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Scenario of Pulses Production in India: An Economic Analysis

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Abstract

Pulses are very much important for Indian diet. India is at top amongst all the major pulses producing countries but it is unable to meet out the domestic demand. The production till now is not sufficient to feed the whole Indian population. The domestic yield of pulses is very low as compared to global average and the same situation prevails in case of per capita availability. Thus, the present study is an attempt to examine the growth and instability in area, production and yield and to identify the components due to which production is increasing in present scenario.

The empirical results of the study reveal that the maximum growth (3.4%) in area was found in case of gram followed by tur (1.5%). There is negative growth in area in urd and moong. The production registered highest growth (5.4%) in case of gram followed by tur (2.2%). The productivity witnessed the highest growth in urd (2.5%) followed by moong (2.3%).

The maximum instability was observed in case of gram followed by moong and Tur as far as area is concerned. With respect to production the maximum variability was found in case of moong followed by gram. Moong experienced maximum instability (23.68%) followed by urd 13.09% as far as productivity is concerned. In case of lentil, tur and gram the production increased because of increase in area mainly whereas in case of urd and moong the production increased due to productivity followed by area.

Keywords: Growth rate, instability, area effect, yield effect, interaction effect

A large portion of the Indian population is vegetarian and pulses are an important source of protein in the daily diet, as they contain 20–25% protein, which is double of wheat and three times of rice. Apart from this pulses are beneficial for human health in a variety of ways. Some of the nutritional benefits and corresponding health benefits are as follows:

- It contains low fat/high complex carbohydrate which helps in dieting and phytochemical which works as anti-cancer agent.
- It reduces the chances of cardiovascular diseases.
- It helps in reduction of diabetes due to low glycemic index.

Developing countries contribute about 74% to the global pulses production and the remaining comes from developed countries. India, China, Brazil, Canada, Myanmar and Australia are the major pulse producing countries with relative share of 25%, 10%, 5%, 5% and 4%, respectively (Vision2030). In 2011, the global production of pulses was 67.84 million tons from an area of 78.07 million ha, with an average yield of 869 kg/ha. India has acquired the top position with 18.45 million tons of pulse production in 2012-13 from 23.47 million ha. and yield is 786kg/ha. However, the yield (around 786 kg/hectare) is less than the global average (869kg/ha)and the per capita availability (per day) is 41.64gm in 2012 whereas 65gm/day/capita is recommended by ICMR. The projected pulses demand

Table 1: Growth rate of area, production and yield along with instability in Total Pulses

Total Pulses	Particulars	Study period (1951-2012)	Sub-period					
			1951-60	1961-70	1971-80	1981-90	1991-2000	2001-2012
Area	Beginning year area (million ha)	18.78	18.78	24.24	22.15	23.84	22.54	22.01
	End year area (million ha)	23.47	23.56	22.54	22.46	24.66	20.35	23.47
	No. of observation	62	10	10	10	10	10	62
	Growth rate	0.4	2.6*	-1.3*	0.4	0.1	-0.6	1.2**
	Coefficient of Variation	5.63	8.52	4.7	4.47	4.09	4.12	6.36
Production	Beginning year production (million tonnes)	8.42	8.42	11.76	11.09	11.51	12.02	13.37
	End year production (million tonnes)	18.45	12.70	11.82	10.63	14.26	11.08	18.45
	No. of observation	62	10	10	10	10	10	12
	Growth rate	0.7*	3.7*	0	0	1.5	0	3.4*
	Coefficient of Variation	16.96	13.85	11.56	12.12	8.67	8.64	14.62
Yield	Beginning year yield (Kg/ha)	448	448	485	501	483	533	607
	End year yield (Kg/ha)	786	539	524	473	578	544	786
	No. of observation	62	10	10	10	10	10	12
	Growth rate	0.6*	1.1	1.3	-0.5	1.4**	0.7	2.2*
	Coefficient of Variation	14.51	7.58	11.15	9.38	6.38	6.72	9.97

* significant at 1% level and ** significant at 5% level

Table 2: Contribution of area and yield in Total Pulses production

Components \ Year	1951-12	1951-60	1961-70	1971-80	1981-90	1991 -2000	2001-12
Area effect ? $A.Y_0$ (%)	24.89	60.83	-592.07	-236.33	11.32	-56.39	34.89
Yield effect ? $Y.A_0$ (%)	60.74	32.52	764.31	342.93	87.41	159.96	57.55
Interaction effect ? A. ? Y (%)	14.37	6.64	-72.24	-6.61	1.27	-3.57	7.56

Table 3: Growth rate of area, production and yield along with instability in Gram

Gram	Particulars	Study period (1951-2012)	Sub-period					
			1951-60	1961-70	1971-80	1981-90	1991-2000	2001-2012
Area	Beginning year area (million ha)	6.83	6.83	9.57	7.91	7.87	5.58	6.42
	End year area (million ha)	8.7	9.28	7.84	6.58	7.52	5.19	8.7
	No. of observation	62	10	10	10	10	10	12
	Growth rate	0.4*	3.8*	-2.8*	-0.8	-1.4	.3	3.4*
	Coefficient of Variation	14.82	13.38	9.6	7.66	9	14.69	12.91
Production	Beginning year production (million tonnes)	3.39	3.39	5.79	5.08	4.64	4.12	5.47
	End year production (million tonnes)	8.88	6.25	5.2	4.33	5.36	3.85	8.88
	No. of observation	62	10	10	10	10	10	12
	Growth rate	0.4*	5.5*	-0.6	-0.6	-0.5	1.2	5.4*
	Coefficient of Variation	21.29	19.85	16.06	17.53	13.03	18.85	21.06
Yield	Beginning year yield (Kg/ha)	496	496	605	642	590	739	853
	End year yield (Kg/ha)	1021	674	663	657	712	744	1021
	No. of observation	62	10	10	10	10	10	12
	Growth rate	0.8*	1.7	2.2	0.2	0.8	0.9	2*
	Coefficient of Variation	17.6	10.78	15.33	13.02	7.7	7.34	9.53

* significant at 1% level and ** significant at 5% level

Table 4: Contribution of area and yield in Gram production

Year / Components	1951-1912	1951-1960	1961-1970	1971-1980	1981-1990	1991 -2000	2001-2012
Area effect $\Delta A.Y_0$ (%)	41.98	64.48	-26.51	295.94	100	64.37	66.11
Yield effect $\Delta Y.A_0$ (%)	29.05	26.55	131.55	-189.47	0	30.55	21.06
Interaction effect $\Delta A.\Delta Y$ (%)	28.97	8.97	-5.04	-6.46	0	5.08	12.83

Table 5: Growth rate of area, production and yield along with instability in Tur

Tur	Particulars	Study period (1951-2012)	Sub-period					
			1951-60	1961-70	1971-80	1981-90	1991-2000	2001-2012
Area	Beginning year area (million ha)	2.45	2.45	2.45	2.35	3.0	3.53	3.33
	End year area (million ha)	3.81	2.43	2.66	2.84	3.59	3.63	3.81
	No. of observation	62	10	10	10	10	10	12
	Growth rate	0.9*	0.1	0.9*	1.6*	2.2*	-0.2	1.5**
	Coefficient of Variation	17.54	2.58	3.3	5.51	7.1	3.12	8.36
Production	Beginning year production (million tonnes)	1.83	1.83	1.37	1.68	2.24	2.13	2.26
	End year production (million tonnes)	3.07	2.07	1.88	1.96	2.41	2.25	3.07
	No. of observation	62	10	10	10	10	10	12
	Growth rate	0.9*	0.2	2.8	1.3	1.7	0.8	2.2**
	Coefficient of Variation	20.76	9.4	15.97	10.45	9.81	12.58	12.55
Yield	Beginning year yield (Kg/ha)	748	748	559	718	745	588	679
	End year yield (Kg/ha)	806	849	709	689	673	618	806
	No. of observation	62	10	10	10	10	10	12
	Growth rate	0.12	0.1	1.9	-0.3	-0.5	1	0.7
	Coefficient of Variation	11.49	10.25	14.33	10.76	6.96	12.59	8.95

* significant at 1% level and ** significant at 5% level

Table 6: Contribution of area and yield in Tur production

Year / Components	1951-12	1951-60	1961-70	1971-80	1981-90	1991 -2000	2001-2012
Area effect $\Delta A.Y_0$ (%)	115.5	0	51.54	98.65	104.10	41.38	77.34
Yield effect $\Delta Y.A_0$ (%)	-9.75	100	37.72	1.21	-3.54	54.71	17.99
Interaction effect $\Delta A.\Delta Y$ (%)	-5.74	0	10.74	0.14	-0.56	3.91	4.67

Table 7: Growth rate of area, production and yield along with instability in Lentil

Lentil	Particulars	Study period (1971-2011)	Sub-period			
			1971-80	1981-90	1991-2000	2001-2011
Area	Beginning year area (million ha)	0.63	0.63	0.95	1.19	1.47
	End year area (million ha)	1.56	0.93	1.19	1.46	1.56
	No. of observation	41	10	10	10	11
	Growth rate	1.7*	2.3	2.2*	2.3*	0.7
	Coefficient of Variation	20.6	11.88	7.62	8.26	5.8
Production	Beginning year production (million tonnes)	0.3	0.3	0.5	0.8	0.97
	End year production (million tonnes)	1.06	0.47	0.85	0.92	1.06
	No. of observation	41	10	10	10	11
	Growth rate	2.8*	1.7	5.8*	3*	0.7
	Coefficient of Variation	32.81	14.55	18.4	13.47	7.81
Yield	Beginning year yield (Kg/ha)	481	481	525	674	664
	End year yield (Kg/ha)	678	498	717	619	678
	No. of observation	41	10	10	10	11
	Growth rate	1.1*	-0.7	3.6*	0.2	-0.3
	Coefficient of Variation	16.22	7.82	11.48	7.29	6.66

* significant at 1% level and ** significant at 5% level

Table 8: Contribution of area and yield in Lentil production

Year / Components	1971-11	1971-80	1971-90	1991-2000	2001-11
Area effect $\Delta A.Y_0$ (%)	101.28	75.9	53.61	50.46	388.57
Yield effect $\Delta Y.A_0$ (%)	-45.47	21.16	31.13	39.43	-274.29
Interaction effect $\Delta A.\Delta Y$ (%)	44.2	2.94	15.26	10.11	-14.29

Table 9: Growth rate of area, production and yield along with instability in Urd

Urd	Particulars	Study period (1971-2012)	Sub-period			
			1971-80	1981-90	1991-2000	2001-2012
Area	Beginning year area (million ha)	1.87	1.87	2.78	3.42	3.3
	End year area (million ha)	3.19	2.83	3.48	3.01	3.19
	No. of observation	42	10	10	10	12
	Growth rate	0.9*	3.6*	2.5*	-0.5	-0.7
	Coefficient of Variation	14.91	13.67	8.19	5.79	7.41
Production	Beginning year production (million tonnes)	0.53	0.53	1.01	1.5	1.5
	End year production (million tonnes)	1.9	0.96	1.65	1.29	1.9
	No. of observation	42	10	10	10	12
	Growth rate	2.1*	4.3*	5.9*	-1.2	1.9
	Co-efficient of Variation	28.34	15.62	18.87	8	16.06
Yield	Beginning year yield (Kg/ha)	286	286	364	438	454
	End year yield (Kg/ha)	596	339	473	431	596
	No. of observation	42	10	10	10	12
	Growth rate	1.2*	0.6	3.3*	-0.5	2.5*
	Coefficient of Variation	16.84	7.5	11.17	6.59	13.09

* significant at 1% level and ** significant at 5% level

Table 10: Contribution of area and yield in Urd production

Year / Components	1971-12	1971-80	1981-90	1991-2000	2001-2012
Area effect $\Delta A.Y_0$ (%)	43.62	89.8	55.44	74.91	39.15
Yield effect $\Delta Y.A_0$ (%)	19.41	7.84	29.06	28.13	49.21
Interaction effect $\Delta A.\Delta Y$ (%)	36.97	2.36	15.5	-3.04	11.64

Table 11: Growth rate of area, production and yield along with instability in Moong

Moong	Particulars	Study period (1971-2012)	Sub-period			
			1971-80	1981-90	1991-2000	2001-2012
Area	Beginning year area (million ha)	1.84	1.84	2.85	3.49	3.09
	End year area (million ha)	2.75	2.84	3.36	3.01	2.75
	No. of observation	42	10	10	10	12
	Growth rate	0.9*	3.8*	2.2*	-0.7	-0.2
	Coefficient of Variation	13.98	12.4	7.88	6.57	9.35
Production	Beginning year production (million tonnes)	0.56	0.56	1.06	1.28	1.11
	End year production (million tonnes)	1.2	0.98	1.38	1.03	1.2
	No. of observation	42	10	10	10	12
	Growth rate	1.3*	5.1**	2.7**	-2.5	2
	Coefficient of Variation	27.46	19.36	12.26	15.92	29.66
Yield	Beginning year yield (Kg/ha)	306	306	372	368	360
	End year yield (Kg/ha)	436	344	413	340	436
	No. of observation	42	10	10	10	12
	Growth rate	0.5	2.3	0.5	-1.8	2.3
	Coefficient of Variation	18.39	13.28	7.27	13.76	23.68

* significant at 1% level and ** significant at 5% level.

Table 12: Contribution of area and yield in Moong production

Components \ Year	1971-12	1971-80	1981-90	1991-2000	2001-12
Area effect $\Delta A.Y_0$ (%)	43.06	58.20	92.58	60.46	42.86
Yield effect $\Delta Y.A_0$(%)	22.85	30.98	6.28	47.52	44.77
Interaction effect $\Delta A.\Delta Y$ (%)	34.09	10.82	1.14	-7.98	12.38

is 32 million tonnes by 2030 (Vision 2030) and 50 million tonnes by the year 2050 which necessitates an annual growth rate of 4.2% (Vision 2050).

Even though producing the highest quantity of pulses, import would have become necessary to bridge the gap between demand and supply. In order to narrow down the demand supply gap, the country has to import pulses to the tune of 2.0 – 4.0 million tons every year.

In order to ensure self-sufficiency there is a strong need to boost production and yield of pulse crops so that India would be capable of meeting domestic requirement and would also produce sufficient surplus for export.Hence, there is an urgent need to examine the whole scenario of pulse production.

Objectives of the Study

The specific objectives are as follows:

(i) To examine the growth in area, production and yield of major pulses.
(ii) To measure the instability in area, production and yield of pulses.
(iii) To estimate the relative contribution of acreage and yield in pulse production.

Research Methodology

The entire study is based on secondary data of pulses at macro level. The first objective of the study is to estimate growth rate in area, production and yield of various pulses and pulses as a whole at macro level. The data is taken from 1951 to 2012 for total pulses, gram and tur whereas 1971 to 2011 for lentil and 1971-2012 for urd and moong. SPSS programme is used for the analysis of growth rate.

1. To examine the growth in area, production and yield of major pulses

Analytical Tool

The growth in area, production and yield, is analyzed using the exponential growth function of the form:

$$Y_t = ab^t$$

Where,

Y_t - dependant variable for which growth is estimated.

a- intercept

b- Regression coefficient

t- Time variable

The compound growth rate would be obtained from the logarithmic form of the equation as below:

$$\log Y_t = \log a + t \log b$$

The percent compound growth rate (g) would be derived using the relationship

$$g = [(\text{Anti ln of } b) - 1] * 100$$

2. To measure instability in area, production and yield

Analytical Tool

In order to study the variability in the area, production and yield of pulses, Coefficient of Variation (CV) is used.

$$cv = \frac{\sigma}{\bar{X}} * 100$$

Where,

σ = Standard deviation of variables concerned i.e. area/production/yield

$\bar{X}$ = Mean value of the variable.

3. To estimate the relative contribution of acreage and yield in the growth of pulses production

Analytical Tool

$$\Delta P = P_2 - P_1 = A_0.\Delta Y + \Delta A.Y_0 + \Delta A.\Delta Y$$

Where,

ΔP = difference in average production over two periods

A_0 = Average area of base period

Y_0 = Average yield of base period

ΔA = change in average area between two periods

ΔY = change in average yield between two periods

$\Delta A.Y_0$ = Area effect

$A_0.\Delta Y$ = Yield effect

$\Delta A.\Delta Y$ = interaction effect between area and yield

Thus, total change in production is decomposed into three effects i.e. area effect ($\Delta A.Y_0$), yield effect ($A_0.\Delta Y$) and interaction affect, $\Delta A.\Delta Y$, between area and yield.

Results and Discussion

Total pulses

Growth in area, production and productivity in total pulses:

The area increased from 18.78 million ha. to 23.47 million ha. in 62 years from 1951 to 2012 with a very slow rate (0.4% only). The highest positive and significant growth (2.6%) was registered in 1951-60 followed by 1.2% in 2001-12 (Table 1).

In sixty-two years the production increased at the rate of 0.7% from 8.42 million tonnes to 18.45 million tonnes. The maximum growth was observed in 1951-60 (3.7%) followed by 3.4% in 2001-12 (Table 1).

The yield of total pulses increased from 448 kg/ha to 786 kg/ha in the reported period (1951-2012) with a rate of 0.6%. Yield registered maximum growth (2.2%) during 2001-12. (Table 1)

Instability analysis in the total pulses: To examine instability, the variability as indicated by coefficient of variation in area, production and productivity were examined (Table 1). The maximum variability in area was observed to be 8.52% during 1951-60 followed by 6.36% and 5.63% in 2001-12 and 1951-2012, respectively.

The maximum variability in production was found to be 16.96% in 1951-2012 followed by 14.62% in 2001-12 and minimum (8.64%) during 1991-2000.

The yield variability was observed maximum in 1951-2012 with 14.51% followed by 1961-70 with 11.15%. During 1981-90 the variability was minimum (6.38%).

Decomposition analysis in total pulses: The yield effect was more pronounced than the area effect in total pulses except 1951-60 where area effect was more than the yield effect (Table 2).

Gram

Growth in area, production and productivity in Gram: The area increased from 6.83 million ha. to 8.7 million ha. in 62 years from 1951 to 2012 with a very slow rate (0.4% only). The highest positive and significant growth (3.8%) was registered in 1951-60 followed by 3.4% in 2001-12 (Table 3).

In sixty-two years the production increased at the rate of 0.4% from 3.39 million tonnes to 8.88 million tonnes. The maximum growth was observed in 1951-60 (5.5%) followed by 5.4% in 2001-12.

The yield of gram increased from 496 kg/ha to 1021 kg/ha in the reported period (1951-2012) with a rate of 0.8%. Yield registered maximum and significant growth (2%) during 2001-12.

Instability analysis in Gram: The maximum area variability observed was 14.82% during 1951-2012 followed by 14.69% and 13.38% in 1991-2000 and 1951-60, respectively.

The maximum production variability (21.29%) was found in 1951-2012 followed by 21.06% in 2001-12.

The yield variability observed maximum in 1951-2012 with 17.6% followed by 1961-70 with 15.33% and minimum during 1991-2000 with 7.34% (Table 3).

Decomposition analysis in Gram: The maximum area contribution is 295.94% in gram production during 1971-80 and least during 1961-70 (Table 4) whereas the maximum yield contribution was observed during 1961-70 (131.55%).

Tur

Growth in area, production and productivity in Tur: The area increased from 2.45 million ha. to 3.81 million ha. in 62 years from 1951 to 2012 with a very slow rate (0.9% only). The highest positive and significant growth (2.2%) was registered in 1981-90 followed by 1.6% and 1.5% in 1971-80 and 2001-12, respectively (Table 5).

In sixty-two years the production increased at the rate of 0.9% from 1.83 million tonnes to 3.07 million tonnes. The maximum and significant growth was observed in 2001-12 (2.2%).

The yield of Tur increased from 748 kg/ha to 806 kg/ha in the reported period (1951-2012) with a very slow growth rate of 0.12%. Yield registered maximum growth (1.9%) during 1961-70.

Instability analysis in Tur: The maximum area variability in area was observed 17.54% during 1951-2012 followed by 8.36% in 2001-12.

The maximum production variability (20.76%) found in 1951-2012 followed by 15.97% in 1961-70 and minimum (9.81%) during 1981-90.

The yield variability observed was maximum in 1961-70 with 14.33% followed by 1991-2000 with 12.59% and minimum during 1981-90 with 6.96% (Table 5).

Decomposition analysis in Tur: The maximum area contribution is 115.5% in Tur production during 1951-12 and least during 1951-60 whereas the maximum yield contribution (100%) during 1951-60. The lowest yield effect is -9.75% during 1951-12 (Table 6).

Lentil

Growth in area, production and productivity in Lentil: The area increased from 0.63 million ha. to 1.56 million ha. in 41 years from 1951 to 2011 with 1.7% growth rate. The highest positive and significant growth (2.3%) was registered in 1991-2000 followed by 2.2% in 1981-90 (Table 7).

During the forty-one years Lentil production increased at the rate of 2.8% from 0.3 million tonnes to 1.06 million tonnes. The maximum growth was observed in 1981-90 (5.8%) followed by 3% in 1991-2000 (Table 7).

The yield of Lentil increased from 481 kg/ha to 678 kg/ha in the reported period (1971-2011) with a growth rate of 1.1%. Yield registered maximum and significant growth (3.6%) during 1981-90 (Table 7).

Instability analysis in Lentil: The maximum area variability was found to be 20.6% during 1971-2011 followed by 11.88% in 1971-80.

The maximum production variability (32.81%) was found in 1971-2011 followed by 18.4% in 1981-90 and least (7.81%) during 2001-11.

The yield variability was observed maximum in 1971-2011 with 16.22% followed by 1981-90 with 11.48% and minimum during 2001-11 with 6.66% (Table 7).

Decomposition analysis in Lentil: The maximum area contribution is 388.57% in lentil production during 2001-11 and least during 1991-2000 whereas the maximum yield contribution (39.43%) was during 1991-2000.The lowest yield effect is -274.29% during 2001-11.The area effect was more pronounced than the yield effect in lentil throughout the reported periods (Table 8).

Urd

Growth in area, production and productivity in Urd: The area increased from 1.87 million ha. to 3.19 million ha. from 1971 to 2012 with 0.9% growth rate. The highest growth (3.6%) was registered in 1971-1980 followed by 2.5% in 1981-90 (Table 9).

Urd production increased at the rate of 2.1% from 0.53 million tonnes to 1.9 million tonnes. The maximum growth was observed in 1981-90 (5.9%) followed by 4.3% in 1971-80.

The yield of Urd increased from 286 kg/ha to 596 kg/ha in the reported period (1971-2012) with a rate of 1.2%. Yield registered maximum growth (3.3%) during 1981-90 followed by 2.5% during 2001-12.

Instability analysis in Urd: The maximum variability in area was observed 14.91% during 1971-2012 followed by 13.67% in 1971-80.

The maximum variability (28.34%) in production was found in 1971-2012 followed by 18.87% in 1981-90 and least (8%) during 1991-2000.

The yield variability observed was maximum in 1971-2012 with 16.84% followed by 2001-12 with 13.09% and minimum during 1991-2000 with 6.59%.

Decomposition analysis in Urd: The maximum area contribution is 89.8% in Urd production during 1971-80 and least during 2001-12.The yield contribution 49.21% was maximum during 2001-12. The lowest yield effect is 7.84% during 1971-80. The area effect was more pronounced than the yield effect in Urd except 2001-12 (Table 10).

Moong

Growth in area, production and productivity in Moong: The area increased from 1.84 million ha. to 2.75 million ha. from 1971 to 2012 with 0.9% growth rate. The highest growth (3.8%) was registered in 1971-1980 followed by 2.2% in 1981-90 (Table 11).

During the forty-two years moong production increased at the rate of 1.3% from 0.56 million tonnes to 1.2 million tonnes. The maximum growth was observed in 1971-80 (5.1%) followed by 2.7% in 1981-90 (Table 11).

The yield of moong increased from 306 kg/ha to 436 kg/ha in the reported period (1971-2012) with a slow growth rate of 0.5% (Table 11).

Instability analysis in Moong: The maximum area variability observed was 13.98% during 1971-2012 followed by 12.4% in 1971-80.

The maximum production variability (29.66%) was found in 2001-12 followed by 27.46% in 1971-12 and least (12.26%) during 1981-90.

The yield variability observed was maximum in 2001-12 with 23.68% followed by 1971-12 with 18.39% and minimum during 1981-90 with 7.27% (Table 11).

Decomposition analysis in Moong: From 1971-2000, the contribution of area was more pronounced as compared to yield. The yield effect was more in 2001-2012 (Table 12).

Conclusion

The findings of the study empower to generate a clear picture of major pulses production in India and formulate the policies to break the slow growth in pulse production. In case of pulse crops, generally the production has increased because of increase in area and not because of increase in yield. Therefore, there is urgent need to evolve the improved technology for enhancing the productivity in order to increase production to cater the food and nutritional security of Indian population in year to come.

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