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Regional Shift in Chickpea Production in India

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INTRODUCTION

Chickpea (*Cicer arietinum* L.) is one of the earliest grain crops cultivated by man. Even today, chickpea continues to play an important role in agricultural systems, ranking third behind dry beans (*Phaseolus* spp.) and field pea (*Pisum sativum* L.) in terms of world pulses production. It is a low input-requiring crop, deriving over 70% of its N requirement through symbiotic N fixation. Being a legume, it is particularly important to the farmers as a rotation or second crop after cereals, often maturing in the driest and hottest part of the year.

Around 95% of the total annual production (8.4 million tonnes) of chickpea occurs in Asia and Africa (FAOSTAT 2006.) Major chickpea production countries include India (65%), Pakistan (10%), Turkey (7%), Iran (3%), Myanmar (2%), Mexico (1.5%) and Australia (1.5%). South and South East Asia contribute about 81% of the world chickpea production and India is the principal chickpea producing country with a share of 80% in the region.

Chickpea seed is a protein-rich supplement to the cereal-based diets, especially critical to the poor in the developing countries where people cannot afford animal proteins or are vegetarians. Chickpea grain is relatively free from anti-nutritional factors, has high protein digestibility and is richer in phosphorus and calcium than other pulse crops. Its primary use in the United States is for *salad* bars; while in the Middle East and India, it is frequently cooked whole or used as *dhal*. In addition to its importance in human food and animal feed, chickpea also plays an important role in sustaining soil fertility by fixing upto 141 kg nitrogen per ha (Rupela 1987).

Chickpea is mainly grown as a cool-season crop under both rained and irrigated conditions. During the last few years, the development of early maturing varieties of chickpea with resistance to Fusarium wilt has made significant impacts on enhancing chickpea area and production in the central and southern India. These short duration cultivars offer the chickpea crop with comparative advantage in contributing to crop diversification through remunerative rotations and intercrops, besides having great potential under late sown conditions after paddy harvest. Damage by Helicoverpa pod borer is comparatively higher in the warmer climates of central and southern India This paper highlights the regional shift in chickpea area and production in India, factors underlying the shift, impacts of chickpea in central and southern India and finally looks at future directions and implications for research.

SHIFT IN CHICKPEA AREA

All-India and Regions

Chickpea is grown in India from 32° N in the northern India with cooler long-season environment to 10° N in southern India with warmer short-season environments. The chickpea area in the country has declined from 8.0 million ha in 1965-66 to 6.7 million ha in 2004-05, but production has gone up from 4.2 to 5.5 million tonnes during the same period (Fig. 1). This increase in production was mainly due to steady increase in yield from 527 kg/ha in 1965-66 to 815 kg/ha in 2004-05 as can be seen from the decline in the gap between area and production.

In terms of growth rates at the all-India level, chickpea area declined by 0.6% per annum between 1965 and 2004, but production increased marginally due to productivity increase close to 1% during the same period (Table 1).

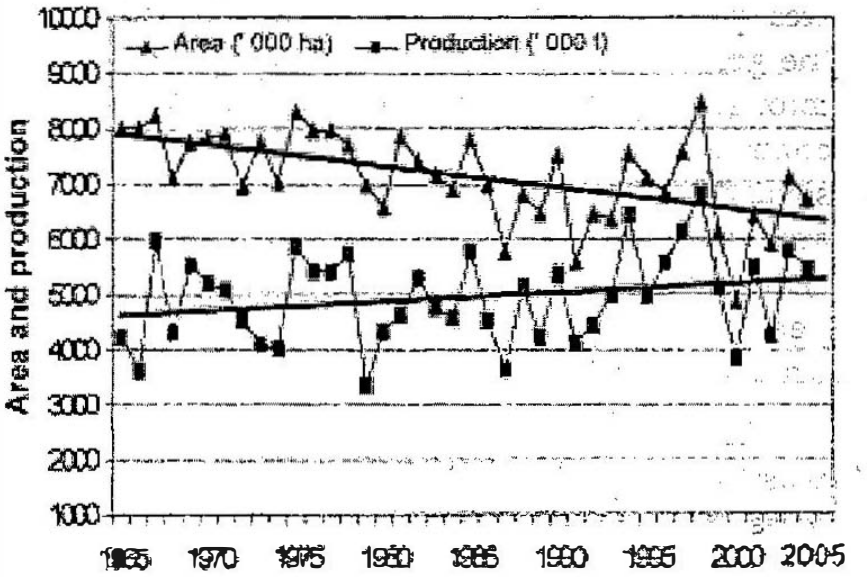

Fig. 1 : Area & production of chickpea in India (1965-2005)

Table 1. Annaul growth rate (%) in national chickpea area, production and yield

Period	Area	Production	Yield
1965-1984	-0.54	0.11	0.65
1985-2004	-0.30	0.76	1.06
1965-2004	-0.57	0.33	0.91

However, the all-India picture masks the dynamic changes taking place in the centre of production for chickpeas in India Gradual increase in area under rice coupled with availability of late sown varieties of wheat has made rice-wheat rotation one of the most profitable cropping systems in the Indo-Gangetic plains of North India, leading to substantial decrease in chickpea area in the northern states-Uttar Pradesh, Bihar, Haryana, Punjab and West Bengal. During 1965-69 (average), the chickpea area in the northern states of India was about 4.3 million ha which declined to 1.1 million ha during 2000-04 (average). Similarly, chickpea production fell from 3.1 million tonnes to 1.0 million tonnes during this period (Fig. 2). On the contrary, there has been expansion in area under chickea in central and southern India-Andhra Pradesh, Gujarata, Karnatka, Madhya Pradesh, Chhattisgarh, and Maharashtra, from 2.2 million ha (1965-69) to 4.2 million ha (2004-05) while production increased from 1.0 to 3.2 million tonnes. Because of this dramatic change in the centre of chickpea production in 2000-04, the central and southern states of India accounted for 66% of the total chickpea production from 67% of the area, compared to 21% of production from 28% area in 1965-69. Chickpea area in the North western states dominated by Rajasthan continued to maintain its position in production despite decline in area and production in the nineties. These trends are reflected in the regional compound growth rates in chickpea area, production and yield (Table 2) For the northern and North the growth rates for area and production are significantly negative (<-3%) throughout the 40-year period. Chickpea yields, however, grew by about 1% per annum. For the central and southern states, area and production growths were significantly positive and the growth rates in production (>3%) are higher than area growth rates (>2%) due to significant growth in yields. In the North western states, area and production growths were positive and significant during the period 1965-84, but turned negative thereafter, perhaps as a reflection of several drought years in Rajasthan.

The main reason for this reduction in chickpea area in the northern states was the development of high-yielding and fertilizer responsive semi-dwarf varieties of wheat which replaced chickpea. The expansion in area under irrigated cultivation of wheat and other irrigated crops became more profitable as compared to chickpea.

The shift in the chickpea area from cooler long season environments to warmer short season environments of southern India was attributed to the introduction of improved short duration and Fusarium wilt resistant varieties which did well with limited available moisture and also fetched good price in the market.

The productivity of chickpea has not gone down despite being relegated to marginal and high-risk prone areas with short growth cycle due to terminal drought. On the contrary, chickpea productivity increased by 1.7% in the central and peninsular India and is now at par with the yield levels in the traditional growing areas where yield have increased only marginally (Table 2, Fig. 2). This was possible due to the development of early maturing chickpea cultivars tolerant to heat stress and resistant to Fusarium wilt and well adapted to the semi-arid conditions leading to higher and stable yield. These improved varieties have extended the area of the crop into zones further South than ever before. However, managing Helicoverpa pod borer is essential to harvest reasonable yields.

Table 2. Region-wise chickpea area, production and yield growth rates (% per annum)

Period	Region								
	North & North eastern			Central & South			North west		
	A	P	Y	A	P	Y	A	P	Y
1965-1984	-3.35	-3.02	0.34	1.76	3.18	1.40	2.33	4.00	1.64
1985-2004	-4.73	-3.92	0.85	2.13	3.94	1.77	-1.77	-1.26	0.52
1965-2004	-3.88	-2.99	0 93	1.93	3.64	1.68	-0.52	0 04	0.56

A: Area; P : Production; Y: Yield

State and District Level

At the disaggregated state level, chickpea area and production have become more specialized (concentrated) with Madhya Pradesh accounting for 41% of the national area and 45% of all-India production in 2000-04 compared to 20% and 16%, respectively in 1965-69. The Simpson Index of diversification for chickpea area decreased from 0.82 to 0.77, indicating a higher degree of specialization (concentration) in chickpea area compared to mid-sixties. The index also declined for chickpea production. At the same time, share of northern states declined dramatically, for example in Punjab from 9% to 0.1% share in area, and in Haryana from 13% to 1.8% share in all-India area. (For details of state-wise trends in area, production and yield, see Table 3).

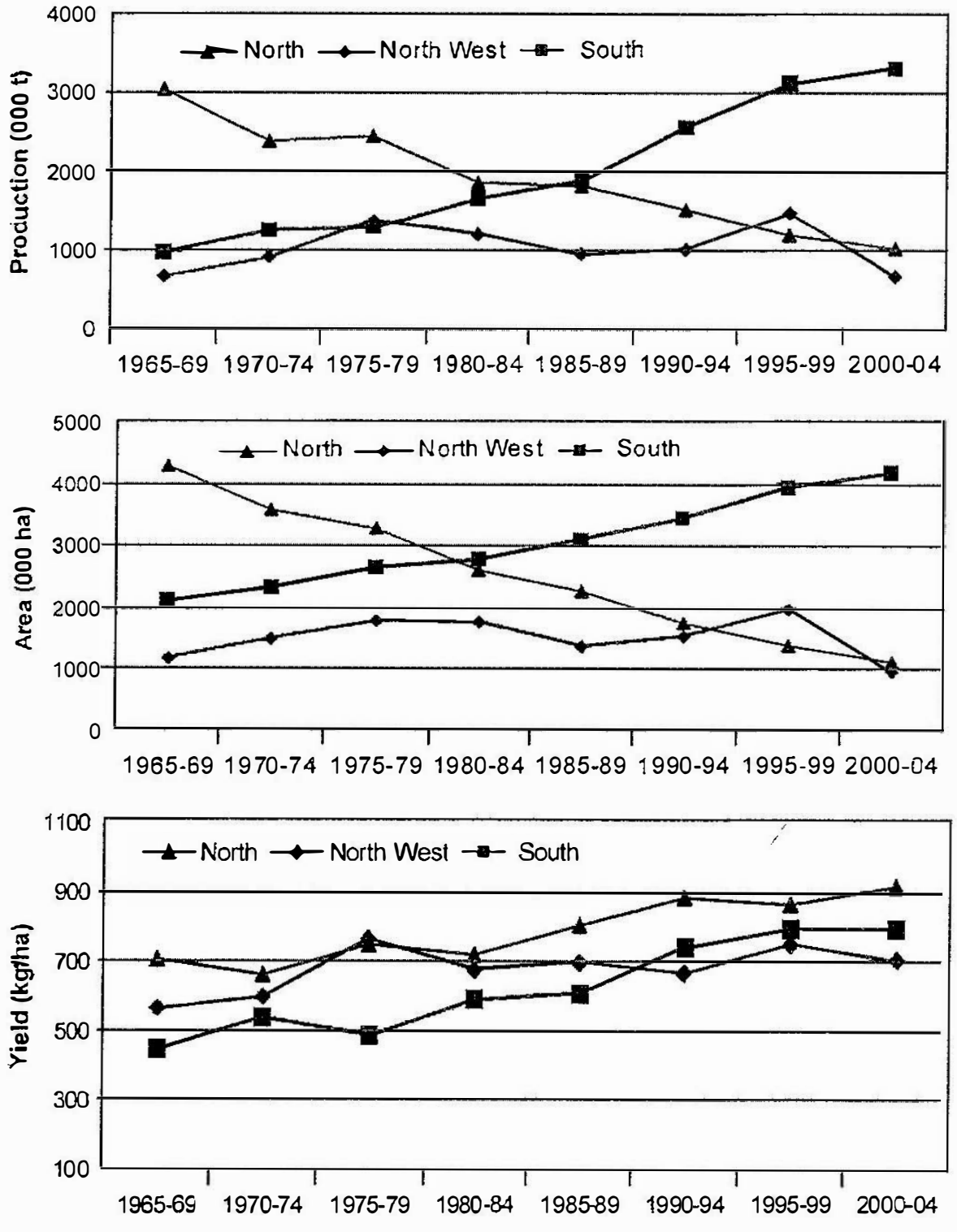

Fig. 2 : Region-wise trends in chickpea area, production and yield in India

Table 3. Share of different Indian states in national area and production of chickpea and change over time

State	1965-69		2000-04	
	Area (%)	Production (%)	Area (%)	Production (%)
Andhra Pradesh	0.95	0.39	5.28	7.16
Bihar	3.98	3.96	2.05	2.33
Gujarat	0.57	0.35	1.27	1.19
Haryana	13.06	18.72	1.79	1.76
Karnatka	2.21	1.44	7.20	4.64
Madhya Pradesh	19.79	16 45	41.40	44.98
Maharashtra	4.63	2.18	12.58	8.90
Orissa	0.28	0.26	0.43	0.31
Punjab	8.82	9.97	0.11	0.12
Rajasthan	14.95	14.22	13.67	11.90
Tamilnadu	0.10	0.08	0.10	0.08
Uttar Pradesh	29.84	33.20	12.99	15.09
West Bengal	2.15	2.60	0.79	0.87
All India	7826.20	4734.40	6210.12	4963.40
Simpson Index of Diversity[1]	0.82	0.79	0.77	0.74

[1]The index ranges between 0 and 1. If complete specialization exists, the index moves towards 0 and if there is diversification, the index moves towards 1. The index provides a clear dispersion of crop in a given geographical region

The changes in chickpea area and production are also observed at the more disaggregated district level. Fig. 3 gives an indication of the change in chickpea area between 1966 and 2003. Districts falling along the diagonal line indicate no significant change in area between the two periods. From the figure we find that a majority of the districts are either above or below the diagonal indicating increase or decrease in area, respectively. Generally, we find that chickpea area increased in districts with small area (<15,000 ha) under the crop in 1966, while it declined in districts with large area (>25,000 ha) in 1966 with some exceptions. These findings are further corroborated by computing the ratio of chickpea area between 1966 and 2004 (area in 2004/area in 1966) which shows that chickpea area decreased significantly (ratio<0.85) in 119 districts, while it increased significantly (>1.15) in 69 districts and remained constant (0.85 to 1.15) in only 11 districts (Table 4). From Table 4, it can also be seen that about two third of the districts where area declined had more than 25,000 ha area under chickpea in the base year (1966). The disaggregated data further illustrate the dynamic changes taking

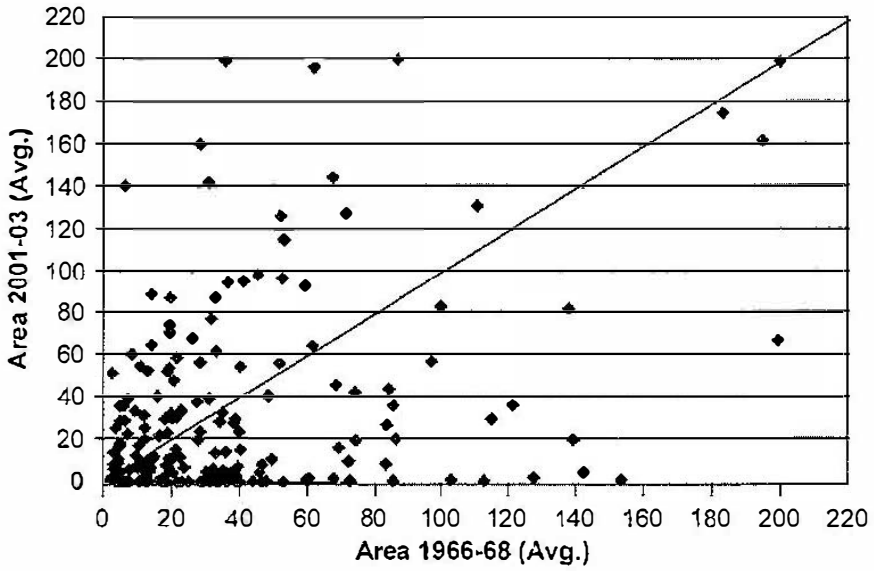

Fig. 3 : Change in area under chickpea at district level (000 ha)

1. Includes all districts above 2,500 ha under chickpea in 1966-68 (No. of districts = 199)

place in the center of chickpea area and production. These changes also allude to greater specialization of chickpea area and production. For instance, in 1966, the top 50 districts (in terms of chickpea area) accounted for 63% of chickpea area in India while in 2004, the top 50 districts accounted for 73% of chickpea area indicating greater relative concentration.

Table 4. Change in ratio of chickpea area at district level between 1966 and 2003

Area in 1966 ('000 ha)	No. of districts	Increase in ratio (>1.15)	Decrease in ratio (< 0.85)	No change in ratio (0.85 to 1.15)
Low (•2.5 and <10)	47	22	20	5
Medium (•10 and < 25)	56	24	31	1
High (•25)	96	23	68	5
All districts	199	69	119	11
Per cent to all districts	–	34.7	59.8	5.5

REASONS FOR REGIONAL SHIFT

Change in Chickpea Profitability

The decline in chickpea in the northern states was largely driven by change in profitability of chickpea *vis-a-vis* other competing crops. Change in per unit cost of production (technical change leading to higher yields) and relative prices determine relative profitability. An earlier study conducted by Kelly and

Parthasarathy Rao (1996) found that between 1970 and 1989 the increase in wheat yields by 3.1% translated into a 1.4% increase in wheat area despite a fall in real wheat prices by –2.6%. Chickpea area in contrast, declined by 0.9% due to stagnant yields despite an increase in real prices, implying the increase in real prices did not compensate for the stagnant yields. For rapeseed and mustard, growth in real prices by 2.9% led to 1.8% increase in area despite a marginal decline in yields.

Yield stability is another factor determining production risks. Under irrigated conditions between 1971 and 1986, chickpea yields were found to be more variable compared to wheat with a CV of 19% (detrended data) compared to 8% for wheat and 11% for rape and mustard (Kelly and Parthasarathy Rao 1994). In the southern states (Andhra Pradesh and Karnataka), the increase in chickpea area can be attributed to growth in real prices and high productivity growth making chickpea competitive among other dryland crops.

Availability of Early Maturing Varieties

Chickpea is a hardy crop well adapted to stress environments. More than 90% of the tropical chickpeas are grown as a post-rainy season crop, deriving most of their water requirement from stored soil moisture. Chickpea is known to be photo-thermo sensitive and its maturity duration ranges from 80 to 180 days depending on genotype, soil moisture, time of sowing, latitude and altitude. Low temperatures, shorter photoperiods and optimal soil moisture, individually or in combination, help in extending the growth period while higher temperatures, longer photoperiods and moisture stress conditions are known to shorten all developmental phases, thereby reducing the crop duration (Summerfield et al. 1990).

As chickpea is a cool season food legume, the general perception is that it requires cooler and longer winter season and hence is more suited to northern India. However, a major shift in chickpea area from northern India to central and southern India suggests that it can be grown successfully throughout India, provided suitable varieties and production technologies are available.

Phenology (time to flowering, podding and maturity) plays critical role in adaptation of chickpea cultivars to varied environments (Berger et al. 2004, 2006). Early maturity is desirable in chickpea for its adaptation to short season environments and for escape from terminal drought, which is the most serious constraint to chickpea productivity in the semi-arid tropics. The central and

southern parts of India have typical short season tropical environment where the growing season available for chickpea is short (90-120 days) and is terminated by drought at the end of the season (pod filling stage of the crop) and evapo-transpiration.

Availability of early maturing *desi* and *kabuli* chickpea cultivars along with suitable crop production packages has been the main catalyst behind the expansion of chickpea area in central and southern India. ICRISAT-NARS collaborative efforts have led to the development of several early maturing *kabuli* cultivars well adapted to the semi-arid environments, *e.g.*, ICCV 2 (ICRISAT 1990), PKV Kabuli 2 or KAK 2 (Zope et al. 2002), JGK 1 (Gaur et al. 2004) and Chefe (Ketema et al. 2005). The development of extra short duration *kabuli* variety ICCV 2, which matures in 85-90 days and has resistance to Fusarium wilt, was instrumental in expanding the *kabuli* chickpea area in lower latitudes, with warmer temperatures.

In *desi* chickpea also, several short duration cultivars are available which are ideally suited for the short winter season. Some of the most popular cultivars include ICCC 37 and JG 11 (ICCV 93954) in southern India. The variety ICCC 37 was released in 1989 for general cultivation by the Government of Andhra Pradesh under the name Kranthi. It matures in 90-100 days and gives an average yield of 1.6-1.8 tonnes/ha. In Gujarat, early maturing cultivars of chickpea, ICCV 2 and ICCV 10 are preferred by the farmers because the grain price is relatively higher early in the season. Moreover, the farmers also felt that earlier maturing cultivars would escape the stress caused by receding soil moisture and pod-borer infestation. ICCV 96029 and ICCV 96030 are two super early and cold tolerant lines that mature in 75-80 in South India. These lines are being extensively used by NARS in India as source of earliness in chickpea breeding programmes. Key traits such as short internode, double podding and early flowering could be used to induce earliness in order to reduce the requirement of a long growing season for chickpea and subsequently minimize end-of-season production risk. The early maturing varieties of chickpea adapted to late sown conditions have occupied considerable area left fallow after the harvest of rainy season rice in Madhya Pradesh and Chhattisgarh.

Epidemics of Blight in North Western States

Ascochyta blight, caused by *Ascochyta rabiei* (Pass.) Lab. is a major constraint to the production of chickpea in the North western part of India. The chickpea crop was completely damaged due to Ascochyta blight in North western states of

India during the epidemic of 1981-83. Epidemic of blight are favoured by temperatures between 10-20°C and moderate to high (> 60%) relative humidity (Nene 1982). Reddy and Singh (1990) estimated yield loss in a range of genotypes differing in reactions to Ascochyta blight. The yield loss varied from 10% in resistant genotypes to 100% in susceptible cultivars by foliar application of a fungicide. Hence, many farmers in the blight endemic northwestern part of India discarded chickpea cultivation due to the risk of the crop being wiped out by the blight.

A Guaranteed Crop for Semi-arid Farmers

The most important factors determining chickpea area are profitability and risk avoidance. In India, chickpea fetches a higher price as compared to other pulses which provides a strong incentive to farmers for expanding area under chickpea, provided adaptation is improved in order to minimize risk. Chickpea brought hope to farmers of central India in 1990s when the cotton crop failed repeatedly and the debt-ridden farmers were driven to suicide. The heavy pest damage in other cash crops like chilli and tobacco and rising prices of inputs like fertilizers and pesticides forced to look for better alternatives.

Chickpea helped the farmers to reduce costs of cultivation besides increasing their net income. Impact studies conducted by ICRISAT have revealed that the net income of the farmers in the Gujarat State increased by 84% by the adoption of cultivar ICCV 10 over the local variety (Shiyani et al. 2001). With the availability of improved short duration and Fusarium wilt resistant *desi* and *kabuli* cultivars, and higher chickpea prices in the market during the past few years, farmers have responded favourably towards chickpea cultivation. These varieties are a boon to chickpea farmers of the semi-arid tropics, providing them with a rewarding new option for their marginal lands.

Andhra Pradesh is one state which has witnessed dramatic change in chickpea cultivation. Many farmers of the state have now switched from cotton to chickpea cultivation as it required less investment in terms of labour and of insecticides and was drought tolerant. Yet it gave high returns at the end each cropping season.

Resistance to Fusarium Wilt

Fusarium wilt, caused by *Fusarium oxysporum* f.sp. *ciceri*, is the most important root disease of chickpea in the semi-arid tropics (SAT), where the growing season

is dry and warm. Thus, chickpea cultivars targeted for SAT must have resistance to Fusarium wilt. Effective field, greenhouse and laboratory procedures for screening against Fusarium wilt have been developed (Nene et al. 1981) and more than 160 resistant accessions (150 *desi* and 10 *kabuli*) were identified and used in developing wilt resistant cultivars (Haware et al. 1992).

IMPACT OF CHICKPEA IN CENTRAL AND SOUTHERN INDIA

Chickpea as a winter pulse crop has gained considerable importance in the past few years in peninsular India. Several cultivars with high yield potential, early maturity and durable resistance to Fusarium wilt have been released for cultivation in the semi-arid regions of central and southern India and their adoption is showing impact on enhancement of chickpea production in short season environments. A silent chickpea revolution has taken place in Andhra Pradesh where the area has increased from 106,000 hectares in 1996-97 to 384,000 hectares in 2005-06. The most remarkable feature is the increase in yield from 853 to 1596 kg/ha during this period. The increase in area and yield level has led to almost 7-fold increase in chickpea production (90,000 to 629,000 tonnes). Andhra Pradesh which was once a low productive state for chickpea has now become the state with highest chickpea yields in India. This silent chickpea revolution in Andhra Pradesh was attributed to the introduction of improved short duration and Fusarium wilt resistant varieties which did well with limited available moisture and also fetched good price in the local market.

In Andhra Pradesh, chickpea has replaced other crops such as chillies, tobacco and winter sorghum. The short duration chickpea varieties have carved a niche in the cotton belt of Andhra Pradesh in India. Many farmers have adopted two new cropping patterns, soybean-chickpea and sesame-chickpea, to replace cotton cultivation. The farmers no longer suffer from health hazards arising from persistant use of insecticides required for cotton cultivation. There are lesser pest attacks because the crop rotation has averted the build-up of pests.

The popularization of improved, disease resistant varieties and production technology through frontline demonstrations has led to significant increase in production and yield in western Maharashtra. The soybean-chickpea rotation has become popular in central Madhya Pradesh. In Karnataka, improved varieties of chickpea have led to gradual shift in the cropping system from *rabi* sorghum to chickpea.

FUTURE DIRECTION

Development of high yielding, short-duration, multi-stress tolerant, input responsive and photo-thermo insensitive varieties suited for varied agro-ecological conditions can bring additional area under chickpea. The gene pool of wild species of *Cicer* needs to be exploited using tools of biotechnology for harnessing genes for various biotic and abiotic stresses.

Chickpea breeding programmes need to focus on the most preferred quality traits such as grain size, color, texture, type and cooking quality with a view to meet consumer preferences which vary from region to region.

Developing cultivars with resistance to the prevalent races is a continuous breeding objective. In addition, there is need to incorporate resistance to pod borer. Emphasis needs to be placed on the use of Integrated Pest Management (IPM) based on judicious insecticide use and biological pest control through appropriate cropping systems and using chickpea varieties which are less susceptible or escape damage. An alternative approach to control pod borer damage is transfer of genes coding for insecticidal proteins such as *Bt* in chickpea using genotype independent regeneration and transformation system.

Among abiotic stresses, drought and frost are more important in central and southern India. Frost may sometimes damage the chickpea crop in Gujarat and Madhya Pradesh during mid-December to late January. The damage is severe if the frost coincides with early pod development. Selection of cold tolerant varieties or change in the time of sowing may minimize the damage due to frost. As the chickpea crop is grown on residual soil moisture, grain yield is drastically reduced to drought. In such a situation, adopting early maturing varieties can give good returns.

About 11.6 million ha area in India remains fallow after the harvest of rice due to lack of irrigation (Subbarao et al. 2001). The short-duration chickpea cultivars offer enormous potential for expansion of area in the rice-fallows of northern and central India.

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Appendix

State-wise trend in area ('000 ha), production ('000 t) and yield (kg/ha) of chickpea

State		1966-70	1971-75	1976-80	1981-85	1986-90	1991-95	1996-2000	2001-05	2005-06
Madhya Pradesh	A	1606.9	1724.7	1925.6	2034.9	2225.9	2405.8	2598.5	2522.4	2581.0
	P	803.7	10.62.7	1027.6	1321.5	1503.0	1961.1	2344.2	2191.2	2371.0
	Y	500.8	616.8	537.6	647.4	674.8	812.0	903.0	863.0	925.0
Maharashtra	A	370.6	379.9	453.8	466.3	574.1	628.4	803.6	781.4	1088.0
	P	104.1	112.3	169.5	177.7	255.2	365.4	465.4	441.8	713.0
	Y	280.0	292.0	351.6	379.2	429.8	571.2	572.2	564.0	655.0
Andhra Pradesh	A	75.6	67.1	67.7	51.7	53.2	93.9	134.9	327.8	354.0
	P	20.9	23.1	23.3	19.1	22.8	66.6	88.9	355.2	629.0
	Y	278.0	344.4	337.8	368.4	428.6	677.2	670.8	1096.8	1596.0
Karnatka	A	180.6	152.9	167.9	162.8	215.1	273.1	330.6	447.4	390.0
	P	76.0	56.8	67.3	68.4	77.6	114.5	165.6	232.0	196.0
	Y	412.8	364.2	399.8	420.8	357.2	400.0	499.8	525.8	500.0
Uttar Pradesh	A	2347.4	1932.8	1647.1	1461.6	1409.6	1098.9	902.6	809.1	740.0
	P	1500.8	1325.1	1135.3	1239.8	1150.5	978.9	769.9	751.6	661.0
	Y	622.8	682.6	693.6	851.4	814.6	891.8	858.2	930.6	893.0
Bihar	A	311.3	251.2	218.9	184.6	175.4	144.2	119.0	70.4	66.0
	P	202.1	149.8	130.6	142.4	141.9	142.7	104.8	68.7	59.0
	Y	639.0	600.0	598.6	771.8	811.0	989.2	895.2	976.4	894.
Haryana	A	991.2	966.7	980.0	712.6	547.8	429.8	306.8	110.6	0146.0
	P	786.0	552.6	811.2	338.2	414.6	355.0	264.0	86.8	81.0
	Y	773	564.8	802.8	496.0	692.8	829.0	818.0	780.2	555.0
Gujarat	A	40.0	47.9	71.4	109.2	72.2	122.0	113.4	79.2	167.0
	P	18.1	36.2	46.5	91.2	43.3	82.1	82.2	59.2	142.0
	Y	448.8	773.8	651.6	828.4	596.0	654.0	698.4	654.6	850.0
Orissa	A	21.9	24.1	35.5	44.7	43.8	36.1	33.2	26.6	35.0
	P	11.7	12.6	16.8	26.4	28.2	22.4	19.5	16.0	23.0
	Y	527.2	520.2	472.0	597.4	643.4	613.6	586.2	594.4	657.0
Rajasthan	A	1166.2	1478.0	1743.1	1658.5	1292.4	1387.7	1828.9	848.9	1082.0
	P	672.7	878.9	1337 4	1098.2	907.3	920.4	1367.5	590.6	479.0
	Y	568.4	596.0	755.2	663.6	679.2	659.2	735.8	697.2	443.0
Punjab	A	512.9	326.0	334.0	164.7	83.1	30.4	13.6	6.6	4.0
	P	393.6	272.8	291.0	89.0	64.0	53.2	11.9	6.0	3.0
	Y	766.2	836.0	856.8	548.6	753.2	785.8	878.4	908.2	750.0
West Bengal	A	168.5	115.5	98.6	71.7	53.3	21.4	27.2	47.5	40.0
	P	123.3	74.1	73.0	51.1	39.1	18.3	23.5	43.4	45.0
	Y	732.4	641.8	743.8	729.0	729.6	874.6	852.6	919.8	913.0
Tamil Nadu	A	3.0	8.1	8.4	10.2	7.1	7.6	8.0	6.4	-
	P	1.6	4.3	4.9	6.3	4.7	4.9	5.2	4.3	-
	Y	535.0	554.0	580.0	610.4	656.4	630.2	655.0	672.8	-

A: Area; P : Production; Y: Yield

Source: Agricultural Statistics at a Glance