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## Trends of maize production in Jammu & Kashmir

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**Abstract**

An attempt was made in this study to analyze the trends in maize production in the state employing chronological data from 1980-81 to 2015-16, collected from various issues of Digest of Statistics, GoJK. The results of this study revealed a discouraging scenario of maize in the state. The area under this crop has been increasing steadily till 2000-01 but in recent years its area has declining; consistent with which the production of maize has also shown a decline. The decline in area coupled with stagnant productivity of the crop in the state is really a cause of concern and need to be addressed on priority. The productivity level at the state level appears unsatisfactory though it is relatively better for Kashmir valley. The decomposition analysis have shown that while area effect has a positive contribution in increase in maize production, the productivity and interaction of area and productivity effects have negatively contributed to production differential of maize between 1980-81 and 2015-16. The study emphasis upon an important role of institutions in addressing the various issues confronting maize production in the state. The study came up with few policy suggestions worth emulating for the development of maize crop in the state.

**Keywords:** maize, trends, decomposition analysis, Jammu & Kashmir

**Introduction**

According to projections made by the IFPRI, during the period 1990-2020, demand for maize in least advanced countries (LAC) will grow at an average annual rate of over 2 per cent, fuelled by population growth and per capita income gains (Rosegrant *et al*, 1995) [3]. Maize requirements in the developing world alone will surpass the demand for both wheat and rice and will increase from 282 million tons in 1995 to 504 million tons in 2020 (Baba and Mir, 2018) [1]. In Asia, maize demand is expected to rise from 138 million tonnes in 1993 to 243 million tonnes, accounting for 60 per cent of the global increase in maize consumption by 2020 (Baba and Mir, 2018) [1]. Asia contributes about one-third to the world's total maize production with China taking the lead both in terms of yield and harvested area. The rapid adoption of high-yielding/improved maize varieties in Asia has led to significant yield increases in the favourable rain-fed and irrigated maize growing areas. In recent years, the majority of farmers in favourable maize growing areas have switched to improved/hybrid varieties for its superior yield and profit, despite the higher seed cost. India is one of the major producers of maize in the world (USDA-FAS, 2013) [6] and this crop constitutes about 9 per cent of the total quantity of cereals produced in the country. Commensurate with rising demand in India, maize has been placed in the National Food Security Mission. KPMG (2013) [2] has estimated that India would require over 44 Mt of maize by 2022-23. To keep pace with projected demand, maize production has to increase significantly and the major emphasis would be on yield gains.

Jammu & Kashmir, one of the Himalayan states of India, is the traditional maize growing region in the country. Augmentation of maize productivity is imperative for uplifting smallholder farmers in the state. R&D institutions have developed a number of varieties and input technologies for the development of maize sector of the state. Besides, the state government also promotes composite seeds through State Seed Corporation and the promising varieties are generally procured from the private sector (Sood, 2011) [5]. However there are apprehensions about the stagnant or declining productivity of maize in the state. In this backdrop, the present study intends to investigate in the growth scenario of maize crop in the state.

**Methodology**

The study was based upon secondary data collected from various published and unpublished records of different Directorates/offices of Government of Jammu & Kashmir.

**Growth analysis:** The period-wise annual growth rates for area, production and yield of maize were estimated for by employing exponential function of following form:

$$Y_t = A B^t \dots\dots\dots I$$

Where,  $Y_t$  = Area/production/yield of maize for the year 't'  
 A = Constant  
 B = Regression coefficient  
 t = Time variable (1, 2 ...n (for each period.)

The function (I) was estimated separately for each variable in log linear form by using ordinary least square (OLS) procedure. Later the compound growth rates (CGR) were worked out by the following formula:

$$CGR = (\text{antiLn}B-1) \times 100$$

$$\text{Standard error (SE)} = (100 B/\text{Ln}10^e) \times \text{SQRT} ((\sum \text{Ln}Y^2 - (\sum \text{Ln}Y)^2/N - \text{Ln}B(\sum t \text{Ln}Y - \sum t \sum \text{Ln}Y/N) / (N-2) (\sum t^2 - (\sum t)^2/N))$$

The calculated growth rates were then tested for their significance by using t-statistics, the t-values of the growth rates were obtained by dividing compound growth rates with corresponding standard error as:

$$t_{cal.} = CGR/SE$$

An attempt has also been made to examine the effect of area, productivity and their interactions towards changing maize production in the state. The interaction effects were obtained by using the following method (Sharma, 1977)<sup>[4]</sup>.

$$\Delta P = Y_0 \Delta A + A_0 \Delta Y + \Delta A \Delta Y$$

$$\Delta A = A_n - A_0$$

$$\Delta Y = Y_n - Y_0$$

Where,  $\Delta P$  is the differential production,  $\Delta A$  is change in area,  $\Delta Y$  is change in yield.  $A_0$  and  $Y_0$  are area and yield, respectively in the base year. The first, second & third item on the right side of equation represents area, productivity and interaction effect, respectively in the maize production over the years.

**Results & Discussion**

**Growth of maize in Jammu & Kashmir**

Maize is one of the important crops grown generally under rain-fed conditions in temperate region (Kashmir) of Jammu & Kashmir. Maize production in J&K has touched about 5.2 million quintals in 2015-16 and has experienced a meagre increase since 1980-81. The area, production and yield of maize in J&K during the last three decades is reported in Table 1. The area under maize has expanded by about 19 thousand hectares since mid 1980s' and has an allocation of about 2.9 lakh hectares in 2015-16 (Table 3). Despite the area increase, the share of this crop in total sown area has declined by 3 per cent since 2005-06 and since late 2000s' the area under maize has shown a declining trend.

**Table 1:** Area, production and yield of maize in J&K

Year	Area(000 ha)	% of TSA	Prod. (000 q)	% of FGP	Yield (q/ha)
1980	275	28.3	4933	37.8	17.93
1990	295	27.6	4440	32.5	15.06
2000	330	29.6	5258	47.0	15.92
2010	308	27.0	5277	34.7	17.12
2015	294	25.4	5237	30.1	17.82

TSA = Total sown area and FGP = Foodgrain production

The production of maize has increased steadily over the years though the output curve exhibited a flat stretch with lesser fluctuations between 1993 and 2005 (Figure 1). Consistent with the area allocation, the maize production has shown a fluctuating pattern and has shown an increase over 3 lakh quintals though its behavior seems stagnant since mid 1990s'. The maize production was seen to keep pace with productivity level of this crop. In 2015-16 despite decline in the area under maize, its production has increased on account of productivity gains.

To analyze the growth pattern of area, production and productivity of maize in the state, the entire period from 1980-81 to 2015-16 was categorized into two sub-period for clarity and comparison. The estimates of compound growth rates revealed that the area under maize has increased significantly since mid 1980-81 (Table 2). The growth estimates revealed that the area under maize has increased at an annual rate of 0.60 per cent in period I, however, in later period its area start declining significantly at -0.49 per cent per year. The growth pattern of production and yield of maize has been discouraging and thereby signifies the role of technologies for strengthening economy of this crop in the state.

**Table 2:** Growth pattern of area, production and yield of maize in J&K (CGR in %)

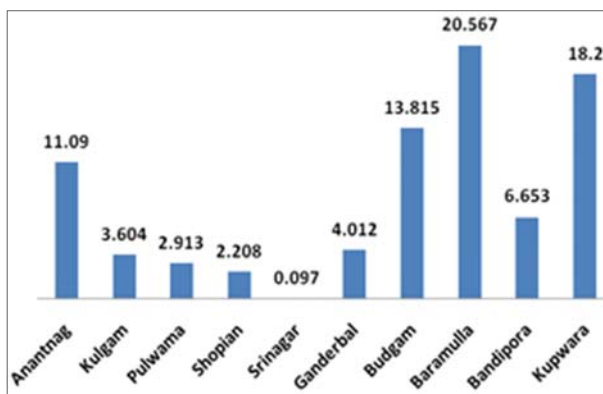
Period	Area	Production	Yield
1980-1997	0.66*(0.06)	0.18(0.61)	-0.48(0.63)
1998-2015	-0.49*(0.11)	-0.37(0.51)	0.12(0.52)
1980-2015	0.34*(0.06)	0.24(0.20)	-0.10(0.20)

Figures with parentheses indicate standard errors, CGR= Compound growth rate

\*Denotes significance at 0.05 or better probability levels

**Status of Maize in Kashmir**

In Kashmir regions of J&K, maize is cultivated on 0.77 lakh hectares which comprise over 26 per cent of total maize area in the state. The crop is grown in all districts of Kashmir valley though maximum area under maize falls in Baramulla with 20.57 thousand hectare followed by Kupwara and Budgam districts (Figure 2). Owing to predominance of horticultural system, Shopian has relatively less area under maize.



**Fig 1:** District-wise area under maize in Kashmir-2015-16 (000'ha)

Over the years, with the transformation process there has been a drastic change in the cropping pattern and area allocation under maize in the valley. Figure 3 depicts trends in maize area across different districts of Kashmir province. There has been an increase of about 9 thousand hectares to the maize

area in the province between 2007-08 and 2015-16. Since 2007-08 there has been an increase in area under maize in Budgam i.e. 1.8 thousand hectares. Area under maize in Bandipora has also shown an increase in the said period. Of the 10 districts of Kashmir, 06 districts have experienced an unfavourable decrease between 2007 and 2015. The unplanned switch to horticultural crops like apple has to be checked and a policy advisory on this account should be extended to the stakeholders for desirable outcomes.

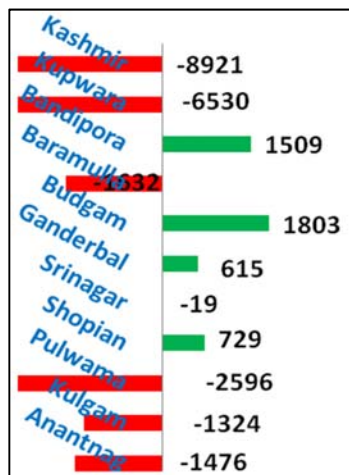


Fig 2: Trend of maize area in Kashmir between 2007-08 & 2015-16 (ha)

### Estimates of decomposition: Effect of area, productivity and their interactions

The results in the Table 3 revealed that the area-productivity interaction effect has exhibited a negative contribution (-0.6 %) to the total increase in maize production in the state. The productivity effect has been discouraging for any increase in maize production in the state. The increase in the production of maize (3 lakh quintals) since 1980-81 was exclusively because of area expansion in this crop. The period-wise analysis of these effects has shown that area effect dominated in differential production in first period though it could not fully compensated for the negative contribution of productivity effect and area-productivity effects. During 1998-99 to 2015-16, although the productivity has shown desirable effect on the increase in maize production but owing to decline of area under this crop, the area effect and interaction effect of area and productivity has been negative. The declining productivity effect implies that the production can be improved significantly if serious efforts in terms of bridging technological gaps especially in nutrient management and application of plant protection chemical are taken. The decline in the interaction effect indicated that the increase in the area under fruits was not matched with the proportional increase in productivity despite the adoption of innovations. To sum up, the area, productivity and interaction effect was found to insignificant influence on maize production thereby implying the important role of R&D institution and extension agencies in the development maize economy in the state.

Table 3: Percentage contribution of area, productivity and their interactions towards increasing fruit production in J&K

Period	Differential production	Area effect	Productivity effect	Interaction effect
	$\Delta P$	$Y_0 \Delta A$	$A_0 \Delta Y$	$\Delta A \Delta Y$
1980-81 to - 1997-98	-524	640	-1030	-134
		(122.1)	(-196.6)	(25.5)
1998-99 to 2015-16	-87	-301	227	-13
		(-345.8)	(260.5)	(-14.7)
1980-81 to 2015-16	304	335	-29	-2
		(110.1)	(-9.4)	(-0.6)

Figure in the parenthesis indicate per cent of differential production

### Major hurdles facing maize economy

The maize cultivation of the Kashmir valley is beset with number of constraints; of which few are:

- The maize crop is taken up under rainfed conditions and the erratic behaviour of climate often unfavourably affects its performance. Further undulated topography and fragmentation of holdings limits application of critical inputs and mechanization,
- There is rampant encroachment in land meant for maize cultivation in the valley and the implementation of land laws is very poor in absence of concrete plan for township and urban expansion,
- Ignorance about the technology and scientific package for cultural practices of the crop and poor extension services in the domain area was observed as a major hurdle,
- There is no authentic source of certified seeds of improved varieties or land races,
- A major issue confronting maize cultivators is non-availability of assured marketing infrastructure/market place, and unregulated trade practices,
- Illiteracy, inadequate skill and poor capacity development among grower and labour engaged in its cultivation resulted in unscientific management of this crop,

Besides there are number of problems/constraints perceived by maize grower in production, and in marketing of maize which need to be explored out and redressed in a holistic manner.

### Conclusion & policy suggestions

The results of this study revealed a gloomy picture of maize in the state. The area under this crop has been increasing steadily till 2000-01 but in recent years its area has declining; consistent with which the production of maize has also shown a decline. The decline in area coupled with stagnant productivity of the crop in the state is really a cause of concern and need to be addressed on priority. Within Kashmir province there has been a decline of about 9000 hectare area under maize though only four out of 10 districts have shown an increase in the area under maize. After positive growth in period I, the area and production of maize has exhibited a declining trend which has to be reversed with concerted efforts. The productivity level at the state level appears unsatisfactory though it is relatively better for Kashmir valley. Within Kashmir there has been a drastic transformation in maize cultivation while few district has expanded their area under this crop, number of districts have experience decline in maize area. Although the valley has made commendable

progress on front of productivity enhancement but our existing system of maize cultivation is subject to severe challenges. The decomposition analysis have shown that while area effect has a positive contribution in increase in maize production, the productivity and interaction of area and productivity effects have negatively contributed to production differential of maize between 1980-81 and 2015-16. Following policy suggestions emerge in light of the findings of this study:

Institutions have to play yet more crucial role in addressing the various issues confronting maize cultivation in the state. There is need to bridge the time lag between technology development and its dissemination. The improved varieties not only improve yield and reduce cost of production but have important role in development socio-economic overheads, therefore, are to be taken to the field through streamlined extension system. Serious measures are to be taken to achieve desirable seed replacement rate of maize to replace obsolete seed technologies and unidentified land races with true to type elite varieties. The irrigation capacities should be expanded with installation of low gestation micro-irrigation schemes so that application of critical inputs as per scientific package may be encouraged. There is a need to launch a maize economy campaign to educate farmers about increasing demand of maize and its role in industrialization. Integration of value chain and provision of market facilities would definitely have positive impact on maize production.

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