Harnessing Pulses Productivity

भाकृअनुप
ICAR

Division of Agricultural Extension
Indian Council of Agricultural Research
New Delhi - 110 012

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शरद पवार
Sharad Pawar

कृषि एवं खाद्य प्रसंस्करण उद्योग मंत्री
भारत सरकार
Minister of Agriculture &
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Message

Pulses are very important for Indian agriculture both in terms of enriching soil health and nutritional security of country's ever growing population. Pulses being predominantly rainfed crop with multiple constraints and limiting factors in its growing environment, the increase in the productivity had remained a major challenge for several decades. However, India made break through and produced around 18.0 million tonnes of pulses in 2010-11 from an area of 24.78 million hectare, and thus, become one of the largest pulses producing countries in the world. However, about 2-3 million tonnes of pulses are imported annually to meet the requirement of domestic consumption. Hence, there is a need to increase production and productivity of pulses in the country by more intensive interventions. Presently, pulses development programmes are being implemented through the Centrally Sponsored Schemes of NFSM-Pulses, Accelerated Pulses Production Programme, RKVY, etc.

I am happy to know that ICAR has taken an initiative to address the issue of harnessing productivity of pulses by conducting frontline demonstrations in 137 districts of 11 states of the country in a compact block emphasizing on five major crops namely chickpea, pigeonpea, mungbean, urdbean and lentil. The yield advantage of about 40% recorded at farmers' fields over existing practices, indicated in this document, give us a hope to break the yield barriers and produce sufficient quantity of pulses for masses. I am sure this publication will be very useful for all the stakeholders including the farmers.

(Sharad Pawar)

24th June, 2013
New Delhi

डा. एस. अय्यप्पन
सचिव एवं महानिदेशक
Dr. S. AYYAPPAN
Secretary & Director General

भारत सरकार
कृषि अनुसंधान और शिक्षा विभाग एवं
भारतीय कृषि अनुसंधान परिषद्
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Indian Council of Agricultural Research
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Foreword

Pulses play an important role in providing a nutritionally balanced diet. These are the principal source of protein for vegetarians. India is the world's largest producer with 25% share in the global production. Production of pulses increased significantly in 2010-11 to 18.2 million tonnes compared to 14.7 million tonnes in the previous year. The important pulse crops are chickpea (48%), pigeonpea (15%), mungbean (7%), urdbean (7%), lentil (5%) and fieldpea (5%). The major pulse producing states are Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and Andhra Pradesh, which together account for about 80% of the total production. About 90% of the global pigeonpea, 75% of chickpea and 37% of lentil area fall in India. Due to rising population, net availability of pulses has come down from 60 gm/person/day in 1951 to 37 gm/person/day in 2010-11.

Though, some initiatives are already in place through the centrally sponsored schemes, Indian Council of Agricultural Research is concerned and has thus, envisioned to undertake well designed programme of Technology Demonstration for Harnessing Pulses Productivity (TDHPP). The KVKs, extension workers and farmers are roped in to organize around 6000 demonstrations each year in 137 districts of 11 states. The results of consecutive two years 2010-11 and 2011-12 have been quite encouraging in showing production potential of technologies in different field situations across the country. The efforts of IIPR, Kanpur, Zonal Project Directorates and KVKs have provided a good platform to move on for a better future.

Dated the 24th June, 2013
New Delhi

(S. Ayyappan)

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Preface

Pulses are important for food and nutritional security of the country. Though the requirements are quite high, the production and productivity levels have not risen proportionately. To address this, a brain storming workshop was organized and based on its outcomes, a programme on ***"Technology Demonstration for Harnessing Pulses Productivity"*** with an objective to demonstrate the production potential of technologies of major crops like chickpea, pigeonpea, lentil, urdbean and mungbean was taken up in major pulses growing states viz. Andhra Pradesh, Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

In this programme, special attention was given for planning, capacity development, preparation of district specific technology module, regular monitoring and implementation by a group of scientists/experts. The results have been quite encouraging showing increasing trend of productivity over local, state and national average. Technology centric adaption model was designed and applied in the field situation with farmers' participation through 11536 demonstrations covering an area of 11228 acres on five major crops demonstrated across the country in 137 districts of 11 states during 2010-11 and 2011-12.

I express my sincere gratitude to Hon'ble Union Minister of Agriculture and Food Processing Industries and Secretary, DARE and DG, ICAR for their kind support and guidance for execution of this programme. I appreciate the efforts of all the participating centres for effective implementation and monitoring of this programme. I hope this publication will be helpful for the scientists, policy makers, extension workers and farmers.

27th May, 2013
New Delhi

(K.D. Kokate)

Contents

Chapter-1

Prelude

Pulses are very important for Indian agriculture both in terms of enriching soil health and nutritional security of country's ever growing population. Pulses being predominantly rainfed crop with multiple constraints and limiting factors in its growing environment, the increase in productivity had remained a major challenge for several decades until 2010. There was no desirable increase in area and productivity of pulses over the years. However, there are number of technological breakthroughs with promise to raise the productivity levels.

National Scenario

India grows a variety of pulse crops such as chickpea, pigeonpea, green gram (mungbean), black gram (urdbean), pea and lentil under a wide range of agro-climatic conditions. The production of total pulses in India is ranging between 17 to 18 million tonnes for last 2-3 years covering an area of about 24.78 million hectares, majority of which fall under rainfed, resource poor and harsh environments frequently prone to drought and other abiotic stress conditions (Fig. 1.1). About 90% of the global pigeonpea, 75% of chickpea and 37% of lentil area falls in India, (FAOSTAT 2009). Chickpea contributes highest (40-50%) of the total pulse production of the country followed by pigeonpea (15-16%), urdbean (10-12%) and lentil (9-10%). Due to stagnant production, the net availability of pulses came down from 60 gm/day/person in 1951 to 31 gm/day/person in 2008. India is the largest producer and consumer of pulses in the world contributing around 25-28% of the total global production. Pulses are least preferred by farmers because of high risk and uncertain returns than cereals and it is the main reason to cause low production of pulses. To meet the demand of pulses, about 3 million tonnes is imported by India.

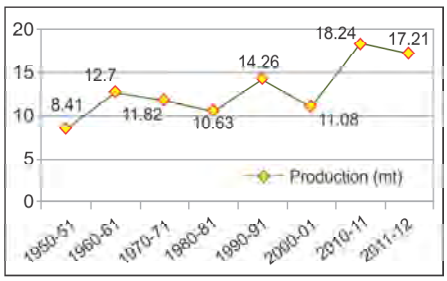


Fig. 1.1: Production of Pulses in India
Source: Directorate of Economics and Statistics, Department of Agriculture & Cooperation, Govt. of India

The need thus, is to demonstrate the technologies at farmers' fields with their active participation so as to convince and build their confidence in new technologies. Old varieties and practices are still in operation in many parts. In this perspective, Technology Demonstration for Harnessing Pulses Productivity (TDHPP) programme addressed the application of selected technologies related to five major pulse crops viz. chickpea, pigeonpea, mungbean, urdbean and lentil.

Regional Contributions

The major producers of pulses in the country are Madhya Pradesh (24%), Uttar Pradesh (16%), Maharashtra (14%), Rajasthan (6%), Andhra Pradesh (10%) and Karnataka (7%). Together these states share about 77% of total pulse production while remaining 23% is contributed by Gujarat, Chhattisgarh, Bihar, Odisha and Jharkhand (Fig. 1.2). During 1971-2010, there has been a marginal increase of approximately 10% in the area under pulse cultivation with a nominal gain of total production, however the yield of pulses remained virtually stagnant for the last 20 years (580 kg/ha in 1990's to nearly 607 kg/ha during 2010). In terms of area, production and yield, chickpea contributes maximum among all major pulse crops (Fig. 1.3 & Table 1.1).

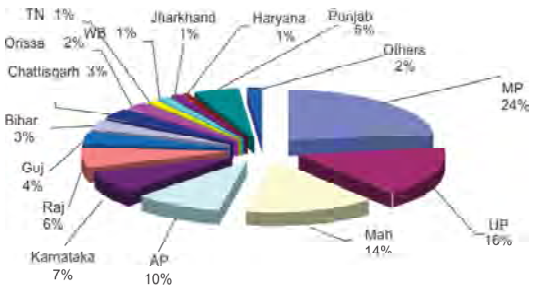


Fig. 1.2: Production of pulses by various states

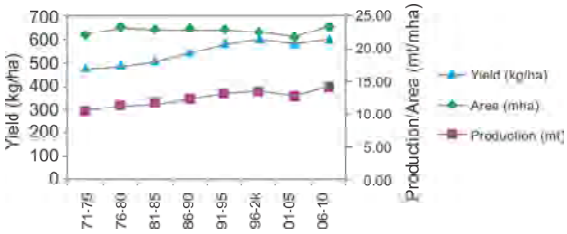


Fig. 1.3: Area, production and productivity trends of pulses in India (1971-2010)

Table 1.1: Crop-wise national scenario (2011-12)

Crop	Area (mha)	Production (mt)	Yield (Kg/ha)	Major states
Chickpea	8.32	7.58	912	MP, UP, AP, Rajasthan, Karnataka, Haryana, Maharashtra
Pigeonpea	4.04	2.65	656	Maharashtra, UP, MP, Karnataka, AP, Gujarat
Lentil	1.60	0.94	591	UP, MP, Bihar, West Bengal
Urdbean	3.10	1.40	452	Maharashtra, AP, UP, MP, Tamil Nadu, Karnataka, Orissa
Mungbean	3.44	1.40	406	Rajasthan, Maharashtra, AP, Bihar, Karnataka, Gujarat
Total pulses	24.78	17.21	694	

Shift in area under pulses

The coverage of area under pulses is highly correlated with availability of irrigation and micro agro-eco-situations. It is a fact that with growing irrigation potential, the area under pulses has declined drastically particularly in Indo Gangatic plains. In rainfed areas also, the similar pattern is noticeable. There has been major shift in chickpea area (about 3.0 million hectares) from northern India to southern India during the past four decades.

Ongoing Schemes

Pulses development programmes are being implemented through the Centrally Sponsored Schemes of NFSM-Pulses, Integrated Scheme on Oilseeds, Pulses, Oil Palm and Maize (ISOPOM) and Integrated Crop Development Programme (ICDP)-Pulses under Macro Management Mode. While ISOPOM is implemented in all the 433 districts of 14 states, NFSM Pulses is being implemented in mission mode in 171 districts of these states. In addition, 15 districts of Jharkhand and 10 districts of Assam were included under NFSM-Pulses for implementation with effect from 1st April, 2010. ICDP-Pulses is implemented in states other than the 14 NFSM/ISOPOM states.

Technology Demonstration Initiative

To achieve target of additional production of pulses, it was realized by ICAR to concentrate efforts on five most important pulse crops depending upon their contribution in national production. In this context, Technology Demonstration for Harnessing Pulses Productivity programme was conceived with specific objective to demonstrate production potential of selected technologies in a compact block.

Brain storming

Two brain storming workshops were held at ICAR, New Delhi and IIPR, Kanpur under the Chairmanship of Secretary, DARE and DG, ICAR, New Delhi. In the light of workshops, outcomes technology demonstrations for showing production potential of modern technologies were planned for 137 districts of 11 states. A total of 6000 demonstrations were targeted for each year with focus on specific technology modules for each district including newly developed varieties, planting techniques, integrated plant nutrient management, integrated weed management, integrated pest management, intercropping, etc.

The emphasis was given to bridge the gap between existing and available technology options through availability of critical inputs, meticulous planning of demonstrations and monitoring of crops by the KVKs at critical stages.

Financial assistance was given to KVKs for conducting demonstrations by the Indian Council of Agricultural Research, New Delhi through Zonal Project Directorates.

Chapter-2

Process and Methodology

The genesis of the programme *'Technology Demonstration for Harnessing Pulses Productivity (TDHPP)'* lies in two brain storming sessions held at Indian Council of Agricultural Research, New Delhi and Indian Institute of Pulses Research, Kanpur. The outcomes of the programme envisaged demonstration of production potentiality of newly developed technologies and varieties of pulses at farmers' fields through KVKs, so as to bring in enhanced application of modern technologies to address the issues related to production and productivity of pulses in the country.

Exploring Potential

The five crops contributing towards major acreage and production in 137 districts of 11 states were identified for technology demonstrations. The detailed exploration of existing prominent varieties, cropping systems and productivity level was made in respect of each of the selected crop in each of the selected district.

Area Coverage

The programme was launched in 11 states and 137 districts viz., Andhra Pradesh (15), Bihar (5), Gujarat (11), Karnataka (11), Madhya Pradesh (19), Maharashtra (16), Odisha (8), Rajasthan (15), Tamil Nadu (10), Uttar Pradesh (25), and West Bengal (2). 6164 demonstrations on major five crops viz., chickpea, pigeonpea, mungbean, urdbean and lentil were conducted in first year 2010-11 with coverage of 5920.67 acres. In 2011-12, 5372 demonstrations were laid out with coverage of 5307.69 acre area. The cropwise area covered in each participating state is depicted in Annexure. The allocation of area was based on the scope of the crop in the concerned state and district.

Technology Modules

Technology modules were prepared for each district by Indian Institute of Pulses Research, Kanpur. Such modules included recently released varieties, planting techniques, integrated nutrient management, integrated weed management, integrated disease-insect management and intercropping systems. State and district specific technology modules are illustrated separately (Annexure).

Capacity Building

A detailed training plan was developed which included training of selected KVK experts, development officials and farmers at different levels: national and district. Four training programmes for orienting the Programme Coordinators and Subject Matter Specialists of participating KVKs were organized at different locations viz. IIPR, Kanpur (10-11 May, 2010); JNKVV, Jabalpur (11-12 June, 2010); MPKV, Rahuri (02-03 June, 2010) and Zonal Project Directorate, Kanpur (18-19 June, 2010). At district level, KVKs conducted training programmes for extension workers and participating farmers of the programme.

200 training programmes were conducted with the participation of about 30 farmers in each batch.

Critical Inputs

Critical inputs were provided to the farmers like seeds of improved varieties, fungicides/culture for seed treatment, fertilizers, insecticides, pesticides and micro nutrients like sulphur and zinc. Some demonstrations in technology assessment mode were conducted on application of drip irrigation in pigeonpea at KVK farms.

Institutional Support

KVKs were responsible to identify the farmers in consultation with local organizations and departments, provide critical inputs to farmers and organize training for them and conduct the demonstrations at farmers' fields with their participation. The technical support was obtained from IIPR, Kanpur and nearby Agricultural Universities/AICRP centres. The role of the Zonal Project Directorate was to monitor the conduct of the programme and establish linkages with concerned stakeholders.

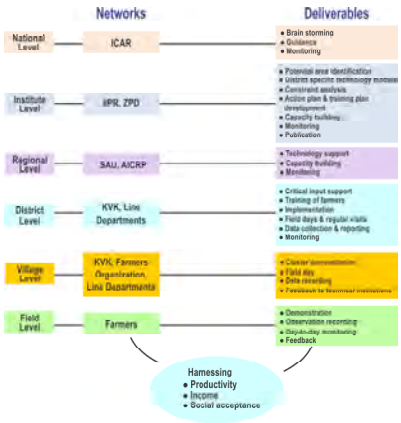


Fig. 2.1: Technology centric adaptation model

A commodity supportive technology centric adaptation model was developed for effective delivery of district specific technology modules (Fig. 2.1). This model produces representation of networks and deliverables.

Upscaling

Field days were organized at the site of clusters of demonstrations which were participated by farmers, field extension workers, officials, scientists and other stakeholders. The utilization of other sources of communication like mobiles, radio, television and newspapers was made for sharing the information with larger group of farmers. Successes were also shared at different scientific forums.

Monitoring

There was a strong monitoring mechanism with the involvement of all the stakeholders. At the state level, the responsibility was with Zonal Project Directorates with the involvement of IIPR, Kanpur and representatives of other stakeholders. At the national level, DDG (AE) monitored the programme.

Evaluation

For ascertaining the impact of the programme, it was required to have baseline data of the clusters where demonstrations were organized. Periodical evaluation was conducted by a team of experts.

Reporting

The reports were submitted by the Programme Coordinators of KVKs to the concerned Zonal Project Directorates (ZPD) on a prescribed format. The ZPDs were responsible for further compilation, analysis and consolidated reporting to the ICAR.

Technology Demonstration Matrix

Under this programme, 11536 demonstrations were organized covering 11228.36 acre area on five major pulse crops (mungbean, urdbean, chickpea, pigeonpea and lentil) during 2010-11 and 2011-12. The state-wise and crop-wise area under pulse crops demonstrated for consecutive two years are shown in Table 2.1. Crop-wise and state-wise area and number of demonstrations under different pulse crops are given in Annexure.

Table 2.1: State-wise and crop-wise area under demonstrations during 2010-11 and 2011-12

States	Crops & Area (acre)				
	Pigeonpea	Chickpea	Urdbean	Mungbean	Lentil
Bihar	-	-	-	-	297.68
West Bengal	-	-	-	-	20.85
Uttar Pradesh	347	309.08	204	210.13	376.07
Andhra Pradesh	479.5	421.25	240	371.25	-
Maharashtra	845	775	225	292.5	-
Rajasthan	-	325	98	640	-
Gujarat	282.5	154	-	121	-
Madhya Pradesh	418.3	1206	322.48	-	294.63
Odisha	17.73	-	80.98	59.43	-
Karnataka	507	525	99.25	324.5	-
Tamil Nadu	-	-	230.75	107.5	-
Total	**2897.03 (2958)***	**3715.33 (3819)**	**1500.46 (1565)**	**2126.31 (2205)**	**989.23 (989)**
Grand Total			**11228.36 (11536)**		

*Figure in parenthesis indicates number of demonstrations

Bench mark

i) Each demonstration to be conducted on one acre area.

ii) Critical inputs to be provided to the farmers by the KVKs including seed, fertilizer, plant protection chemicals, etc.

iii) Demonstrations were conducted following the district specific technology modules described in the document.

iv) Demonstrations to be conducted in clusters and one cluster should have not been less than 10.0 acre.

v) With each cluster, a control plot of 1-2 acre to be maintained. The practices followed by the farmers to be considered as control plot.

vi) The demonstration site to be kept invariably accessible, so that the demonstrations could be shown to more number of stakeholders.

vii) Selection of farmers based on his/her readiness to conduct the demonstration as per the technology prescribed by the experts and willingness to support the field programmes on the site and to provide the related data as and when required.

viii) The data to be collected by each KVK at different stages of the crop.

ix) KVKs to organize two days training programme for participating farmers.

x) Organization of one field day at each cluster with the participation of farmers, line departments and others.

Chapter-3

Productivity Performance

Uttar Pradesh

Summer Mungbean (*Vigna radiata*)

During 2010-11 and 2011-12, 246 demonstrations were conducted on summer mungbean mainly in 7 districts of central Uttar Pradesh on an area of 210.13 acre with average productivity of 10.51 q/ha (Table 3.1). The yield recorded under these demonstrations was 38.84% higher over local check, 89.37% to state average and 158.23% to national average (Fig. 3.1).

Table 3.1: Performance of summer mungbean demonstrations - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
Samrat	Kannauj, Banda, Etawah, Fatehpur, Etah, Sitapur	94.75 (151)*	11.11	8.06	37.84	39399	26346	49.54
IPM 02-03	Kannauj, Etawah, Fatehpur	40.88 (20)	9.32	6.64	40.36	46836	32341	44.82
Meha	Kannauj, Fatehpur	24.50 (27)	9.92	7.71	28.66	48635	36926	31.71
SML-668	Faizabad	10 (10)	10.67	5.18	105	33244	10102	229.08
Narendra Mung-1	Unnao	20.00 (20)	11.42	9.9	15.35	44550	38340	16.20
HUM-16	Pratapgarh, Sitapur	20.00 (18)	9.85	5.80	69.83	26040	11700	122.56
Total/Wt. Mean		210.13 (246)	10.51	7.57	38.84	40848	27720	59.00

*Figure in parentheses indicates number of demonstrations

Summer mungbean is an addition of new crop mainly in existing rice-wheat and maize-potato cropping systems. Short crop duration specially of cultivars Samrat (60 days) and Meha (65 days), low input requirements (two irrigations, one insecticidal spray, etc.) are

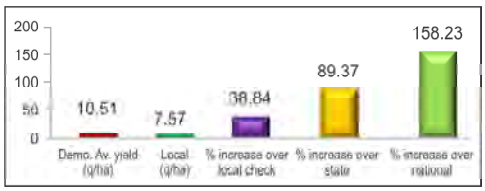


Fig. 3.1: Yield performance of summer mungbean in Uttar Pradesh : 2010-11 & 2011-12

encouraging features attracting farmers to grow summer mungbean. The crop does not have any competition as the fields in summer are generally kept fallow by the farmers.

The introduction of this crop to the existing cropping systems, fetches ₹ 40848 per ha of net income and also adds 40 kg/ha of nitrogen to the soil every year. The crop cover during summer also checks soil erosion, besides, its advantage as nutritional value to the malnutritioned village population. The area under summer mungbean is showing an increasing trend in Uttar Pradesh and with little support for post harvest and value addition, the farmer's interest can be further aroused to bring more area under summer mungbean.

Lentil (*Lens esculenta L.*)

Basically, it is grown in the crop rotation of rice-lentil and maize-lentil in the central and eastern part of Uttar Pradesh where in the Bundelkhand region, it is grown in fallow-lentil rotation. The demonstrations (381) conducted on lentil crop with improved varieties and technologies showed an yield advantage of about 33% over local check, 114% to state and 141.71% to national average (Fig. 3.2). A net return of ₹ 34403/ha was realized which was 46% higher to local check. Lentil is one of the important crops of Bundelkhand region but also has shown good performance in central and eastern part of Uttar Pradesh in rice fallows. Wilt infestation is one area which needs regular monitoring and proper solution. Uttar Pradesh accounts about 40% of area and 45% of the total lentil production of the country with highest average productivity of 7.15 q/ha (Table 3.2).

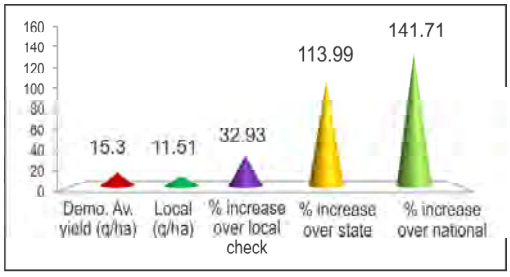


Fig. 3.2: Yield performance of lentil in Uttar Pradesh: 2011-12

Table 3.2: Performance of lentil demonstrations - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
NDL-1	Chandauli, Ballia, Sonbhadra, Bahraich	189.00 (190)	15.84	12.20	29.84	37608	27144	38.55
DPL-62	Chitrakoot, Hamirpur, Lalitpur, Jhansi, Jalaun	146.00 (127)	14.87	10.59	40.42	31135	20987	48.35
K-75	Jhansi, Jalaun	43.50 (45)	14.24	10.35	37.58	34835	23787	46.45
Total/Wt. Mean		359.50 (381)	15.30	11.51	32.93	34403	24064	46.00

* Figure in parentheses indicates number of demonstrations

Urdbean (Kharif) (*Vigna mungo L.*)

Urdbean is grown in an area of 3.91 lakh ha with production of 1.72 lakh tonnes and average productivity of 4.40 q/ha, which is slightly lower to the national level of 4.51 q/ha. Urdbean is basically grown in urdbean-wheat, urdbean-fallow, urdbean-sugarcane, urdbean-chickpea/pea/mustard and urdbean-wheat-mentha crop rotation. In western Uttar Pradesh, sizable area is also under sugarcane + urdbean intercropping grown as summer crop. The productivity of PU-31 cultivar was highest i.e. 10.08 q/ha showing an increase of 60% over local check (Table 3.3).

Overall, an yield of 8.75 q/ha was realized in demonstrations indicating an increase of 54% over local check, 98.86% over state and 93.58% over national average (Fig. 3.3).

Table 3.3: Performance of urdbean (kharif) demonstrations - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
Azad-2	Budaun, Jhansi, Hamirpur	64.00 (73)	7.58	5.68	33.45	16524	11071	49.25
Shekhar-2	Jalaun, Barabanki	26.00 (26)	7.87	4.33	81.76	22814	11464	99.01
PU-31	Shahjahanpur, Sitapur, Barabanki	60.00 (57)	10.08	6.38	57.99	39141	20073	94.99
PU-35	Shahjahanpur	14 (07)	10.00	5.20	92.00	19000	9800	93.88
Total/Wt. Mean		164.00 (163)	8.75	5.68	54.05	26007	14318	78.00

* Figure in parentheses indicates number of demonstrations

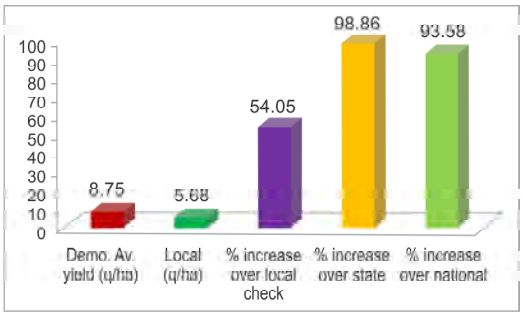


Fig. 3.3: Yield performance of urdbean in Uttar Pradesh: 2010-11 & 2011-12

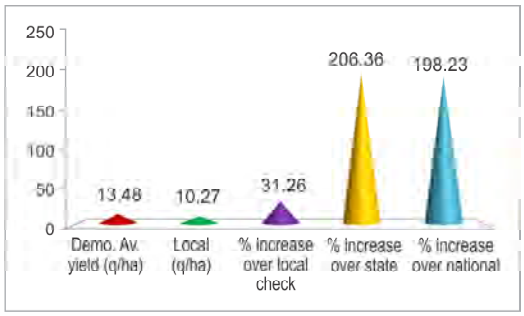


Fig. 3.4: Yield performance of urdbean (summer) in Uttar Pradesh: 2011-12

The highest net return of ₹ 39141 per ha was obtained from PU-31 which was more than double over the local check. An average of ₹ 26000 per ha of net return was obtained which was 78% higher as compared to local check. These demonstrations acted as confidence building measures for the urdbean growers who were getting poor yields and witnessing crop failures for last 2-3 years.

The demonstrations of summer urdbean in western Uttar Pradesh indicated 54.06 % higher yield (13.48 q/ha) as compared to kharif urdbean (8.75 q/ha). Net returns were also higher ₹ 40450 per ha as compared to ₹ 26000 per ha in kharif urdbean. PU-31 cultivar has been performing well during kharif and summer season both, where as Shekhar-2 has given highest yield of 15.92 q/ha during summer season (Table 3.4 and Fig. 3.4). As the farmers in the rice-wheat system generally keep their fields fallow during summer, urdbean can be a potential crop along with summer mungbean.

Table 3.4: Performance of summer urdbean demonstrations - 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
Shekhar-2	Muzaffarnagar, Saharanpur	20.00 (20)	15.92	12.27	29.75	53966	40681	32.66
PU-19	Bijnor	10.00 (8)	8.5	6.9	23.19	10500	5600	87.50
PU-31	Muzaffarnagar	5.00 (5)	13.67	9	51.89	46300	37000	25.14
Total/Wt. Mean		35.00 (33)	13.48	10.27	31.26	40450	30130	47.00

* Figure in parentheses indicates number of demonstrations

Chickpea (*Cicer arietinum L.*)

Chickpea is cultivated in an area of 5.05 lakh ha with production of 3.78 lakh tonnes and crop productivity of 7.48 q/ha. The productivity of chickpea in the state is

quite low as compared to the states like Andhra Pradesh (14.47 q/ha) and Gujarat (9.76 q/ha). Mainly the crop is grown in the rainfed areas of Bundelkhand region of Uttar Pradesh crop under different crop rotation viz urdbean-chickpea and fallow-chickpea. A total of 409 demonstrations were conducted with average productivity of 16.59 q/ha which was about 40% higher to local check, 121.79 % to state and 107.63 % to national average (Table 3.5 and Fig. 3.5). The average net return of ₹ 33531 per ha was realized against ₹ 21472 per ha from local check. In some of the districts, average returns were more than ₹ 60000 per ha. The encouraging results of crop productivity and net returns are attributed to skill training provided to the farmers, extension workers and application of improved varieties and package of technologies.

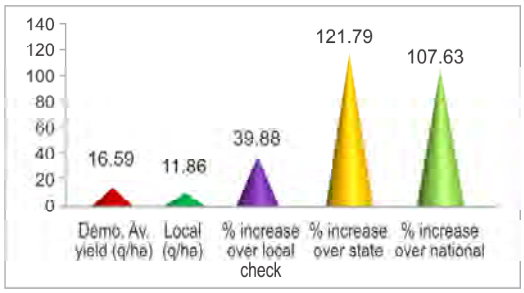


Fig. 3.5: Yield performance of chickpea in Uttar Pradesh : 2010-11 & 2011-12

Table 3.5: Performance of chickpea demonstrations - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
Awarodhi	Banda, Sonbhadra, Hamirpur, Kanpur Dehat, Jhansi, Chitrakoot	115.80 (150)	17.81	13.13	35.64	33092	22344	48.10
DCP-92-3	Chitrakoot, Lalitpur	16.40 (50)	16.79	11.93	40.74	37844	25960	45.78
Udai	Kanpur Dehat, Hamirpur, Hamirpur, Jalaun, Banda	110.00 (102)	15.16	10.19	48.77	33638	18926	77.73
Pusa-1103	Chitrakoot	11.00 (39)	12.78	10.00	27.80	16795	11800	42.33
KWR-108	Chitrakoot, Jalaun	12.50 (24)	14.88	10.60	40.38	18830	10779	74.69
BG-256	Lalitpur	20.00 (22)	17	11.4	49.12	30200	19730	53.07
Pusa-362	Sonbhadra	16.00 (16)	19.5	15.15	28.71	47750	34755	37.39
Vardan	Jhansi	6.25 (5)	20.2	16.2	24.69	61500	47700	28.93
Radhey	Jalaun	1.13 (1)	15.25	12	27.08	33825	24900	35.84
Total/Wt. Mean		309.08 (409)	16.59	11.86	39.88	33531	21472	59.00

* Figure in parentheses indicates number of demonstrations

Pigeonpea (*Cajanus cajan*)

Pigeonpea is grown in an area of 3.68 lakh ha in Uttar Pradesh with production of 3.27 lakh tonnes and productivity of 8.89 q/ha and sharing about 10 and 11% of the total area and production of the country. Two types of pulses i.e. short duration (120 days) and long duration (240 days) are grown in Uttar Pradesh. In the entire Bundelkhand region, pigeonpea-fallow crop rotation is followed with cultivation of long duration crop where as in the central and western Uttar Pradesh, pigeonpea-wheat crop rotation is followed with short duration varieties.

The average productivity of short duration variety UPAS-120 has been reported as 13.10 q/ha as compared to 9.87 q/ha of local check (Fig. 3.6 and Table 3.6). There has been a gain of 32% in yield and 43% in net return over local check in case of short duration cultivar UPAS-120. There has been a significant rise in yield in case of long duration varieties. An average of 16.59 q/ha of yield has been recorded as compared to 11.97 q/ha over local check with net returns of ₹ 44611 per ha. Overall, there has been an increase of 38% in yield and 53% in net return in demonstration over local check. The highest yield of 19.75 q/ha was achieved from MAL-13 cultivar and lowest from variety Amar (12 q/ha) under long duration pigeonpea demonstration. NA-1 with 15.75 q/ha and NA-2 with 17.10 q/ha performed equally well in farm conditions (Table 3.7 and Fig. 3.7). The pigeonpea is grown variety as rainfed crop and hence,

Table 3.6: Performance of pigeonpea (short duration) demonstrations - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
UPAS-120	Aligarh, Etah, Fatehpur	80.00 (71)*	13.10	9.87	32.73	25844	18068	43.04

* Figure in parentheses indicates number of demonstrations

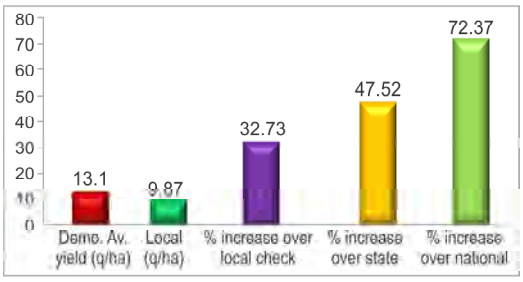


Fig. 3.6: Yield performance of pigeonpea (short duration) in Uttar Pradesh : 2010-11 & 2011-12

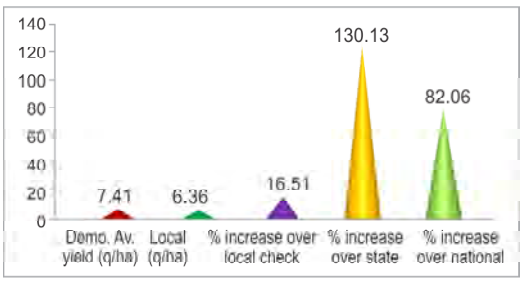


Fig. 3.7: Yield performance of pigeonpea (long duration) in Uttar Pradesh : 2010-11 & 2011-12

Table 3.7: Performance of pigeonpea (long duration) demonstrations - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
NA-1	Allahabad, Chitrakoot, Jaunpur, Kaushambi	115.00 (127)	15.75	11.39	38.28	39966	27070	47.64
Mal-13	Deoria, Sitapur	67.00 (95)	19.75	14.85	33.00	55169	37970	45.30
Mal-6	Allahabad	20.00 (23)	12.90	7.00	84.29	36711	17540	109.30
NA-2	Jaunpur	45.00 (46)	17.10	13.25	29.06	47390	35525	33.40
Amar	Banda	14.00 (13)	12.00	6.00	100.00	34600	15700	120.38
Total/Wt. Mean		261.00 (304)	16.59	11.97	38.60	44611	29985	53.00

* Figure in parentheses indicates number of demonstrations

the irrigation intervention at critical stages may further enhance the yield levels accrued in the demonstrations. There is a serious issue of blue bull attack preferably on pigeonpea crop which is a threat to this crop. During demonstration, it was observed that pod borer infestation was most damaging this crop and its proper control may indicate significant yield realization.

Bihar

Lentil

Lentil is grown in an area of 1.62 lakh ha with production of 1.14 lakh tonnes and productivity of 7.04 q/ha in Bihar. The state contributes about 11% to the total area and 12% to total production of the country. Lentil is grown mainly in rice-fallow. The performance of lentil crop under demonstration was good in terms of average productivity (15.11 q/ha) and net return (₹ 51199 per ha). In some of the districts, like Nalanda, the average productivity of 23.05 q/ha was achieved as compared to 10.89 q/ha of local check (Table 3.8). The demonstrations indicated average increase

of 48% in yield and 145% in net returns. The average yield in these demonstrations varied between 11.45 to 23.05 q/ha. Overall, the average productivity (15.11 q/ha) was 114.63%, higher to state and 138.70% to national average. There is tremendous scope to enhance the area and productivity of lentil in the state of Bihar in rice fallows.

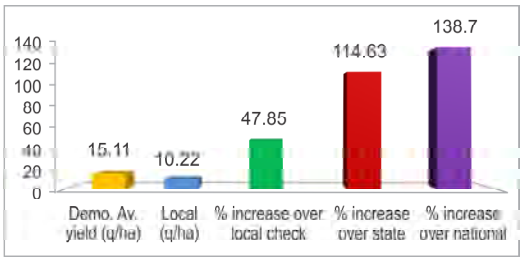


Fig. 3.8: Yield performance of lentil in Bihar : 2010-11 & 2011-12

Table 3.8: Performance of lentil demonstrations in Bihar - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
Arun	Aurangabad, Nalanda, Patna	152.35 (68)*	15.73	11.64	35.14	71004	30193	135.17
Hul-57	Rohtas, Bhojpur	72.00 (53)	11.54	6.84	68.71	14355	4513	218.08
K-75 (Malika)	Patna	12.00 (12)	17.5	13.3	31.7	91120	50178	81.59
Harnaut, Chandi, Rahui, Sarmera	Nalanda	12.50 (14)	23.05	10.89	111.66	44630	15227	193.10
WBL-58	Murshidabad	15.00 (6)	15.13	12.36	22.41	28346	22711	24.81
B-77	Nadia	33.83 (41)	16.11	8.74	84.32	38813	19965	94.41
Total/Wt. Mean		297.68 (194)	15.11	10.22	47.85	51199	22620	145.00

*Figure in parentheses indicates number of demonstrations

West Bengal

Lentil

Lentil is cultivated in an area of 0.57 lakh ha with production of 0.47 lakh tonnes and productivity of 9.11 q/ha. It is normally grown in rice-lentil and maize-lentil cropping systems in the state. An average productivity of 16.04 q/ha was obtained in demonstrations against 9.0 q/ha in local check (Table 3.9 and Fig. 3.9). The performance of two varieties viz WBL-58 and B-77 were alike in terms of yield. The enhancement in yield over local was 78.22% and it was 109% in respect to net returns. Lentil holds the potential to be rolled out on larger area especially in rice-fallow in the state to fulfill the requirement of pulses.

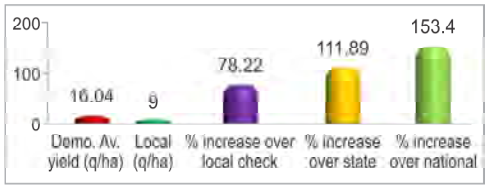


Fig. 3.9: Yield performance of lentil in West Bengal: 2010-11

Table 3.9: Performance of lentil demonstrations in West Bengal - 2010-11

Variety	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
WBL-58(Subrata)	Murshidabad	6.00 (6)*	15.9	10.5	51.2	17065	9340	82.71
B-77	Nadia	14.85 (45)	16.1	8.4	91.8	28974	13204	119.43
Total/Wt. Mean		20.85 (51)	16.04	9.00	78.22	25545	12092	109.00

* Figure in parentheses indicates number of demonstrations

Andhra Pradesh

Mungbean

Mungbean is an important short duration grain legume grown in rainy and post rainy seasons in Andhra Pradesh. It occupies an area of 3.78 lakh ha with an average productivity of 439 kg/ha in good rainfall years. To increase the productivity and income of mungbean, 217 demonstrations were conducted in 277.5 ha with improved varieties LGG-460, MGG-295 and Ekasila (WGG-37). In the demonstrations an average yield of 7.64 q/ha was reported with improved technologies against local check yield of 5.62 q/ha (Table 3.10 and Fig. 3.10). The highest average yield of 10.7 q/ha was recorded in Warangal

Fig. 3.10: Yield performance of mungbean in Andhra Pradesh : 2010-11 & 2011-12

Table 3.10: Performance of mungbean demonstrations in Andhra Pradesh-2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
LGG-460	Mahboobnagar, Nalgonda, Nizamabad, Prakasam	192.50 (132)*	7.68	5.54	38.63	15620	8268	88.92
ML-267	Nalgonda	25.00 (25)	3.80	2.60	46.00	7090	3680	92.66
MGG-295	Warangal	30.00 (30)	10.70	7.40	44.59	20700	18200	13.74
WGG-37	Khammam	30.00 (30)	7.50	6.87	9.17	11400	9260	23.11
Total/Wt. Mean		277.50 (217)	7.64	5.62	35.94	14945	9036	74.00

* Figure in parentheses indicates number of demonstrations

district during 2011-12 under rainfed red soil situation with variety MGG-295 which is tolerant to drought as well as excess moisture conditions and black spot disease. Due to adoption of improved technologies, the farmers could get additional return of Rs. 5909/ha.

Chickpea

In Andhra Pradesh, chickpea is grown under rabi rainfed on residual moisture conditions in medium to heavy black soils. The area under chickpea cultivation is 0.65 million hectares with a production of 0.85 million tonnes and the productivity of 13.08 q/ha (2009-10). The technology demonstrations on chickpea with whole package were organized with improved varieties JG-11 and JAKI-9218 during the years 2010-11 and 2011-12. Variety JG-11 gave an average yield of 19.26 q/ha against the local check (14.21 q/ha) with the increase in yield of 35.54 percent (Table 3.11 and Fig. 3.11). Varieties JG-11 and JAKI-9218 are wilt tolerant, bold seeded and can withstand moisture stress. Variety JAKI-9218 also performed well with an average yield of 17.59 q/ha while the local check yield was 15.45 q/ha. The pooled data of demonstrations of two years showed that variety JG-11 gave an additional yield of 1.67q/ha over JAKI-9218. On the whole, in Andhra Pradesh the technology demonstrations on chickpea recorded higher average yield of 18.42 q/ha with an additional net return of ₹ 7192/ha.

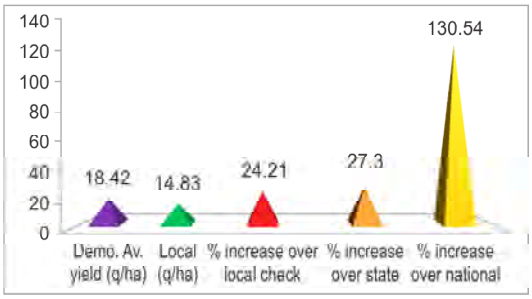


Fig. 3.11: Yield performance of chickpea in Andhra Pradesh: 2010-11 & 2011-12

Table 3.11: Performance of chickpea demonstrations in Andhra Pradesh - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
JG-11	Adilabad, Mahaboobnagar, Nizamabad, Warangal	210.00 (192)*	19.26	14.21	35.54	29387	21189	38.69
Jaki-9218	Anantapur, Kadapa, Kurnool, Mahaboobnagar	211.25 (210)	17.59	15.45	13.85	31797	25606	24.18
Total/Wt. Mean		421.25 (402)	18.42	14.83	24.21	30596	23404	31.00

* Figure in parentheses indicates number of demonstrations

Pigeonpea

The pigeonpea demonstrations in Andhra Pradesh were organized in kharif season under rainfed situation in both red and black soils. Improved high yielding varieties LRG-41 and PRG-158 were demonstrated along with recommended package of practices. The performance of the demonstrations showed that improved variety LRG-41 gave an average yield of 12.54 q/ha against the local check yield of 9.92 q/ha. Variety LRG-41 is highly tolerant to Helicoverpa/pod borer, medium in duration (180 days) and suitable for vertisols and irrigated situation. PRG-158, a tolerant variety for Fusarium wilt and recommended for Southern Telangana region gave an average yield of 10.63 q/ha compared to the local check yield of 7.0 q/ha. The improved technology gave 32.27 percent higher yield and net return of ₹ 9379/ha over farmers practice (Table 3.12 and Fig. 3.12).

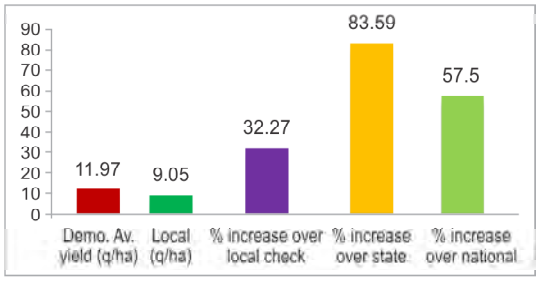


Fig. 3.12: Yield performance of pigeonpea in Andhra Pradesh: 2010-11 & 2011-12

Table 3.12: Performance of pigeonpea demonstrations in Andhra Pradesh - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
LRG-41	Anantapur, Kurnool, Nalgonda, Khammam, Prakassam, Warangal	315.00 (285)*	12.54	9.92	26.41	25867	17391	48.74

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
PRG-158	Adilabad, Kurnool, Mahboobnagar	134.50 (134)	10.63	7.00	51.86	25147	13656	84.15
Total/Wt. Mean		449.50 (419)	11.97	9.05	32.27	25652	16273	59.00

* Figure in parentheses indicates number of demonstrations

Urdbean

In Andhra Pradesh, urdbean is cultivated in 4.5 lakh hectares area in kharif and rabi/summer seasons. Due to mild winter, the crop is grown in winter season particularly in rice fallows which is a special feature of Andhra Pradesh. The technology demonstrations on urdbean crop were taken up with improved varieties LBG-709, 645, 752, 623 and 20 and recommended package of practices during 2010-11 and 2011-12 under rainfed/residual moisture conditions. The improved technologies resulted higher average yield of 6.81 q/ha against local check yield of 5.23 q/ha (Table 3.13 and Fig. 3.13). The highest average yield of 9.31 q/ha was recorded in Srikakulam district (2011-12) with LBG-709, 752, 645 and LBG-20 which are high yielding, disease (YMV) and insect/pests tolerant varieties. The use of improved technology fetched an additional net return of ₹ 8426/ha.

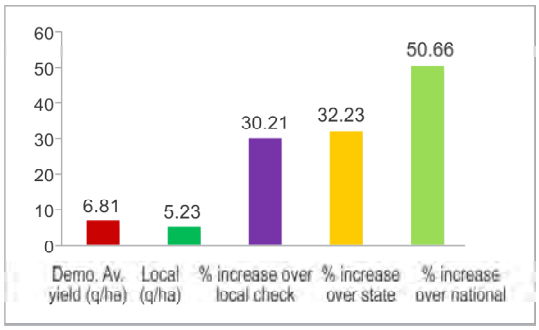


Fig. 3.13: Yield performance of urdbean in Andhra Pradesh: 2010-11 & 2011-12

Table 3.13: Performance of urdbean (Rabi) demonstrations in Andhra Pradesh - 2010-11 & 2011-12

Varieties	District	Area (acre)	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
LBG-709	Nellore	60.00 (60)	8.58	7.63	12.45	20086	16197	24.01
LBG-645, 709, 752	Srikakulam	30.0 (35)	5.25	3.50	50.00	12376	10000	23.76
LBG-645	Krishna	30.00 (30)	5.05	4.77	5.87	13667	11215	21.86

Varieties	District	Area (acre)	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
LBG-623	Prakassam	60.00 (30)	5.00	3.60	1.40	17800	9090	95.82
LBG-752	East Godavari, Krishna	60.00 (60)	7.26	4.91	47.86	20737	6876	201.59
LBG-20, 645, 709, 752	Srikakulam	30.00 (31)	9.31	6.56	41.80	28178	10096	179.10
Total/Wt. Mean		270.00 (246)	6.81	5.23	30.21	19052	10626	96.00

Maharashtra

Mungbean

In Maharashtra, the technology demonstrations on mungbean were organized with high yielding varieties viz., AKM-8802, BM-2002-1, AMK-4, etc. The recommended package of technologies gave an additional yield of 1.97q/ha over the existing farmers' practice (Table 3.14 and Fig. 3.14). The additional return obtained by the farmers was ₹ 6147/ha with the application of improved technologies.

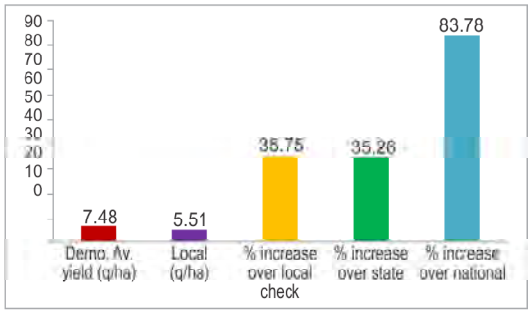


Fig. 3.14: Yield performance of mungbean in Maharashtra: 2010-11 & 2011-12

Table 3.14: Performance of mungbean (kharif) demonstrations in Maharashtra - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
BM-4	Jalna, Nanded	60.00 (60)	5.72	3.75	52.53	10745	4388	144.87
AKM 8802	Amravati (G)	30.00 (30)	7.51	6.5	15.54	11140	8540	30.44

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
AKM-4	Buldhana	30.00 (30)	6.58	5.7	15.43	7306	5540	31.88
BM-2002-1	Parbhani	30.00 (30)	9.08	6.25	45.28	19013	12138	56.64
Kopargaon	Washim	30.00 (30)	10.27	7.1	44.64	28230	15300	84.51
Total/Wt. Mean		180.00 (180)	7.48	5.51	35.75	14530	8383	82.00

* Figure in parentheses indicates number of demonstrations

Chickpea

In Maharashtra, chickpea is cultivated in an area of 1.29 million hectares with a production of 1.11 million tonnes occupying second position in the country (2009-10). The average productivity of the crop is 8.63 q/ha. Demonstrations on an area of 310 ha involving 800 farmers were conducted with improved varieties BDNG-797, Digvijay, Vijay and JAKI-9218 in medium to deep black soils under rabi rainfed situation.

The improved technologies contributed towards higher average yield i.e. 16.18 to 20.10 q/ha registering 25.52 to 46.08 per cent increase in yield over farmers' practice (Table 3.15). The highest average yield of 20.1 q/ha was recorded with variety Vijay followed by (19.34 q/ha) BDNG 797 (Akash).

The grains were small sized and no incidence of wilt on the crop was reported. Variety BDNG-797 exhibited spreading character with medium sized leaves. The demonstrations revealed an average yield increase of 34.9 percent over the farmer's practice (Fig. 3.15). The economic analysis of demonstrations indicated that the improved technology gave an additional net return of ₹ 10237/ha.

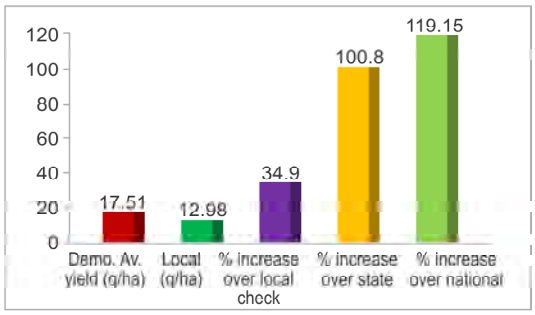


Fig. 3.15: Yield performance of chickpea in Maharashtra: 2010-11 & 2011-12

Table 3.15: Performance of chickpea demonstrations in Maharashtra - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
BDNG-797	Osmanabad	60.00 (60)*	19.34	14.43	34.03	30068	20512	46.59
Digvijay	Ahmednagar, Amravati (D), Aurangabad, Jalgaon, Parbhani, Nashik	300.00 (310)	17.03	12.38	37.56	27512	17529	56.95
JAKI-9218	Amravati (G), Buldhana, Wardha, Washim, Yavatmal, Amravati (D), Buldhana	265.00 (280)	16.18	12.89	25.52	27768	20286	36.88
Vijay	Hingoli, Jalgaon, Nagpur	150.00 (150)	20.10	13.76	46.08	34783	18434	88.69
Total/Wt. Mean		775.00 (800)	17.51	12.98	34.90	29205	18878	55.00

* Figure in parentheses indicates number of demonstrations

Pigeonpea

Maharashtra stands first in the country in cultivation of pigeonpea crop with an area of 1.09 million ha and production of 0.92 million tonnes. The average productivity of the crop is 8.41 q/ha (2009-10). During 2010-11 and 2011-12, the pigeonpea demonstrations were conducted in 338 ha covering 845 farmers. High yielding varieties viz., BSMR-736, BDN-708, ICPL-87, PKV-TARA and Vipula with recommended technology package were demonstrated. In these demonstrations, the average yield obtained was 11.27 q/ha against the local check yield of 8.53 q/ha showing an increase of 32.12 percent over local check (Table 3.16 and Fig. 3.16).

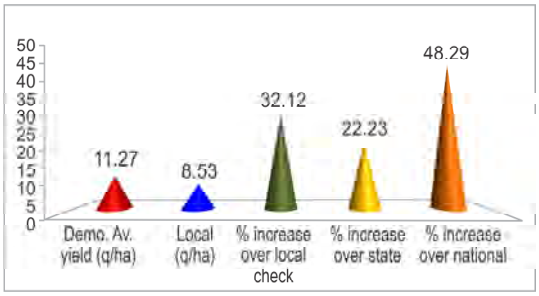


Fig. 3.16: Yield performance of pigeonpea in Maharashtra: 2010-11 & 2011-12

Table 3.16: Performance of pigeonpea demonstrations in Maharashtra - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
BDN-708	Hingoli, Jalna, Washim, Nanded	210.00 (210)*	10.70	7.88	35.79	26848	14252	88.38
ICPL-87	Ahmednagar	45.00 (45)	15.19	12.92	17.57	10822	4000	170.55
PKV Tara	Nagpur	30.00 (30)	16.15	13.17	22.63	30835	20150	53.03
BSMR-736	Ahmednagar, Amravati (D), Aurangabad, Buldhana, Chandrapur, Nanded, Osmanabad, Parbhani, Wardha, Yavatmal, Nagpur	550.00 (550)	10.87	8.13	33.70	21829	13918	56.84
Vipula	Amravati (D)	10.00 (10)	12.65	10.81	17.02	27390	22480	21.84
	Total/Wt. Mean	845.00 (845)	11.27	8.53	32.12	22876	13795	70.00

*Figure in parentheses indicates number of demonstrations

Variety PKV-TARA gave the highest average yield of 16.15 q/ha at Nagpur followed by ICPL-87 (short duration variety) with 15.19 q/ha in Ahmednagar district. Variety Vipula which is tolerant to wilt and sterility mosaic disease, also performed well with 12.65 q/ha against the local variety (10.81 q/ha) in Amaravati district in Vidarbha region of Maharashtra. Variety BSMR-736 and BDN-708 (Amol) gave an average yield of 10.87 and 10.70 q/ha, respectively.

Urdbean

In Maharashtra, the urdbean demonstrations were conducted in four districts viz., Buldhana, Washim in Vidarbha region and Nanded and Osmanabad district in Marathwada region during kharif under rainfed situation. In the demonstrations, an average yield of 7.49 q/ha was obtained with improved technologies against 5.58 q/ha with farmers' practice (Table 3.17 and Fig. 3.17). The highest yield of 9.56 q/ha was recorded in Buldhana & Washim districts with variety AKU-15 during 2011-12.

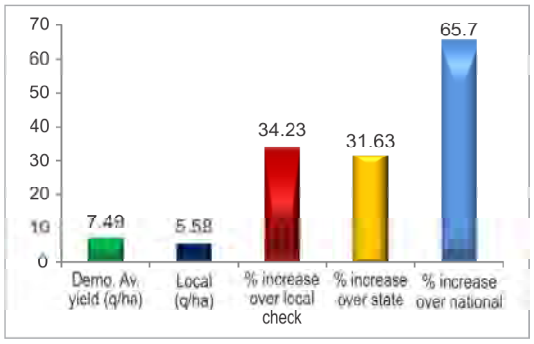


Fig. 3.17: Yield performance of urdbean (kharif) demonstration in Maharashtra : 2011-12

Table 3.17: Performance of urdbean (kharif) demonstrations in Maharashtra - 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
AKU -15	Buldhana, Washim	60.00 (60)*	9.56	6.96	37.36	22755	13349	70.46
TAU-1	Nanded, Osmanabad	60.00 (60)	5.78	4.47	29.31	11453	6542	75.07
BAU-1	Osmanabad	30.00 (30)	6.75	5.03	25.48	15900	10214	55.67
Total/Wt. Mean		150.00 (150)	7.49	5.58	34.23	16863	9999	69.00

* Figure in parentheses indicates number of demonstrations

Gujarat

Mungbean

Mungbean, a third important pulse crop after chickpea and pigeonpea and is widely grown in Kutch, Banaskantha, Mehsana, Patan, Sabarkantha, Surendranagar, Gandhinagar, Surat, Amreli, Rajkot, Jamnagar and Panchmahals districts of Gujarat. The acreage fluctuates between 1,70,000 to 1,90,000 ha depending on rainfall pattern and distribution. The rainfall ranges from 200-300 mm in Kutch, 400-500 mm (north and central Gujarat), 700-2200 mm (south Gujarat) is highly erratic and uneven from year to year. The northern and western Gujarat often experience drought every third year.

Mungbean is mainly grown on three types of soils viz., sandy loam to loamy sand (Kutch, Banaskantha, Mehsana, Patan, Sabarkantha and Gandhinagar), medium to heavy black (Surat, Panchmahal, Valsad, Surendranagar, Rajkot) and laterite (Tapi & Panchmahal). Mungbean-wheat, mustard-mungbean, castor-mungbean, cotton-mungbean, sorghum-mungbean are the major cropping systems. The demonstrations (83) were conducted in Banaskantha, Kutch, Sabarkantha, Panchmahal and Tapi districts.

The yield and net return from the crop grown on sandy soils was 20.81 and 41.64 per cent higher than the crop grown on medium black soils that recorded 9.60 q/ha grain yield and ₹ 20000/ha net return in the state. Although most of the crop is cultivated during kharif season under rainfed conditions, the yield and net returns were recorded slightly higher under irrigated crop grown during summer after harvest

Table 3.18: Performance of mungbean (kharif) demonstrations in Gujarat - 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
GM-4	Banaskantha, Kutch, Panchmahal, Sabarkantha	63.00 (63)*	10.36	8.07	28.38	20223	13890	45.59
Pusa Vishal	Tapi	25.00 (20)	13.75	10.7	28.50	45420	33375	36.09
Total/Wt. Mean		88.00 (83)	11.32	8.82	28.34	27379	19425	43.00

*Figure in parentheses indicates number of demonstrations

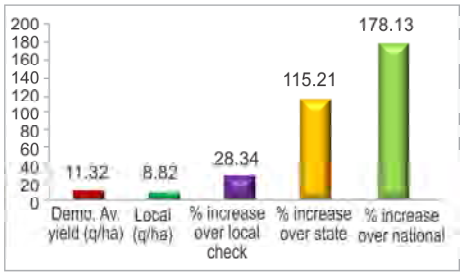


Fig. 3.18: Yield performance of mungbean in Gujarat: 2011-12

of rabi crops. The grain yield of 11.73 q/ha and 10.84 q/ha were recorded with irrigated and rainfed crops, respectively in the state. The corresponding net returns under irrigated and rainfed crops were ₹ 33085/ha and ₹ 20536/ha. Although, increase in grain yield over farmers' practices in both irrigated and rainfed conditions recorded 28 per cent, the increase in net return under irrigated conditions was considerably higher with the crop grown under irrigated conditions in summer. In the state, variety GM-4 is most common and recorded grain yield of 10.36 q/ha which was 28.38 per cent higher than the farmers' practice in Banaskantha, Kutch, Panchmahal and Sabarkantha districts under 63 demonstrations. Similarly, the increase in net return was 45.59 per cent over the local check (₹ 13890/ha). Variety Pusa Vishal, a bold seeded variety gave good returns in terms of grain yield (13.75 q/ha) and net returns (₹ 45420/ha) which were 28.50 and 36.09 per cent higher than the grain yield and net return obtained from the local check (Table 3.18 and Fig. 3.18). The crop grown during kharif season has been infested with sucking insect pests and leaf curl virus. The biotic load of pests and disease is comparatively lower in the crop grown during summer.

Chickpea

Chickpea is the third important pulse crop of Gujarat after pigeonpea and mungbean. It was cultivated on 175500 ha during 2010-11 with the corresponding production of 199800 tonnes of grains. The average productivity of the crop during the period was 11.38 q/ha which was higher than the country average (8.95 q/ha). Gujarat state contributed 1.92 and 2.67 per cent in the total national acreage and production. The major chickpea producing districts of the state include Dahod, Panchmahal, Patan, Jamnagar, Junagadh, Porbandar, Rajkot and Surendranagar.


The soils of the chickpea growing districts are heavy in texture and thus the crop is generally raised on the conserved soil moisture conditions. Sowing of the crop is done with the receding of south-west monsoon beginning from the month of September. During 210-11 and 2011-12, 135 demonstrations were conducted on the farmers' fields using technologies related to nutrient management, varietal introduction, integrated pest management and inclusion of bio pesticides, and integrated disease management in Dahod, Bharuch, Jamnagar, Sabarkantha, Vadodara districts. The introduction of new variety in Jamnagar district recorded 31.25 q/ha grain yield which was 25.62% higher than the local check practiced by the farmers (Table 3.19). However, in terms of net return variety GG-2 demonstrated in Jamnagar, Narmada, Sabarkantha and Bharuch districts registered 49.77 per cent higher net return over the farmers' practice (₹ 21672/ha). The weighted average mean of grain yield under demonstrations was found as 23.89, 83.11 and 123.9 per cent higher than the average yield of local check, state average and national average (Fig. 3.19).

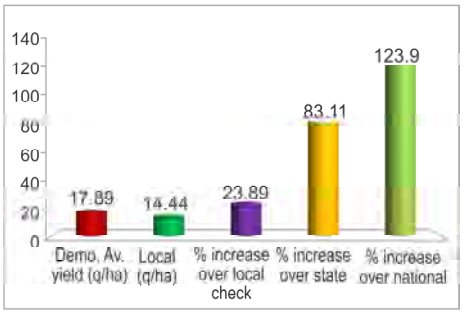


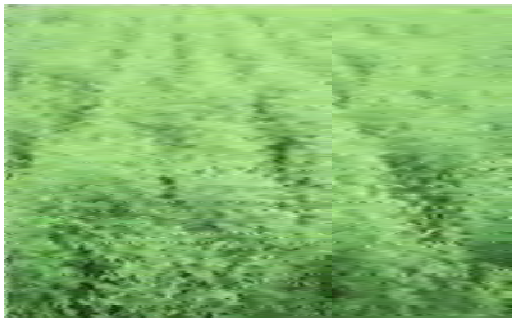
Fig. 3.17: Yield performance of chickpea in Gujarat: 2011-12 & 2011-12

Table 3.19: Performance of chickpea demonstrations in Gujarat- 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
GG-1	Dahod, Bharuch, Vadodara	71.50 (53)*	17.44	14.38	21.28	52171	42725	22.11
GG-2	Jamnagar, Narmada, Sabarkantha, Bharuch	67.50 (67)	15.39	12.02	28.04	32459	21672	49.77
GG-3	Jamnagar	15.00 (15)	31.25	25.62	21.98	82750	67360	22.85
Total/Wt. Mean		154.00 (135)	17.89	14.44	23.89	46508	35895	34.00

*Figure in parentheses indicate number of demonstrations

Pigeonpea



Gujarat is ranked at sixth position in terms of acreage under pigeonpea cultivation in India. It was being cultivated on 276700 ha during 2010-11 with production of 272900 tonnes.The average productivity of the crop was 9.86 q/ha during the corresponding period which was higher than the national average (6.65 q/ha). There is very wide variation in the sowing time of the crop, staggered over between July to September in the state. Being a long duration crop, it often suffers from moisture stress during critical growth stages. Pigeonpea-wheat is the most commonly practiced cropping pattern in the state.

It is being cultivated under both irrigated and rainfed conditions mostly in Bharuch, Dahod, Narmada, Panchmahal, Sabarkantha, Surat, Tapi and Vadodara districts as the rainfall is comparatively higher with long duration spell. However, dry spell also cause droughts in some of the years. A total of 310 demonstrations on 282.51 acre area were conducted in Narmada, Panchmahal, Vadodara, Surat, Tapi, Sabarkantha, Dahod district during 2011-12. The average yield under irrigated conditions was 22.47 per cent higher than the grain yield of demonstrations under rainfed conditions (10.99 q/ha). Among the seven districts, variety Vaishali demonstrated at Panchmahal recorded highest grain yield (17.30 q/ha) and per cent increase (66.60 %) in the net return over the local check (₹ 25150/ha) as shown in Table 3.20. The comparison of weighted mean yield of varieties demonstrated, further revealed that Vaishali variety recorded higher grain yield (15.38 q/ha) as well as net returns (₹ 30810/ha) over GT-1, AGT-2 and BDN-2. The average yield of the varieties was 26.33, 25.88 and 83.68 per cent higher than the average yield of local check, state and national yields, respectively (Fig. 3.20).

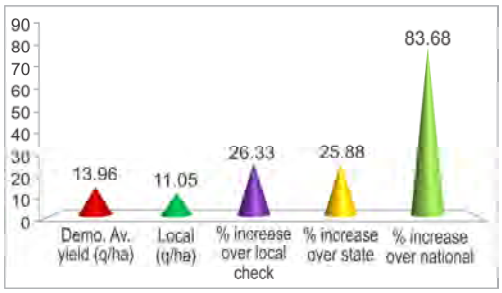


Fig. 3.20: Yield performance of pigeonpea in Gujarat: 2010-11 & 2011-12

Table 3.20: Performance of pigeonpea demonstrations in Gujarat - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
Vaishali	Narmada, Panchmahal, Vadodara, Surat, Tapi	207.00 (230)*	15.38	12.19	26.17	43927	30810	42.57
GT-1	Panchmahal, Sabarkantha, Dahod	46.13 (48)	10.96	8.49	29.09	25377	18178	39.60
AGT-2	Dahod	4.38 (8)	11.52	9.38	22.81	33655	25931	29.79
BDN-2	Dahod	25.00 (24)	8.2	6.6	24.2	15280	10180	50.10
Total/Wt. Mean		282.51 (310)	13.96	11.05	26.33	38204	26846	43.00

* Figure in parentheses indicate number of demonstrations

Rajasthan

Mungbean

Mungbean is second most important pulse crop of the Rajasthan state. It was cultivated on an area of 1272228 ha during kharif 2011-12. The production of the crop during the corresponding period was 647177 tonnes and the productivity was 5.09 q/ha. Rajasthan ranked first both in area and production of mungbean in the country and contributed 40 per cent in the total acreage and 30 per cent in total production of crop in India. The major mungbean growing districts of the state include Ajmer, Jaipur, Nagaur, Jodhpur, Jalore, Pali and Tonk in which it is grown as rainfed crop during kharif season. The rainfall varies from year to year due to climatic variability which often leads to droughts once in 5 years in arid and semi-arid districts of Rajasthan. In western districts especially in Sri Ganganagar, the crop is being cultivated under irrigated conditions on about 23578 ha during kharif season. It is also grown under irrigated conditions on considerable area in Hanumangarh, Bikaner, Jaisalmer and Jodhpur districts. The total irrigated area of the crop in the state was 47473 ha during 2011-12. Munbean - wheat, mungbean - mustard, mungbean-barley and mungbean-castor are the major cropping patterns practiced in the state. Sandy loam, loam and clay loam are the major soil types on which it is grown in the state. The demonstrations on mungbean were conducted in districts Chittorgarh, Churu, Sriganganagar, Jaipur, Barmer, Jodhpur, Sikar, Jhunjhunu, Ajmer, Hanumangarh, Tonk and Nagaur.

The productivity of mungbean was recorded considerably higher (10.34 q/ha) with the crop grown on loamy soils in Jaipur, Tonk and Ajmer, it was 17.5 and 15.89 per cent higher over the crop grown on clay loam (8.80 q/ha) of Chittorgarh and sandy loam soils (8.93 q/ha) of Churu, Hanumangarh, Sri Ganganagar, Jhunjhunu, Sikar, Nagaur, Barmer and Jodhpur districts. The crop grown on clay loam, loam and sandy loam soils recorded 6.70, 7.88 and 7.08 per cent higher grain yield over the farmers' practices in the state (Table 3.21 and Fig. 3.21). The grain yield of mungbean under rainfed conditions was recorded 13.21 per cent higher over irrigated crop under the demonstration during the year 2011-12 due to good rainfall conditions in the state, although net return per ha was recorded considerably higher (₹ 24378/ha) over the rainfed crop. The grain yield under irrigated and rainfed conditions recorded 16.16 and 33.80% higher than the local check. Among the eight technologies demonstrated, integrated crop management (9.91 q/ha) and production technology + varietal improvement (9.81 q/ha) recorded comparatively higher grain yield over integrated nutrient management + plant protection (8.27 q/ha), seed treatment + INM + IPM (8.86 q/ha) and varietal evaluation + biofertilizer (6.50 q/ha). However, per cent increase in grain yield due to demonstrations over local check was recorded highest in case of varietal evaluation as compared to other technologies. Among the eight varieties demonstrated, GM-4 recorded the highest grain yield of 9.98 q/ha

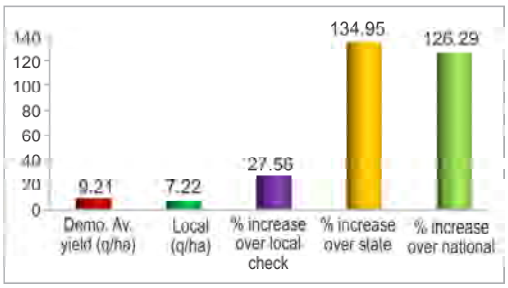


Fig. 3.21: Yield performance of mungbean in Rajasthan: 2011-12

Table 3.21: Performance of mungbean demonstrations in Rajasthan - 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
SML-668	Chittorgarh, Churu, Sriganganagar	75.00 (75)*	9.19	7.04	30.54	31968	22974	39.15
RMG-268	Jaipur, Barmer, Jodhpur, Sikar	83.00 (83)	8.81	7.05	24.96	18513	14238	30.03
RMG-492	Ajmer, Jaipur, Jhunjhunu	76.00 (76)	9.98	7.62	30.97	17153	12276	39.73
IPM-02-03	Hanumangarh, Tonk	30.00 (30)	9.03	7.26	24.38	17957	11092	61.89
RMG-62	Jodhpur, Nagaur	45.00 (45)	8.79	6.72	30.80	21912	15473	41.61
Satya	Hanumangarh	10.00 (10)	9.4	9.02	4.44	24452	18912	29.29
Total/Wt. Mean		319.00 (319)	9.21	7.22	27.56	21965	15849	39.00

*Figure in parentheses indicates number of demonstrations

followed by variety SML-668 (9.19 q/ha). The grain yield and net return from the demonstrations were 27.56 and 39.00 per cent higher than the grain yield (7.22 q/ha) and net return (₹ 15849/ha) obtained under local check. The productivity of the crop often suffer because of terminal moisture stress conditions during the growing period due to failure and uneven distribution of rainfall.

Urdbean

Urdbean is an important pulse crop of the southern districts of the Rajasthan. During 2011-12, it was cultivated on 255221 ha with production of 131689 tonnes. The productivity of the crop in the state was 5.16 q/ha which was at par of the national average (5.59 q/ha). Major urdbean growing districts of Rajasthan are Ajmer, Chittorgarh, Udaipur, Tonk, Kota, Bundi, Jhalawar, Banswara, Dungarpur and Bhilwara. The crop is mostly grown during kharif season under rainfed conditions. These districts experience a total rainfall of 600-900 mm/year. Urdbean-wheat, urdbean-barley and urdbean-mustard are the common cropping patterns in the state. The crop is mostly confined to heavy textured soils.

51 demonstrations on the crop were conducted on 52 acre during 2011-12. Among the four varieties demonstrated in the state, PU-31 variety demonstrated at Kota, recorded highest grain yield (11.30 q/ha) as well as net return of ₹ 13500/ha which were 43 and 80 per cent higher than the grain yield and net return obtained with local check (Table 3.22). The next variety that registered higher grain and net return was IPU-94-1 (Uttra). Variety KU-96-3 demonstrated at Chittorgarh recorded comparatively lower per cent increase in grain yield as well as net return over farmers' practice. The yield of the crop was 128 and 110 per cent higher than the state and national average of the crop, respectively (Fig. 3.22). Terminal moisture stress and

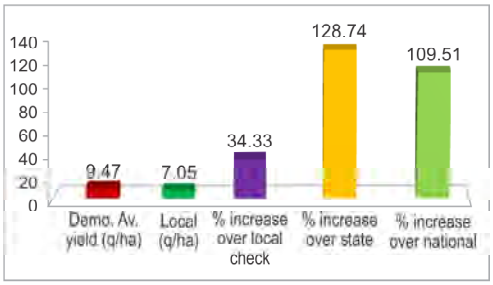


Fig. 3.22: Yield performance of urdbean in Rajasthan : 2011-12

Table 3.22: Performance of urdbean demonstrations in Rajasthan - 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
KU-300	Ajmer	15.00 (15)*	8.25	6.16	33.92	13474	7994	68.55
KU 96-3	Chittorgarh	15.00 (14)	8.65	7.02	23.21	18033	13270	35.89
PU-31	Kota	10.00 (10)	11.3	7.9	43.03	15424	8590	79.56
IPU 94-1(Uttra)	Tonk	12.00 (12)	10.5	7.5	40.00	24000	13500	77.78
Total/Wt. Mean		52.00 (51)	9.47	7.05	34.33	17594	10901	63.00

*Figure in parentheses indicates number of demonstrations

poor plant nutrient management are the most common constraints to the crop in the state.

Chickpea

Rajasthan is the second largest chickpea producing state in the country after Madhya Pradesh with contribution of 16 per cent in the acreage and 12 per cent in total production of the country. Chickpea is cultivated during rabi season almost in all the 33 districts of Rajasthan. However, Jaipur, Ajmer, Tonk, Sikar, Jhunjhunu, Bikaner, Churu, Jaisalmer, Sri Ganganagar, Hanumangarh and Bhilwara are the major districts of the state. During 2011-12, it was cultivated on 1433928 ha in the state with a production of 989986 tonnes of grains. The average productivity of the crop in the state was 6.90 q/ha which was lower than the national average (8.95 q/ha). It is mostly grown on conserved soil moisture conditions in the east-central districts of Rajasthan besides, Jalore and Pali districts. The total irrigated area of the crop is 488907 ha which is 35 per cent of the total cultivated area of the crop. The irrigated crop is mostly confined to the canal irrigated (335620 ha) command districts Jaisalmer, Bikaner, Sri Ganganagar and Hanumangarh and tube-well irrigated (94777 ha) area in Sikar, Jhunjhunu, Nagaur, Jaipur, Tonk and Ajmer. Bajra-gram, bajra-maize and bajra-sorghum are the main cropping patterns practiced in the state.

278 demonstrations were conducted to demonstrate production potential of technologies to the farmers. Among the technologies demonstrated, integrated crop management (INM+IWM+IPM+ varietal improvement) at Kota recorded highest grain yield of 25 q/ha (Table 3.23). The yield under rainfed condition at Chittorgarh was

Table 3.23: Performance of chickpea demonstrations in Rajasthan - 2010-11

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
RSG-888	Ajmer, Bikaner, Chittorgarh, Hanumangarh, Jhunjhunu, Nagaur, Sriganganagar, Tonk	132.00 (132)*	15.94	12.58	26.71	22380	16774	33.42
GNG-663	Bikaner, Churu, Dausa, Sikar, Sriganganagar	101.00 (101)	16.45	12.76	28.92	21365	16204	31.85
GNG-1561	Hanumangarh	15.00 (15)	16.21	14.58	11.18	27743	24320	14.07
GNG-1581	Sriganganagar	10.00 (10)	18.60	11.18	66.37	32470	17618	84.30
RSG-973	Kota	20.00 (20)	25.10	20.15	24.57	39160	30283	29.31
Total/Wt. Mean		278.00 (278)	16.89	13.25	27.47	23871	17976	33.00

* Figure in parentheses indicates number of demonstrations

recorded as 11.85 q/ha which was higher than state and national averages by 72 and 32 per cent, respectively. On weighted mean basis, grain yield was 27, 272 and 117 per cent higher than the local check, state average and national average, respectively (Fig. 3.23).

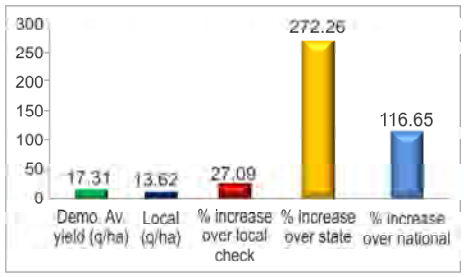


Fig. 3.23: Yield performance of chickpea in Rajasthan: 2010-11

Madhya Pradesh

Urdbean

Urdbean is an important crop cultivated during *kharif, rabi* and summer season in Madhya Pradesh. The crop is grown on about 5.51 lakh hectare with annual production of 1.48 lakh tonnes and productivity of 2.69 kg/ha. It is grown in urdbean-mustard, urdbean-wheat/mustard cropping system. The main varieties grown in Madhya Pradesh are PU-35, PU-31, JU-3, JU-86, LBG-20, TU 9814, Azad-1, RBU-38 and PDU-1. These varieties with technology package were demonstrated at 190 farmers' fields on a area of 144.49 acre. Overall, there was 43.93 per cent yield gain in the demonstrations (9.60 q/ha) over the farmers' practice (6.67 q/ha). Besides, incremental net gain was 72.0 per cent (₹ 12279 to ₹ 19834). Variety TU 98-14 was the highest yielder (12.5 q/ha) in district Jabalpur and PU-31 lowest

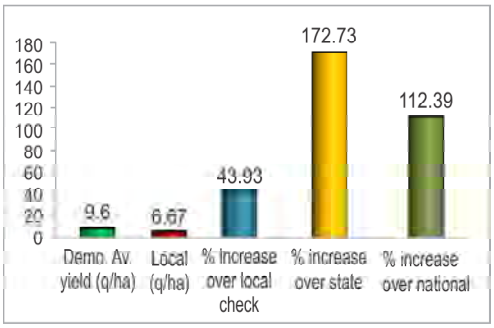


Fig. 3.24: Yield performance of urdbean in Madhya Pradesh : 2010-11

Table 3.24: Performance of urdbean (kharif) demonstrations in Madhya Pradesh - 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
PU -35	Chhatarpur, Shivpuri	28.35 (40)*	10.42	7.56	37.83	24466	16107	51.90
JU-86	Raisen, Ujjain	17.20 (24)	7.23	5.36	34.89	16420	11519	42.55
LBG-20	Narsinghpur, Rewa	14.18 (24)	11.17	7.19	55.35	19371	11236	72.40
TU 98-14	Jabalpur	12.15 (12)	12.5	9.5	31.58	33200	23600	40.68
PU-31	Satna	8.10 (19)	6.15	3.31	85.8	10255	3112	229.53
JU-3	Sagar	20.25 (20)	6.43	4.78	34.52	12245	8537	43.43
Azad-1	Tikamgarh	26.33 (26)	11.1	7.13	55.68	21735	11427	90.21
RBU-38	Shajapur	12.65 (12)	9.8	6.6	48.48	14500	7000	107.14
PDU-1	Aron	5.28 (13)	11.56	8.55	35.2	23648	16252	45.51
Total/Wt. Mean		144.49 (190)	9.60	6.67	43.93	19834	12279	72.00

* Figure in parentheses indicate number of demonstrations

(6.15 q/ha) in district Satna (Table 3.24). A comparative yield trend given in the figure indicates yield gain of 172.73 per cent over state and 112.39 per cent over national average yield (Fig. 3.24). The state average is lower than national average and thus, there is vast scope for yield improvement by the appropriate technological interventions and farmers' capacity building through better knowledge enhancement and information accessibility.

Pigeonpea

Pigeonpea is being grown on an area of 5.30 lakh ha with annual production of 3.30 lakh tonnes and productivity of 6.25 q/ha in Madhya Pradesh. Traditionally,

medium and long duration varieties of pigeonpea are grown as mixed crop or intercrop with sorghum, maize, cotton, soybean and urdbean. However, farmers prefer sole crop in most of the growing areas. In Madhya Pradesh, 299 demonstrations were conducted in 13 districts.

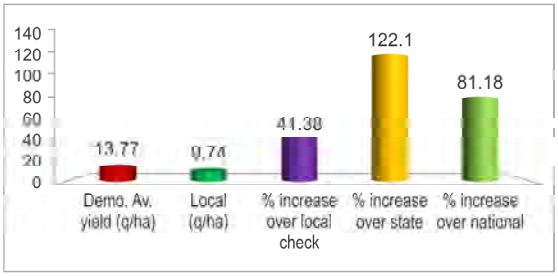


Fig. 3.25: Yield performance of pigeonpea in Madhya Pradesh : 2010-11 & 2011-12

An area of 252.33 acre was covered using improved varieties viz. Asha, JKM-189, TJT-501, JA-4, ICPL 87-119 and ICPL-88039 (Table 3.25 and Fig. 3.25). In these demonstrations, 41.38 per cent of yield enhancement and 54 per cent increase in net returns were observed. 106 demonstrations were conducted using JKM-189 variety

Table 3.25: Performance of pigeonpea demonstrations in Madhya Pradesh - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
JKM-189	Chhindwara, Jabalpur, Jhabua, Panna, Raisen, Satna, Chhaterpur,	92.41 (106)*	13.22	9.82	34.62	30926	21163	46.13
TJT-501	Dewas, Narsinghpur, Panna	44.36 (62)	14.64	11.47	27.64	30015	22130	35.63
JA- 4	Dewas, Chhatarpur, Rajgarh	29.00 (36)	14.00	10.03	39.58	37305	25655	45.41
ICPL 87-119	Jabalpur, Seoni, Rewa	40.00 (40)	14.13	8.87	59.30	25397	13107	93.77
ICPL-88039	Jabalpur, Satna	35.43 (35)	12.37	7.50	64.93	44123	28518	54.72
ICPH 2671	SEONI	6.08 (15)	15.25	9.58	59.19	26950	17597	53.15
Asha	Damoh	5.05 (5)	20.1	14.3	40.56	28100	14690	91.29
Total/Wt. Mean		252.33 (299)	13.77	9.74	41.38	32323	21390	54.00

* Figure in parentheses indicate number of demonstrations

in seven districts covering an area of 92.41 acres. Results show that there was an increase of 34.62 per cent in yield and 46.13 per cent in net return.

Lentil

Lentil is next to chickpea, being grown on an area of 5.90 lakh ha with annual production of 1.80 lakh tonnes and productivity of 3.05 q/ha in Madhya Pradesh. It is generally grown as rainfed crop during rabi season after rice, maize, pearl millet or kharif fallow. In central parts of India, large seeded types are preferred. High yielding varieties with tolerance to wilt have been developed for this region. In Madhya Pradesh, 339 lentil demonstrations were conducted in 12 districts of Madhya Pradesh.

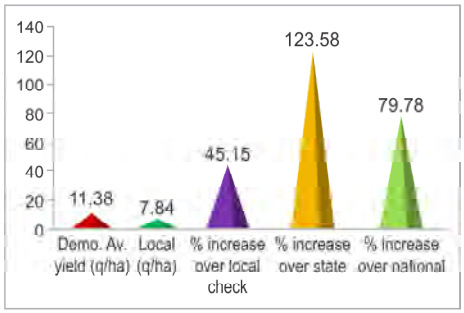


Fig. 3.26: Yield performance of lentil in Madhya Pradesh: 2010-11 & 2011-12

294.64 acre area was covered under demonstrations using improved varieties viz. JL-1, JL-3 and DPL-62. Through demonstrations, 45.15 per cent yield enhancement and 58 per cent increase in net return was realized (Table 3.26). Comparative yield trends show that there is 123.58 % and 79.78 % yield increase over the state and national average, respectively (Fig. 3.26). A total of 278 demonstrations were conducted in 11 districts of M.P. using improved variety JL-3 covering 233.14 acre

Table 3.26: Performance of lentil demonstrations in Madhya Pradesh - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
JL-3	Chhatarpur, Jabalpur, Narsinghpur, Panna, Raisen, Rajgarh, Sagar, Satna, Seoni, Shajapur, Shivpuri	233.14 (278)*	11.57	7.89	46.64	28283	17562	61.05
JL-1	Rewa	20.00 (20)	13.64	8.21	44.58	26600	13725	93.81
DPL-62	Raisen, Sagar	41.50 (41)	9.25	7.37	25.51	21687	17454	24.25
Total/Wt. Mean		294.64 (339)	11.38	7.84	45.15	27240	17286	58.00

*Figure in parentheses indicate number of demonstrations

area. 46.64 % increase in yield and 61.05 % gain in net return was noticed. A total of 20 demonstrations were conducted in district Rewa using improved variety JL-1 which provided best result in the state with 44.58 % yield and 93.81 % net return.

Chickpea

About 1.75 million ha chickpea is grown in rainfed rice fallows in the state of Madhya Pradesh. In the state, chickpea is grown in 3.04 million ha with production of 3.29 million tonnes and yield of 10.81 q/ha. In Madhya Pradesh, 1275 chickpea demonstrations were conducted in 20 districts. Demonstrations on chickpea included seed priming, treatment with fungicides, insecticides, Rhizobium, PSB, fertilizer, Pheromone traps, etc.

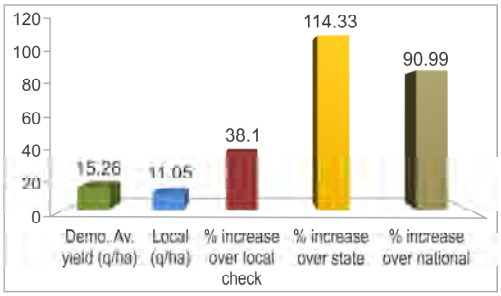


Fig. 3.27: Yield performance of chickpea in Madhya Pradesh : 2010-11 & 2011-12

Many cropping sequences viz. Rice–chickpea, Soybean- chickpea are prevalent. 1206.07 acre area was brought under demonstrations using improved varieties viz. JG 16, JG 63, JG 130, JG 11, JG 315, Vijay, JG 218, JG 30, JG 322 & JAKI 9218. It was observed that 38.10 per cent enhanced yield and 49 per cent net return was gained in demonstrations (Table 3.27 and Fig. 3.27). A total of 35 demonstrations were conducted in district Guna using improved variety JG 218 in an area of 35 acre which resulted in 33.66 % yield and 37.68 % increase in net return. JG 63, JG 11, JG 130, JG 313 and JG 30 yielded more than 15 q/ha in demonstrations.

Odisha

Urdbean

In Odisha, urdbean ranks second in acreage (597.31 thousand ha) and production (242.83 thousand tonnes) after mungbean. It is grown in *kharif, rabi* and summer. Though Ganjam occupies the highest area (52.26 thousand ha) but Kalahandi is the

Table 3.27: Performance of chickpea demonstrations in Madhya Pradesh - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		%	Net Return (₹/ha)		%
			Demo	Check	Increase	Demo	Local Check	Increase
JG-16	Chhatarpur, Narsinghpur, Sagar, Satna, Seoni, Jhabua, Panna, Damoh	317.91 (364)*	12.73	8.96	42.08	18469	11184	65.14
JG-130	Dewas, Jabalpur, Rajgarh, Rewa, Shivpuri, Tikamgarh, Ujjain, Aron	282.71 (353)	16.63	11.74	41.65	27045	18160	48.93
JG-11	Guna, Shajapur, Chhindwara, Dewas, Jabalpur, Jhabua, Satna	191.34 (243)	17.51	13.10	33.66	35394	25929	36.50
JG-315	Damoh, Jhabua	45.00 (45)	15.56	11.61	34.02	19562	13526	44.63
Vijay	Panna, Raisen	75.00 (75)	13.61	9.41	44.63	17752	11152	59.18
JG-218	Guna	35.00 (35)	19.30	14.67	32.17	34181	24827	37.68
JG-63	Narsinghpur, Damoh	21.25 (45)	17.74	12.45	42.49	40540	23683	71.18
JG-30	Shajapur	35.43 (35)	16.2	14.2	14.08	25500	21300	19.72
JG-322	Seoni	161.95 (40)	14.8	10.78	37.29	16660	12736	30.81
JAKI-9218	Raisen	40.48 (40)	13.78	9.7	42.06	25172	16380	53.68
Total/Wt. Mean		1206.07 (1275)	15.26	11.05	38.10	24194	16540	49.00

* Figure in parentheses indicate number of demonstrations

highest in production (27.91 thousand tonnes) from 45.54 thousand ha. Demonstrations of improved variety with full package of practice were laid out on 46 farmers' fields in 42 acre area in six districts - Nayagarh, Bolangir, Ganjam, Kalahandi, Bargarh and Cuttack during kharif 2011-12. The varieties included were PU-31, PU-35, Shekhar-2. Results show that Shekhar-2 yielded highest (8.2 q/ha) with the yield gain of 41.38 per cent and incremental net gain of 72.27 per cent (Table 3.28). It was observed that there was 33.21 per cent yield gain in demonstrations (6.94 q/ha) over farmers practices (5.21 q/ha). The yield trend as given in figure shows that there is 147.86 per cent yield gain over state average and 53.54 per cent over national average (Fig. 3.28).

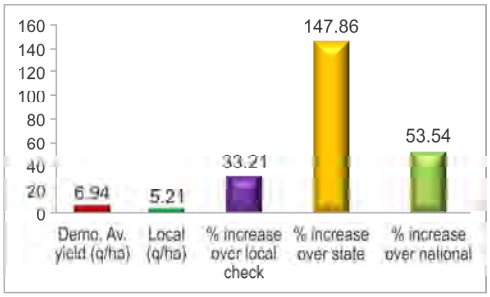


Fig. 3.28: Yield performance of urdbean in Odisha: 2011-12

Table 3.28: Performance of urdbean demonstrations in Odisha - 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
PU-31	Nayagarh, Bolangir, Ganjam, Klahandi	24.29 (29)*	6.41	4.91	30.55	13058	8823	48.00
PU-35	Bargarh	5.05 (5)	6.3	5.2	21.15	10200	7300	39.73
Shekhar-2	Cuttack	12.65 (12)	8.2	5.8	41.38	17020	9880	72.27
Total/Wt. Mean		41.99 (46)	6.94	5.21	33.21	13909	8959	54.00

* Figure in parentheses indicate number of demonstrations

Pigeonpea

In Odisha, pigeonpea is grown in an area of 1.40 lakh ha with production of 1.20 lakh tonnes and productivity of 8.13 q/ha. Rayagada district occupies highest position in area (17.22 thousand ha), production (16.00 thousand tonnes) and productivity (9.29 q/ha) followed by Kalahandi district (area 13.06 thousand ha, production: 9.72 thousand tonnes and productivity: 744 kg/ha) and Ganjam (area: 11.98 thousand ha, production: 9.22 thousand tonnes and productivity: 770 kg/ha). A total of 15 demonstrations were laid out on 17.73 acre area including the variety Asha and UPAS-120. Variety Asha exhibited 22.37 % yield increase and 40.97 % gain in net return (Table 3.29 and Fig. 3.29). Whereas, variety UPAS-120 showed 38.71 % increase in yield and 68.42 % gain in net return. Though, in respect to the productivity, Asha performed better than UPAS-120.

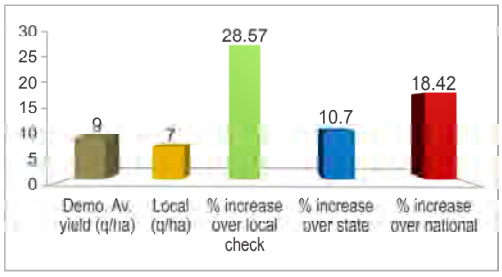


Fig. 3.29: Yield performance of pigeonpea (rainfed) in Odisha: 2011-12

Table 3.29: Performance of pigeonpea demonstrations in Odisha - 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
Asha	Ganjam	10.13 (5)*	9.3	7.6	22.37	15380	10910	40.97
UPAS-120	Cuttack	7.6 (10)	8.6	6.2	38.71	21120	12540	68.42
Total/Wt. Mean		17.73 (15)	9.00	7.00	28.57	17842	11609	53.00

* Figure in parentheses indicate number of demonstrations

Mungbean

In Odisha, mungbean ranks first followed by urdbean and pigeonpea. Mungbean is grown in kharif, rabi and summer season in the state. It is grown in 8.32 lakh ha with production of 3.41 lakh tonnes and yield of 4.11 q/ha. During kharif, district Bargarh occupies the highest position in area (41.56 thousand ha), production (15.67 thousand tonnes) and productivity (3.77 q/ha) followed by district Kalahandi (area-41.34 thousand ha, production-27.08 thousand tonnes and productivity-6.55 q/ha). During rabi, Ganjam district occupies the highest area (150.82 thousand ha), production (68.62 thousand tonnes) and productivity (4.55 q/ha) followed by Nayagarh (52.98 thousand ha, production 14.83 thousand tonnes and productivity (2.80 q/ha). Out of total mungbean area, the share of kharif is 30 % and that of rabi it is 70 %.

A total of 63 demonstrations were laid out in six districts of Odisha in 60 acre area with improved variety and package of practices (Table 3.30). Results show that there was 44.27 % yield and 77 % net return increase due to technological interventions with proper management in the demonstration plots. Comparative yield trends given in the figure, shows that there is yield gain of 2.11 q/ha and 85.75 % over the state and national average (Fig. 3.30).

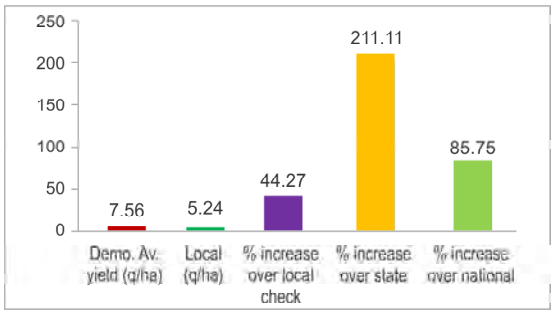


Fig. 3.30: Yield performance of mungbean in Odisha: 2011-12

Table 3.30: Performance of mungbean demonstrations in Odisha - 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
PDM-139	Bolangir, Klahandi	15.40 (20)*	7.35	5.26	39.73	18996	11372	67.04
TARM-1	Ganjam, Bargarh, Cuttack, Nayagarh	44.03 (43)	7.63	5.23	45.89	20296	11272	80.06
Total/Wt. Mean		59.43 (63)	7.56	5.24	44.27	19959	11298	77.00

*Figure in parentheses indicates number of demonstrations

Karnataka

Urdbean

Urdbean is very popularly grown in all the seasons in Karnataka. However, maximum area is under kharif cultivation where it is intercropped with sorghum, pearl millet, maize, cotton, castor, pigeonpea, etc. Development of short duration, photo thermo insensitive and disease resistant varieties have led to its cultivation as a sole relay crop during rabi season in the rice fallows of the coastal districts and black soils of northern Karnataka. In summer, urdbean is cultivated under protected irrigation. It occupies about 1.28 lakh ha area in Karnataka producing 0.45 lakh tonnes. The average productivity of crop in the state is 3.52 q/ha. The major urdbean growing districts of state are Belgaum, Bidar, Dharwad, Gulberga, Haveri, Koppal, Udupi, Dakshina Kannada, Hassan, Chickmagalur, Mysore, Mandya, Tumkur and Chamarajanagar.

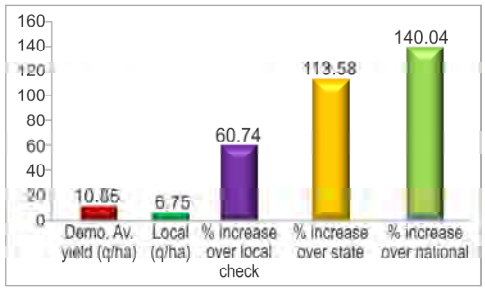


Fig. 3.31: Yield performance of urdbean in Karnataka: 2011-12

The demonstrations on urdbean variety and production technology conducted in Bidar district of Karnataka during rabi have revealed that the yield was enhanced by 60.74% over farmers' practice by adopting improved DU-1 variety and production technology (Table 3.31 and Fig. 3.31). An average yield recorded under demonstration was 10.85 q/ha as against 6.75 q/ha under farmers' practice. The overall net gain in

Table 3.31: Performance of urdbean (rabi) demonstrations in Karnataka- 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
DU-1	Bidar	20.00 (20)*	10.85	6.75	60.74	33884	18210	86.07

*Figure in parentheses indicate number of demonstrations

farmers' income was increased by 86.07% under demonstrations as compared to farmers practice.

Pigeonpea

In Karnataka among different pulse crops grown, pigeonpea is considered as the most important crop of the state due to its drought tolerance, ability to recover from the losses caused by various stresses, high protein (20-22%) grains, quality fodder and fuel wood. Around 33 per cent of the area under total pulses in Karnataka is covered by pigeonpea. It occupies an area of 8.9 lakh ha with total production of 5.3 lakh tonnes and productivity of 5.96 q/ha. Around 90% of the pigeonpea area comes under northern Karnataka, Gulbarga and Bidar districts cover 79% of the total pigeonpea area of the state, while Gulbarga district alone covers 65% of the state's share. Gulbarga district ranks first in both area (2.8 lakh ha) and production (1.8 lakh tonnes) and also it ranks first in the area under modern varieties of pigeonpea in the state. Gulbarga is the most important pigeonpea growing district of Karnataka with an area of 55 per cent and production of 45 per cent of the state. Gulbarga district is popularly known as "pulse bowl" of Karnataka and any adverse effect in production of pigeonpea in this district will affect the state production and productivity, yet there is lot of scope to enhance the productivity of the crop through improved production technology.

The low productivity of pigeonpea in Karnataka is due to erratic and scanty rainfall; prolonged dry spell during critical growth stages such as flowering and pod formation which results in significant reduction in yield of pigeonpea. Under such conditions, it is imperative that seed treatment with chemicals, use of drought tolerant variety, transplanting technique, foliar application of nutrients and in situ moisture conservation practices play an important role in crop stand establishment and production.

In order to demonstrate the worthiness of improved technology in pigeonpea, 32 demonstrations were conducted in the farmers' fields under irrigation by Krishi Vigyan Kendras of Bidar and Bellary districts. The results recorded have shown an average yield of 21.51 q/ha under demonstration of varieties ICPL-87119 and BSMR-736 with improved production technology as compared to 15.52 q/ha under farmers practice, thus an increase of 38.60% in yield over farmers' practice (Table 3.32 and Fig. 3.32). The net gain increased by 48% due to adoption of improved technology under demonstrations over farmers' practice.

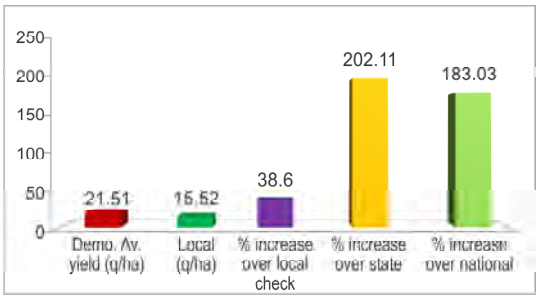


Fig. 3.32: Yield performance of pigeonpea (irrigated) in Karnataka: 2011-12

Table 3.32: Performance of pigeonpea (irrigated) demonstrations in Karnataka - 2011-12

Varieties	District	Area (acre)	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
ICPL-87119	Bellary	12.50 (12)*	18.38	15.54	18.28	35946	28478	26.22
BSMR-736	Bidar	20.00 (20)	23.47	15.5	51.42	66242	41040	61.41
Total/Wt. Mean		32.50 (32)	21.51	15.52	38.60	54593	36210	48.00

* Figure in parentheses indicates number of demonstrations

Similarly, under rainfed condition, 330 demonstrations conducted during kharif in Belgaum, Gulberga, Koppal, Raichur, Bidar, Bellary, Chitradurga, Tumkur and Mysore districts by Krishi Vigyan Kendras have revealed superior performance of pigeonpea varieties TS-3R, BSMR-736, BRG-1 and BRG-2 by recording an average yield of 13.80 q/ha as compared to 10.04 q/ha under farmers' practice. The improved technology demonstrations have resulted in an overall increase of 37.45% in yield and 42% in economic returns over farmers' practice (Table 3.33 and Fig. 3.33).

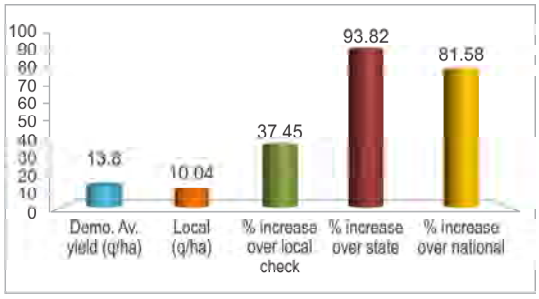


Fig. 3.33: Yield performance of pigeonpea (rainfed) in Karnataka : 2010-11 & 2011-12

Table 3.33: Performance of pigeonpea demonstrations (rainfed) in Karnataka - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
TS-3R	Belgaum, Gulbarga, Koppal, Raichur	195 (195)*	11.46	9.06	26.49	31093	23721	31.08
BSMR 736	Bellary, Bidar	56.25 (56)	25.84	15.58	65.85	82468	43667	88.86
BRG 2	Chitradurga	30.00 (28)	10.5	8.2	28.05	24150	17290	39.68
BRG-1	Tumkur, Mysore	50.00 (51)	11.38	8.75	30.06	23688	17625	34.40
Total/Wt. Mean		331.25 (330)	13.80	10.04	37.45	38069	25605	42.00

*Figure in parentheses indicates number of demonstrations

Chickpea

Chickpea is the major pulse crop in Karnataka state. However, its area and production are fluctuating year after year due to high incidence of pest and diseases, stressed conditions and fluctuating marketing prices. Karnataka ranks fifth in the cultivation of chickpea with an area of 9.6 lakh ha, 6.3 lakh tonnes of production and 6.56 q/ha of productivity. In Karnataka, Gulbarga occupies the first position in chickpea area, production and productivity followed by Bijapur, Bidar, Gadag, Dharwad. The lower productivity of chickpea is due to less importance given to this crop, non-adoption of proper production technologies, severe incidence of pests and diseases, non-remunerative market price, lack of area under irrigation and its cultivation mainly as a mixed crop. 267 demonstrations conducted in Raichur, Dharwad, Mysore, Koppal, Gadag, Gulberga, Chitradurga, Belgaum, Bellary, Bidar districts under irrigation with JG-11 variety recorded an increased average yield of 15.12 q/ha as compared to 11.64 q/ha under farmers' practice (Table 3.34 and Fig. 3.34).

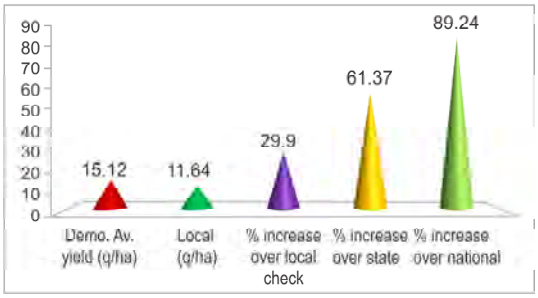


Fig. 3.34: Yield performance of chickpea (irrigated) in Karnataka : 2010-11 & 2011-12

Table 3.34: Performance of chickpea demonstrations in Karnataka - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
JG-11	Raichur, Dharwad, Mysore, Koppal, Gadag, Gulberga, Chitradurga, Belgaum, Bellary, Bidar	267.50 (267)*	15.12	11.64	29.90	30826	21497	43.40

* Figure in parentheses indicates number of demonstrations

This has clearly demonstrated the benefits of improved technology in chickpea by increasing the yield by 29.90% and economic returns by 43.40% over farmers' practice. Similarly, 206 demonstrations conducted in farmers' fields under rainfed conditions in the major chickpea growing districts, namely Bellary, Gadag, Gulbarga, Koppal, Raichur, Dharwad, Tumkur and Mysore have revealed an increase of 26.48% in yield by recording an average yield of 11.08 q/ha as against 8.76 q/ha under farmers practice (Table 3.35 and Fig. 3.35). The economic returns also increased by 44% over farmers' practice due to adoption of improved technology and varieties like JG-11 and ICCV-37 under rainfed conditions.

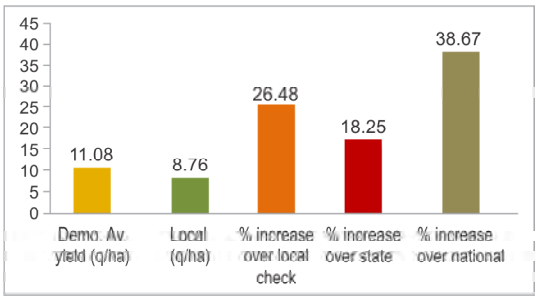


Fig. 3.35: Yield performance of chickpea (rainfed) in Karnataka: 2011-12

Table 3.35: Chickpea (rainfed) demonstrations in Karnataka - 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
JG-11	Bellary, Gadag, Gulbarga, Koppal, Raichur, Tumkur-A, Tumkur, Mysore	245 (194)*	11.11	8.73	27.26	24649	16939	45.52
ICCV-37	Dharwad	12.50 (12)	10.5	9.3	12.9	21125	18750	12.67
Total/Wt. Mean		257.50 (206)	11.08	8.76	26.48	24478	17027	44.00

* Figure in parentheses indicates number of demonstrations

Mungbean

Mungbean is one of the important pulse crops of Karnataka state. Karnataka accounts for 15.35% of its country acreage and 7.71% of the country production. It is grown on about 4.04 lakh ha in the state mainly in Bagalkote, Belgaum, Bellary,

Bidar, Bijapur, Dharwad, Gadag, Gulberga, Haveri, Koppal, Raichur, Hassan, Chickmagalur, Chitradurga, Chamrajanagar, Mysore, Tumkur and Shimoga districts. The crop is mainly cultivated in red soils during kharif as rainfed and during summer as irrigated crop, besides in paddy fallow under residual moisture in coastal districts of Karnataka.

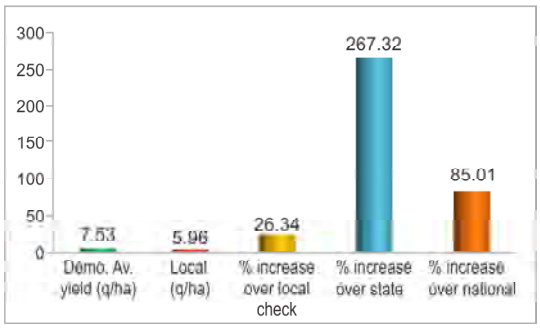


Fig. 3.36: Yield performance of mungbean in Karnataka: 2010-11 & 2011-12

The state is producing 1.11 lakh tonnes of mungbean with an average productivity of 2.75 q/ha. Mungbean is grown mostly during kharif under rainfed condition, however development of short duration and disease resistant varieties led to its cultivation during rabi and summer seasons in most parts of Karnataka. Being a short duration crop, it is ideal for catch cropping, intercropping and relay cropping. In order to increase the production, productivity and farmer's income, 170 demonstrations were conducted during kharif under rainfed situation in various districts of Karnataka state by Krishi Vigyan Kendras during 2010-11 and 2011-12. The results revealed that the yield could be increased by 26.34% over farmers' practice by adopting improved varieties such as Selection-4, China Moong, BGS-9 and Shiny moong with improved production technology by recording an average yield of 7.53 q/ha as against 5.96 q/ha under farmers' practice. In terms of economic returns also, an overall increase of 52% was recorded over and above the farmers' practice (Table 3.36 and Fig. 3.36).

Table 3.36: Performance of mungbean demonstrations (kharif) in Karnataka - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
Selection-4	Gadag, Gulbarga, Tumkur	85.00 (83)*	7.09	5.92	19.76	14641	10961	33.57
China Moong	Belgaum, Bellary	32.50 (32)	7.37	5.34	38.01	20931	14148	47.94
BGS-9	Bidar	12.50 (13)	13.12	9.5	38.11	35879	25300	41.81
Local	Chitradurga	30.00 (30)	5.1	4.02	26.87	16650	7490	122.30
Shinymoong	Dharwad	12.50 (12)	11.2	8.9	25.84	31580	24330	29.80
Total/Wt. Mean		172.50 (170)	7.53	5.96	26.34	18942	12965	52.00

* Figure in parentheses indicates number of demonstrations

Tamil Nadu

Mungbean

In Tamil Nadu, the area is around 1.97 lakh ha with a production of 0.72 lakh tonnes which works out to an average productivity of 3.68 kg/ha. Although this average is slightly above the national average, but is lesser than that recorded in other states. The crop is mostly cultivated in rabi under rainfed condition and also in paddy fallows utilizing residual moisture during summer season. The demonstrations conducted in 75 acre area in the state of Tamil Nadu in farmers' fields during rabi revealed that the yield increased by 16.36% due to adoption of improved varieties namely VRM-1, VBN-2, VBN-3 and VRM-2 combined with improved production technology by recording an average yield of 7.41 q/ha as compared to 6.36 q/ha in farmers' practice (Table 3.37 and Fig. 3.37). This also led to an increase of 31% economic returns under demonstrations over farmers' practice.

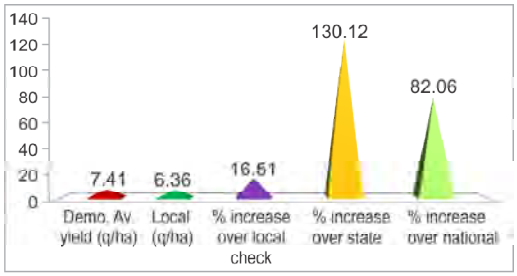


Fig. 3.37: Yield performance of mungbean (rabi) in Tamil Nadu: 2010-11 & 2011-12

Table 3.37: Performance of mungbean demonstrations (rabi) in Tamil Nadu - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
VRM-1	Vellore, Thiruvanamalai	22.50 (15)*	7.42	6.41	15.76	12049	9217	30.73
VBN-2	Tiruvallur, Vellore	22.50 (25)	7.68	6.48	18.52	16052	11885	35.06
VBN 3	Virudhanagar	25.00 (25)	7.22	6.22	16.08	17712	13908	27.35
VRM(GG)-2	Thiruvanamalai	5.00 (10)	7.16	6.34	12.9	10044	7756	29.50
Total/Wt. Mean		75.00 (75)	7.41	6.36	16.51	15004	11484	31.00

* Figure in parentheses indicates number of demonstrations

Urdbean

The area under urdbean in the state of Tamil Nadu is around 3.19 lakh ha with a production of 1.27 lakh tonnes and an average productivity of 3.98 q/ha. The increase

in popularity of urdbean in the state is attributed to the development of high yielding and YVM resistant varieties suitable for cultivation in rabi season in rice fallows. Further, development of location specific agrotechniques for urdbean in rice fallows of Tamil Nadu is the cause for the horizontal expansion in area. Vamban 3 variety maturing in 70 days, is capable of yielding an average of 8.00 - 9.50 q/ha under rainfed/ irrigated conditions.

It is resistant to MYMV and can be grown during kharif, rabi and summer in all districts of Tamil Nadu except Nilgiris and Kanyakumari. ADT-3, Vamban 3, Vamban 5 and CO-6 urdbean varieties are very suitable for this situation. To show the worthiness of improved technology in the farmers' fields, 191 demonstrations were conducted by Krishi Vigyan Kendras of Virudhunagar, Thiruvanamalai, Tuticorin, Villupuram, Vellore, Tiruvallur, Namakkal, Erode, Thiruvarur and Nagapattinam districts of Tamil Nadu under rainfed conditions. The results revealed that overall yield increased by 29.60% by recording an average yield of 6.48 q/ha due to adoption of improved varieties such as VBN-3, VBN-4, VBN-5, ADT-3, Co-6 with improved production technology as against 5 q/ha under farmers practice (Table 3.38 and Fig. 3.38). The net gain in returns

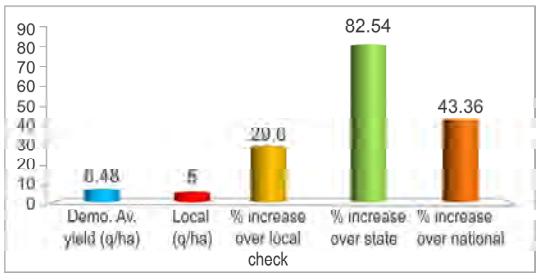


Fig. 3.38: Yield performance of urdbean (rainfed) in Tamil Nadu: 2010-11 & 2011-12

Table 3.38: Performance of urdbean demonstrations (rainfed) in Tamil Nadu - 2010-11 & 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		%	Net Return (₹/ha)		%
			Demo	Check	Increase	Demo	Local Check	Increase
VBN-3	Virudhunagar, Thiruvanamalai	20.00 (20)*	7.65	6.13	24.80	12358	7849	57.45
VBN-4	Tuticorin, Villupuram, Vellore, Virudhanagar	52.50 (52)	8.54	5.70	49.82	23525	10033	134.48
VBN-5	Namakkal, Tiruvallur, Erode, Villupuram, Tuticorin	49.00 (52)	6.85	5.46	25.46	19900	9373	112.31
ADT-3	Thiruvarur, Nagapattinam	81.00 (61.25)	4.45	3.80	17.11	9100	7050	29.08
Co.6	Namakkal	6.00 (6)	9	7.4	21.62	32000	23200	37.93
Total/Wt. Mean		208.50 (191)	6.48	5.00	29.60	16243	8889	78.00

*Figure in parentheses indicate number of demonstrations

varied from 29.08% to 134.48% with different varieties and showed average of 78% increase over farmers practice.

Similarly, 53 demonstrations were conducted by Krishi Vigyan Kendras of Villupuram, Vellore, Tiruvallur and Erode districts of Tamil Nadu under irrigated condition which recorded overall yield increase of 35% due to adoption of improved variety and production technology over farmers' practice. The gain in returns varied from 32% in VBN-4 variety to 180.97 % in VBN-5 with an average of 119% increase over farmers' practice (Table 3.39 and Fig. 3.39).

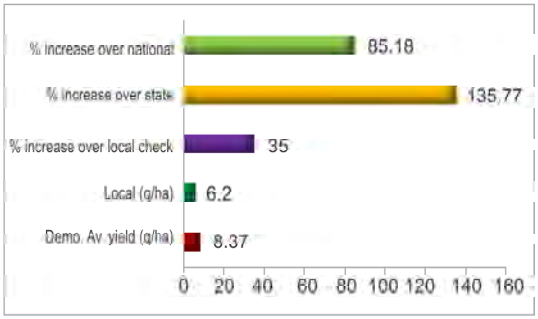


Fig. 3.39: Yield performance of urdbean (irrigated) in Tamil Nadu: 2011-12

Table 3.39: Performance of urdbean (irrigated) demonstrations in Tamil Nadu - 2011-12

Varieties	District	Area (acre) & No. of Demo.	Yield (q/ha)		% Increase	Net Return (₹/ha)		% Increase
			Demo	Check		Demo	Local Check	
VBN-5	Erode, Thiruvallur, Villupuram	28.00 (33)*	8.52	5.78	47.40	18915	6732	180.97
VBN-4	Vellore	20 (20)	8.16	6.78	20.35	16390	12417	32.00
Total/Wt. Mean		48.00 (53)	8.37	6.20	35.00	17863	9101	119.00

* Figure in parentheses indicate number of demonstrations

Chapter-4

Outcome and Implications

1. There is a wide gap between demand and supply of pulses and about 20% of the total demand is met by imports. In this context, Technology Demonstration for Harnessing Pulses Productivity (TDHPP) initiated in 2010 as a technology intervention by Indian Council of Agricultural Research to address issues related to production and productivity of pulses, has been able to sensitize farmers and stakeholders across the country and contributed in realizing record production of pulses, around 18.0 million tonnes.
2. TDHPP imbibed district specific planning; capacity building of farmers, extension workers and KVK experts; district specific technology modules developed by IIPR; regular monitoring and support by the Zonal Project Directorates and implementation by KVKs.
3. While planning, the major emphasis was given on potential area identification, constraint analysis, action plan and training plan development, monitoring and documentation. KVKs provided critical input support and training to farmers and conducted regular visits, field days, data collection, reporting, etc. related to these demonstrations. Feedback to the technical institutions was one of the important ingredients of the programme to make further corrections in the technology demonstration mechanism. The two years efforts led to development of a Technology Adaptation Model for Harnessing Productivity with participation of technology institutions, development departments and KVKs.
4. During 2010-11 and 2011-12, 11536 demonstrations with coverage of 11228.36 acre area on 5 major crops (mungbean, urdbean, pigeonpea, chickpea and lentil) were laid out across the country in 137 districts of 11 states (Bihar, West Bengal, Uttar Pradesh, Andhra Pradesh, Maharashtra, Rajasthan, Gujarat, Madhya Pradesh, Odisha, Karnataka and Tamil Nadu).
5. Productivity Performance: The yield advantage ranging between 33 to 41% and net profit ₹ 20000 to 28000 were realized in different crops (Table 4.1).

Table 4.1: Crop wise technology demonstrations on pulses in 2010-11 & 2011-12

Crops	Demo. yield (q/ha)	Local (q/ha)	% increase	Cost of cultivation (₹/ha)	Net profit (₹/ha)	National average 2011-12 (q/ha)
Mungbean	8.88	6.60	34.55	11854	20405	4.06
Urdbean	8.05	5.76	39.76	10721	19413	4.52
Pigeonpea	12.54	9.39	33.55	14134	28680	6.56
Chickpea	16.15	12.14	33.03	14058	27357	9.12
Lentil	14.12	10.00	41.20	11144	28246	5.91

Some of the important inferences drawn from the technology demonstrations are cited as under:

5.1 **Mungbean:** Under this crop, 2205 demonstrations in selected districts of 8 states with coverage of 2126.31 acre area were conducted. On an average 8.88 q/ha yield was recorded which was 34.55% higher over local check with net economic gain of ₹ 20405 per ha (Fig. 4.1). 246 demonstrations of summer mungbean were organized on 210.13 acre area in 7 districts of Uttar Pradesh. From summer mungbean, 10.56 q/ha yield was realized under demonstrations which was 41.31 % higher over local check with net profit of ₹ 36795 per ha. The yield recorded under summer mungbean demonstrations showed significant increase (118.18%) over national average.

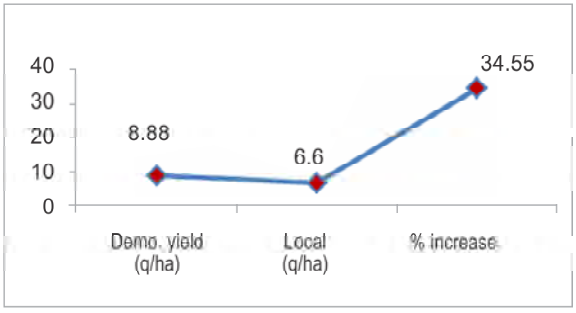


Fig. 4.1: Performance of mungbean demonstrations

5.2 **Urdbean:** The demonstrations (1565) on urdbean were organized on 1500.46 acre area in selected districts of 8 states. The average yield (8.05 q/ha) under demonstrations, was 39.76% higher over local check. Net profit of ₹ 19413 per ha was realized by the farmers (Fig. 4.2). The demonstration yield was higher up to the extent of 92% over local check. The average yield of urdbean was 78.10% higher over national average yield.

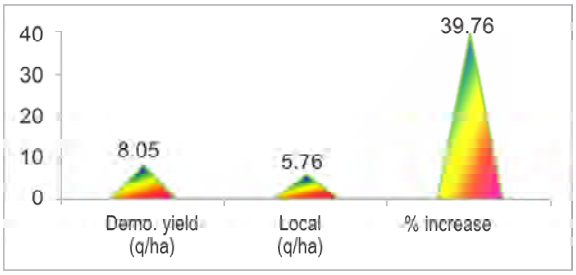


Fig. 4.2: Performance of urdbean demonstrations

5.3 **Pigeonpea:** Overall 2958 demonstrations were laid out. The demonstration yield (12.54 q/ha) was 33.55% higher over local check and 65% over national average (Fig. 4.3). The net economic gain of ₹ 28680 per ha was obtained by the participating farmers with cost of cultivation of ₹ 14134 per ha. Capacity building and technology module played key role in enhanced productivity realization.

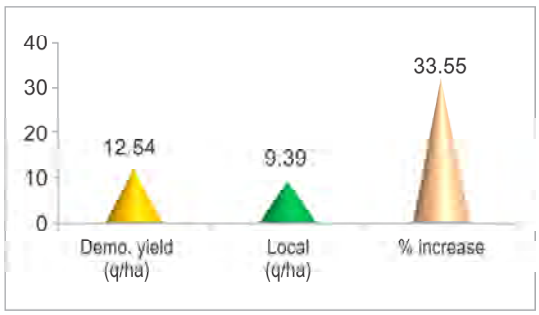


Fig. 4.3: Performance of pigeonpea demonstrations

5.4 **Chickpea:** Chickpea demonstrations (3819) were conducted on 3715.33 acre area. On an average 16.15 q/ha yield was achieved which was 33.03% higher over farmers' practice and 102.13% superior over national average (Fig. 4.4). The net profit of ₹ 27357 per ha was recorded by the farmers with ₹ 14058 per ha as cost of cultivation. The percentage yield increase across the states ranged between 15.93 to 39.39.

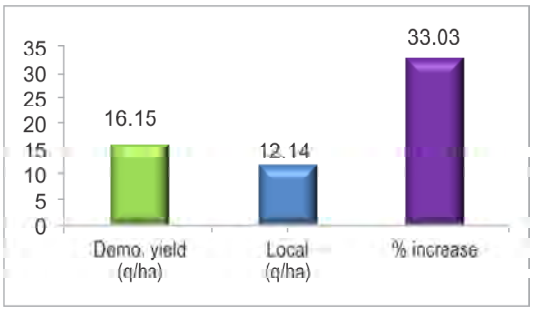


Fig. 4.4: Performance of chickpea demonstrations

5.5 **Lentil:** The demonstrations (989) on lentil were organized with coverage of 989.23 acre area in selected districts of four states. The average demonstration yield of 14.12 q/ha was attained which was 41.20% higher over farmers' practice and 123.06% higher over national average (Fig. 4.5). The yield ranged between 6.95 q/ha to 11.82 q/ha across the states. The net economic gain of ₹ 28246 per ha was realized by the farmers.

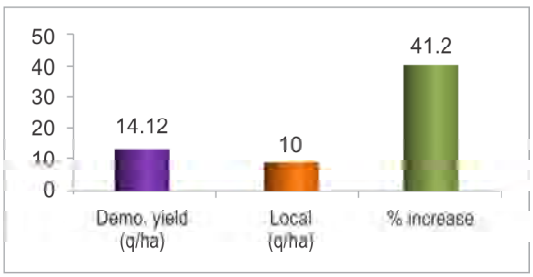


Fig. 4.5: Performance of lentil demonstrations

6. Emerging best practices

6.1 Summer mungbean is a great success with short duration varieties of 60 to 65 days like Samrat, Meha, IPM 2-3 particularly in Indo-gangetic plains which is facing declining trend under pulses particularly of chickpea. Addition of summer

mungbean is nutritionally enriching the existing rice-wheat system and providing nutritional and livelihood security to the farmers.

6.2 Mungbean is grown in Gujarat in all three crop seasons kharif, rabi and summer. The productivity levels of kharif mungbean is encouraging with an average of 11.3 q/ha. The performance of Pusa Vishal variety (13.75 q/ha) was significantly better than other varieties across all the states.

6.3 The performance of kharif urdbean was significantly better than the rabi urdbean grown in Andhra Pradesh, Maharashtra and Tamil Nadu. The varieties yielding more than 11 q/ha are PU-31 in Rajasthan; LBG-20, TU-98-14, Azad-1 and PDU-1 in Madhya Pradesh.

6.4 Lentil has shown great promise in rainfed as well as rice-fallows. The entire eastern Uttar Pradesh, Bihar, part of West Bengal and Bundelkhand region of Uttar Pradesh have tremendous scope of raising productivity and production.

6.5 Short duration pigeonpea (UPAS-120) still performs better as compared to other varieties and with options of other good varieties, the area under short duration pigeonpea can be enhanced. BSMR 736 has given highest yield (23.47 q/ha in Karnataka as compared to other varieties. It was observed that winter rainfalls cause flower drop and re-flowering which result into low productivity of pigeonpea. This issue may be addressed by the scientists.

6.6 The performance of chickpea has been exceedingly well in states like Andhra Pradesh (20.95 q/ha), Maharashtra (16.95 q/ha), Rajasthan and Gujarat (17.31 q/ha), Uttar Pradesh and Maharashtra (16.5 q/ha). Some of the varieties like Pusa 362 and Vardan in Uttar Pradesh, JG-11 in Andhra Pradesh, BDNG-797 and Vijay in

Maharashtra have given about 19 q/ha yield whereas GG-3 in Gujarat and RSG 973 in Rajasthan have yielded around 31 and 25 q/ha, respectively.

6.7 The varieties of pigeonpea which have excelled across the states are Mal 13 (19.75 q/ha) and NA-2 (17.19 q/ha) in Uttar Pradesh; and Asha (20.1 q/ha) in Madhya Pradesh.

6.8 The technology demonstration on pulses (TDHPP) has been evolved as a technology dissemination model which can be adopted for other commodities.

Cropping Systems and Technology Modules

Crop-wise and district wise existing cropping systems are given in this section. Technology modules of different crops demonstrated in identified states are also presented along with existing varieties in identified districts.

Andhra Pradesh

Pigeonpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Adilabad	38000	Cotton-Pigeonpea	LRG-41 PRG-158 100, MRG-66 Laxmi	7.72
Anantapur	37000	Groundnut-Pigeonpea		4.67
Khammam	23000	Mungbean-Pigeonpea		5.76
Kurnool	34000	Cotton-Pigeonpea		6.31
Mahaboobnagar	69000	Castor-Pigeonpea		7.08
Nalgonda	38000	Castor-Pigeonpea Groundnut-Pigeonpea		4.87
Prakasam	82000			7.85
Warangal	22000			4.04

2. Technology Module

Seed rate: 6-7 kg seed/acre. Seed treatment with fungicides like Thirum/ Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: 2nd fortnight of June/ onset of monsoon.

Spacing: 75cmx25cm for medium duration and 60cmx20cm for early duration.

Cultivars: LRG-41, PRG- 158100, MRG-66 Laxmi

Irrigation: Pre- sowing and in absence of rains at flowering and pod development stage.

Fertilizer dose and plant protection measures were followed as per locations specific requirements in different districts.

Mungbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Prakasam	26000	Rice-Mungbean	WGG – 37, LGG – 460, MGG – 345	4.18
Mahaboobnagar	33000			1.90
Nizamabad	21000			3.07
Warangal	24000	Groundnut-Mungbean		5.42
Khammam	20000	Maize-Mungbean		6.14
Nalgonda	44000			4.07

2. Technology Module

Seed rate: 10 kg seed/acre. Application of rhizobium culture @ one packet (200 g) per 10 kg seed. Seed treatment with Thirum / Captan / Carbendazem @ 30 g /10 kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: Warrangal 2, LGG 410, LGG 460, Madhira 295, LGG 407.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per requirements of the district.

Chickpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Prakassam	105000	Redgram-Bengalgram	JG-11, Swetha, Annegiri, KAK - 2	12.88
Kurnool	236000	Groundnut-Bengalgram		17.47
Kadapa	67000	Groundnut-Sunflower-Bengalgram		12.96
Anantapur	75000	Groundnut-Bengalgram		10.45
Nizamabad	27000	Soybean-Bengalgram		17.56
Adilabad	22000	Cotton-Sorghum-Bengalgram		16.07
Mahaboobnagar	21000	Sorghum-Bengalgram		16.03

2. Technology Module

Seed rate: 32 kg seed/acre. Seed treatment with Trichoderma (6g/kg) and Vitavax (Carboxin) (1g/kg). Application of Rhizobium culture one packet (200 g)/10 kg seed.

Sowing time: Rainfed: Last week of Sept. to 1st week of Oct., Irrigated : 2nd fortnight of Oct. to 1st week of Nov.

Spacing: 30cmx10cm.

Cultivars: JG-11, Phule G 95311 (K).

Irrigation: One irrigation at pod initiation stage.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Urdbean (Rabi)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Srikakulam	47000	Rice-Blackgram	LBG – 645, 645, LBG – 17, LBG – 20	4.81
East Godavari	48000	Rice-Rice-Blackgram		2.19
Krishna	122000	Rice-Blackgram		7.06
Guntur	107000	Rice-Blackgram		2.88
Nellore	25000	Blackgram		4.79
Prakasam	17000			7.94

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: October and December

Spacing: 30cmx10cm

Cultivars: TM 94-2, LBG 611, LBG 20, LBG 402, WBG 26, LBG 623.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Bihar

Lentil

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Productivity (q/ha)
Patna	23584	Rice-Fallow, Rice-Lentil, Maize-Lentil	7.30
Nalanda	11436		7.25
Bhojpur	9533		6.11
Rohtas	5631		5.86
Aurangabad	14345		8.68

2. Technology Module

Seed rate: 16 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed and seed treatment with Trichoderma @ 4.0 g / kg seed.

Sowing time: 15th October to 15th November

Spacing: 30cmx10cm

Cultivars: Arun, PL 639, HUL 57, KLS 218, PL 5, PL4.

Irrigation: One at flower initiation stage.

Fertilizer dose and plant protection measures were followed as per local requirement of the district.

Gujarat

Mungbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Banaskantha	40700	Wheat - Greengram	GM-1, GM-4	6.64
Jamnagar	4185	Wheat – Greengram	GM-1, GM-4	5.60
Kutch	83960	Sorghum – Greengram	GM-1, GM-4	6.50
Sabarkantha	5900	Wheat – Greengram	GM-1, GM-4	1.75
Surat	6587	Paddy – Greengram	GM-1, GM-4	7.10

2. Technology Module

Seed rate: 10 kg seed/acre. Application of rhizobium culture @ one packet (200 g) per 10 kg seed. Seed treatment with Thirum / Captan / Carbendazem @ 3 g / kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: BM 4, GM 2, GM 3, GM 4, PIMS 4, Meha.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per need of the district.

Pigeonpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Dahod	15400	Paddy / Wheat / Gram - Pigeonpea	ICPL-87, GT-101, BDN-2, Vaishali, GT-1	13.98
Narmada	17845	Paddy /Wheat - Pigeonpea	ICPL-87, GT-101, BDN-2, Vaishali, GT-4	9.95
Panchamahal	34380	Wheat / Barley - Pigeonpea	ICPL-87, GT-101, BDN-2, Vaishali, GT-5	9.00
Patan	68470	Wheat / Barley - Pigeonpea	ICPL-87, GT-101, BDN-2, Vaishali, GT-6	7.13
Sabarkantha	25011	Wheat / Barley - Pigeonpea	ICPL-87, GT-101, BDN-2, Vaishali, GT-7	7.78
Surat	34083	Paddy - Pigeonpea	ICPL-87, GT-101, BDN-2, Vaishali, GT-8	10.60
Vadodara	115000		ICPL-87, GT-101, BDN-2, Vaishali, GT-9	7.80

2. Technology Module

Seed rate: 6-7 kg seed/acre. Seed treatment with fungicides like Thirum/ Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: 2nd fort night of June/ onset of monsoon

Spacing: 75cmx25cm for medium duration and 60cmx20cm for early duration

Cultivars: ICPL-87, GT-101, BDN-2, Vaishali, GT-1, Baras

Irrigation: Pre- sowing and in absence of rains at flowering and pod development stage.

Fertilizer dose and plant protection measures were followed as per requirements.

Chickpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Bharuch	2442	Pearlmillet / Paddy – Gram	Dahod Pila, GC-1, GG-2, GG-4	5.00
Dahod	56700	Pearlmillet / Paddy – Gram	Dahod Pila, GC-1, GG-2, GG-4	9.39
Jamnagar	31300	Pearlmillet / Sorghum - Gram	Dahod Pila, GC-1, GG-2, GG-4	11.20
Narmada	98649	Paddy / Sorghum - Gram	Dahod Pila, GC-1, GG-2, GG-4	8.27
Sabarkantha	6162	Pearlmillet / Sorghum - Gram	Dahod Pila, GC-1, GG-2, GG-4	7.94

2. Technology Module

Seed rate: 32 kg seed/acre. Seed treatment with Trichoderma (6g/kg) and Vitavax (Carboxin) (1g/kg). Application of Rhizobium culture one packet (200 g)/10 kg seed.

Sowing time: Rainfed: 1st fortnight of Oct.; Irrigated : Last week of Oct. to 1st week of Nov

Spacing: 30cmx10cm (line sowing)

Cultivars: Gujarat Gram-1, GG-2, JG-16, Pusa 391, Pusa 372, KAK 2 (K), JGK-1 (K).

Irrigation: Two irrigations, first at branching and 2nd at pod initiation stage.

Fertilizer dose and plant protection measures were followed as per locations.

Karnataka

Mungbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Bidar	28187	Rabi jowar-Greengram	Sel-4	2
Gulbarga	89479	Greengram-sorghum	Selection-4, China Mung	8
Koppal	11334	Greengram followed by Rabi Jowar, Wheat	China moong	4.3
Bellary	745	Greengram-Sorghum	China Moong	3.87
Tumkur	7578	Pure crop	Pusabaisaki, S-4, Chinamug	0.45
Chitradurga	5000	Pure crop	Pusabaisaki, S-4, Chinamug	3.43
Mysore	5666	Pure crop	Pusabaisaki, S-4,Chinamug	6.24
Gadag	30228	Greengram-Rabi jowar/ Sunflower/Cotton	China Moong, Selection-4	3
Belgaum	23722	Green Gram+Rabi Jowar, Greengram+ Sunflower, Greengram + Cotton (3:1)	China mung and S-4	2.41
Dharwad	35600	Pure crop, Onion + Greengram	S-4, China Moong, Pusa Baisaki	5

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: HUM 1, PDM 84-178, ML 131, China Moong.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per locations' need.

Urdbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Bidar	33063	Redgram-Blackgram	TAU-1	2.33
Gulbarga	40737	Blackgram-sorghum	TAU-1, DU-1	8.00

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: KU 301, WBG 26, LGG 402, TU 94-2.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per locations' need.

Pigeonpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Bidar	65642	Rabi jowar-Pigeonpea	BSMR-736, ICPL-87199	5.2
Gulbarga	328087	Pigeonpea-sorghum	ICP-8863, ICPL-87119, BSMR-736, Gullual local, TS-3R	7.5
Raichur	14056	Pure pulse	ICP-8863, ICPL-87199, Gulyal	5
Koppal	9145	Bajra - Pigeonpea, Inter crop Bajra + Pigeonpea	Local, PT-221, JS-1	2.25
Bellary	7400	Maize+Pigeonpea	TS-3, ICP-8863, ICPL-87199	5.17
Chitradurga	11000	Pure crop	TTB-7, Hyderbad-3C, BRG-1, BRG-2	8.25
Tumkur	22968	Pure crop	TTB-7, Hyderbad-3C, BRG-1, BRG-2	10.15
Mysore	4000	Pure crop	TTB-7, Hyderbad-3C, BRG-1, BRG-2	6.4
Belgaum	4973	Pigeonpea+Hybrid Jowar (1:2), Pigeonpea + Hybrid bajra (1:2)	ICPL- 87, ICP-8863	2.15
Dharwad	3600	Pure crop, Maize + Pigeonpea	ICPL-87119, ICP-8863	7

2. Technology Module

Seed rate: 6-7 kg seed/acre. Seed treatment with fungicides like Thirum/ Captan / Carbendazim @ 3.0 gram / kg seed, seed treatment. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: 2nd fortnight of June/ onset of monsoon

Spacing: 75cmx25cm for medium duration and 60cmx20cm for early duration

Cultivars: BRG-1, BRG-2, BSMR-736, GC11-39, Gulyal, Hy 3C, Hyderbad-3C, ICP - 8863, ICPL-87119, JS-1, Maruthi, PT-221, TS-3, TS-3R (New), TTB-7, WRP1

Irrigation: Pre- sowing and in absence of rains at flowering and pod development stage.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Chickpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Bidar	79825	Greengram-Pulses	A-1 & JG-11	7.68
Gulbarga	236189	Chickpea-Pigeonpea	Annigeri-1, JG-11	7.50
Raichur	196000	Bengalgram-Sunflower	A-1, JG-11	6.97
Koppal	17881	Sunflower- engalgram, Bengalgram - Maize	Annigeri-1	2.35
Bellary	53828	Bengalgram+safflower(4:2/6:1)	A-1, JG-11	17.49
Chitradurga	21000	Pure crop	Ann1gere-1, JG-11	1.40
Mysore	1500	Pure crop	Annigere-1, JG-11	4.50
Gadag	44808	Maize-Bengalgram, pure bengalgram	A-1, JG-11	8.00
Belgaum	74756	Bengalgram + Safflower (3:1), Bengalgram + Rabi Jowar (1:2)	Annigeri-1, ICCV-10, GBS-864 and JG -11	3.67
Dharwad (Rainfed)	44100	Pure crop	A-1, JG-11, GBS-964	8.00
Dharwad (Irrigated)	9300	Pure crop	A-1, JG-11, GBS-964	13.00

2. Technology Module

Seed rate: 32 kg seed/acre. Seed treatment with Trichoderma (6g/kg) and Vitavax (Carboxin) (1g/kg). Application of Rhizobium culture one packet (200 g)/10 kg seed.

Sowing time: Rainfed: Last of week of Sept. to 1st week of Oct.; Irrigated : 2nd fort night of Oct.

Spacing: 30cmx10cm (line sowing)

Cultivars: Phule G 95311 (K), JG-11, ICCV 37, Bharati-10

Irrigation: One irrigation at pod initiation stage.

Fertilizer dose and plant protection measures were followed as per locations' need.

Madhya Pradesh

Pigeonpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Narsinghpur	24.9	Sole crop	ICPL-87	11.72
Chhindwara	19.1	Sole crop	ICPL-89	14.68
Raisen	15.0	Sole crop	JKM-189	5.67
Satna	14.6	Sole crop	ICPL-89	2.92
Rewa	13.4	Sole crop	ICPL-89	4.28
Chhatarpur	8.8	Sole crop	ICPL-89	3.76
Jabalpur	6.9	Sole crop	ICPL-88039	7.14
Dewas	6.8	Sole crop	ICPL-89	5.76
Seoni	6.4	Sole crop	ICPL-89	9.79
Panna	6.2	Sole crop	JKM-189	3.07
Jhabua	5.9	Sole crop	JKM-189	4.76
Rajgarh	4.1	Sole crop	JKM-189	6.31

2. Technology Module

Seed rate: 6-7 kg seed/acre. Seed treatment with fungicides like Thirum/Captan / Carbendazim @ 3.0 g/kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: 2nd fortnight of June to 1st fort night of July/onset of mansoon

Spacing: 75cmx25cm for medium duration and 60cmx20cm for early duration

Cultivars: JKM 189, JKM 7, JA 4, MA 3, Asha, ICPL 87,

Irrigation: Pre- sowing and in absence of rains at flowering and pod development stage.

Fertilizer dose and plant protection measures were followed as per needs of the district.

Urdbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Tikamgarh	69.5	Urdbean- Mustard	IPU-94	2.89
Jhabua	65.5	Urdbean- Mustard	PU-35	5.00
Chhatarpur	61.6	Urdbean- Mustard	JU-86	1.78
Damoh	38.0	Urdbean- Wheat/Mustard	JU-86	2.84
Sagar	29.0	Urdbean- Wheat/Mustard	PU-35	3.38
Jabalpur	22.7	Urdbean- Wheat/Mustard	JU-86	2.11
Shivpuri	18.0	Urdbean- Wheat/Mustard	JU-86	2.89
Satna	15.8	Urdbean- Wheat/Mustard	PU-31	2.50

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum/Captan/ Carbendazim @ 3.0 g/kg seed. Application of rhizobium culture @ one packet/10 kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: TPU 4, Jawahar Urd 2, Jawahar Urd 3, Pant U 30, Pant U 31.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Lentil

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Sagar	62.4	Soybean- Lentil	JL-3	4.15
Jabalpur	40.5	Soybean- Lentil	JL-3	3.07
Raisen	38.9	Soybean- Lentil	JL-3	5.93
Narsinghpur	31.5	Soybean- Lentil	JL-3	4.36
Satna	28.7	Soybean- Lentil	JL-3	3.03
Rewa	24.9	Soybean- Lentil	JL-3	2.96
Panna	20.4	Soybean- Lentil	JL-3	4.82
Damoh	15.0	Soybean- Lentil	JL-3	4.75
Seoni	12.7	Soybean- Lentil	JL-3	3.61
Chhatarpur	7.7	Soybean- Lentil	JL-3	2.14

2. Technology Module

Seed rate: 20 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed and seed treatment with Trichoderma @ 4.0 g / kg seed.

Sowing time: October

Spacing: 30cmx10cm

Cultivars: DPL 62, JL 3, L 4076, IPL 81, PL 5.

Irrigation: One at flower initiation stage.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Chickpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Sagar	190.8	Soybean- Chickpea	JAKI-92-18	6.11
Damoh	157.8	Soybean- Chickpea	JAKI-92-18	6.67
Raisen	145.3	Soybean- Chickpea	JAKI-92-18	7.98
Narsinghpur	135.3	Soybean- Chickpea	JG-322	10.25
Ujjain	133.7	Soybean- Chickpea	JAKI-92-18	6.83
Shajapur	132.3	Soybean- Chickpea	JAKI-92-18	5.67
Dewas	102.4	Soybean- Chickpea	JAKI-92-18	11.24
Satna	98.2	Soybean- Chickpea	JG-16/JG-63	3.31
Panna	92.9	Soybean- Chickpea	JG-11	7.43
Rajgarh	90.0	Soybean- Chickpea	JAKI-92-18	7.14
Guna	73.0	Soybean- Chickpea	JAKI-92-18	5.14
Jabalpur	69.7	Soybean- Chickpea	JG-130	8.98
Rewa	57.1	Soybean- Chickpea	JG-322	8.34
Chhatarpur	51.9	Soybean- Chickpea	JAKI-92-18	7.26
Shivpuri	49.4	Soybean- Chickpea	JAKI-92-18	8.14
Seoni	47.2	Soybean- Chickpea	JG-130	4.64
Chhindwara	34.5	Soybean- Chickpea	JG-130	11.29
Jhabua	24.1	Soybean- Chickpea	JAKI-92-18	5.57
Tikamgarh	7.7	Soybean- Chickpea	JG-130	8.28

2. Technology Module

Seed rate: 32 kg (D) and 38 kg (K) seed/acre. Seed treatment with Trichoderma (6g/kg) and Vitavax (Carboxin) (1g/kg). Application of Rhizobium culture one packet (200 g)/10 kg seed.

Sowing time: Rainfed: 1st fortnight of Oct., Irrigated : Last week of Oct. to 1st week of Nov.

Spacing: 30cmx10cm (line sowing)

Cultivars: JG-16, JG 74, JG 130, JG 218, JG 315, JG 322, BGD-72, Vijay, JGG-1, JGK-1 (K), JAKI 9218, IPCK 2002-29 (K), PKV-4 (K)

Irrigation: Two irrigations, first at branching and 2nd at pod initiation stage.

Fertilizer dose and plant protection measures were followed as per locations' need.

Maharashtra

Pigeonpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Ahmednagar	19500	Sugarcane-Soybean-Pigeonpea	BSMR-736, 853, BDN – 708, ICPL-87, VIPULA, ASHA	9.39
Amravati	74500	Sorghum-Pigeonpea, Cotton-Pigeonpea		10.00
Aurangabad	41300	Sorghum- Pigeonpea, Maize – Pigeonpea		6.17
Buldhana	58321	Cotton – Pigeonpea		10.02
Chandrapur	27600	Soybean, Pigeonpea		10.00
Jalna	34500	Sorghum – Pigeonpea, Cotton, Pigeonpea Soybean, Pigeonpea		6.57
Nagpur	52900			6.34
Nanded	43000	Sugarcane, Pigeonpea		5.28
Osmanabad	56800	Sorghum, Pigeonpea		5.49
Parbhani	58100	Soybean, Cotton, Sorghum, Pigeonpea		7.80
Wardha	68600	Cotton, Soybean, Sorghum, Pigeonpea		9.80
Washim	41000	Soybean, Cotton, Pigeonpea		7.79
Yavatmal	112993	Sorghum, Cotton, Pigeonpea		9.50

2. Technology Module

Seed rate: 6-7 kg seed/acre. Seed treatment with fungicides like Thirum/ Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: 2nd fortnight of June to 1st fortnight of July/ onset of monsoon

Spacing: 75cmx25cm for medium duration and 60cmx20cm for early duration

Cultivars: BSMR- 736, 853, BDN-708, ICPL- 87, VIPULA, Asha

Irrigation: Pre- sowing and in absence of rains at flowering and pod development stage.

Fertilizer dose and plant protection measures were followed as per locations' need.

Mungbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Amravati	64400	Cotton-Mungbean	BPMR – 145	4.80
Buldhana	41044	Cotton-Mungbean	BPMR – 145	6.84
Jalna	21400	Cotton-Mungbean	BPMR – 145	1.21
Nanded	26600	Cotton-Mungbean	BPMR – 145	3.50
Parbhani	36300	Cotton-Mungbean	BPMR – 145	6.38
Washim	36200	Cotton-Mungbean	PKVM – 8802	3.73

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: HUM 1, PKVM 4, AKM 8802, Kopergaon.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Urdbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Buldhana	36943	Cotton-Urdbean	TAU – 1	6.43
Nanded	33800	Cotton-Urdbean	TAU – 2	5.99
Osmanabad	20600	Safflower-Urdbean	BDU – 1	1.55
Washim	31000	Safflower-Urdbean	BDU – 1	4.45

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: TPU 4, Pant U 30, TAU1, AKU 4, AKU 15, NUL 7.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Chickpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Ahmednagar	48062	Sugarcane, Pigeonpea, Chickpea	Vijay, Digvijay, Vishal, JAKI-9218, Virat	6.70
Amaravati	65500	Cotton, Sorghum, Chickpea		9.30
Aurangabad	39100	Soybean, Pigeonpea, Chickpea		7.20
Buldhana	64555	-do-		9.15
Jalgaon	8786	-do-		8.53
Nagpur	73700	Cotton, Soybean, Chickpea		6.15
Nashik	39100			6.26
Osmanabad	56800	Sorghum, Pigeonpea, Chickpea		7.22
Parbhani	49600			6.53
Wardha	18900			6.80
Washim	51311	Cotton, Pigeonpea, Chickpea		6.56
Yavatmal	65412			4.12

2. Technology Module

Seed rate: 32 kg seed/acre. Seed treatment with Trichoderma (6g/kg) and Vitavax (Carboxin) (1g/kg). Application of Rhizobium culture one packet (200 g)/10 kg seed.

Sowing time: Rainfed: 1st fortnight of Oct., Irrigated : Last week of Oct. to 1st week of Nov.

Spacing: 30cmx10cm (line sowing)

Cultivars: Digvijay, IPCK 2002-29 (K), JAKI 9218, JG-16, JGK 1 (K), KAK 2 (K), Phule G 12, PKV-4 (K), Vijay, Vikas, Virat (K), Vishal, Vishwas.

Irrigation: Two irrigations, first at branching and 2nd at pod initiation stage.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Odisha

Urdbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Cuttack	18.96	Paddy-Urdbean-Paddy	Ujala, Prasad	0.37
Puri	8.54	Paddy-Urdbean-Paddy	Ujala, Prasad	0.26
Bolangir	8.06	Paddy-Urdbean-Paddy	Ujala, Prasad	0.16
Ganjam	7.95	Paddy-Urdbean-Paddy	Ujala, Prasad	0.20
Buragarh	6.98	Paddy-Urdbean-Paddy	Ujala, Prasad	0.27
Nayagarh	6.72	Paddy-Urdbean-Paddy	Ujala, Prasad	0.21
Kalahandi	5.13	Paddy-Urdbean-Paddy	Ujala, Prasad	0.19

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: KU 301, WBG 26, WBU 108, IPU 02-43, Pant U 31.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Mungbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Ganjam	50.84	Paddy-Mungbean-Paddy	PDM-54, Durga, OBCG-52	2.07
Cuttack	32.05	Paddy-Mungbean-Paddy	-do-	3.22
Nayagarh	26.17	Paddy-Mungbean-Paddy	-do-	2.08
Khurda	14.84	Paddy-Mungbean-Paddy	-do-	1.76
Buragarh	12.83	Paddy-Mungbean-Paddy	-do-	2.72
Bolangir	10.47	Paddy-Mungbean-Paddy	-do-	1.75
Kalahandi	6.82	Paddy-Mungbean-Paddy	-do-	1.75

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: TARM 1, COGG 912, PDM 139.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Rajasthan

Mungbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Ajmer	74071	Wheat / Barley - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	2.82
Bikaner	2437	Wheat / Barley - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	8.00
Barmer	54703	Mustard - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	6.52
Churu	55000	Barley / Wheat - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	0.50
Ganganagar	27000	Barley / Wheat - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	7.86
Hanumangarh	44160	Barley / Wheat - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	2.00
Jaipur	66776	Mustard / Wheat - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	3.24
Jhunjhunu	73000	Mustard / Wheat - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	3.28
Jodhpur	90000	Castor / Mothbean / Seseame - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	2.50
Nagaur	247000	Wheat / Mustard / or Mothbean / Clusterbean/ Fenugreek - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	5.26
Sikar	50000	Wheat / Mustard / Barley - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	4.13
Tonk	40000	Wheat / Mustard / Barley - Mungbean	G-1, SML-668, GM-4, RMG-62, RMG-268, Ganga-8, Pusavishal, PDM 139 and RMG-344	2.84

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: RMG 62, RMG 268, RMG 492, IPM 02-3, MH 2-15.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Urdbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Ajmer	9223	Wheat / Barley - Urdbean	RBU-38, PU-19, T-9	4.61
Chittorgarh	23516	Wheat - Urdbean	RBU-38, PU-19, T-9	3.85
Kota	11768	Wheat / Mustard - Urdbean	RBU-38, PU-19, T-9	1.20
Tonk	5000	Wheat / Mustard - Urdbean	RBU-38, PU-19, T-9	2.24

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: IPU 94-1, WBU – 108, Pant U 31, KU -300.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Chickpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Ajmer	20783	Sorghum / Bajra / Maize - Chickpea	CSJD-884, GNG-469, GNG-663, PKV-2, Pratap Chana-1, RSG-44, RSG-793, RSG-888, RSG-961, RSG-973 and Samrat	4.55
Bikaner	164000	Bajra - Chickpea		8.10
Chittorgarh	41042	Maize / Sorghum / Groundnut - Chickpea		8.11
Churu	281800	Bajra - Chickpea		4.93
Dausa	8765	Bajra - Chickpea		8.00
Ganganagar	96602	Bajra / Groundnut / Moong - Chickpea		7.52
Hanumangarh	273735	Bajra / Groundnut / Moong - Chickpea		5.50
Jaipur	60525	Bajra - Chickpea		9.41
Jhunjhunu	87590	Bajra - Chickpea		8.13
Kota	7968	Sorghum / Maize - Chickpea		8.00
Nagaur	24000	Bajra - Chickpea		9.00
Sikar	42455	Bajra - Chickpea		11.50
Tonk	23000	Sorghum / Bajra / Maize - Chickpea		8.00

2. Technology Module

Seed rate: 32 kg seed/acre. Seed treatment with Trichoderma (6g/kg) and Vitavax (Carboxin) (1g/kg). Application of Rhizobium culture one packet (200 g)/10 kg seed.

Sowing time: Rainfed: 1st fortnight of Oct., Irrigated : Last week of Oct. to 1st week of Nov.

Spacing: 30cmx10cm (line sowing)

Cultivars: GNG 663, GNG 469, GNG 1581, RSG 888, RSG 963, Pratap Chana-1.

Irrigation: Two irrigations, first at branching and 2nd at pod initiation stage (sprinkler irrigation).

Fertilizer dose and plant protection measures were followed as per locations of the district.

Tamil Nadu

Mungbean (Kharif)

1. Existing Cropping Systems

The existing cropping systems in the identified districts were followed by the farmers are Pure crop, Cotton + Greengram, Maize + Greengram. VBN-2 was most prominent existing variety.

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: Onset of monsoon

Spacing: 30cmx10cm

Cultivars: Paiyur 1, COGG 912, TM 96-2, Vamban 1, CO 5, VBN 2, ADT 3.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Mungbean (Rabi)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Thiruvallur	8837	Rice fallow pulse	VBN-2	4.9
Thiruvarur	24214	Rice fallow pulse	Co-Gg-7	1.4
Vellore	763	Rice fallow pulse	Co-Gg-7	2.6
Virudhunagar	11393	Rice fallow pulse	VBN-2	2.7

2. Technology Module

Seed rate: 12-14 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: October and December

Spacing: 25 cm x 10 cm

Cultivars: VBN-4, HUM-1, TM-96-2.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Urdbean (Rabi)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Erode	1736	Rice fallow pulse	VBN-4	5.1
Namakkal	846	Rice fallow pulse	VBN-4	7.3
Thiruvallur	1129	Rice fallow pulse	VBN-4	3.3
Thiruvarur	41090	Rice fallow pulse	VBN-4	2
Tuticorin	21099	Rice fallow pulse	VBN-4	4
Thiruvannamalai	2338	Rice fallow pulse	VBN-4	3.6
Vellore	1346	Rice fallow pulse	VBN-4	2.7
Villupuram	18158	Rice fallow pulse	VBN-4	5.1
Virudhunagar	6996	Rice fallow pulse	VBN-4	4.2
Nagapattinam	42930	Rice fallow pulse	VBN-4	1.9

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: October and December

Spacing: 30cmx10cm

Cultivars: WBG 26, Vamban 3, TU 94-2, VBN 5, IPU 02-43, Vamban 2.

Irrigation: Life saving irrigation at pod initiation stage as and when required.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Uttar Pradesh

Summer Mungbean

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Etah	3855	Sorghum-Wheat-Mung Rice-Wheat-Mung	Samrat	5.26
Etawah	2513	Rice-Wheat-Mung Bajra-Wheat-Mung	Samrat	6.75
Kannauj	1415	Maize-Potato-Mung; Maize-Wheat- Mung	Samrat	5.70
Fatehpur	1280	Rice-Wheat-Mung	Samrat	6.28
Sitapur	-	Rice-Wheat-Mung	Samrat	7.71
Faizabad	666	Rice-Wheat-Mung	Samrat	4.25

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum /Captan / Carbendazim @ 3.0 gram /kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: 15th March to 5th April

Spacing: 25 cm x 10 cm

Cultivars: Samrat, Meha, IPM 02-3 and HUM 16

Irrigation: First irrigation after 25 days after sowing and subsequent irrigation at 10-12 days interval.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Urdbean (Kharif)

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Budaun	16405	Urdbean-Wheat- Vegetable/Fallow Urd-Sugarcane	T-9, PU-19	7.24
Shahjahanpur	8248	Urdbean-Wheat- Vegetable/Fallow Urd-Sugarcane	T-9, PU-19	6.19
Jhansi	33583	Urdbean-Wheat/Chickpea/Pea/Mustard	T-9, PU-19	4.27
Jalaun	15954	Urdbean-Wheat/Chickpea/Pea/Mustard	T-9, PU-19	5.08
Hamirpur	13895	Urdbean-Wheat/Chickpea/Pea/Mustard	T-9, PU-19	3.06
Sitapur	9189	Urd-Wheat/Mustrad	PU-19	5.10
Barabanki	8348	Urd-Wheat-Mentha	PU-19	5.76

2. Technology Module

Seed rate: 10 kg seed/acre. Seed treatment with fungicides like Thirum /Captan / Carbendazim @ 3.0 gram/kg seed. Application of rhizobium culture @ one packet per 10 kg seed were adopted.

Sowing time: Onset of monsoon

Spacing: 30 cm x 10 cm

Cultivars: Uttara, Azad Urd 2, Shekhar 3, Narendra Urd 1 and Pant Urd 31

Irrigation: First irrigation after 25 days after sowing and subsequent irrigation at 10-12 days interval was applied.

Pigeonpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Budaun	16405	Urdbean-Wheat- Vegetable/Fallow Urd-Sugarcane	T-9, PU-19	7.24
Shahjahanpur	8248	Urdbean-Wheat- Vegetable/Fallow Urd-Sugarcane	T-9, PU-19	6.19
Jhansi	33583	Urdbean-Wheat/Chickpea/Pea/Mustard	T-9, PU-19	4.27
Jalaun	15954	Urdbean-Wheat/Chickpea/Pea/Mustard	T-9, PU-19	5.08
Hamirpur	13895	Urdbean-Wheat/Chickpea/Pea/Mustard	T-9, PU-19	3.06
Sitapur	9189	Urd-Wheat/Mustrad	PU-19	5.10
Barabanki	8348	Urd-Wheat-Mentha	PU-19	5.76

2. Technology Module

Seed rate: 6-7 kg seed/acre. Seed treatment with fungicides like Thirum/ Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed.

Sowing time: 1-15 June

Spacing: 60cmx20cm

Cultivars: UPAS 120, PUSA 992, Bahar, NDA 1, MAL 13, MAL 6, Amar,

Irrigation: Pre- sowing and in absence of rains at flowering and pod development stage.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Chickpea

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Jhansi	41434	Urdbean-Chickpea, Fallow-Chickpea	Udai, Radhey, Awarodhi	6.73
Chitrakoot	46277	Urdbean-Chickpea, Fallow-Chickpea	Udai, Radhey, Awarodhi	4.10
Hamirpur	86301	Urdbean-Chickpea, Fallow-Chickpea	Udai, Radhey, Awarodhi	6.2
Banda	107862	Urdbean-Chickpea, Fallow-Chickpea	Udai, Radhey, Awarodhi	5.69
Lalitpur	30272	Urdbean-Chickpea, Fallow-Chickpea	Udai, Radhey, Awarodhi	10.09
Jalaun	47921	Urdbean-Chickpea, Fallow-Chickpea	Udai, Radhey, Awarodhi	6.56
Kanpur Dehat	26486	Maize-Chickpea, Urdbean-Chickpea	Udai, K-850	13.09
Sonbhadra	10486	Rice-Chickpea, Fallow-Chickpea	Awarodhi, Udai	8.77

2. Technology Module

Seed rate: 32 kg (normal sown), 35.0 kg (late sown) seed/acre. Seed treatment with Trichoderma (6g/kg) and Vitavax (Carboxin) (1g/kg). Application of Rhizobium culture one packet (200 g)/10 kg seed.

Sowing time: Rainfed: 1st fortnight of Oct., Irrigated : Last week of Oct. to 1st week of Nov.

Spacing: 30cmx10cm (line sowing)

Cultivars: DCP 92-3, KWR 108, KPG 59, HK 2 (K), Pusa 372, IPCK 2002-29 (K), Gujarat Gram-4.

Irrigation: Two irrigations, first at branching and 2nd at pod initiation stage.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Lentil

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Chandauli	13883	Rice-Lentil, Maize-Lentil	DPL-62, Local	5.83
Ballia	18663	Rice-Lentil, Maize-Lentil	DPL-62, Local	9.32
Bahraich	46588	Rice-Lentil, Maize-Lentil	PL-406	8.40
Jhansi	23573	Fallow-Lentil	K-75, DPL-62	5.03
Chitrakoot	18618	Fallow-Lentil	K-75, DPL-62	3.18
Hamirpur	42193	Fallow-Lentil	K-75, DPL-62	4.49
Banda	44046	Fallow-Lentil	K-75, DPL-62	4.85
Lalitpur	39911	Fallow-Lentil	K-75, DPL-62	8.99
Jalaun	27081	Fallow-Lentil	K-75, DPL-62	6.45
Sonbhadra	9220	Fallow-Lentil	NLM-1, Local	5.78

2. Technology Module

Seed rate: 16 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed and seed treatment with Trichoderma @ 4.0 g / kg seed.

Sowing time: 15th October to 15th November

Spacing: 30cmx10cm

Cultivars: HUL 57, KLS 218, Narendra Masoor 1, Pl 639, PL 4, PL 5, DPL 62, JL 3, L 4076, IPL 81

Irrigation: One at flower initiation stage.

Fertilizer dose and plant protection measures were followed as per locations of the district.

West Bengal

Lentil

1. Existing Cropping Systems

District	Total area (ha)	Cropping systems	Existing varieties	Productivity (q/ha)
Murshidabad	19707	Paddy-Lentil	Asha, Subrata	7.84
Nadia	18735	Paddy-Lentil	Asha, Subrata	7.30

2. Technology Module

Seed rate: 16 kg seed/acre. Seed treatment with fungicides like Thirum / Captan / Carbendazim @ 3.0 gram / kg seed. Application of rhizobium culture @ one packet per 10 kg seed and seed treatment with Trichoderma @ 4.0 g / kg seed.

Sowing time: 15th October to 15th November

Spacing: 30cmx10cm

Cultivars: DPL 62, JL 3, L 4076, IPL 81, PL 5

Irrigation: One at flower initiation stage.

Fertilizer dose and plant protection measures were followed as per locations of the district.

Crop-wise and State-wise Area covered under different Pulse Crops

Lentil

States	Year-wise area (acre)		
	2010-11	2011-12	Total
Bihar	62.75 (66)*	234.93 (128)	297.68 (194)
West Bengal	20.85 (51)	-	20.85 (51)
Uttar Pradesh	188.57 (197)	187.5 (208)	376.07 (405)
Madhya Pradesh	210 (215)	84.63 (124)	294.63 (339)
Total	**482.17 (529)**	**507.06 (460)**	**989.23 (989)**

* Figure in parenthesis indicates number of demonstrations

Mungbean

States	Year-wise area (acre)		
	2010-11	2011-12	Total
Uttar Pradesh	88.5 (90)	121.63 (156)	210.13 (246)
Andhra Pradesh	178.75 (205)	192.5 (162)	371.25 (367)
Maharashtra	112.5 (180)	180 (180)	292.5 (360)
Rajasthan	321 (321)	319 (319)	640 (640)
Gujarat	33 (25)	88 (83)	121 (108)
Odisha	-	59.43 (63)	59.43 (63)
Karnataka	174.5 (144)	150 (148)	324.5 (292)
Tamil Nadu	52.5 (74)	55 (55)	107.5 (129)
Total	**960.75 (1039)**	**1165.56 (1166)**	**2126.31 (2205)**

Urdbean

States	Year-wise area (acre)		
	2010-11	2011-12	Total
Uttar Pradesh	90 (95)	114 (109)	204 (204)
Andhra Pradesh	150 (125)	90 (91)	240 (216)
Maharashtra	105 (152)	120 (120)	225 (272)
Rajasthan	46 (46)	52 (51)	98 (97)
Madhya Pradesh	178 (180)	144.48 (190)	322.48 (370)
Odisha	39 (40)	41.98 (46)	80.98 (86)
Karnataka	79.25 (46)	20 (20)	99.25 (66)
Tamil Nadu	117.75 (113)	113 (141)	230.75 (254)
Total	**805 (797)**	**695.46 (768)**	**1500.46 (1565)**

Chickpea

States	Year-wise area (acre)		
	2010-11	2011-12	Total
Uttar Pradesh	148 (235)	161.08 (174)	309.08 (409)
Andhra Pradesh	241.25 (214)	180 (188)	421.25 (402)
Maharashtra	360 (375)	415 (425)	775 (800)
Rajasthan	325 (325)	-	325 (325)
Gujarat	114.5 (96)	39.5 (39)	154 (135)
Madhya Pradesh	702 (749)	504 (526)	1206 (1275)
Karnataka	205 (205)	320 (268)	525 (473)
Total	**2095.75 (2199)**	**1619.58 (1620)**	**3715.33 (3819)**

Pigeonpea

States	Year-wise area (acre)		
	2010-11	2011-12	Total
Uttar Pradesh	180 (190)	167 (195)	347 (385)
Andhra Pradesh	216 (216)	263.5 (233)	479.5 (449)
Maharashtra	425 (425)	420 (420)	845 (845)
Gujarat	152.5 (177)	130 (133)	282.5 (310)
Madhya Pradesh	309 (319)	109.3 (149)	418.3 (468)
Odisha	-	17.73 (15)	17.73 (15)
Karnataka	294.5 (273)	212.5 (213)	507 (486)
Total	**1577 (1600)**	**1320.03 (1358)**	**2897.03 (2958)**

Do and Not to Do

A strategy for effective implementation of pulses demonstration programme was devised and KVK experts, extension workers and farmers were advised what to do and what not to do?

Pigeonpea

What to do:

1. Well drained area for field selection.
2. Ridge & furrow and raised bed for proper drainage.
3. Summer ploughing to reduce wilt incidence in field preparation.
4. Selection of quality seed.
5. Seed treatment (Rhizobium and Trichoderma) and seed priming (Boron, Molybdenum. Zinc), chemical (Thirum, Captan and Carbendazim)
6. Recently released high yielding varieties.
7. Timely sowing
8. Application of organic fertilizer for sustainable agriculture and soil health in addition to inorganic fertilizer
9. Timely weeding and use of effective herbicide
10. Life saving and judicious application of irrigation
11. Use of resistant varieties for prevailing condition
12. Monitoring of insect pest and disease incidence and proper plant protection measures.
13. Maximum care of cultural operations than chemicals.
14. Monitoring and control of harmful insect population. (Pheromone-traps, Light-trap bird perches and need based application of NSKE5%, HaNPV@ 250 LE, Indoxacarb) other cultural operation.

What not to do:

1. Selection of water logged area.
2. Repetition in the same plot to minimize wilt incidence.
3. Growing ratoon crop or perennial pigeonpea. It may increase mite population and SMD incidence.
4. Planting in shade area as pigeonpea is susceptibile to low light intensity.
5. Use of infested, damaged or immature seed/old seed.
6. Too old varieties.
7. Too late sowing.
8. Use of imbalanced fertilizer.
9. Unnecessary and excess use of chemicals. It may harm the population of beneficial predators and parasites.

Lentil

What to do:

1. Use recommended seed rate for small and large seeded variety to ensure proper plant population.
2. Treat the seed with fungicide & Rhizobium.
3. Use pre-emergence herbicide to avoid weed competition during early stage of crop.
4. Monitoring of crop is required to control aphid infestation.

What not to do:

1. Irrigation at reproductive stage. If necessary, apply light irrigation at vegetative stage only.

Mungbean

What to do:

1. Use only recommended varieties for specific region.
2. Treat the seed with fungicide & Rhizobium.
3. Avoid moisture stress at flowering & podding (35-50 DAS)
4. First irrigation should be given after 25 days after sowing in irrigated spring/ summer crop.
5. Crop must be closely monitored at 35-45 days after sowing for the control of sucking insects.
6. Plant protection measures to mange thrips in spring/summer crop.

What not to do:

1. Application of fertilizer in spring/summer mungbean & Urdbean if planted after potato.
2. Planting spring Urdbean after 25 March.
3. Planting summer mungbean after 10 April.
4. Applying irrigation in irrigated spring/summer mungbean and Urdbean before 25 days after sowing

Urdbean

What to do:

1. Use only recommended varieties for specific region.
2. Treat the seed with fungicide & Rhizobium.
3. Avoid moisture stress at flowering & podding (35-50 DAS)

4. First irrigation should be given after 25 days after sowing in irrigated spring/ summer crop.
5. Crop must be closely monitored at 35-45 days after sowing for the control of sucking insects

What not to do:

1. Applying fertilizer in spring/summer mungbean & Urdbean if planted after potato.
2. Planting spring urdbean after 25 March.
3. Planting summer mungbean after 10 April.
4. Applying irrigation in irrigated spring/summer mungbean and Urdbean before 25 days after sowing

Chickpea

What to do:

1. Use quality seed of the variety
2. Use newly released high yielding varieties recommended for the area
3. Procure seed from authentic sources
4. Always treat the seed with fungicide first (2-3 days in advance) and then with Rhizobium culture
5. Use recommended dose of fertilizer and micronutrients as per need
6. Adhere to appropriate time of sowing and seed rate
7. Adopt line sowing/ridge furrow method/raised bed method as per need
8. Pre emergence application of Pendimethaline
9. Irrigate the crop to avoid moisture stress/frost damage
10. Spray 2% Urea/DAP solution in rainfed areas for late sown crops
11. Sun drying of grains before bagging/storage

What not to do:

1. Use of damaged seed and traditional varieties
2. Broadcasting the seed
3. Direct contact of seed and fertilizer
4. Treating the seed with fungicide and Rhizobium simultaneously
5. Spraying pendimethaline on dry soil
6. Flooding the field and irrigating crop at time of flowering
7. Put bird perches in the field at the time of grain formation

Acronyms

AICRP	:	All India Coordinated Research Project
ANGRAU	:	Acharya N. G. Ranga Agricultural University, Hyderabad
AP	:	Andhra Pradesh
BHU	:	Banaras Hindu University, Varanasi
CAZRI	:	Central Arid Zone Research Institute
CRIDA	:	Central Research Institute for Dryland Agriculture
CSAUAT	:	Chandra Shekhar Azad University of Agriculture and Technology, Kanpur
DARE	:	Department of Agriculture Research and Education
DAS	:	Days After Sowing
DDG	:	Deputy Director General
DEE	:	Directorate of Extension Education
DG	:	Director General
FAO	:	Food and Agriculture Organization
GDP	:	Gross Domestic Product
IARI	:	Indian Agricultural Research Institute
ICAR	:	Indian Council of Agricultural Research
ICDP	:	Indian Child Development Programme
ICRISAT	:	International Crop Research Institute for Semi Arid Tropics, Hyderabad
IGAU	:	Indira Gandhi Agriculture University, Raipur
IGP	:	Indo-Gangetic Plains
IIPR	:	Indian Institute of Pulses Research
ISOPOM	:	Integrated Scheme on Oilseed Pulses Oilpalm and Maize
JNKVV	:	Jawaharlal Nehru Krishi Vishwa Vidyalaya
MP	:	Madhya Pradesh
MPUAT	:	Maharana Pratap University of Agriculture and Technology, Udaipur
NARS	:	National Agricultural Research Station

NDUAT	:	Narendra Dev University of Agriculture and Technology, Faizabad
NFSM	:	National Food Security Mission
OUAT	:	Orissa University of Agriculture and Technology, Bhuvaneshwar
RVSKVV	:	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior
SAUs	:	State Agriculture Universities
SVPUAT	:	Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut
TDHPP	:	Technology Demonstration for Harnessing Pulses Productivity
TNAU	:	Tamil Nadu Agricultural University, Coimbatore
UAS	:	University of Agriculture Sciences, Bangalore
UP	:	Uttar Pradesh
ZPD	:	Zonal Project Directorate

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