Drought can broadly be classified into four major types: meteorological, agricultural, hydrological and societal.

**Meteorological drought**

The standard definition of a meteorological drought is based on a region's rainfall variance from the long-term average. Rainfall distribution is deemed "normal" by IMD when its departure from the long-term average in a given year is between 0 and 19%. A rainfall shortage of 20% to 59% of the long-term average is referred to as "deficient," while a deficiency of 60% or more is referred to as "scanty." IMD defines "moderate drought" as a rainfall departure of -26 to -50 percent from the normal, while "severe drought" is defined as a departure of more than -50 percent (Sikka, 2004). Chronically drought-prone regions are those that have suffered drought for more than 40% of the years with rainfall records, whereas drought-prone regions have experienced drought for 20% to 40% of those years.

**Agricultural drought**

A situation known as an agricultural drought occurs when the soil's moisture content is insufficient to satisfy the needs of a certain crop or set of crops at each stage of growth. It may be brought by by insufficient rain, its uneven distribution, and a late or early monsoon recession, which can cause crops to wilt, produce less, or in the worst circumstances, fail completely. Although there are several methods for calculating agricultural drought, no one method has yet been widely recognised due to the difficulties in monitoring a number of essential characteristics. Aridity index (Ia), calculated by the India Meteorological Department (IMD) as ((AE-PE) x 100/PE), where AE is mean evapo-transpiration and PE is prospective evapo-transpiration, is a measure of agricultural drought. Ia is figured out on a weekly basis. It is serious if the value is 50%. (Sikka, 2004). The severity of the agricultural drought in north India is based on the amount of rain received during the summer monsoon, which causes a decline in the production of kharif crops or the failure of some or all of them because the delicate plants do not receive enough moisture during the critical growth phases or at the time of sowing. CAZRI suggested that AE/PE be determined for the Indian arid zone throughout various phenophases of crop growth to determine the condition of agricultural drought as mild, moderate, and severe (Ramana Rao et al., 1981; Sastri et al., 1982; Ramakrishna, 1993; Rao, 1997; Table 1).

**Table 1. Classification of agricultural drought**

| AE/PE (%) during different phenophases | Drought intensity | Drought code | | |
|---|---|---|---|---|
| | | Seedling (S) | Vegetative (V) | Reproductive (R) |
| 76 – 100 | Nil | $S_0$ | $V_0$ | $R_0$ |
| 51 – 75 | Mild | $S_1$ | $V_1$ | $R_1$ |
| 26 – 50 | Moderate | $S_2$ | $V_2$ | $R_2$ |
| 25 or less | Severe | $S_3$ | $V_3$ | $R_3$ |

Agricultural drought (A) is defined using various combinations of the S, V, and R codes, and the aforementioned categorization is a generalised one that doesn't include any particular crop. In the case of a light agricultural drought, S0 + V1 + R2 = A1, and S3 + V2 + R3 = A3. (Extreme agrarian drought). The programme has been applied to particular crops, such as pearl millet, the main food crop in western Rajasthan. The crop typically grows for 14 weeks, which may be roughly broken down into the pheno-phases of S (3 weeks), V (4 weeks), R (4 weeks), and maturity (M) (3 weeks). With this criteria in mind, calculations of the likelihood and severity of drought for pearl millet at various locations showed that Jaisalmer had the highest likelihood of a severe drought, followed by Barmer and Jodhpur, Jodhpur had the highest likelihood of a moderate drought, and Barmer and Sikar had the lowest likelihood of a drought (Table 2). The frequent entrance of the Arabian Sea branch of the monsoon current in the lower part of the district may be the cause of Barmer's high likelihood percentage of mild drought for the crop. For pearl millet, the likelihood of a moderate to severe drought is lowest in the Sikar district in the east.

**Table 2. Probability of agricultural drought for pearl millet at some stations in western Rajasthan**

| Station | Mean annual rainfall (mm) | Probability of agricultural drought (%) | | | |
|---|---|---|---|---|---|
| | | No drought ($A_0$) | Mild ($A_1$) | Moderate ($A_2$) | Severe ($A_3$) |
| Sikar | 468 | 31 | 44 | 3 | 22 |
| Jodhpur | 368 | 16 | 28 | 16 | 40 |
| Barmer | 260 | 7 | 46 | 7 | 40 |
| Jaisalmer | 189 | 1 | 11 | 9 | 79 |

Source: Sastri et al. (1982).

**Hydrological drought**

Deficiency in surface and subsurface water availability, as determined by lake and reservoir levels, ground water level, stream flow, etc., is referred to as a hydrological drought. Hydrological drought has a phase lag with meteorological and agricultural droughts even though it is caused by a lack of rainfall because it takes longer for hydrological drought to emerge than agricultural or meteorological droughts.

**Societal drought**

Societal drought refers to the effects of agricultural, meteorological, and hydrological droughts on society, particularly with regard to the supply and demand of goods and the average person's purchasing capacity. People who live below the poverty line and landless people are the most severely affected groups in society during droughts. A nation that depends more on agriculture, with a focus on rain-fed agriculture, than it does on other economic sectors, such as the manufacturing industry, etc., is more susceptible to drought because, as soon as agricultural production declines due to drought, a domino effect occurs that lowers commodity availability, lowers purchasing power, and slows economic growth. The result might be hunger, death, and social upheaval. Severe societal drought may even trigger widespread migration in search of food, fodder, water, and employment.

**Human Mortality during Droughts**

Famine-related deaths were common in the years before independence, but they are now uncommon. One estimate states that throughout the 20th century, catastrophic droughts in India killed more than 3 million people and had an impact on 10.9 billion people. The largest and most pervasive droughts in U.S. history affected 67, 66, 69, and 53% of the country, respectively, in 1877, 1901, 1918, and 1987. The most drought-related deaths in the post-independence era occurred between 1965 and 1967, when the nation was more reliant on foreign food aid and its agriculture was more reliant on rain and subsistence farming. Since then, advances in agricultural research and development have led to a "green revolution," the production of enough food for food-scarce areas or periods, while advancements in infrastructure have increased irrigated command areas, resulting in self-sufficiency in food grain production, storage, and public distribution systems. Together, these developments have gradually improved the situation. For instance, Rajasthan's total food grain output climbed from 4.78 million tonnes during the Third Five-Year Plan (1961–1966) to 12.33 million tonnes at the conclusion of the Ninth Five-Year Plan (1997-2002). During the same time span, oilseed output rose from 0.26 million tonnes to 3.14 million tonnes.

**OBJECTIVE OF STUDY**

1. To find out draught intensity in Rajasthan.
2. To find out the impact of drought on total cropped area, production and productivity in Rajasthan.
3. To find out the impact of drought n the use of main agricultural inputs.

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**Figure 1 Geographical location and administrative subdivision of the Rajasthan State in 2001.**

## RESEARCH METHODOLOGY

The study's approach is as follows: Subject Area: For the purposes of the current analysis, the state of Rajasthan was specifically chosen since it is a rural state with about 80 percent of its residents living in villages where agriculture and animal husbandry are the major sources of income. The Rajasthan impoverished farmers' rural economy has been destroyed by drought. Rajasthan's weather varies greatly from area to region, and the state consistently receives less rainfall than is necessary. The agriculture and animal industries of Rajasthan suffered significant damage as a result of. Therefore, it is crucial to research how droughts affect the state's economy and how well the agricultural sector performs. The state of Rajasthan is chosen for the investigation in light of this. Tools for gathering data and using statistical methods: The current study's foundation is secondary data. These figures were gathered from several issues of the statistical abstract, the Rajasthan Agriculture Statistics Report, and other government of India, Rajasthan, and other authorities publications. Correlation Using SPSS techniques, data analysis was done on the acquired information, and correlations between drought intensity and net cropped area, production, productivity, fertiliser usage, distribution of HYV seeds, and plant conservation were found. The following formula has been used to determine the intensity of the drought:

$$\text{Drought intensity:} = \frac{\text{Total number of drought affected districts}}{\text{Total number of districts in Rajasthan}} * 100$$

## RESULTS AND DISCUSSION

### Impact on Area, Production And Productivity

This research evaluates the effects of drought on Rajasthan's overall cultivated area, crop output, and agricultural productivity. Table 1 displays how the Kharif Corps' effects on total cropped area, output, and productivity. Data indicates that total planted area, yield, and productivity of Kharif crops are low when the intensity of the drought is high.

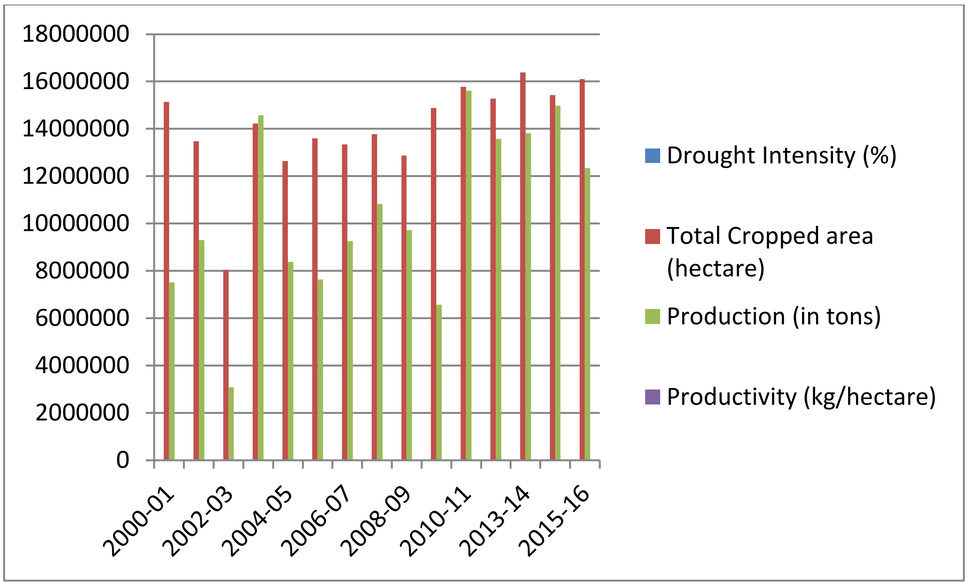
**Table-1 Impact of drought on area, production and productivity (Kharif Crops )**

| year | Drought Intensity (%) | Total Cropped area (hectare) | Production (in tons) | Productivity (kg/hectare) |
|---|---|---|---|---|
| 2000-01 | 96.87 | 15143158 | 7509417 | 496 |
| 2001-02 | 56.25 | 13483567 | 9293387 | 689 |
| 2002-03 | 100 | 8040233 | 3081572 | 383 |
| 2003-04 | 9.37 | 14225720 | 14578489 | 1025 |
| 2004-05 | 96.87 | 12633057 | 8380590 | 663 |
| 2005-06 | 68.75 | 13595594 | 7633566 | 561 |
| 2006-07 | 68.75 | 13337202 | 9253022 | 694 |
| 2007-08 | 67.25 | 13777430 | 10820644 | 785 |
| 2008-09 | 71.70 | 12874820 | 9719530 | 781 |
| 2009-10 | 81.81 | 14877743 | 6561895 | 441 |
| 2010-11 | 6.06 | 15777577 | 15616855 | 988 |
| 2012-13 | 36.36 | 15279890 | 13567690 | 888 |
| 2013-14 | 87.87 | 16378420 | 13821634 | 844 |
| 2014-15 | 69.70 | 15423436 | 14981844 | 971 |
| 2015-16 | 39.39 | 16099728 | 12342637 | 766 |

*Source: Agricultural Statistics*

*Significant at 5% level (two tailed)

** Significant at I% level (two tailed)




Correlation coefficient between drought intensity and total cropped area is (-) 0.41, while it is (-) 0.71** and (-) 0.72** in the case of production and productivity.

Table 2 displays the effect of Rabi crops on cultivated area, production, and productivity. The same conclusions are drawn from this data, namely that Rabi crop productivity, production, and total planted area decrease when the intensity of the drought is high.

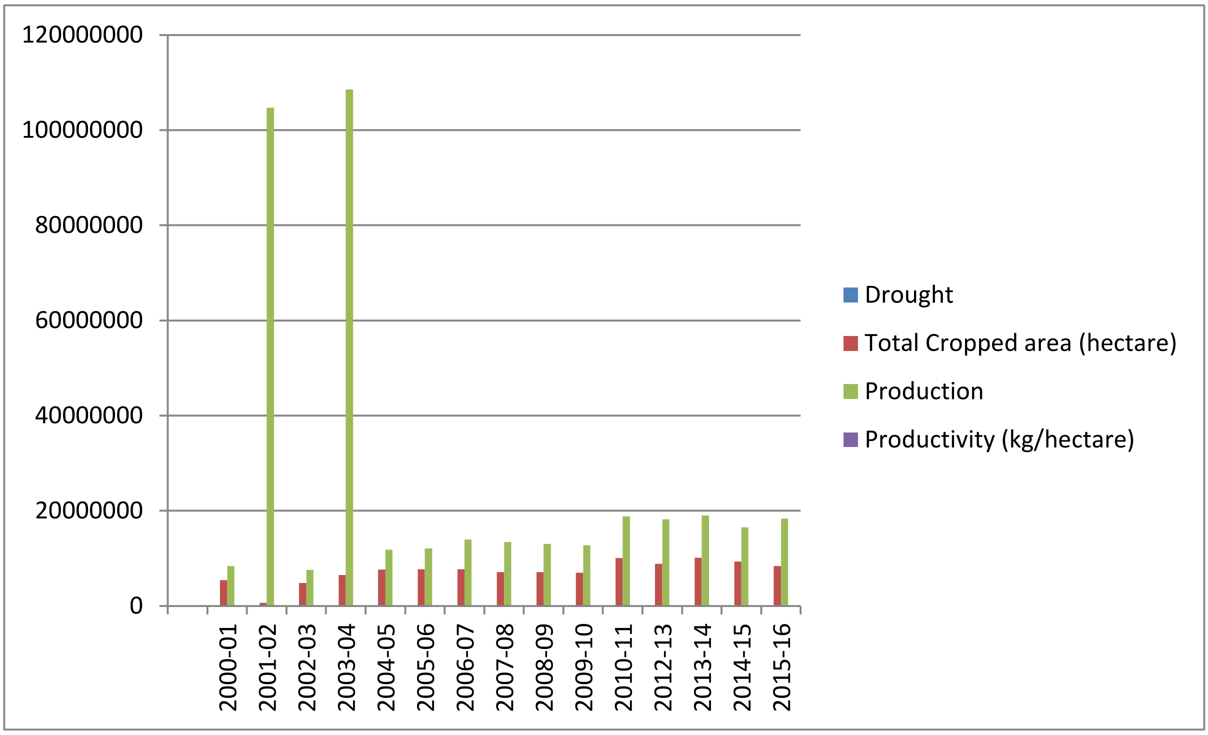
***Table-2 Impact of drought on area, production and productivity (Rabi Crops )***

| year | Drought Intensity (%) | Total Cropped area (hectare) | Production (in tons) | Productivity (kg/hectare) |
|---|---|---|---|---|
| 2000-01 | 96.87 | 5390530 | 8396262 | 1558 |
| 2001-02 | 56.25 | 629629 | 104675515 | 1662 |
| 2002-03 | 100 | 4786756 | 7586693 | 1586 |
| 2003-04 | 9.37 | 6514442 | 108519336 | 1666 |
| 2004-05 | 96.87 | 7637006 | 11802366 | 1545 |
| 2005-06 | 68.75 | 7704256 | 12060245 | 1565 |
| 2006-07 | 68.75 | 7740859 | 13942841 | 1801 |
| 2007-08 | 67.25 | 7126335 | 13452540 | 1905 |
| 2008-09 | 71.70 | 7074540 | 13042512 | 2052 |
| 2009-10 | 81.81 | 6974229 | 12759913 | 1830 |
| 2010-11 | 6.06 | 10042722 | 18787018 | 1870 |
| 2012-13 | 36.36 | 8876994 | 18214785 | 2052 |
| 2013-14 | 87.87 | 10099049 | 19031208 | 1884 |
| 2014-15 | 69.70 | 9326258 | 16545966 | 1774 |

| | | | | |
|---|---|---|---|---|
| 2015-16 | 39.39 | 8392252 | 18325103 | 2183 |

*Source: Agricultural Statistics*

The correlation coefficient between the extent of the drought and the total area under cultivation and output is (-) 0.20 and (-) 0.49, compared to (-) 0.39 for productivity brought on by agricultural growth.




**Impact on use of inputs:**

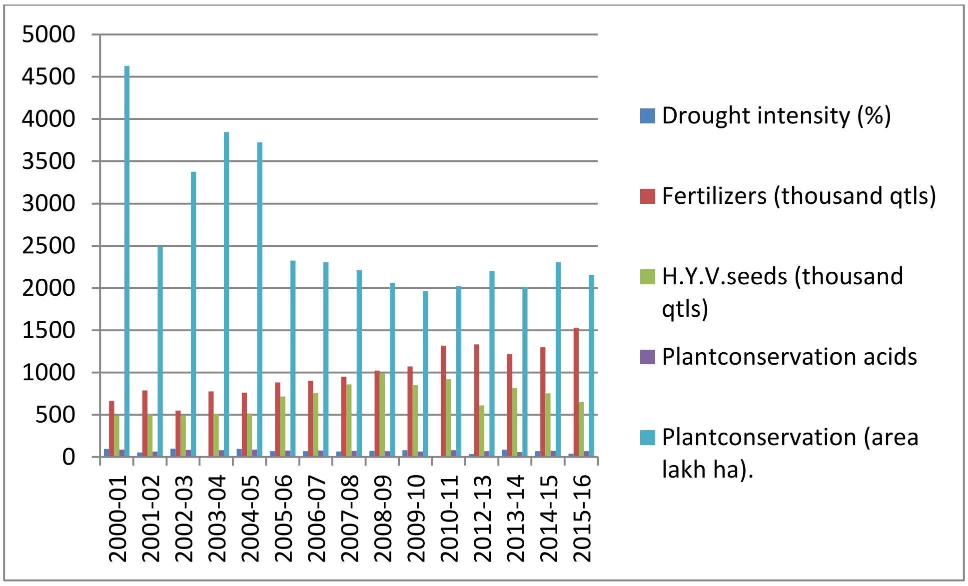
The effect of drought on the usage of agricultural inputs is seen in Table 3 The three primary agricultural inputs are fertilisers, H.Y.V. and enhanced seeds, and pesticides. Data indicates that the usage of fertilisers and better seeds declines when the intensity of the drought is high. The state's agricultural industry is suffering from the drought. The worst scenario occurred in 2002–2003 when there was a severe drought and little of these inputs were used. The similar tendency may also be seen in other variables like the area designated for plant conservation and the use of plant conservation acids. With the drought's increasing severity, less of these inputs are being used.

*Table-3 Impact on use of agricultural inputs*

| year | Drought intensity (%) | Fertilizers (thousand qtls) | H.Y.V.seeds (thousand qtls) | Plant conservati onacids | Plant conservatio n (area lakh ha). |
|---|---|---|---|---|---|
| 2000-01 | 96.87 | 664.0 | 489.95 | 88.32 | 4628 |
| 2001-02 | 56.25 | 789.8 | 504.55 | 65.11 | 2496 |
| 2002-03 | 100 | 550.5 | 483.94 | 86.44 | 3376 |
| 2003-04 | 9.37 | 778.6 | 513.11 | 80.68 | 3847 |
| 2004-05 | 96.87 | 761.3 | 515.11 | 88.23 | 3725 |
| 2005-06 | 68.75 | 884.5 | 717.00 | 76.23 | 2323 |

| | | | | | |
|---|---|---|---|---|---|
| 2006-07 | 68.75 | 901.2 | 757.35 | 76.23 | 2305 |
| 2007-08 | 67.25 | 950.4 | 860.20 | 72.15 | 2210 |
| 2008-09 | 71.70 | 1022.0 | 992.00 | 70.50 | 2060 |
| 2009-10 | 81.81 | 1073.2 | 852.00 | 65.02 | 1962 |
| 2010-11 | 6.06 | 1318.6 | 921.00 | 82.21 | 2023 |
| 2012-13 | 36.36 | 1331.6 | 611.00 | 70.44 | 2198 |
| 2013-14 | 87.87 | 1221.0 | 820.00 | 60.02 | 2013 |
| 2014-15 | 69.70 | 1298.9 | 754.00 | 72.11 | 2304 |
| 2015-16 | 39.39 | 1530.6 | 653.00 | 68.21 | 2156 |

In contrast to H.Y.V. Seeds, the correlation coefficient between the severity of the drought and fertilisers is (-) 0.46 rather than (-) 0.12. The correlation coefficient between the severity of the drought and the area covered by plant conservation measures (+) 0.09, but it measures (+) 0.24 when plant conservation acids are used.




## CONCLUSIONS

Rajasthan was notorious for having frequent droughts decades ago, but recent years have seen a significant decrease in the frequency of these conditions because to government initiatives and policy changes. On the overall area planted to crops, agricultural yield, and crop productivity, droughts have a negative effect. Similar to this, extreme draught conditions have a detrimental effect on the utilisation of numerous agricultural inputs. Since there is a negative link between the intensity of the drought and these factors, according to the data analysis, our initial theory is confirmed and approved. Additionally, the usage of agricultural inputs in the state is impacted by the drought, and the analytical trend reveals that input use was low when the intensity of the drought was high. The correlation study also shows a medium negative link between the region under the drought and the usage of plant conservation acids. The use of fertilisers and H.Y.V. seeds and the severity of the drought have been found to somewhat positively correlate. The state's agricultural growth is what led to the discovery of this relationship.

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