

## DYNAMICS OF GUAR CULTIVATION IN RAJASTHAN IN POST GLOBALIZATION PERIOD

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**Abstract:** *The purpose of the present paper is to unravel the spatio-temporal changes in guar cultivation and factors responsible in Rajasthan from 1990-91 to 2020-21. This paper has three folds. In the first part, the spatial patterns of guar cultivation for the time period 1990-91, 2005-06 and 2020-21 are explained. The second part finds out the changes in guar cultivation during study period. While conclusions are drawn and suggestions are made in third part. The study has found that the guar area has increased from 9.17 percent in 1990-91 to 9.89 percent in 2005-06 and 10.84 percent in 2020-21 and registered an overall increase of 1.67 percent in the study region. Jaisalmer district has recorded highest area of 44.91 percent under its cultivation, while Bikaner and Hanumangarh districts have noted highest positive change of 18.85 percent and 24.42 percent, respectively, during study period. It is also observed that districts of Jaisalmer, Barmer, Jodhpur, Bikaner, Ganganagar, Hanumangarh, Churu, Nagaur, Jhunjhunu, and Sikar have registered over 6 percent of total cropped area under guar cultivation, which shows that its cultivation is largely confined to the Thar Desert of India and reasons identified are sandy soil, high temperature, low rainfall, low to moderate extent of irrigation, traditionally guar growing areas, high demand and high price that ensure higher and assured economic returns to farmers. It is suggested that guar cultivation should be encouraged by the Government policies, State Agricultural Universities, and Agricultural Research Institutes. The study is based on secondary sources of data, which is obtained from Statistical Abstracts of Rajasthan. Three time periods of 1990-91, 2005-06 and 2020-21 are selected, statistical methods and cartographic techniques are used.*

**Key words:** Spatio-Temporal, Government Policy, Change, Factors, Thar Desert.

## Introduction

The name guar is believed to have arisen from the Sanskrit words “gau and ahaar” which mean fodder for cow (Garg, 1986). It is a multi-purpose crop which can be used as animal feed, vegetable, green manure and for extraction of gum for various industrial uses. Guar gum is used in many different industries, including food processing, oil and gas, paper, textile, cosmetics, mining, and explosives (Bhupender et al. 2020). Guar, also known as cluster bean, has traditionally been used as a fodder and vegetable crop. Because of its ability to fix nitrogen in the soil, it also serves green manure (Abidi et al. 2015; Singh et al. 2018). Guar is a drought-hardy, deep-rooted, annual legume grown in the summer season. In India, guar is mainly grown in the dry habitats of Rajasthan, Haryana, Gujarat, and Punjab and to a limited extent in Uttar Pradesh and Madhya Pradesh. Guar is also grown in Pakistan as a cash crop, and to a limited extent in other parts of the world such as Australia, Bangladesh, Brazil, Myanmar, South Africa, southwestern USA, and Sri Lanka (Kuravadi et al. 2013; Ravelombola et al. 2021). India is the largest producer of Guar and contributes about 85 percent of total Guar production in the world in 2021-22 (Sindhuja et al. 2022). Total production of Guar grain in India is estimated to have crossed 2.7 million metric tons during the agricultural year 2013-14 (Sharma et al. 2014; Adams et al. 2020). About 98 percent of guar cultivation is concentrated in just these three states i.e., Rajasthan, Haryana and Gujarat. Rajasthan is the most important guar-growing state and accounts for more than 80 percent of area under guar cultivation in the country (Arora, 1988; Rai, 2015). In the context of Rajasthan, it is India’s largest State which ranked first in guar production. The districts of Bikaner, Churu, Ganganagar, Hanumangarh, Jodhpur, Barmer, Nagaur, Pali and Jaisalmer account for about 80 per cent of the total production in Rajasthan (Sharma & Gummagolmath, 2012; Sharma et al. 2014). It is a legume crop and due to its pods like arrangement in clusters, it is also known as cluster beans. This crop is native to India as it was originated here and produced in the hot weather, mostly in arid zone because it is able to tolerate the high temperature (Yadav & Shalendra, 2014; Alexander et al. 1988). Guar is a type of crop which mainly grows in desert areas of Rajasthan and used as a fodder also. India ranks first in growing guar in the world and it is only possible because this crop is draught tolerant. 70-80 percent of the world’s total production is produced by India. Though, the range of temperature for this crop to grow lies between 30°C to 38°C yet it can also survive even in 45°C because of its heat tolerance capacity. It can grow with 20 to 40 cm rainfall in sandy-to-sandy loam soils (Bhalla, 2011; Saxena, 2019).

## Study Area

Rajasthan is located between 23° 3’ to 30° 12’ North latitude and 69° 30’ to 78° 17’ East longitudes. It is the largest state of India from the view point of area; its total area is 3, 42,329 sq. km. which is equivalent to about 10.41 percent area of the Indian sub-continent. It shares its boundary with Pakistan in the west, linked with the north-eastern parts of Haryana and south-eastern parts of Madhya Pradesh. It also shares its boundary with Punjab in the north, Gujarat on the southern side and Uttar Pradesh on the east. The study area from physiographical point of view, these are sand dunes, Aravalli’s, eastern Rajasthan plains, and Hadoti plateau in Rajasthan. This area is blessed with eight river systems namely Chambal-Banas drainage system, Mahi drainage system, Sabarmati drainage, western Banas-Sipu drainage, Gambhir drainage, Ghaggar drainage, Luni-Jawai-Sukri drainage, and inland drainage system of Rajasthan. The soils of Rajasthan can be divided into eight soil systems namely desert soil, dune soil, brown soil, sierozems soil, red soil, alluvial soil, hill soil, saline and sodic soils, etc. Its total population is 68.5 million according the census of 2011. Rajasthan has been divided into 7 divisions, 33 districts, 289 sub-divisions, 314 tehsils, 297 towns and total 44672 villages for administrative purposes.

## Objectives

- To describe the spatial patterns of guar cultivation in Rajasthan: 1990-91, 2005-06 and 2020-21.
- To explore the changes in guar cultivation during 1990-91 to 2020-21.
- To identify factors responsible for changes in guar cultivation.
- To conclude and make suggestions.

## Methodology

The present study is based on secondary sources of data. The district is taken as unit of study. Three time periods are selected for the present study i.e.1990-91, 2005-06 and 2020-21. During the study period, Rajasthan has undergone some changes in its administrative boundaries. Thus, for making the unit of analysis comparable for each time period, the administrative boundaries of 2020-21 are taken as basis and adjustments are made in data by subtracting the figures of new units from their respective parent units. The cartographic method is used for mapping the results.

## Discussion and Results

An attempt is made to explain the spatial patterns and changes in guar cultivation in Rajasthan during 1990-91 to 2020-21 under the following heads.

1. Spatial Patterns of Guar Cultivation in Rajasthan: 1990-91
2. Spatial Patterns of Guar Cultivation in Rajasthan: 2005-06
3. Spatial Patterns of Guar Cultivation in Rajasthan: 2020-21
4. Changes in Guar Cultivation in Rajasthan: 1990-91 to 2020-21

### Spatial Patterns of Guar Cultivation: 1990-91

Guar cultivation had 9.17 percent of the total cropped area in Rajasthan in the year 1990-91 which varied from 0.02 percent in Jhalawar district to 43.47 percent in Jaisalmer district. For identifying the reasons of its uneven spatial distribution in the state, and for making an in-depth study fig. 2 is mapped, which reveals the following three categories.

#### Areas of High Share of Guar Cultivation (> 12 percent)

High share of guar production was found in Sikar, Nagaur, Jhunjhunu, Jalore, Jaisalmer, Ganganagar, Churu, Bikaner and Barmer with approximately 27 percent of total occurrences. Generally, because of the low fertility and frequent occurrences of sand dunes, this crop was grown in northern and western parts of Rajasthan. More specifically guar concentration was confined to west of Aravalli's or western Rajasthan. Other reasons were inadequate irrigation facilities, very low rainfall, easy marketing and higher economic returns than other crops in this belt. Thus, all these mentioned factors were responsible for high percent share of guar crop in this category.

#### Areas of Moderate Share of Guar Cultivation (6-12 percent)

Jaipur and Jodhpur districts form this category. These districts were known as bajra growing which considered as a traditional crop, because of the dry climate, sandy soils and low irrigation facilities. These conditions were also favorable for guar cultivation, thus farmers also cultivated guar, because of its higher economic returns and assured marketing. Which led to its moderate share in these districts.

#### Areas of Low Share of Guar Cultivation (< 6 percent)

There are 22 districts which were under low category of guar cultivation which comprised 66 percent of total occurrences. Low category was further categorized into one belt, and one patch. The belt covered the districts of Udaipur, Tonk, Sirohi, S. Madhopur, Rajasmand, Pratapgarh, Pali, Kota, Karauli, Jhalawar, Dungarpur, Dholpur, Dausa, Chittorgarh, Bundi,

Bhilwara, Bharatpur, Baran, Banswara, Alwar and Ajmer. These districts had received moderate to high rainfall, occurrence of Aravalli's, Hadoti plateau, sandy loam to black soil, moderate to high extent of irrigation, semi developed agricultural infrastructure, etc. which were ideal for bajra, jowar in central and south-eastern parts, maize in south and south-eastern parts. Thus, the guar cultivation had low percent share in cropping pattern. The patch of this low category had Hanumangarh districts, where though high temperature, low rainfall, sandy soils were found, yet moderate extent of irrigation enthused the farmers for cotton cultivation. Moreover, this district was bajra predominant growing area. Hence, consequently the percent share of guar cultivation was registered low. The study has observed that areas with frequently occurrences of sand dunes, low rainfall, high temperature, low extent of irrigation, sandy to sandy loam soil, underdeveloped agricultural infrastructure, etc. had generally low to moderate share of guar cultivation. But areas with high temperature, moderate to high rainfall, sandy loam to black soils, moderate to high extent of irrigation, comparatively developed agricultural infrastructure, etc. have registered low percent share of guar cultivation.

**Table 01: Percent Share of Guar Cultivation in Rajasthan: 1990-91**

District	Percent	District	Percent
Ajmer	0.22	Jaisalmer	43.47
Alwar	3.67	Jalore	14.2
Banswara	0.07	Jhalawar	0.02
Baran	0.03	Jhunjhunu	12.03
Barmer	24.9	Jodhpur	6.95
Bharatpur	0.69	Karauli	0.41
Bhilwara	0.78	Kota	0.02
Bikaner	12.32	Nagaur	12.73
Bundi	0.18	Pali	0.81
Chittorgarh	0.82	Pratapgarh	0.02
Churu	28.22	Rajsamand	0.48
Dausa	2.63	Sawai Madhopur	0.52
Dholpur	0.74	Sikar	18.93
Dungarpur	0.28	Sirohi	3.6
Ganganagar	12.48	Tonk	1.03
Hanumangarh	1.6	Udaipur	0.11
Jaipur	6.73	<b>Rajasthan</b>	<b>9.17</b>

Source: Directorate of Economics and Statistics, Rajasthan

### **SPATIAL PATTERNS OF GUAR CULTIVATION: 2005-06**

It covered 9.89 percent of the total cropped area of the state. The lowest share was held by Jhalawar district with 0.01percent cultivation and highest with Jaisalmer district with 53.68 percent. Fig. 3 is prepared which helps to discuss its spatial patterns, because it depicts three categories which are elaborated as follow:

#### **Category of High Share of Guar Cultivation (> 12 percent)**

Districts included in high share of guar cultivation were Jaisalmer, Churu, Hanumangarh, Ganganagar, Bikaner and Barmer with the total occurrence of 18.17 percent of cropped area. There is one belt which contained all these districts which laid in western parts of Rajasthan. The production of guar was high because of sandy soil, desert topography, high temperature and low rainfall, low to moderately developed agricultural infrastructure, low to moderate extent of irrigation, higher economic returns than bajra, etc. All these geo-climatic and socio-economic conditions created ideal growing conditions for guar crop and as a result, farmers gave preferred to its cultivation which ultimately led to high proportion of area under guar cultivation in this category.

### Category of Moderate Share of Guar Cultivation (6-12 percent)

Districts of Bikaner, Jhunjhunu, Sirohi, Sikar, Nagaur, Jodhpur, Jhunjhunu, Jalore and Jaipur formed moderate category of guar cultivation. It was also found in a compact belt which laid to the east of high category of guar cultivation. These districts had also hot-arid climatic conditions, sandy to loamy soils, low to moderate extent of irrigation, moderately developed agricultural infrastructure, predominance of Bajra in kharif season, etc. These factors were responsible for moderate share of guar cultivation in these districts.

**Table 02: Percent Share of Guar Cultivation in Rajasthan: 2005-06**

District	Percent	District	Percent
Ajmer	1.26	Jaisalmer	53.68
Alwar	3.83	Jalore	7.38
Banswara	0.92	Jhalawar	0.01
Baran	0.02	Jhunjhunu	8.34
Barmer	13.81	Jodhpur	11.06
Bharatpur	1.51	Karauli	1.4
Bhilwara	2.29	Kota	0.96
Bikaner	16.12	Nagaur	10.01
Bundi	0.44	Pali	4.28
Chittorgarh	1.82	Pratapgarh	0.77
Churu	25.71	Rajsamand	2.61
Dausa	3.25	Sawai Madhopur	1.63
Dholpur	1.13	Sikar	11.16
Dungarpur	1.72	Sirohi	7.41
Ganganagar	13.42	Tonk	2.58
Hanumangarh	18.53	Udaipur	2.36
Jaipur	8.44	<b>Rajasthan</b>	<b>9.89</b>

Source: Directorate of Economics and Statistics, Rajasthan

### Category of Low Share of Guar Cultivation (< 6 percent)

The remaining twenty districts of Rajasthan had low share of guar cultivation, which varied from 0.02 percent in Baran district to 4.28 percent in Pali district. These districts were Udaipur, Tonk, S. Madhopur, Rajasmand, Pratapgarh, Pali, Kota, Karauli, Jhalawar, Dungarpur, Dholpur, Dausa, Chittorgarh, Bundi, Bhilwara, Bharatpur, Baran, Banswara, Alwar and Ajmer. These areas had sandy loam to clay and black soils, moderate to high extent of irrigation, moderate to high rainfall, traditionally non-guar growing areas. These were bajra, jowar, maize, predominant areas, etc. Hence, in these districts' guar cultivation had its insignificant share in the cropping pattern. It is concluded that guar cultivation was concentrated in western half of Rajasthan, where there was harsh physical environment, low to moderate extent of irrigation, less developed agricultural infrastructure, etc. while areas with moderate to high rainfall, comparatively fertile soils which ranged from sandy loam to black soils, moderate to high extent of irrigation, had predominance of bajra, jowar and maize crops, etc. All these factors had led to low share of guar cultivation in this category. Moreover, its cultivation patterns also inverse to rainfall regime, because as rainfall started increasing its cultivation started declining.

### SPATIAL PATTERNS OF GUAR CULTIVATION: 2020-21

Guar has 10.84 percent of the total cropped area of the state under its cultivation in 2020-21. The lowest share is held by Jhalawar district with 0.01 percent and highest of 41.95 percent Jaisalmer district. Fig. 4 is mapped to show the spatial patterns of guar cultivation in Rajasthan, which helps to understand the factors responsible for its variation. Its exhibits the following three categories.

### Districts of High Share of Guar Cultivation (> 12 percent)

Districts fall under high share of guar category are Jaisalmer, Hanumangarh, Ganganagar, Bikaner and Barmer with the total occurrences of 15.15 percent. This category has a compact

belt which confined to western parts of Rajasthan. The share of guar cultivation is high because of high temperature and low rainfall, moderately developed agricultural infrastructure and inadequate irrigation facilities, higher and assured economic returns and easy marketing. These factors have enthused the farmers to shift from water-intensive crops to crop which require less water and can be grown in harsh climatic conditions. Thus, farmers have preferred to growing of guar crop.

**Table 03: Percent Share of Guar Cultivation in Rajasthan: 2020-21**

District	Percent	District	Percent
Ajmer	1.64	Jaisalmer	44.91
Alwar	0.71	Jalore	5.89
Banswara	0.05	Jhalawar	0.01
Baran	0.02	Jhunjhunu	8.62
Barmar	16.8	Jodhpur	8.33
Bharatpur	0.52	Karauli	0.02
Bhilwara	0.58	Kota	0.01
Bikaner	31.17	Nagaur	5.68
Bundi	0.04	Pali	3.11
Chittorgarh	0.42	Pratapgarh	0.01
Churu	11.67	Rajsamand	1.95
Dausa	2.15	Sawai Madhopur	0.18
Dholpur	0.15	Sikar	11.19
Dungarpur	0.23	Sirohi	5.87
Ganganagar	20.87	Tonk	0.26
Hanumangarh	26.02	Udaipur	2.66
Jaipur	4.24	<b>Rajasthan</b>	<b>10.84</b>

Source: Directorate of Economics and Statistics, Rajasthan

#### **Districts of Moderate Share of Guar Cultivation (6-12 percent)**

Moderate share of guar cultivation consists of four districts, namely Sikar, Jodhpur, Jhunjhunu and Churu. It has one belt and one patch. The belt covers districts of Churu, Jhunjhunu and Sikar, while the patch includes Jodhpur district. All these districts have hot arid climatic conditions which are suitable for guar crop, but being traditionally bajra growing districts, guar is introduced few years back, because of it higher economic returns and easy marketing. Thus, its share is noted moderate.

#### **Districts of Low Share of Guar Cultivation (< 6 percent)**

Highest number of districts fall in this category as guar is not grown as significant crop in most of the districts of the low category. These districts are Udaipur, Tonk, Sirohi, S. Madhopur, Rajasmand, Pratapgarh, Pali, Kota, Karauli, Jhalawar, Jalore, Jaipur, Dungarpur, Dholpur, Dausa, Chittorgarh, Bundi, Bhilwara, Bharatpur, Baran, Banswara, Alwar and Ajmer. These districts have a high to moderate temperature, high rainfall, presence of Aravalli ranges, moderate to high extent of irrigation, large variety of soils, bajra, jowar, maize, growing predominant areas, etc. All this has led to low share of guar cultivation in the districts of this low category.

#### **CHANGES IN GUAR CROP OF RAJASTHAN: 1990-91 TO 2020-21**

Rajasthan has gone through some important changes in its physio-socio-economic-technological from 1990-91 to 2020-21 period. Some of the sand dunes in western Rajasthan having leveled by the farmers. Leveling of land near the Aravalli's reclamation of kallar soils, soil building measures, increase in irrigation facilities, introduction of sprinkler irrigation, increase in tractors density, tube-wells density, road density, and accessibility to marketing, Agriculture Research and Extension Services by state Agricultural Universities and Research

Institutes, Government policies, awakening among farmers about the latest farming techniques, etc. All these factors combined lead to changes in cultivation. Hence, guar cultivation in Rajasthan has increased from 9.17 percent in 1990-91 to 10.84 percent in 2020-21, and registered a positive change of 1.67 percent. Some districts have noted positive changes, while others have registered negative changes. For knowing spatial-temporal changes in guar cultivation during period under present investigation, help is taken from fig. 5 and table 4, which yield the following categories:

**Table 04: Volume Change in Guar Cultivation in Rajasthan: 1990-91 to 2020-21**

District	Percent Change	District	Percent Change
Ajmer	1.42	Jaisalmer	1.44
Alwar	-2.96	Jalore	-8.31
Banswara	-0.02	Jhalawar	-0.01
Baran	-0.01	Jhunjhunu	-3.41
Barmer	-8.1	Jodhpur	1.38
Bharatpur	-0.17	Karauli	-0.39
Bhilwara	-0.2	Kota	-0.01
Bikaner	18.85	Nagaur	-7.05
Bundi	-0.14	Pali	2.3
Chittorgarh	-0.4	Pratapgarh	-0.01
Churu	-16.55	Rajsamand	1.47
Dausa	-0.48	Sawai Madhopur	-0.34
Dholpur	-0.59	Sikar	-7.74
Dungarpur	-0.05	Sirohi	2.27
Ganganagar	8.39	Tonk	-0.77
Hanumangarh	24.42	Udaipur	2.55
Jaipur	-2.49	<b>Rajasthan</b>	<b>1.67</b>

Source: Directorate of Economics and Statistics, Rajasthan

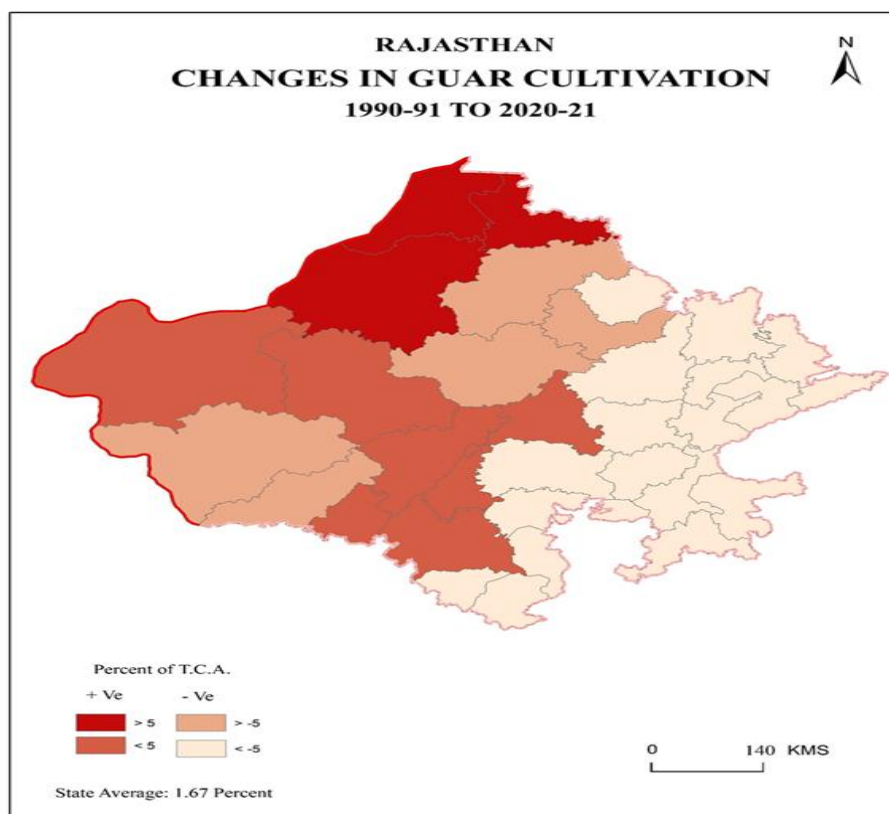
#### **Category of High Positive Volume of Change (> 5 percent)**

Three districts namely Bikaner, Ganganagar and Hanumangarh, form this category. Here, the positive change in guar cultivation varies from 8.39 percent in Ganganagar to 24.42 percent in Hanumangarh district. These districts are ideal for guar cultivation, because farmers are well awakened who know the economic and market aspects of guar. Moreover, guar yield higher and assured economic returns as compared to bajra and cotton in kharif season followed by developed agricultural infrastructure, favorable physical environment, etc. Hence, all these factors become responsible for high positive volume of change (> 5 percent) in guar cultivation.

#### **Category of Low Positive Volume of Change (< 5 percent)**

It contains seven districts, namely Barmer, Jodhpur, Ajmer, Pali, Rajasmand, Sirohi and Udaipur. In all these districts, percent change is mapped minimum of 1.38 percent in Jodhpur district and maximum of 2.55 percent in Udaipur district. The low positive change in respect of Jaisalmer is owing to its highest share 43.47 percent in 1990-91, which has increases to 44.91 percent in 2020-21 and recorded 1.44 percent of change. Thus, there is not much scope for further increasing in area under guar, though geo-climatic and socio-economic conditions are ideal for its cultivation. The low positive maximum change in case of Udaipur, Rajasmand and Ajmer is because there were non-guar growing areas in 1990-91. Thus, the share was less than 0.05 percent in 1990-91. But in recent years, owing to its economic significance, farmers have started cultivating this crop, which has resulted into low positive change. Therefore, these are different factors for different districts for low positive change in this category.

**Figure 01: Changes in Guar Cultivation, 1990-2020-21**



#### **Category of High Negative Volume of Change (> -5 percent)**

Five districts which lay in western Rajasthan form this category. It has two belts. First belt comprises districts of Churu, Sikar and Nagaur. These districts were significant guar growing areas in 1990-91. All districts had over ten percent area under their cultivation which varied between 12.36 percent in Nagaur and 28.22 percent in Churu district. Churu was the second largest guar growing area after Jaisalmer in 1990-91. But in 2020-21 with increasing irrigation facilities, reclamation of land, etc. have increased area under Rabi crops like wheat, pulses, oilseeds, etc. which is mainly responsible for its declining percent share in the cropping pattern in these districts which ultimately lead to maximum negative volume of change of guar crop (Statistical Abstract of Rajasthan, 1990-91 and 2020-21). Second belt had Barmer and Jalore districts. These were also important guar growing districts with 14.02 percent and 24.90 percent. Still, these are important guar growing areas, but their percent share has declined because of increase in area under Rabi crops, especially pulses.

#### **Category of Low Negative Volume of Change (< -5 percent)**

The remaining districts which are eighteen in number have witnessed low negative volume of change, which is less than 5 percent. This category includes the districts of Alwar, Banswara, Baran, Bharatpur, Bhilwara, Bundi, Chittorgarh, Dausa, Dholpur, Dungarpur, Jaipur, Jhalawar, Jhunjhunu, Karauli, Kota, Pratapgarh, Sawai Madhopur and Tonk. It ranged from minimum of -0.01 percent in Baran districts and highest of -3.41 percent in Jhunjhunu district. Except Jhunjhunu, Jaipur and Alwar, these are insignificant guar-growing districts throughout the study period. Where the percent share was almost less than 1.0 percent. These are non-guar growing areas, because of high rainfall, irrigation facilities, the Hadoti Plateau, predominance of Bajra, Maize, Jowar, etc. and as a result all these districts have noted less than 5 percent negative of change.

## Conclusion and Suggestions

It observed that guar cultivation has moderate to high share in the cropping pattern of the districts lying west in Aravalli's throughout the three time periods, because western parts have ideal geo-climatic conditions for its cultivation like high temperature, low rainfall, frequently occurrences of sand dunes, sandy to sandy loam soil followed by traditionally guar growing areas, low extent of irrigation, semi developed agricultural infrastructure, etc. whereas, districts with moderate to high temperature, moderate to high rainfall, sandy loam to black soil, moderate to high extent of irrigation, comparatively semi developed to developed agricultural infrastructure have registered low percent share of guar cultivation. The study has also deduced that during 1990-91 to 2020-21 period area under guar cultivation has increased from 9.17 percent to 10.87 percent. Highest positive percent change of 24.24 percent is experienced by Hanumangarh district followed by 18.35 percent in Bikaner district. But the highest negative change of 16.55 percent is noted in Churu district. It is also noted development of irrigation facilities and development in agricultural infrastructure have led to increase in area under pulses, oilseeds, etc. which has also affected the changes in percentage share of guar crop. Finally, it is found that the pattern of rainfall and pattern of guar cultivation are largely inverse to each other. The study has also suggested that area under guar cultivation should be increased by providing high quality seeds, assured marketing, setting up of guar processing plants, liberal credit facilities to farmers, favorable government policies, etc.

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