Indian Journal of Agricultural Sciences **85** (4): 555–60, April 2015/Article

Impact of adoption of improved varieties of chikpea (*Cicer arietinum*) on yield and income in Madhya Pradesh

NARAYAN SHARMA RIMAL[1] , SHIV KUMAR[2] , V P CHAHAL[3] and VIKRAM SINGH[4]

Indian Agricultural Research Institute, New Delhi 110 012

Received : 16 September 2014; Revised accepted: 29 December 2014

ABSTRACT

The adoption pattern of improved varieties of chickpea (*Cicer arietinum* L.) and their impact on farm income in Madhya Pradesh with 100 chickpea growing households spread over Vindhyan, Malwa and Bhagelkhand regions for the survey period of 2012-13 provided insight into the incidence and intensity/ penetration power of varieties in seed supply chain and increase in overall chickpea production in the state. Farmers of Vindhyan and Bhagelkhand regions mostly preferred *desi* varieties as they adopted JG 315 followed by JG 335, Ujjan 21 and JG 11, while Dollar and KAK 2 were dominant *kabuli* varieties in Malwa region. In general, the average price of *kabuli* chickpea was 31.17% higher than *desi* chickpea. In case *of kabuli* chickpea, the net revenue from Dollar variety was about 10% more than that obtained from KAK2.The physical and financial performance of JG 315 and Ujjain 21 were also better compared to other varieties in Vindhyan and Bhagelkhand regions. As a result of adoption of improved varieties the seed replacement rate of pulses has increased from 2.15% in 2002 to 11% in 2012. The major constraints expressed by farmers in adoption of improved varieties of chickpea included: low awareness of the new varieties; lack of pest resistant varieties; non availability of seeds of improved varieties; lack of access to credit; high cost of seed; and lack of short or extra short duration varieties. The paper recommends putting in place a system for demonstrating the production potential of the new and promising chickpea varieties and providing timely information, credit, inputs and market support to accelerate the adoption and production of chickpea in the state. The results also provide deep insight to stakeholders of chickpea not only to penetrate in seed markets but also help in deciding how to design R&D program as well.

Key words: Adoption, Chickpea, Farm income, Varieties

In India, chickpea (*Cicer arietinum* L.) rank first in production among all the pulses. It is cultivated on about 8.7 million hectares equivalent to one-third of the total pulses area and contributes close to 47% of the total output of the pulses (GoI 2012). However, chickpea yield has remained low, around 1 000 kg/ha which is much less than the obtainable yield. During 1970-71 to 1993-94 chickpea yield increased at an annual rate of 0.7% as compared to an annual growth rate of 2.5% in the yield of wheat.

Further, chickpea has remained largely a rainfed crop with only 29% of its area under irrigation in 2011-12 (GOI 2012). This policy bias resulted in substitution of chickpea by more remunerative crops, mainly wheat and rapeseed-mustard in the semi-arid regions of Indo-Gangetic plains where chickpea used to be an important winter season crop before 1980s. Production base of chickpea has gradually shifted from the semi-arid northern regions towards arid and semi-arid tropics and spread over the states of Madhya Pradesh, Andhra Pradesh and Karnataka (Parthasarathy Rao *et al*. 2010). Appropriate strategies to harness potential benefits of improved varieties in diverse agro-ecological and socio-economic environments are essential. Although a large number of improved varieties are developed and released for cultivation, no sincere efforts were initiated to disseminate them on farmers' fields either by private or public seed sectors (Sethi and Van Rheenen 1994). Only 64 per cent of farmers adopted improved chickpea varieties and 61.5 per cent adopted appropriate seed rate (Nain *et al.* 2014) Recently, pulses including chickpea started attracting attention of the policy makers. Farmers were provided subsidized improved seeds and other technologies under various national schemes such as Accelerated Pulses Production Program (A3P) through the National Food Security Mission-Pulses (NFSM-Pulses) and Rashtriya Krishi Vikas Yojana (RKVY). Minimum support price of chickpea was raised substantially in the past five years. All these efforts led to significant increase in chickpea output and remains highest (8.88 million tonnes) in 2012-13, however, chickpea yield is still highly uncertain. Seed replacement rate although has gradually increased but

[1]Research Scholar, Division of Agricultural Economics; [2]Principal Scientist (Agricultural Economics) Email: chahal_vp@rediffmail.com, [3]Principal Scientist (Agril. Extension), [4]Scientist (Agricultural Extension), IP&TM Unit, KAB-I, ICAR, Pusa, New Delhi 110 012

remains less than the recommended rate of 33 percent for self-pollinated crops like chickpea (Seednet India 2014). The non-availability of quality seeds, non-systematic seed distribution system along with the farmers' lack of access to new information and technologies have been major limiting factors in the adoption of improved technologies (Kumar *et al*. 2010) and sustainable intensification of chickpea production in the country. In this backdrop, the present study aims to assess the adoption pattern of improved varieties of chickpea and their impact on production and farm income in Madhya Pradesh.

MATERIALS AND METHODS

The state of Madhya Pradesh has higher share of area and production of chickpea in the country. In order to examine the impact of adoption of modern varieties of chickpea on production and farm income, field level survey was conducted in three purposively selected agro-climatic regions including Vindhyan, Malwa and Bhagelkhand which together account for around 80% of the total chickpea area as well as its production in the state. To generate primary data on pattern of adoption along with yield, cost and revenue of various varieties of chickpea, a semi-structured interview schedule was used for the sample of 100 chickpea growing farm households. From each of the region, two districts were selected based on maximum area under chickpea. The proportion of each of the selected district's chickpea area to the total chickpea area of the entire selected district's within a region was considered as a criterion to decide number of villages and sample size from each district. The districts selected for primary survey were: Ujjain and Shajapur from Malwa region; Vidisha and Sagar from Vindhyan region and Panna and Satna from Bhagelkhand region. With the same criteria two tehsils/blocks were selected from each of the identified district. The villages from each block were randomly selected as to ensure representativeness of the sample with respect to landholding size, crop yield etc. After discussion with key informants in the selected village, 4 chickpea growing households were selected from each village for collecting the required and relevant information. The sampling framework for the collection of primary data is shown in Table 1. Information on chickpea production with a focus on adoption pattern of modern varieties was collected from the head of households for the year 2012-13. Relevant information and data were collected on various personal and household characteristics from the selected households which was supplemented by Focused Group Discussion (FGDs) with farmers and other stakeholders in few villages in each district to understand reasons for the dominance or low adoption of the varieties. Traders were involved to understand market preferences for different chickpea traits. The data collected were subjected to tabular analysis in respect to intensity and incidence of adoption, yield, cost and revenue of each improved variety.

Table 1 Sampling framework for collection of primary data

Agro-climatic region	Districts	Chickpea area (₹'000 ha)	Number of blocks	Number of villages	House-holds sample
Vindhyan	Vidisha	166	2	5	20
	Sagar	160	2	5	20
Malwa	Ujjain	197	2	6	24
	Shajapur	137	2	4	16
Bhagelkhand	Panna	72	2	3	12
	Satna	84	2	2	8

RESULTS AND DISCUSSION

Status of chickpea production in Madhya Pradesh

Madhya Pradesh has benefitted from technological advances in chickpea breeding and emerged as the largest producer of chickpea in India. In triennial ending (TE) 2012-13, the state accounted for more than one-third of the country's total chickpea area and contributed close to 39% to total chickpea production which was almost three times compared to in early 1970s (Table 2). During the same period, area under chickpea cultivation almost doubled (from 1.64 to 3.16 Mha). Compared to all-India, Madhya Pradesh has performed better in chickpea production. There was gradual decline in the area during 1970 to 2002 at national level while it was expanded in the state although at a decelerating rate. Chickpea production was stagnating around 5 Mt during the same period in India, whereas it had increased steadily in Madhya Pradesh. The average yield of chickpea also showed a gradual improvement in Madhya Pradesh, especially in the decades of 1990s and 2000s during which chickpea yield was higher than that of national level. In 2012 chickpea yield was estimated around 1 000 kg/ha which was almost 8% more than the national average. In the past four decades chickpea yield in the state had grown at a faster rate as compared to the all-India average.

As shown in the Fig 1, in TE 2012 chickpea occupied around 59% of the total cropped area under pulses in Madhya

Table 2 Trend in area, production and yield of chickpea in Madhya Pradesh

Periods	India			Madhya Pradesh		
(TE)	Area	Production	Yield	Area	Production	Yield
1972	7.57	4.94	652	1.64	1.04	631
1982	7.28	4.75	654	2.07	1.36	650
1992	6.51	4.63	711	2.31	1.79	773
2002	5.84	4.52	771	2.33	1.91	827
2012	8.73	8.27	947	3.16	3.18	1026
			Growth (%)			
1970	–0.18	–0.62	–0.41	2.22	–0.61	–2.77
1980	–1.42	–0.81	0.63	1.35	2.06	0.69
1990	1.26	2.96	1.68	1.59	2.38	2.75
2000	4.31	5.98	1.68	2.61	4.47	1.71
2010	–2.71	3.94	6.86	0.29	14.95	14.63

Source: DES, DAC, GoI, 2012

Area, Million hectare (Mha), Production, Million tons (Mt) and Yield = kg/ha

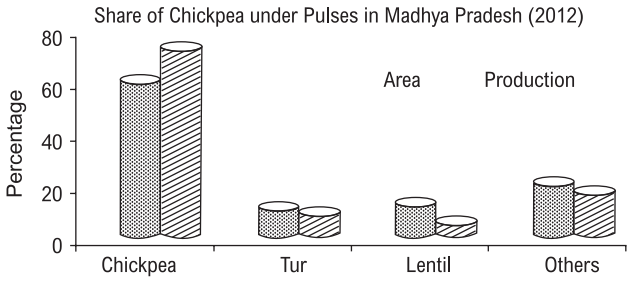

Fig 1 Share of chickpea in total area and production under pulses in Madhya Pradesh

Source: DES, DAC, GOI, 2012

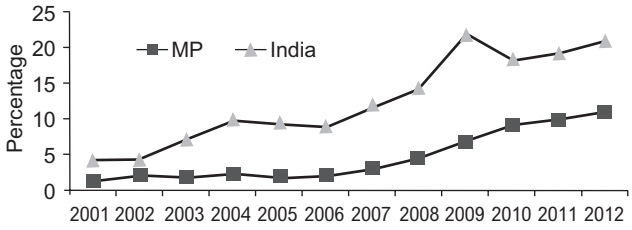

Fig 2 Trend in seed replacement rate of pulses in Madhya Pradesh vis-a-vis India

Source: http://seednet.gov.in

Pradesh and contributed up to 71% of the total pulses production in the state which was comparatively higher than other pulses having more share in area but less addition in the production. This might be due implementation of A3P under NFSM by the government.

Apart from Government of India, the Government of Madhya Pradesh has also taken several initiatives towards enhancing the productivity of pulses through tangible and intangible measures. Amongst major tangible measures; certified seed production and its distribution are the major interventions. The production of seed has increased almost 136%, while the growth in distribution increased by 160% in the XI plan period. The success in seed production and its distribution resulted in an increase of seed replacement rate (SRR) in pulse crops. Although SRR in the state remained low as compared to all-India (Fig 2). In 2006, the SRR of pulses in the state was only 2.15%, which showed gradual increment with 11% during 2012.

On-farm varietal diversity and adoption

Different varieties of chickpea were grown in all the three regions (Table 3). In Vindhyan region, eight varieties of *desi* and only two varieties (Dollar and KAK 2) of *kabuli* chickpea were found to be grown by the farmers. In the same region, JG 315 was widely grown variety of *desi* chickpea with area share of around 45% followed by JG 335 (33%), Ujjain 21 (16%), Vijay (3%), JG 322 (2%) and others (1%). The variety JG 315 was also dominant in Bhagelkhand region with 60% of the total chickpea area followed by JG 11 and Ujjain 21 varieties each occupying about 17% and 15% of the total chickpea area. The JG 74, JG 322 and JG 335 varieties of *desi* chickpea occupied meagre area. Thus, in both regions JG 315 was found to be

Table 3 Area under improved varieties of chickpea in the study regions (%)

Varieties	Vindhyan	Malwa	Bhagelkhand
JG 315 *Desi*	44.68	0.02	60.11
JG 335	32.81		0.22
Ujjain 21	16.38	4.72	14.82
Vijay	2.68	0.91	
JG322	2.45	0.02	3.78
Gulabi (JGG-1)	0.08	0.01	0.02
JG11	0.01	0.41	17.15
JG74			3.89
Mausami		3.85	
Vishal	0.02	2.86	0.01
Kabuli			
Dollar	0.87	60.74	
KAK 2	0.02	26.46	
Total	100	100	100

Source: Field survey, 2012-13

dominant improved variety of chickpea whose intensity of adoption was medium in Vindhyan and higher in Bhagelkhand region. The intensity was medium for JG 335 variety in Vindhyan region, while it showed very low intensity in Bhagelkhand region. The Ujjain 21 variety was having lower intensity of adoption in both the regions (Table 3).

In Malwa region, *kabuli* chickpea was found to be widely and prominently cultivated. Dollar and KAK 2 were the dominant varieties of *kabuli* chickpea which together occupied around 87% area with a share of around 61% and 26% of the total chickpea area, respectively in the region. It may, however, be noted that KAK 2 was predominantly grown in Shajapur district and Dollar in Ujjain district. Dollar (Mexican origin variety) is not recommended for cultivation by the State Department of Agriculture. However, farmers have been cultivating this variety using farm-saved own seeds and also procuring seeds from fellow farmers and market. The main reasons for growing Mexican *kabuli* chickpea were bold seeded, lighter color, better taste and less cooking time. The consumers also prefer these major traits of Mexican Kabuli (Agbola *et al*. 2002). Thus, with such traits it attracts a price premium over other *kabuli* varieties particularly of Indian and Australian origins. Amongst *desi* varieties of chickpea, Ujjain 21, Mausami and Vishal, each occupied not more than 5% of the total chickpea area in Malwa region.

Table 4 shows percentage distribution of farm households growing the identified varieties referred as the incidence of adoption. As expected, in all the study regions the distribution of farmers growing different varieties is almost similar to that of their area share. In Vindhyan and Bhagelkhand regions, majority of the sample farmers grow single variety on their farms. Only around 25% and 5% of the farmers in Vindhyan and Bhagelkhand regions respectively grow more than one variety. In Malwa region, around 57% farmers grew more than one variety of chickpea

Table 4 Percentage distribution of farmers growing improved varieties in the study regions

Varieties	Vindhyan	Malwa	Bhagelkhand
JG 315 *Desi*	52.5	2.5	65.0
JG 335	27.5		5.0
Ujjain 21	22.5	10.0	10.0
Vijay	2.5	2.5	0
JG 322	5.0		5.0
Gulabi (JGG 1)	2.5		0
JG 11	2.5	2.5	15.0
JG 74			
Mausami		5.0	5.0
Vishal	2.5	2.5	
Kabuli			
Dollar	5.0	92.5	
KAK 2	2.5	40.0	
Total	125.0	157.5	105.0

Source: Field survey, 2012-13

Table 5 Average yield of different varieties on farmers field in the study regions (t/ha)

Variety	Yield (tonnes/ha)		
	Vindhyan	Malwa	Bhagelkhand
JG 315 *Desi*	1.59		1.19
JG 322	1.28		1.04
Vijay	1.33	1.05	
Gulabi (JGG 1)	1.35		
JG335	1.17		1.26
Ujjain 21	1.02	1.13	1.27
JG 11		1.42	1.32
JG 74			0.78
Mausami		1.09	
Vishal		1.09	
Kabuli			
Dollar	1.16	1.28	
KAK 2		1.15	

Source: Field survey, 2012-13

and majority of them cultivated both Dollar and KAK 2 varieties. While JG 315 variety of *desi* chickpea was adopted by 52.5% and 65% farmers in Vindhyan and Bhagelkhand regions, respectively, whereas Ujjain 21 and JG 335 were moderately adopted in Vindhyan region. The JG 11 and Ujjain 21 was adopted at lower level in Bhagelkhand region. *Kabuli* chickpea varieties were adopted more in Malwa region which also showed consistency with the area allocation under these varieties, while Ujjain 21 was adopted around 10% in the region.

Thus, intensity and incidence of adoption showed that JG 315, JG 335 and Ujjain 21 were dominant varieties in Vindhyan region, whereas JG 315, JG 11 and Ujjain 21 were prominent in Bhagelkhand and Dollar and KAK 2 were ruling in Malwa region.

Impact on farm income–yield, cost and revenue

Table 5 compares average grain yield of different chickpea varieties on farmers' field in the selected agro-climatic regions. In Vindhyan region, within the *desi* chickpea, JG 315 showed highest grain yield of 1.59 tonnes/ha followed by JG 322 with grain yield of 1.28 tonnes/ha, however its performance under rainfed condition was comparatively not satisfactory. The average yield of Gulabi (JGG 1) and Vijay varieties when grown in irrigated condition was at par (1.3 tonnes/ha), whereas Ujjain 21 being the oldest variety gave the lowest average yield of only 1.02 tonnes/ha in this region. Though the desi chickpea variety, JG 335 (1.17 tonnes/ha) and Dollar (1.16 tonnes/ha) varieties of *kabuli* chickpea grown in this region performed at par but Dollar gave highest net returns due to its higher market price.

JG 11 with an average yield of 1.32 tonnes/ha was identified as the best performing variety of *desi* chickpea, whereas JG 335 emerged as the next best performing variety under irrigated condition of this region. In Malwa region, the JG 11 variety of *desi* chickpea gave an average yield of 1.42 tonnes/ha, which was higher as compared to average yield of Ujjain 21, Vishal and Mausami. The average yield of Dollar was 1.28 tonnes/ha, while that of KAK 2 was 1.15 tonnes/ha.

Response of the farmers regarding cultivation of the improved varieties revealed that they used to grow those varieties having higher yield potential and could withstand biotic or abiotic stresses. Besides these biological traits, farmers' decision to adopt a particular variety was influenced by its acceptability to consumers or market-preferred traits often reflected in its price. On an average, *kabuli* chickpea fetched higher price as compared to *desi* chickpea. The weighted average farm harvest price of *kabuli* varieties was around 4 905 ₹/q, which was around 31% more than average price of *desi* chickpea varieties (3 376 ₹/q). The Mexican variety Dollar priced around 13% higher than KAK 2 which might be due to differences in their market-preferred traits like grain size, color and taste which influenced its cultivation positively.

Among *desi* chickpea varieties, there were no significant differences in the prices except that of Vishal, Mausami and Ujjain21. It may be due to their embodied market-preferred traits like grain size, color and taste besides good cooking quality. The price of the *desi* chickpea varieties ranged between 3 100 to 3 600 ₹/q. The price of JG 335 variety was lowest. It was about 19% less than Vishal which fetched the highest price among all other *desi* chickpea varieties.

It was also apparent from the results that unlike the *kabuli* varieties, the adoption of *desi* chickpea varieties was not bound to the price factor only. Since Vishal fetched highest average price but its adoption in the sampled farms was negligible. It might be subjected to other traits like yield level along with yield risk, resistance of insects and pests etc. Despite the fact that *desi* chickpea varieties fetched around 31% less price than *kabuli*, the cultivation and preference of these varieties were prominent in Vindhyan and Bhagelkhand regions. Moreover, farmers perceived not only price factor in the selection of *desi* chickpea varieties

but also considered the other factors which directly affect the cost of cultivation as well as the crop management. It discerns the fact that government should not only offer remunerative support price but also focus on the dissemination and delivery of quality services including timely and adequate supply of inputs and provision of credit to facilitate and motivate farmers to adopt high-yielding varieties.

It is discerned from the discussion that given production conditions and resource endowments, different biological traits and price are amongst the important factors in farmers' choice of a variety and its viability. Table 6 presents the average cost of cultivation and gross and net returns associated with prominent varieties of chickpea being cultivated in three different regions. In Vindhyan region, the variety JG 315 gave the highest net revenue of 27 278 ₹/ha, although its per hectare cost of cultivation was higher compared to other varieties such as about 10% higher than Ujjain 21, which followed it closely in income generation with a marginal difference of 6% in gross revenue and 3% in net revenue. The net revenue estimated from JG 335 was about 33% less than that of JG 315 and Ujjain 21. On the other hand, in Bhagelkhand region, the cultivation of Ujjain 21 emerged more profitable than JG 315. Its net revenue was 23 447 ₹/ha, higher by 14% over that from JG 315. Although JG 11 was identified the highest yielding variety in this region but its cultivation did not appear to be cost effective in relation to JG 315 and Ujjain 21. The net revenue from cultivation of JG 11 was estimated 30% and 18% less compared to the net revenue from Ujjain 21 and JG 315, respectively. Amongst the *Kabuli* varieties in Malwa region, the Mexican variety Dollar generated gross revenue worth 55 454 ₹/ha, and was followed by KAK 2. The difference in the gross revenue of these two varieties was about 19%. However, the cultivation of Dollar in relation to KAK 2 was expensive by 27% thereby narrowing down the difference in their net revenues up to 10%. The Mexican variety Dollar was highly susceptible *to Helicoverpa armigera* and ascophyta blight; hence it required more expenses on plant protection measures. The share of cost of plant protection associated with total cost of cultivation of Dollar was estimated around 22% more than that of KAK 2. The net revenues from Ujjain 21 and Mausami were almost similar in this region, which was almost 25-30% less than the net revenues from *kabuli* varieties.

Table 6 Cost and returns of selected varieties of chickpea in the study regions (₹/ha)

Varieties	Operational cost	Gross revenue	Net revenue
	Vindhyan Region		
JG 315	20 893	48 171	27 278
JG 335	18 510	36 242	17 732
Ujjain 21	18 896	45 244	26 348
	Malwa Region		
Dollar	29 902	55 454	25 552
KAK 2	21 832	44 875	23 043
Ujjain 21	23 512	41 390	17 878
Mausami	19 022	36 733	17 711
	Bhagelkhand Region		
JG 11	19 563	36 058	16 495
JG 315	16 506	36 682	20 176
Ujjain 21	17 444	40 891	23 447

Source: Field survey, 2012-13

Constraints in adoption of improved varieties

The FGDs were conducted with farmers and other stakeholders to understand the factors that constraint adoption of newer and improved varieties; for example JG 11 which is claimed to have become popular in Andhra Pradesh, but was not widely cultivated in Madhya Pradesh. The major constraints in adoption of improved varieties emanated from the FGDs included low awareness of the new varieties among farmers; lack of pest resistant varieties; non-availability of seeds of improved varieties; lack of access to credit; high cost of seed; and lack of short or extra short duration varieties for cultivation in the study regions. The similar findings are purported by Kumbhare *et al.* (2014). It was observed that about 30-40% farmers in these regions, especially in Vindhyan and Bhagelkhand, were not aware of the new varieties. Chickpea cultivation is risk prone due to susceptible to biotic problems like *Fusarium* wilt and infestation of pod borer (*Helicoverpa armigera)*, which have potential to devastate the crop. Chickpea breeding research has not been able to deliver many location-specific pest resistant varieties. The farmers opined that, even if they knew about the available resistant varieties, many of them were apprehensive of using these varieties without being fully satisfied about their resistance traits and yield potential. SRR was low in the study regions due to higher market price of improved seed than that of the seeds obtained from the informal sources. The seed cost alone was estimated to comprise 20-30% of the total operational cost of cultivation of different varieties. Small farmers, particularly in Bhagelkhand region, reported lack of access to credit as an important constraint in use of improved varieties' seed. Chickpea is grown in residual moisture after harvest of the post-rainy season crops, mainly soybean. Though with irrigation the scope for timely sowing of chickpea is ample enough but there is lack of short or extra-short duration chickpea varieties which can escape terminal drought conditions.

Chickpea being pre-dominantly a rainfed crop in India; about half of the area under its cultivation in Madhya Pradesh is irrigated. In the study regions, a considerable proportion of chickpea area, particularly in Vindhyan and Malwa regions, receives supplementary or protective irrigation at critical growth stages of the crop. Farmers grow both *desi* and *kabuli* chickpea. Farmers of Vindhyachal and Bhagelkhand regions grow *desi* chickpea, while farmers in Malwa region prefer cultivation of *kabuli* chickpea, mainly because of the price premium and enabling climatic conditions for its production. From standpoint of intensity and incidence of adoption of varieties, JG 315 with an area

share of 45% was the ruling variety in Vindhyan region followed by JG 335 (33%) and Ujjain 21. JG 315 ruled in Bhagelkhand region, followed by JG 11 and Ujjain 21. Malwa region was dominated by *kabuli* chickpea. Dollar (a Mexican variety) and KAK 2 were the main varieties but the former occupies almost twice the area occupied by KAK 2. The medium black soil and moist semi-arid climate available in Malwa region favours cultivation of *kabuli* chickpea, whereas hot semi-arid climate in Vindhyan and Bhagelkhand regions is suitable for cultivation of *desi* chickpea. The physical (yield) and financial (revenue) performance of JG 315 and Ujjain 21 was also better compared to other varieties in Vindhyan and Bhagelkhand regions. The net revenue from cultivation of Dollar *kabuli* variety was about 10% more than KAK 2. In general, the average price of *kabuli* chickpea was 31.17% higher than that of *desi* chickpea. The farmers are not only price sensitive but also consider different biological traits along with the cost involved in various crop management activities. Advances of breeding and other technology and policy tilt towards pulses production are indispensable to achieve favourable and sustainable growth in the production of chickpea in the state. There is a need to put in place a system to demonstrate the production potential of promising varieties in farmers' field to generate awareness among farmers about new, short duration and resistant varieties, place and timely availability of quality seeds, weather, market prices etc. The need of an hour is to take up the active and continuous propagation of key (evolving) technologies such as Integrated Nutrient Management (INM), Integrated Pest Management (IPM), varying duration varieties befitting well in prevailing cropping systems, etc for creation of rippling effect for assured higher returns to farmers from the identified pulse crops. This would utilize vast untapped potential, i.e wider spectrum of agro-climatic conditions, favourable thermal regime for almost year round cropping and availability of generally adequate rainfall for improving productivity of pulses and bringing additional area under pulses with the use of large chunk of rice fallow lands with scientific and innovative management. Government should not only offer remunerative support price but also focus on the dissemination and delivery of timely, adequate, quality services and inputs besides provision of credit to facilitate and motivate farmers to adopt high yielding varieties. This could be possible through additional investment and focused intervention by stakeholders. An appropriate mix of technology, policy and institutional support is warranted for sustained chickpea production.

REFERENCES

Agbola F W, Kelley T G, Bent M J and Parthasarathy Rao P. 2002. Eliciting and valuing market preferences with traditional food crops. *Agribusiness Management Review* **5**(1): 7–21.

GOI. 2012. *Agricultural Statistics at a Glance*, Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, New Delhi.

Kumbhare N V, Dubey S K, Nain M S and Bahal R. 2014. Micro analysis of yield gap and profitability in pulses and cereals. *Legume Research- An International Journal* **37**(5): 532–6.

Kumar P, Peshin R, Nain M S and Kumar, V. 2010. Constraints in pulses cultivation as perceived by the farmers. *Green Farming- International Journal of Applied Agriculture and Horticulture Science* **1**: 52–4.

Nain M S, Bahal R, Dubey S K and Kumbhare N V. 2014. Adoption gap as the determinant of instability in Indian legume production: perspective and implications. *Journal of Food Legumes* **27**(2): 146–50.

Parthasarathy Rao P, Birthal P S, Bhagavatula S and Bantilan M C S. 2010. Chickpea and pigeonpea economies in Asia: Facts, trends and outlook. International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Hyderabad, Andra Pradesh.

Seednet India. 2014. Available at http://seednet.gov.in/Material/SRR-13.pdf and accessed on 4th April, 2014

Sethi S C and Van Rheenen H A. 1994. Genetic improvement of chickpea. (*In*) *Evaluating ICRISAT Research Impact*. Bantilan M C S and Joshi P K (Eds), International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Andhra Pradesh.