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Instability in Indian Agriculture during Different Phases of Technology and Policy

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Ramesh Chand and S.S. Raju*

Abstract

The issue of instability attracted lot of attention of researchers in the early phase of adoption of green revolution technology. It was found that adoption of new technology had increased instability in foodgrains and agricultural production in India. This conclusion was based on the period when improved technology had reached very small area. This study shows that when a little longer period is taken into consideration, which witnessed spread of improved technology to large area, the inference on increase in instability due to adoption of new technology get totally refuted. Production of foodgrains and total crop sector was much more stable in the recent period compared to pre green revolution and first two decades of green revolution in the Country. This indicates that Indian agriculture has developed a resilience to absorb various shocks in supply caused by climatic and other factors. There is large variation in instability in foodgrains production across states. Very high risk is involved in foodgrains production in the states of Maharahtra, Tamil Nadu, Orissa, Madhya Pradesh, Rajasthan and Gujarat.

I
INTRODUCTION

Indian agriculture has seen profound changes during the last five and half decades. In the beginning of the era of planned development, that is 1950-51, only 17 percent of cultivated area of the country was under irrigation and 83 percent was entirely rainfed. Accordingly, Indian agriculture was described as a gamble on monsoon. With the beginning of First Five Year Plan, India started making large investments in medium and major irrigation projects with the main aim of raising agricultural production and productivity and also to reduce dependence of agriculture on rainfall. Between 1951[1] and 1965, more than 8 million hectare area was brought under irrigation which also included area under minor irrigation. This raised area under irrigation from 22.56 million hectare to 30.90 million hectare but still 80 percent area remained rainfed. There was not much

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[1] Refer to agricultural year 1950-51. Similarly, other years indicated this way refer to agricultural year ending with the year.

change in technology in this period and change in productivity and increase in output came primarily from expansion in net sown area and gross sown area. The country witnessed droughts during 1965-66 and 1966-67 which put Indian agriculture in a precarious situation. The country then went for adoption of high yielding varieties of wheat and paddy which paved the way for technology led growth. This helped in achieving substantial increase in food production in a short period and India was close to attaining food self sufficiency by early 1980's. However, year to year fluctuations in output continued to be a matter of serious concern. These fluctuations had serious implication for aggregate supply management, price shocks and farm income.

All important studies on instability conducted during 1980s concluded that agriculture production had become more unstable after the introduction of new agricultural technology (Mehra 1981; Hazell 1982; Dev 1987; and Ray *et al* 1988). This was attributed to diverse factors like nature of new technology, increase in variability of rainfall and prices, higher sensitivity of production to variation in rainfall and prices. All these studies covered the period upto early 1980s which represent the early phase of green revolution technology. During this phase new technologies were adopted on a large scale only in the areas with assured irrigation concentrated in north western parts of the country and deltaic region of peninsular India. After mid 1980s, new and improved technology of various crops witnessed wider dissemination and spread to a large area of the country. It is interesting to examine how variability in agricultural production behaved after dissemination of technology to wider areas. India has been able to face severe and mild droughts during this period without much difficulty and, it is felt that, Indian agriculture has developed a resilience to cope with adverse natural factors. However, for a long time, no serious and credible attempt based on sound analytical tools has been made to establish whether instability in agriculture production on the whole has declined or increased. Sharma *et al* 2006 estimated crop wise and state wise variability in production and yield for two time periods, namely 1981/82 - 1990/91 and 1991/92 – 2000/01, and concluded that production of foodgrains became more stable during 1990s compared with 1980s at all India levels and in most of the states. One serious limitation of this study has been that it measured instability by coefficient of variation in the trend

line. This represents variation in trend values and not instability in the series. Ideally, instability can be captured by detrending the series i.e. by substracting trend values from actual values and by looking at the variation in residuals.

This paper is an attempt to update analysis on Instability in agriculture to the recent years based on sound methodology. The instability is estimated for various phases of agriculture growth in the country spanning over last 55 years. The instability is estimated for aggregate of crop sector as well as for the sub sectors and individual commodities at national level and at state level.

II
DATA AND METHODOLOGY

Two sets of data have been used to measure instability. These include (a) index number of area, production and yield of foodgrains and non foodgrains and all crops, and (b) physical production of individual commodities or group of commodities and their decomposition into area and yield.

The entire post Independence period beginning with the year 1950-51 is divided into three phases. These are termed as (1) pre-green revolution period, (2) first phase of green revolution and (3) wider dissemination of technology period. The year separating each phase was identified after looking at raw data series on GDP agriculture and output of major agriculture aggregate. A visual examination of the series shows that the first brake in output growth occurred in mid 1960s. Therefore the first phase is taken as 1951 to 1965. The output during 1966 and 1967 was much lower than the trend and a new trend started from the year 1968. This phase continued till 1988 after which the trend in output witnessed upward jump. Therefore, the second phase was taken from 1968 to 1988. The third phase covered the period 1989 to 2006 or 2007 depending upon the availability of the data.

Beside technological breakthrough the period from 1968 to 1988 i.e. first phase of green revolution also witnessed lot of institutional and policy initiative for agriculture. The

third period is characterized by wider dissemination of technology and liberalization of trade policy.

The variability was estimated by using instability index as below:

"Instability index = Standard deviation of natural logarithm (Y_{t+1}/ Y_t)"

where, Y_t is the area / production / yield in the current year and, Y_{t+1} is for the next year. This index is unit free and very robust and it measures deviations from the underlying trend (log linear in this case). When there are no deviations from trend the ratio of Y_{t+1}/ Y_t is constant and thus standard deviation is zero. As the series fluctuates more, the ratio of Y_{t+1} and Y_t also fluctuates more, and standard deviation increases. Slightly different variant of this index has been used in the literature before to examine instability and impact of drought on it (Ray 1983; Rao *et al*., 1988). The above instability measure also indicates risk involved in agricultural production.

III

RESULTS AND DISCUSSION

Instability in area, production and yield has been studied at national level as well as state level. Indian agriculture is known for its diversity. There is lot of variation in climatic conditions, natural resource endowments, institutions, infrastructure, population density and several other factors across states. Because of these variations, pattern of agricultural growth and development and response to various stimulus and inducements vary greatly across states. Accordingly, instability in agriculture is expected to show different patterns in different agro-ecological settings prevailing in different states. Some states may exhibit same pattern as seen at national level while others may turn out to be totally different than national level picture. This can be seen from volatility or variation in agriculture at state level.

Instability at National Level

Estimates of instability in area, production and productivity of foodgrains, non foodgrains and all crops estimated from the all India index number are presented in Table 1. The Table contains two sets of results, one covering all years of the three sub periods and the

second excluding two extreme years 1979-80 and 2002-03 which experienced very serious droughts that led to 13 and 12 percent decline in crop output. Droughts were experienced in some other years also, like 1987-88, but their intensity was moderate.

Instability in area under foodgrains was quite low during the pre green revolution as growth rates show standard deviation of 2.51 percent. The instability in area increased to 3.39 in the first phase of green revolution and slightly declined after 1988. Instability in yield of foodgrains was more than three times the instability in area during the pre green revolution. Adoption of new technology marked decline in instability from 9.05 to 8.05 between pre green revolution and first phase of green revolution. When improved technology spread to larger areas the variability in productivity declined further. Instability in production of foodgrains shows small increase with the adoption of new technology from 10.05 to 10.31. However, when extreme year of 1979-80 was excluded from the data set the variability in foodgrains output show large decline. Instability in foodgrains production witnessed significant decline after 1988. The decline is found more pronounced when extreme year 2002-03 is excluded from the data set. Variability in foodgrains production after 1989 was 13 percent lower compared to pre green revolution period and 16 percent lower compared to the first phase of green revolution. When extreme years are removed the decline in variability during 1989 -2007 turned out to be lower than pre green revolution period by 46 percent and 37 percent lower compared to the first phase of green revolution.

These results are in complete disagreement with the findings of earlier studies by Mehra 1981; Hazell 1982; Ray *et al* 1988; and Dev 1987. The reason is that all these studies based their inference on 10 to 15 years of adoption of green revolution technology. With the passage of time adoption of green revolution technology spread to much larger area and a large number of improvements in various aspects of technology took place. As the benefit of these advancements got translated at farm, the variability in yield of foodgrains declined and that led to decline in variability of foodgrains production as well. Other factors which might have contributed to the decline in variability in foodgrains yield and

production seems to be (i) policy of minimum support prices (ii) expansion of irrigation and (iii) improvement in availability of other inputs and institutional credit.

Table 1
Instability in area, production and yield of foodgrains and non foodgrains group of crops and all crops in different periods

Crop group	Period	Including extreme years			Excluding extreme years 1979-80 and 2002-03		
		Area	Production	Yield	Area	Production	Yield
Foodgrains	1951 to 1965	2.51	10.05	9.05	2.51	10.05	9.05
	1968 to 1988	3.39	10.31	8.05	3.49	8.64	6.08
	1989 to 2007	3.26	8.70	6.38	1.96	5.46	4.45
Non foodgrains	1951 to 1965	3.96	7.59	7.04	3.96	7.59	7.04
	1968 to 1988	3.54	6.87	5.01	3.40	6.36	4.68
	1989 to 2007	4.33	7.75	6.65	3.18	5.76	4.43
All crops	1951 to 1965	1.86	8.30	7.93	1.86	8.30	7.93
	1968 to 1988	3.19	8.35	6.43	3.23	6.95	4.97
	1989 to 2007	3.06	7.96	6.61	1.36	5.02	4.65

Instability in area and production of non foodgrains crops shows a different pattern as compared to foodgrains. Instability in area under non foodgrains crops declined from 3.96 in the pre green revolution to 3.54 in the first phase of green revolution period but increased thereafter. Similarly, instability in production of non foodgrains declined from 7.59 to 6.87 between pre green revolution and first phase of green revolution. In the third period i.e after 1988 instability in output of non foodgrains crops not only increased but also turned out to be higher even as compared to pre green revolution period. However, when extreme years 1979-80 and 2002-03 are taken out then instability in area as well as production of non foodgrains crops showed decline as we move up from one period to the other period.

It is also interesting to observe that instability in area under non foodgrains crops remained higher than instability in area under foodgrains crops in all the three periods, while instability in productivity was lower than foodgrains in the first and the second period but not in the third period. The net impact of instability in area and yield on production clearly indicates that foodgrains production remain more unstable as compared to production of group of non foodgrains crops.

Area under all crops i.e. including foodgrains and non foodgrains, show a big increase in instability during 1968 to 1988 as compared to the period 1952 to 1965. The period after 1988 shows slightly lower instability as compared to first phase of green revolution but it was much higher as compared to the pre green revolution period. Instability in productivity of crop sector on the whole declined by about 20 percent between pre green revolution period and first phase of green revolution. Instability in productivity show an increase of 2.8 percent after 1988 but it was lower by 17 percent as compared to pre green revolution period. Instability index in crop production was 8.30 during 1951 to 1965 and remained at this level during 1968 to 1988. Instability in production declined by 5 percent during 1989 to 2007. Instability in production of total crops show a very sharp decline over time when the two extreme years are taken out from the data sets.

The index number approach was followed to compare instability in production between group of foodgrains and non foodgrains crops. Due to large heterogeneity in non foodgrains crops aggregation of output of individual crops can give misleading picture of output of the group. Therefore their production is better captured by index number. This problem is much less severe for foodgrains and oilseeds. Therefore, quantity of output was used to estimate instability in production of individual crops and different subgroups of foodgrains and oilseed crops. The results for foodgrains, cereals, pulses and oilseeds are presented in Table 2.

Physical production of foodgrains show decline in instability in the second period compared to first period and in the third period compared to the second period even when extreme years are included in the data set. Instability in area under cereals as well as

pulses turned out to be much higher in the first phase of green revolution compared to pre green revolution period and remained at almost same level during 1989 to 2007.

Table 2
Instability in area, production and yield of major crop groups in different periods at all India level (%)

Crop group	Area			Production			Yield		
	1951-1966	1968-1988	1989-2007	1951-1966	1968-1988	1989-2007	1951-1966	1968-1988	1989-2007
Cereals	2.30	3.00	2.95	9.58	9.43	8.21	7.75	7.33	5.51
Pulses	4.35	5.96	6.00	14.70	13.90	14.18	12.91	10.54	9.76
Foodgrains	2.59	3.39	3.26	10.00	9.65	8.48	8.06	7.28	5.62
Oilseeds	5.01	5.51	6.30	12.74	17.06	18.36	12.07	13.01	15.89

Instability in area under oilseeds increased by 10 percent between pre green revolution and first phase of green revolution and further by 14 percent during recent period. Instability in yield during the corresponding periods increased by about 8 percent and 22 percent. Oilseed production witnessed increase in instability from 12.74 during 1951-1966 to 17.06 during 1968 -1988 and further to 18.36 during 1989-2007.

Yield of cereal and pulses was more stable after pre green revolution period whereas opposite holds true for oilseeds.

Instability in production of total cereal during first phase of green revolution declined by 1.6 percent and after 1988 the decline turned out to be 13 percent. In the case of pulses first phase of green revolution show a decline in instability to the extent of 5.4 percent but post 1988 period witnessed an increase of 2 percent. Between cereals and pulses the latter shows higher instability in all the period and in all respects. Instability in production and productivity of oilseeds remained higher than even pulses after 1968.

Instability in area, production and yield of individual crops is presented in Table 3. Coconut shows minimum instability among all the selected crops in almost all respects during pre green revolution and during the first phase of green revolution. In terms of instability in production it remained at bottom even during the third period. However,

sugarcane yield show least instability followed by wheat in the third period. Maize shows minimum instability in area among the selected crops which also declined over time. Among cereals, bajra showed highest instability in all the periods and in all respects. Adoption of green revolution technology reduced yield instability in wheat by 38 percent. The main factor for this was increase in wheat area brought under irrigation which increased from 43 percent during 1965-66 to 77 percent during 1987-88.

Table 3
Instability in area, production and yield of selected crops in different periods between 1950-51 and 2006-07 at all India level (%)

	Area			Production			Yield		
Year	1951-1966	1968-1988	1989-2007	1951-1966	1968-1988	1989-2007	1951-1966	1968-1988	1989-2007
Paddy	2.13	3.38	2.74	12.18	13.62	9.63	10.96	11.05	7.24
Wheat	6.61	4.59	3.69	12.93	8.97	7.12	10.56	6.58	5.00
Jowar	3.93	3.80	5.08	16.11	13.32	20.20	14.84	11.32	17.03
Bajra	5.89	10.10	11.41	18.30	39.54	40.48	15.32	32.55	30.72
Maize	3.44	3.06	2.80	10.81	18.44	11.77	9.19	16.74	10.13
Gram	8.05	10.42	15.69	20.14	21.68	21.56	17.95	16.94	10.91
Arhar	3.71	5.31	3.72	18.81	14.34	16.91	18.97	14.28	15.97
Groundnut	9.52	4.12	5.85	14.07	23.00	29.81	15.19	20.18	28.27
Rapeseed/Mustard	7.97	9.66	13.76	20.31	21.26	21.88	20.98	18.20	16.63
Coconut	3.12	3.11	3.13	7.21	6.87	5.64	5.82	5.81	5.81
Cotton	5.71	4.76	7.47	17.25	16.51	17.84	15.31	14.52	15.84
Sugrcane	10.90	9.27	7.59	14.67	11.64	9.28	9.47	6.78	4.71
Potato	3.70	6.95	5.62	16.24	14.00	13.39	13.81	10.72	11.18
Tobacco	11.17	10.48	16.41	15.24	13.29	19.80	9.35	7.29	7.45

In paddy, initial years of technology adoption did not help in reducing instability in yield or production – on the contrary, the first phase of green revolution showed higher instability as compared to the pre green revolution period. The main reason for difference in variability between wheat and rice is that expansion of irrigation in rice was far lower than wheat. Between 1965 and 1988 coverage of rice area under irrigation increased from 37 percent to 43 percent only. Wider dissemination of technology after 1988 helped in reducing instability in yield as well as production of rice. Instability in production of bajra more than doubled, while in maize it increased by 70 percent in the first phase of

green revolution. The period after 1988 witnessed very sharp decline in variability of maize production but variability in production of bajra remained high (around 40 percent). The decline in variability of maize production after 1988 resulted from decline in yield instability. Despite this, instability in maize production remained higher than pre green revolution period. Instability in jowar yield and production showed decline during 1968 to 1988 but a big increase during 1989 to 2007. Among pulses, instability in area under gram increased over time but instability in its yield declined sharply after 1988. Because of these counteracting factors instability in production of gram in all the three period remained around 21 percent. Area under arhar shows remarkably low instability but its yield show quite high year to year variability. There was decline in variability in arhar output from 18.8 during 1951-1966 to 14.34 during 1968-1988 which again increased to 16.91 during 1989–2007.

Variability in groundnut shows two interesting features. One, variability in its area declined to less than half during first phase of green revolution and then increased by 42 percent after 1988. Variability in its productivity increased from 15.19 during 1951-1966 to 20.18 during 1968-1988 and, further to 28.27 during 1989-2007. Almost similar increase was experienced in the case of production. The experience of rapeseed mustard is totally different than that of groundnut. Variability in its area show substantial increase over time whereas, productivity show decline in variability. Production of rapeseed and mustard shows inter year variability of about 21 percent, with small increase over time.

Inter year variation in production of coconut was quite small and it show decline over time. Similarly, sugarcane, another perennial crop shows decline in instability in area, yield, production over time. In the case of cotton variability in area witnessed decline during 1968-1988 as compared to pre green revolution but then increased steeply. Variability in yield of cotton varied around 15 percent with little change between different periods. Its production shows variability around 17 percent.

Area variability in potato during post green revolution turned out to be much higher as compared to pre green revolution period. However, its production show decline in

instability over time. Instability in area and production of tobacco followed a small decline in the first phase of green revolution but then increased sharply.

Instability in production across crops is found to depend significantly on irrigation coverage of a crop. Crops like wheat, sugarcane and paddy are grown mostly under irrigated condition which imparts lot of stability to their production. It may be noted that area covered under irrigation is more than 90 percent for sugarcane, around 88 percent for wheat and 53 percent for rice. In contrast, irrigation coverage of bajra is below 10 percent, for maize around 20 percent, for gram around 31 percent and for groundnut around 17 percent.

Instability at State Level

The state level estimates of instability in area, production and yield were prepared for foodgrains for two periods viz 1968 to 1988 and 1989 to 2006. These two periods represent first phase of green revolution and period of wider dissemination of technology respectively. The results are presented in Table 4.

Area under foodgrains shows high instability in the first phase of green revolution in Gujarat, Karnataka, Rajasthan, Haryana and Tamil Nadu. Out of these states year to year variation followed decline in Gujarat, Haryana and Karnataka but it witnessed small increase in Tamil Nadu and a very high increase in Rajasthan. The other states which witnessed increase in variation in area under foodgrains are Andhra Pradesh, Orissa, Kerala, Jammu and Kashmir, Madhya Pradesh and Uttar Pradesh. Despite the increase, instability in foodgrains area was quite low in Uttar Pradesh and Jammu and Kashmir. The states which show below 4 percent year to year deviation from growth trend are Bihar, Kerala, Himachal Pradesh, Punjab, Uttar Pradesh and West Bengal.

Compared to area, variations in yield were much larger. Instability in yield of food grains exceeds 20 percent in Gujarat, Maharashtra, Orissa and Rajasthan in both the periods. It varied around 10 in Andhra Pradesh, Bihar, Himachal Pradesh, Jammu and Kashmir.

Yield variability in foodgrains in Haryana, Uttar Pradesh and West Bengal reduced to less than half after 1988. Large increase in yield instability is shown in Andhra Pradesh, Assam, Madhya Pradesh, Orissa and Rajasthan.

Table 4
Statewise instability in foodgrains production during 1968-2006 (%)

State	Period	Area	Production	Yield
Andhra Pradesh	I	5.99	12.94	8.87
	II	8.04	16.82	9.61
Assam	I	4.87	12.16	9.69
	II	4.11	11.22	11.97
Bihar including Jharkhand	I	4.66	16.43	12.92
	II	3.33	14.16	11.77
Gujarat	I	12.49	40.47	30.41
	II	9.76	35.54	27.66
Haryana	I	10.23	17.54	12.68
	II	5.68	8.57	6.67
Himachal Pradesh	I	1.98	13.73	12.95
	II	1.39	13.04	12.79
Jammu and Kashmir	I	1.60	12.19	11.78
	II	2.31	8.73	9.68
Karnataka	I	10.15	22.27	14.11
	II	4.95	17.80	14.75
Kerala	I	3.20	6.07	4.61
	II	3.56	7.56	5.48
Madhya Pradesh incl. Chattisgarh	I	2.54	18.70	17.55
	II	5.61	23.85	19.05
Maharashtra	I	8.21	27.45	20.89
	II	4.28	23.16	20.76
Orissa	I	5.97	25.34	20.42
	II	7.61	32.87	28.38
Punjab	I	3.56	5.00	5.09
	II	1.92	5.57	4.68
Rajasthan	I	10.97	27.89	21.33
	II	18.35	38.92	23.12
Tamil Nadu	I	10.19	25.97	18.35
	II	11.22	20.15	13.97
Uttar Pradesh incl. Uttaranchal	I	1.98	14.77	13.77
	II	2.46	7.78	6.46
West Bengal	I	4.69	15.46	12.55
	II	3.90	6.66	5.48

Note : Period I is 1968-88 and Period II is 1989-2006.

Yield instability was major source of instability in foodgrains production in most of the states. Production was most stable in the state of Punjab followed by Kerala. Haryana, Uttar Pradesh and West Bengal were able to bring down instability in foodgrains production sharply in the second period. Instability in production remained very high in Maharahtra and Tamil Nadu despite reduction over time. Apart from these two states instability exceeded scale of 20 in Orissa, Madhya Pradesh, Rajasthan and Gujarat. Though Orissa is located in high rainfall eastern region but its agriculture shows high instability like states in the dry-land arid region.

Rainfall Variation in Different Periods

Some studies have attributed change in instability of crop output to the changes in rainfall (Ray 1983). In order to ascertain whether variation in annual rainfall is increasing over time we have examined the level and standard deviation in rainfall in different periods since 1950-51. The trend in rainfall is also presented in Figure 1. This trend shows that there is no apparent increase or decrease in the amount of rainfall received over longer period though some trend can be seen for the short period.

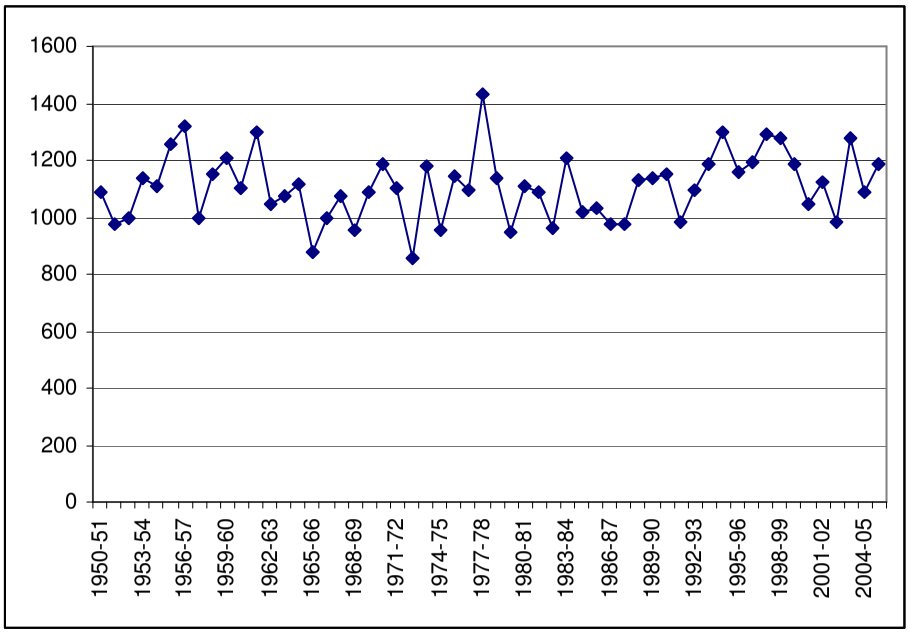
Average amount of rainfall received during agricultural year and its standard deviation during the three periods for which instability in crop output has been studied are presented in Table 5. Average amount of rainfall during 1950-51 to 1964-65, i.e. pre green revolution period was 112.5 cm. In the second period i.e. 1967-68 to 1987-88 average amount of rainfall received in the country was 107.2 cm. Next 18 years received average rainfall of 115.4 cm. The difference in average amount of rainfall received during the three periods was not statistically significant.

Table 5
Average rainfall and its variability in different periods

Period	Average Rainfall cms.	Standard deviation in the annual rainfall: cms
1950-51 to 1964/65	112.5	10.7
1967-68 to 1987-88	107.2	12.5
1988-89 to 2005-06	115.4	9.6

Fig.1: Annual rainfall (June -May) during 1950-51 to 2005-06 in India

Unit: millimetres



As the rainfall data did not show any time trend its variability can be adequately estimated from standard deviation in the amount of rainfall in a given period. There was very small increase in rainfall variation between first phase of green revolution period and pre green revolution period. During the recent years standard deviation in rainfall show a small decline. These results relating to rainfall amount and year to year variation do not support the assertion that rainfall variation is increasing over time.

IV
CONCLUSIONS

Role of technology in increasing agricultural and food production in the country is well known. However, adequate and convincing evidence on impact of improved technologies and policies followed during different periods since 1951 in reducing variation in production and resulting risk has been lacking. The issue of instability attracted lot of attention of researchers, in the early phase of adoption of green revolution technology, who found that adoption of new technology had increased instability in foodgrains and agricultural production in India. This conclusion was based on the period when improved technology had reached very small area. This study shows that when a little longer period is taken into consideration, which witnessed spread of improved technology to large area, the inference on increase in instability due to adoption of new technology get totally refuted. Yield variability in foodgrains crops as well as in non foodgrains crops was much lower in the first phase of green revolution extending upto 1988 as compared to pre green revolution period. Volatility in yield, away from trend, witnessed further decline during 1989-2007. Production of non foodgrains show increase in instability during last two decades but production of foodgrains and total crop sector was much more stable in the recent period compared to pre green revolution and first two decades of green revolution in the Country. This indicates that Indian agriculture has developed resilience to absorb various shocks in supply caused by climatic and other factors. Foodgrains production remained more unstable as compared to production of group of non foodgrains crops. Instability in yield of cereal and pulses declined over time. However, opposite holds true for oilseeds. Oilseed production is also found more risky as compared to cereals and pulses. Among individual crops wheat, paddy and sugarcane are found

least risky whereas bajra, groundnut, rapeseed/mustard, jowar and gram involves high risk. Pattern in area, yield and production instability of foodgrains differs widely across states. Yield instability was major source of instability in foodgrains production in most of the states. Production was most stable in the state of Punjab followed by Kerala. Haryana, Uttar Pradesh and West Bengal have brought down instability in foodgrains production sharply. Foodgrains production is highly unstable in the states of Maharahtra, Tamil Nadu, Orissa, Madhya Pradesh, Rajasthan and Gujarat.

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