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Silent Chickpea Revolution in Non-Traditional Areas - Some Evidences from Andhra Pradesh

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INTRODUCTION

Traditionally, chickpea was not a prominent pulse crop in the hot and dry climate regions. However, this region now contributes more than 70 per cent of the total chickpea production in India, and shows enormous potential for further expansion. The typical characteristics of hot and dry climate pose a major production constraint caused due to severe drought and heat. In addition, the principal biotic constraints, which limit chickpea production in this environment are wilt and root rots among major diseases; and pod borer and leaf minor among insects (Ali *et al.*, 1997). Although the status and intensity of abiotic and biotic constraints over the years have remained unchanged, chickpea area in this non-traditional region has substantially increased since 1990. A swift change of chickpea area in hot and dry climate has raised a logical question on its sources of area expansion, and reasons thereof. The present study is an attempt to unravel this riddle with the following specific objectives: (i) to assess the growth performance of chickpea area, production and yield in hot and dry climate regions, (ii) determine the sources of chickpea area expansion, and (iii) examine the role of policy and technology (improved varieties) on area shift in favour of chickpea. The study postulated two hypotheses: (i) *rabi* fallow and marginal lands released substantial area for chickpea cultivation, and (ii) availability of improved technology (e.g., new varieties) facilitated area expansion of chickpea.

II

METHODOLOGY

Study Area

The study confirmed the set hypotheses in Andhra Pradesh where the area under chickpea increased substantially since 1990. In the state, chickpea area, which was vacillating around 50,000 hectares (ha) during 1980s, has reached to a record level of 1,68,000 ha in 1994-95 (Government of India, 1995). Production of chickpea accelerated more than 16 per cent annually during the last five years.

The state is located in the southern part of India, which experiences severe hot and dry conditions. This type of climatic conditions is not generally conducive for chickpea production. Chickpea in the state is largely grown under rainfed condition. The annual rainfall of the state is less than 1000 mm (925 mm). About 70 per cent of the annual rainfall occurs

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during the south-west monsoon (July to September), 23 per cent of the total annual rainfall is received during the north-east monsoon (October to December) and winter period (January-February). Chickpea in the state is sown from late September to late November. September and October rainfall primarily influences the extent of acreage sown to the crop while the north-west monsoon and winter rains affect the yields.

The state is divided into Coastal Andhra Pradesh, Rayalaseema and Telangana regions. About 90 per cent of the chickpea is sown in Rayalaseema and Telangana regions. In view of their large share under chickpea area in the state, the study was focused on Rayalaseema and Telangana regions.

Data

The study used both secondary and primary data to test the hypothesis of the study in Andhra Pradesh. District-wise secondary data were collected and used to analyse trends in area, production and yields of chickpea from 1970-71 to 1995-96.

The primary data were also collected to assess the adoption of improved chickpea varieties in the selected districts as information on this important aspect is seldom documented. The data were collected in 1995-96 with questions inquiring about farmers' recollection of adoption pattern related to different chickpea varieties for the period 1991-92 to 1994-95. The same was also confirmed with the officials of the extension department of the Andhra Pradesh Government.

To collect primary data, a systematic sampling scheme was developed. First, all the districts sowing chickpea in more than 10,000 ha were selected. These were Anantapur and Kurnool in Rayalaseema regions and Medak in Telangana region. These districts cover almost 80 per cent of the total chickpea area of about 1,35,000 ha in the two regions, and about 65 per cent in Andhra Pradesh.

Three-stage stratified sampling scheme was followed to select chickpea growers from the pre-decided districts. In the first stage, mandals were systematically chosen. Mandals in each district were stratified into three strata according to the intensity of chickpea cultivation: top 33 per cent chickpea growing mandals as high intensity areas; next 33 per cent as medium; and the remaining as low intensity areas. One mandal was randomly picked up from each stratum, making three mandals from each district. For Anantapur district, only one mandal was selected from high intensity stratum as the area under chickpea was too low in the other two strata. In all, seven mandals were selected from the three districts.

In the second stage, three villages were randomly selected from each mandal. Finally, at the third stage, ten chickpea growing farmers from each mandal were randomly chosen, making a total sample of 210 chickpea farmers for the study.

Analytical Approach

(a) *Chickpea in Andhra Pradesh*

To evaluate the performance of area, production and yield of chickpea, their compound growth rates were estimated between 1970-71 and 1995-96. To study the decade-wise

performance, the span of 25 years was divided into three periods: (i) 1970-71 to 1979-80 (decade of the 1970s), (ii) 1980-81 to 1989-90 (decade of the 1980s), and (iii) 1990-91 to 1995-96 (early part of 1990s).

(b) *Sources of chickpea area expansion*

To examine the sources of area expansion of chickpea, temporal changes in cropping pattern during the *rabi* season were studied between 1989-90 and 1995-96. Similarly, information was estimated on the extent of *rabi* fallow which is neither compiled nor reported. To estimate the area under *rabi* fallow, a simple procedure was used as follows:

(i) Separated all crops into *kharif* and *rabi* groups. When a crop was in the field in both the seasons (e.g., sugarcane, cotton, pigeonpea), it was included in both the seasons. Calculated the total area of these crops in two seasons by addition of individual crop areas.
(ii) Took the total area of all crops (both seasons) and subtracted from the gross cropped area. This gave the area of all other crops (e.g., vegetables, spices, other grain, etc.) which were not included in step (i).
(iii) Since there was no information on the seasonality of these crops, arbitrarily assumed half the area in *kharif* and half in *rabi*. These other crops usually cover less than 5 per cent of the gross cropped area in a district.
(iv) Added *rabi* area of principal crops and half the area of all other crops to estimate the total area of *rabi* crops.
(v) Subtracted the area calculated in previous step from net cropped area to estimate *rabi* fallow.

(c) *Extent of improved chickpea varieties*

To understand how improved chickpea varieties were spreading in the selected districts, their adoption pattern between 1991-92 to 1994-95 was estimated on the basis of the on-farm survey.

(d) *Chickpea area response model*

Area response model was estimated to identify the factors which determine chickpea area allocation. The specific model used was as follows:

$$AREA_{cp} = f(AREA^{-1}_{cp}, Y^{-1}_{cp}, Y^{-1}_{cc}, P^{-1}_{cp}, P^{-1}_{cc}, CV_{cp}, CV_{cc}, HYV_{cp}, IR, RF_s, t)$$

where $AREA_{cp}$ is the chickpea area in period t, $AREA^{-1}_{cp}$ is chickpea area in t-1 period, Y^{-1}_{cp} is yield of chickpea in t-1 period, Y^{-1}_{cc} is the yield of the competing crop of chickpea in period t-1, P^{-1}_{cp} is the farm harvest prices of chickpea in t-1 period, P^{-1}_{cp} is the farm harvest prices of the competing crop of chickpea in t-1 period, CV_{cp} is the coefficient of variation in chickpea yield (based on three-year moving average), CV_{cc} is the coefficient of variation of competing crop yield of chickpea (based on three-year moving average), HYV_{cp} is the dummy used for the availability of improved varieties from 1991 onwards, IR is the irrigated

area in period t, RF_s is the rainfall in September-October, and t is the time trend.

In this model, technology related information is represented by chickpea yield, coefficient of variation in yield of chickpea, and area under improved chickpea varieties. Similarly, prices of chickpea and competing crops are proxies for price policy.

III

RESULTS AND DISCUSSION

(i) *Chickpea in Andhra Pradesh*

Chickpea area which was about 70,000 ha in the early 1970s substantially declined to 51,000 ha in the early 1980s, but impressively crossed 1 lakh ha in the early 1990s (Table 1). In an unprecedented trend, chickpea area in the state continuously descended until 1980-81. However, the declining trend stabilised around 50,000 ha during the early 1980s, and later started showing an increasing trend. Since 1990-91, there was a sharp increase in the chickpea area, which was almost doubled in 1995-96 in contrast to 1980-81. Chickpea production also followed a similar pattern.

TABLE 1. CHICKPEA AREA AND PRODUCTION IN ANDHRA PRADESH

Year* (1)	Area (000 ha) (2)	Production (000 tonnes) (3)	Yield ($kg\ ha^{-1}$) (4)
1970	78.87	22.86	290
1980	55.81	16.35	293
1990	60.14	37.50	624
1995	105.68	36.37	723

* Triennium average ending 1970, 1980, 1990 and 1995.

Annual compound growth rates in area, production and yield of chickpea were computed for different periods in the state (Table 2). The results showed that the compound growth rate of chickpea production was declining at an annual rate of 2.31 per cent during 1970-80 period. This decline was due to drop in its area and yields. This was the period when both area and yield were responsible for decreasing chickpea production in the state. There was a conspicuous change in chickpea production in the state during 1981-90 period, when it increased at an annual rate of 5.75 per cent. Increase in production during 1981-90 period was both from yield increments (about 60 per cent) and area expansion (about 40 per cent). During this period (1981-90), chickpea regained the area that was lost during the 1970s. Chickpea production sharply increased during 1991-96 period, an unprecedented annual compound growth rate of 16.05 per cent. Interestingly, the entire growth in production was contributed by area. The area under chickpea during 1991-96 increased at an annual rate of about 20 per cent. Ironically, the yield levels during this period showed a declining trend, and the annual compound growth rate was -3.20 per cent.

TABLE 2. ANNUAL COMPOUND GROWTH RATES OF PRODUCTION, AREA AND YIELD OF CHICKPEA, ANDHRA PRADESH

(per cent)

Period (1)	Production (2)	Area (3)	Yield (4)
1970-80	-2.31	-1.12	-1.21
1981-90	5.75	2.28	3.39
1991-96	16.05	19.88	-3.20

The analysis on growth rates of area and yield during 1991-96 period provided some clue that chickpea cultivation was spreading in the marginal environments. This view was ascertained as the growth in yield was declining despite substantial increase in the area. Such a scenario is expected when the gain in chickpea area comes from marginal lands where yield levels are much lower than on normal lands. Obviously, the lower yield levels on the marginal land will bring down the average yields.

(ii) *Spatial Variation in Chickpea Growth*

District-wise annual compound growth rates in area, production and yield of chickpea were computed and presented in Table 3. District-wise temporal changes in chickpea area are given in Table 4. About 40 per cent of the districts in Andhra Pradesh showed a declining trend in area under chickpea during 1971-80 period. These districts covered about 36.3 thousand ha during 1971-75 which accounted for about half of the total chickpea area and production in the state. With few exceptions, the declining trend in area under chickpea continued during 1981-90 with more districts joining the group. During 1981-90 period, about 70 per cent of all the districts showed negative growth rate in area under chickpea. These districts accounted for about 80 per cent of chickpea area and nearly 75 per cent of total chickpea production in the state. Interestingly, the trends reverted in 1991-96 period, when all the districts, except two (Krishna and Srikakulam), showed positive growth rates in chickpea area. The two districts which showed negative growth rates covered a negligible chickpea area (less than 100 ha).

Interestingly, during 1981-90 period, chickpea production declined because of fall in area as well as yield levels. This indicates that chickpea area was released from better endowed regions for other competing crops, and it was largely confined and relegated to the more marginal lands. Such a phenomenon was evident from the declining yield trends. Chickpea scenario has suddenly changed across districts in Andhra Pradesh after 1990-91. Chickpea production increased in all the districts between 1990-91 and 1995-96. Area expansion was invariably a source of growth in the production of chickpea. In six districts, area expansion outpaced the negative yield effect for a positive and high growth of chickpea production. These districts were Adilabad, Anantapur, Cuddapah, Khammam, Kurnool and Visakhapatnam which covered about 66 per cent of the total chickpea area in the state. Area expansion with declining growth rates in yields is a clear indication that chickpea is gaining importance in marginal lands.

TABLE 3. DISTRICT-WISE ANNUAL COMPOUND GROWTH RATES OF CHICKPEA PRODUCTION, AREA AND YIELD, ANDHRA PRADESH

(per cent)

District	1970-79			1980-89			1990-95		
(1)	Production (2)	Area (3)	Yield (4)	Production (5)	Area (6)	Yield (7)	Production (8)	Area (9)	Yield (10)
Adilabad	-0.17	-3.65	3.61	-14.53	-6.08	-9.00	32.98	11.53	19.21
Anantapur	6.87	0.13	6.73	17.35	21.17	-3.15	24.55	36.88	-9.00
Cuddapah	5.66	3.77	1.82	21.59	27.39	-4.56	15.59	18.88	-2.77
Guntur	2.08	1.53	0.54	-5.49	-4.19	-1.35	44.31	45.09	-0.54
Hyderabad	0.02	-1.93	1.99	-14.36	-3.55	-11.21	25.96	10.46	14.02
Karimnagar	-2.38	-7.52	5.56	-18.71	-12.43	-7.17	31.52	2.88	27.84
Khammam	7.06	1.32	5.67	-19.85	-25.40	7.44	0.00	19.90	-16.59
Krishna	0.93	1.17	-0.24	-14.76	-14.20	-0.65	22.47	-18.35	50.00
Kurnool	5.10	5.12	-0.02	26.54	16.99	8.16	7.21	18.95	-9.87
Mahabubnagar	0.62	-3.66	4.45	-7.15	-2.29	-4.98	51.77	20.22	26.24
Medak	-7.31	0.45	-7.73	6.23	-0.41	6.67	21.16	11.36	8.80
Nalgonda	3.26	4.47	-1.16	-20.98	-17.97	-3.67	67.30	27.02	31.71
Nellore	0.00	8.16	-7.55	20.43	24.72	-3.44	68.58	62.47	3.76
Nizamabad	-15.70	-4.06	-12.14	13.44	-4.88	19.26	12.82	7.65	4.80
Srikakulam	20.76	24.93	-3.34	3.19	-9.56	14.10	0.00	-8.71	9.54
Visakhapatnam	-11.78	-8.73	-3.35	11.05	8.05	2.77	4.88	32.29	-20.72
Warangal	-2.39	-3.39	1.04	-7.21	-4.93	-2.39	11.77	3.15	8.36

TABLE 4. DISTRICT-WISE CHICKPEA AREA IN DIFFERENT PERIODS, ANDHRA PRADESH

(000 ha)

District (1)	1971-75 (2)	1981-85 (3)	1991-95 (4)
Adilabad	5.14	3.00	2.24
Anantapur	2.28	2.64	16.07
Cuddapah	0.90	1.10	7.44
Guntur	5.30	4.70	6.56
Hyderabad	7.70	4.80	4.24
Karimnagar	5.30	1.88	0.96
Khammam	0.86	0.56	0.09
Krishna	1.04	0.38	0.03
Kurnool	5.40	6.38	35.21
Mahabubnagar	4.06	2.64	3.10
Medak	15.82	12.98	14.81
Nalgonda	1.56	1.40	0.76
Nellore	0.12	0.36	2.43
Nizamabad	11.90	6.48	3.64
Srikakulam	0.06	0.38	0.03
Visakhapatnam	0.12	0.16	0.06
Warangal	2.08	1.00	0.91

(iii) *Sources of Area Expansion*

About 48 thousand ha of new area was brought under chickpea cultivation between 1990-91 and 1995-96. Most likely such a large area may have come from either or both sources: (a) crop substitution, and (b) utilisation of fallow and marginal lands. It is not possible to obtain such information from the district-level data. However, based on the shift

in cropping pattern, and extent of fallow land, some indications were available which are given in Table 5. It is expected that the most important source of chickpea area expansion may be utilisation of fallow and marginal lands.

TABLE 5. SOURCES OF CHICKPEA AREA EXPANSION IN SELECTED DISTRICTS OF ANDHRA PRADESH

District	Crop area status		Status of fallow area
	Sorghum	Tobacco	
(1)	(2)	(3)	(4)
Anantapur	Declining	Declining	Declining
Kurnool	Declining	Declining	Declining
Medak	Declining	-	Declining
Andhra Pradesh	Declining	Declining	Declining

(a) *Crop substitution:* One of the important sources of area expansion of chickpea is area released from its competitive crops. It was noted that the area under *rabi* sorghum and tobacco was declining (Table 5). The area released from these crops will also be shared (of course not equally) by other competing crops. The table shows that the area under *rabi* sorghum declined in three selected districts, and that of tobacco in Anantapur and Kurnool. Most likely some area of *rabi* sorghum might be substituted by chickpea. The possible reason for crop substitution may be crop competition that was possible because of higher profitability of chickpea in comparison to *rabi* sorghum.

(b) *Fallow land:* Another significant source of chickpea area expansion is its cultivation in fallow lands. In the rainfed areas, most of the crop land is kept fallow during the *rabi* season due to unavailability of irrigation water and other resources, and low production potential of the soil (marginal lands). Following the steps mentioned in the section on methodology, it was observed that the area under *rabi* fallow in selected districts was decreasing over time (Table 6). The *rabi* fallow area in Kurnool district declined by 74,000 ha between the triennium averages ending 1990-91 and 1994-95 period. The corresponding

TABLE 6. TRENDS OF RABI FALLOW AREA IN SELECTED DISTRICTS OF ANDHRA PRADESH

(000 ha)

Year	Anantapur	Kurnool	Medak	Andhra Pradesh
(1)	(2)	(3)	(4)	(5)
1989	862	570	265	6,437
1990	822	562	254	6,237
1991	797	511	245	6,195
1992	814	514	236	6,472
1993	784	534	239	5,246
1994	727	401	229	4,864
1995	819	486	202	5,113

figures for Anantapur and Medak districts were 50,000 and 32,000 ha respectively. On the other hand, chickpea area was increasing in these districts. It is expected that a large area of the *rabi* fallow was used for chickpea cultivation. Between the triennium averages ending 1990-91 and 1994-95, chickpea area in Kurnool district increased by 16,000 ha, which was about 22 per cent of the *rabi* fallow area which declined during the same period. Similarly,

chickpea area between the triennium averages ending 1990-91 and 1994-95 increased by 13,000 ha in Anantapur district, which was 26 per cent of the declining *rabi* fallow area. In Medak district, chickpea area increased by 5,000 ha, which was 16 per cent of the falling *rabi* fallow area between the triennium averages ending 1990-91 and 1994-95.

(iv) *Reasons for Chickpea Area Expansion*

There are two important reasons for expanding chickpea area in hot and dry climate: (a) rapid increase in the chickpea prices, and (b) availability of improved chickpea varieties.

(a) *Role of prices in chickpea area expansion:* The average farm harvest prices of chickpea in the selected districts increased by 60 per cent between 1989-90 and 1995-96 (Table 7). On the other hand, the farm harvest prices of *rabi* sorghum during the same period increased by only 45 per cent. The temporal changes in absolute prices between chickpea and *rabi* sorghum were statistically significant at 1 per cent probability level. Higher chickpea prices influenced chickpea area in two ways. First, it was responsible to make chickpea more competitive in comparison to *rabi* sorghum. This induced farmers to release *rabi* sorghum area for chickpea. Second, the low yield levels made chickpea profitable at higher prices. It was estimated that the minimum yield of chickpea to cover the total cost which was 700 kg ha^{-1} in 1989-90 came down to 400 kg ha^{-1} due to rise in output prices. This made it possible for farmers to cultivate chickpea in marginal soils with low production potential.

TABLE 7. CHANGES IN FARM HARVEST PRICES OF CHICKPEA AND RABI SORGHUM IN ANDHRA PRADESH

(Rs. t^{-1})

District	Average price of chickpea			Average price of rabi sorghum		
	1988-90	1993-95	Per cent change	1988-90	1993-95	Per cent change
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Anantapur	627	1,100	75	220	360	63
Kurnool	680	1,030	51	225	340	51
Medak	655	1,005	53	255	320	25

(b) *Role of improved chickpea varieties:* Another most important reason for chickpea area expansion in hot and dry climate was the availability of improved new chickpea varieties. Since 1990, three improved chickpea varieties were released for cultivation in Andhra Pradesh. These were ICCC 37, ICCV 2 and ICCC 10, which were developed by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in collaboration with the national program such as Andhra Pradesh Agricultural University. It was noted that ICCC 37 and ICCV 2 were becoming popular in Andhra Pradesh due to their desirable traits to overcome the major constraints of chickpea cultivation, viz., (a) crop mortality due to terminal drought, and (b) low crop yields due to wilt disease. ICCC 37 is a high-yielding variety, matures in 90-100 days and resistant to wilt and tolerant to dry root rot (Kumar *et al.*, 1985). Similarly, ICCV 2 is an extra-short duration (matures in 85 days) kabuli type variety which is resistant to fusarium wilt. It is adapted to normal and late sowing, drought escaping and its green pods are preferred for vegetable purposes. The advantage of early

maturity is that the crop avoids the terminal drought in comparison to local varieties (e.g., Annigiri) which matures in about 140 days. In 1989 the Government of Andhra Pradesh released ICCC 37 and ICCV 2 for general cultivation.

(v) *Adoption of Improved Chickpea Varieties*

Based upon the on-farm survey, estimates on area under improved varieties were made in selected districts of Andhra Pradesh (Table 8). About 30 per cent of the sample farmers have sown improved chickpea varieties in 27 per cent of the total chickpea area in 1994-95. Among improved varieties, the popularity of ICCC 37 was growing in Medak and Anantapur districts, while ICCV 2 was seen to be more accepted in Kurnool district. Interestingly, the local high-yielding variety (namely, Annigeri) was still the ruling variety in Anantapur and Kurnool districts, which covered about 32 and 68 per cent of chickpea area respectively.

TABLE 8. ADOPTION OF IMPROVED CHICKPEA VARIETIES IN ANDHRA PRADESH

(percentage of total chickpea area)

District (1)	Cultivar (2)	1991-92 (3)	1992-93 (4)	1993-94 (5)	1994-95 (6)
Anantapur	Annigeri	24.20	23.15	19.45	32.35
	ICCC 37	5.70	5.15	12.15	19.40
	Local	70.10	71.70	68.40	48.25
Kurnool	Annigeri	86.20	77.40	81.90	67.50
	ICCC 37	0.22	0.20	0.15	0.90
	ICCV 2	4.90	8.40	8.90	22.25
	Other improved	0.60	6.20	0.95	2.00
	Local	8.08	7.80	8.10	7.35
Medak	Annigeri	15.20	11.90	14.80	13.85
	ICCC 37	38.30	49.00	51.45	48.10
	Local	46.50	39.10	33.75	38.05
Andhra Pradesh	Annigeri	74.50	66.20	70.10	57.60
	ICCC 37	4.25	5.50	6.40	8.60
	ICCV 2	4.05	6.85	7.30	17.35
	Other improved	0.60	5.05	0.75	1.55
	Local	16.60	16.40	15.45	15.20

In Medak district, the spread of ICCC 37 reached more than 50 per cent of total chickpea area in 1993-94 and dropped marginally to 48 per cent in 1994-95. In Anantapur district, the area under ICCC 37 was nearly 20 per cent in 1994-95. ICCV 2 which was more popular in Kurnool district experienced a consistent increase in adoption; reached to 22 per cent in 1994-95. Obviously, these varieties were slowly replacing the traditionally grown chickpea varieties. At the aggregate level, their share approached nearly 26 per cent in 1994-95 from about 8 per cent in 1991-92 displacing local varieties. Annigeri and other local varieties were largely replaced by these two varieties in Kurnool and Medak districts. In Anantapur district, both ICCC 37 and Annigeri predominated.

The varying adoption preferences imply that farmers in these regions attach different relative importance to the new varieties. In Kurnool district, preference for ICCV 2 is to escape drought as chickpea in this district is largely grown in uplands where moisture recedes rapidly. ICCV 2 is a short-duration variety which matures earlier than Annigeri and local varieties, hence escapes terminal drought (Kumar *et al.*, 1985). On the other hand, terminal

drought was not the major problem in Anantapur and Medak districts, therefore, farmers preferred ICCC 37, which was high-yielding and wilt resistant. Chickpea in Anantapur district was generally grown under favourable moisture environment, e.g., tank beds. In Medak district, the rainfall distribution is such that the crop gets sufficient moisture for vegetative growth and flowering.

The high-yielding traits of new varieties and their early maturity characteristics induced farmers to sow chickpea in the hitherto *rabi* fallow lands, and also in marginal areas. It is evident from the results that new varieties are spreading at a fast rate in hot and dry climate. Such a trend will certainly increase the farm income by cultivating crops in hitherto fallow lands. Utilisation of fallow lands has an added advantage as it controls soil erosion and conserves soil moisture.

(vi) *Factors Influencing Chickpea Area Expansion*

Regression analysis was done to identify factors influencing area expansion of chickpea in selected districts of Andhra Pradesh (Table 9). The linear regression equations were found best-fit in comparison to log-log and quadratic equations. It can be seen that the variables included in the model explained 93 to 99 per cent of the variation in determining chickpea area.

TABLE 9. RESULTS OF REGRESSION ANALYSIS ON FACTORS INFLUENCING AREA EXPANSION OF CHICKPEA IN SELECTED DISTRICTS OF ANDHRA PRADESH

Variable (1)	Anantapur (2)	Kurnool (3)	Medak (4)
Intercept	137.5403	122.2052	35.1811
Lagged chickpea area	-	-	-0.4499**
			(0.1285)
Chickpea yield	0.0064***	-0.0038	0.0248**
	(0.0037)	(0.0071)	(0.0248)
Sorghum yield	-0.0029*	-0.0045	-0.0194***
	(0.0021)	(0.0074)	(0.0028)
Chickpea prices	0.0293***	0.0615***	0.0264***
	(0.0071)	(0.0113)	(0.0036)
Sorghum prices	0.0276	-0.0047	-0.0273***
	(0.0236)	(0.226)	(0.0042)
Chickpea yield risk	0.0067	-0.0528	0.0562*
	(0.0298)	(0.0990)	(0.0201)
Sorghum yield risk	0.1419***	0.2302***	-0.6012***
	(0.0515)	(0.0945)	(0.0676)
Irrigated area	-0.6309*	-0.6260	0.1498*
	(0.4360)	(1.0691)	(0.0801)
Rabi fallow	-0.1162**	-0.09428	-0.0329
	(0.0518)	(0.0518)	(0.0805)
Pre-sowing rainfall	-0.0061*	-0.0047	0.0132***
	(0.0044)	(0.0109)	(0.0025)
Chickpea HYV	-4.4211*	20.0504***	5.2733***
	(3.1130)	(7.2910)	(0.7509)
Time	-2.3556***	-3.8707**	-1.5247*
	(0.7965)	(1.7832)	(0.9031)
R^2	0.9343	0.9345	0.9909
Adjusted R^2	0.8826	0.8830	0.9547

Figures in parentheses are standard errors of the estimated coefficients.
***, ** and * Significant at 1, 5 and 10 per cent level respectively.

In Anantapur district, chickpea yield, its prices, and *rabi* sorghum yield instability (represented by coefficient of variation in yield of *rabi* sorghum), positively and significantly influenced the chickpea area allocation. On the other hand, the regression coefficients of *rabi* sorghum yield, irrigated area and post-rainy season rainfall were negative and significant, indicating that any increase in these variables would result in area decline of chickpea, *ceteris paribus*.

In Kurnool district, chickpea prices, *rabi* sorghum yield and availability of improved chickpea varieties showed positive response to chickpea area allocation. In Medak district, chickpea yield, its prices, irrigated area, post-rainy season rainfall and availability of improved chickpea varieties positively and significantly determined allocation of chickpea area. The negative regression coefficients of yield, yield risk and prices of *rabi* sorghum suggest that any increase in their magnitude would release chickpea area for other crop(s) in Medak district.

It is interesting to note that there was a negative relationship between chickpea area allocation and the extent of *rabi* fallow in the selected districts, which indicated that any decline in *rabi* fallow would increase chickpea area, *ceteris paribus*. The regression coefficient was significant at 10 per cent probability level in Anantapur district while it was non-significant in Kurnool and Medak. Time trend also showed a negative sign, which implied that chickpea area would have declined if the variables included in the model remained constant. This indicated that in the absence of relatively favourable prices and yield of chickpea in comparison to its competing crop (namely, *rabi* sorghum), a decline in fallow area would have resulted in a decline in chickpea area.

The above analysis clearly implies that policy support (in terms of favourable prices) and technological change (in terms of improved high-yielding and short duration varieties) are necessary conditions for chickpea area expansion in the regions experiencing hot and dry climate.

IV

CONCLUSIONS

Chickpea area has rapidly increased from 1990-91 onwards in regions experiencing hot and dry climate, which is invariably a non-traditional chickpea-growing region. A large part of the area expansion in chickpea crop is coming from the area released by either *rabi* sorghum or *rabi* fallow or both. It was possible due to higher output prices and availability of improved chickpea varieties which were high-yielding, short duration and disease resistant in comparison to local varieties.

It was found that the area under improved chickpea varieties has rapidly increased in the hot and dry climate regions. The farmers preferred early maturing short-duration chickpea variety (ICCV 2) in areas where the soil moisture recedes rapidly, while high-yielding and wilt resistant variety (ICCC 37) in more favourable moisture regime. Farmers' preferences for specific varieties and the adoption pattern are largely influenced by proper targeting of the improved varieties, which suit the agro-climatic conditions.

The analysis confirmed that technological breakthrough (in terms of yield enhancement, quality improvement and risk minimisation) and policy support (in terms of higher prices) are necessary conditions for area expansion of chickpea in the non-traditional areas. A large area under *rabi* sorghum and *rabi* fallow was released for chickpea due to availability of improved high-yielding varieties and higher output prices. The new scenario (i.e., favourable

prices and availability of improved varieties) has witnessed a silent chickpea revolution in the non-traditional regions. This must be sustained by ensuring availability of appropriate seeds of improved varieties.

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