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Inter District and Inter Region Variability of Groundnut Crop in Gujarat: Before and After *BT*-Cotton

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ABSTRACT

The time series data on area, production and productivity of groundnut crop for 31 years were collected for major groundnut growing districts and Gujarat state for the period 1985-86 to 2015-16 from Directorate of Agriculture, Gandhinagar, Gujarat State. The entire study period was divided into two sub-periods on the basis of introduction of *Bt*- cotton as pre *Bt*-cotton and post *Bt*- cotton. Friedman test was used to study the inter district and inter regional variability. The results revealed that the significant variability was observed among districts and regions with respect to area under groundnut, production and productivity of groundnut.

Key Word: Friedman two-way analysis

Introduction

Groundnut (*Arachis Hypogaea* L.) is one of the important oilseed crops among the major oilseed crops. India is one of the world's largest producer of groundnut. India has the largest area under groundnut in the world. Area under groundnut in India was 4596.33 thousand hectare, production was 6733.33 thousand metric tonnes and productivity was 1465 kg/ha during 2016-17. Gujarat is the largest producer of groundnut contributing 43 per cent of the total production during 2016-17. (Anon., 2017c). Japanese biologist, Shigetane Ishiwatari was first discovered Bacillus thuringiensis (*Bt*-cotton) in 1901. *Bt*-cotton was approved in India in March 2002 after stringent assessment for biosafety and profitability. The *Bt*-cotton area increased from 0.4% to 40% of the cotton area in India, in a short period of four years. India became a leading global exporter of raw cotton with exports averaging at 53 lakh bales over nine years from 2003-2011 compared to an average of 1.18 lakh bales during the years 1997 to 2002 prior to the introduction of *Bt*-cotton. (Anon., 2016)

A major increase in cotton area was observed in Gujarat, replacing by groundnut in the Saurashtra region. Cotton priced increased because of quality *Bt*-cotton produced increased. For example in the year 2014, the market price per quintal of cotton varied from Rs. 3800 to 4200 whereas price of groundnut ranged from Rs. 2800 to Rs. 3300 per quintal. Introduction of *Bt*-cotton has larger impact on groundnut area replaced by cotton area that's why production and productivity also decreased. In India area under cotton was about 1634800 hectares, production was 1684600 bales and yield was 175 Kg per hectare during the year 2002-03 which increased to 3010000 hectares, 11089000 bales and 627 Kg per hectare respectively during the year 2014-15. It shows 84.12 per cent, 558.25 per cent and 258.28 per cent increment in area, production and yield respectively. (Anon., 2016)

As the agricultural production is subjected to extent of variation, the growth in agriculture has remained the subject of deep concern in the area of agricultural economics in India and this is true for oilseed production also. The variations in agricultural performance and productivity in India have been studied mostly at the state level, although a few district level studies also exist. States are the appropriate administrative units to study regional variations in many aspects. However, agricultural performance generally differs widely within a state due to varying regional characteristics in terms of resource endowments and climate.

METHODOLOGY:

NATURE AND SOURCE OF THE DATA

The time series data on area, production and productivity of groundnut crop for 31 years were collected for major groundnut growing districts and Gujarat state for the period 1985-86 to 2015-16 from Directorate of Agriculture, Gandhinagar, Gujarat State. The entire study period was divided into two sub-periods on the basis of introduction of *Bt*- cotton as pre *Bt*-cotton and post *Bt*- cotton.

Period-I	1985-1986 to 2001-2002
	(Pre *Bt-* cotton)
Period – II	2002-2003 to 2015-2016
	(Post *Bt-* cotton)
Overall Period	1985-1986 to 2015-2016

Friedman two-way analysis used to test variability between districts and between regions.

Variability based on crop outputs was studied for overall period testing the null hypothesis (H_0) that the inter district and inter region variability in area, production and productivity is of same order against the alternative hypothesis (H_1) that there is significant variability in area, production and productivity between district and region. The regions are divided into four sub regions *viz.,* North Gujarat (Banaskantha and Sabarkantha), Middle Gujarat (Ahmedabad and Kheda), South Gujarat (Surat) and Saurashtra (Amreli, Bhavnagar, Jamnagar, Junagadh, Rajkot, and Surendranagar).

Following steps are involved in application of Friedman's test.

1. Arrange CV % for each district and region in ascending order.

2. Districts and regions are allotted ranks from 1 to K, where K is number of districts and number of regions under study.

3. Obtain the total ranks over different order statistics for each districts and each regions and

4. Compute the test statistics to test null-hypothesis against alternate hypothesis.

$$\chi r^2 = \frac{12}{nK(k+1)} \sum_{j=i}^{k} Rj^2 - 3n(K+1)$$

Where, χr^2= Friedman test statistic distributed as Chi-square variate (k-1) degrees of freedom K = number of districts and number of regions n = number of crop R_j = The sum of ranks of jth district and χr^2 is distributed as Chi-square variate with (k-1) degrees of freedom

Results and Discussion

Test of variability between districts and regions with respect to area, production and productivity

Test of variability between districts

The value of Freidman test statistic for area under groundnut, production and productivity of groundnut (χ_r^2 = 294.79, 245.40 and 75.74, respectively) in different districts of Gujarat was found to be significant implying the rejection of null hypothesis *i.e.* the variability was present among districts with respect to area under groundnut, production and productivity of groundnut.

Table 1: Test of variability between districts and regions

Between districts	χ_r^2	Sig.
Area	294.79	0.01
Production	245.40	0.01
Productivity	75.74	0.01
Between regions	χ_r^2	Sig.
Area	84.87	0.01
Production	70.55	0.01
Productivity	15.80	0.01

Test of variability between regions

The value of Freidman test statistic for area under groundnut, production and productivity of groundnut (χ^2 = 84.87, 70.55 and 15.80, respectively) in different regions of Gujarat was found to be significant implying the rejection of null hypothesis *i.e.* the variability was present among regions with respect to area under groundnut, production and productivity of groundnut.

Conclusion

Significant variability was present among districts and regions with respect to area under groundnut, production and productivity of groundnut.

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