Research Report – ADRTC/197

SEED MINIKITS OF PULSES
PROGRAME RELEVANCE AND DISTRIBUTION EFFICIENCY
A CONSOLIDATED REPORT OF FIVE STATES

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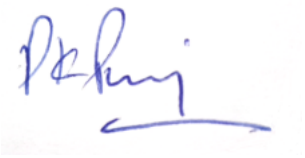

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EXECUTIVE SUMMARY

Background

Pulses are a primary source of protein for a majority of Indians. As an inexpensive, non-animal source of protein, pulses hold a prominent position in Indian diets, and the country is currently the largest producer, consumer and importer of pulses in the world. Its positive externalities such as nitrogen fixation, lower water and chemical consumption, make it an ideal crop for domestic production by small farmers in dry regions. However, a 2010 report titled '*Overcoming the Pulses Crisis*' by the Confederation of Indian Industry stated that the production of pulses grew only by 45 per cent from 1951 to 2008, while wheat production grew by 320 per cent and rice by 230 per cent.

Although the production of pulses has risen in the past decade by 65 per cent between 2009-10 and 2020-21, as per the Third Advance Estimate given by the Ministry on May 2021, over-all growth was not sufficient to meet the domestic demand, which has been met by imports since 1981. This heavy import bill on the exchequer has been due to the stagnant productivity coupled with declining availability, which has created a substantial demand-supply gap. Several reasons have been cited for this decline, such as climatic factors, improvement in irrigation facilities that led to a shift in cropping pattern, ineffective procurement, high variation in procurement prices, while others quote the poor yield and limited access to high-yield varieties of seeds among others.

Looking ahead, the demand for pulses by 2030 is estimated to be 32.64 million tonnes with an annual required growth rate of 2.64 per cent. In view of this forecast, interventions such as the agricultural price policy in the form of minimum support price (MSP), subsidies for inputs, investments in yield increasing technology and infrastructure such as roads and irrigation and direct market procurement have all endeavoured to improve supply responses. Therefore, to raise the domestic production of pulses the Central and state governments have initiated various programme oriented at raising production of pulses though enhancement in area as well as productivity of pulses. NFSM, ISOPOM and several other programmes are implemented since the beginning of the Century. Among these interventions, one of the key strategies was to improve productivity and the reach of time-tested high-yielding pulse varieties. The latter was operationalized with the launch of a Seed Minikit Programme that aimed to distribute high-yielding varieties of seeds of oilseeds and pulses to farmers. They were provided by the Central agencies NAFED, National Seeds Corporation (NCS), and Gujarat State Seeds Corporation and the wholly funded by the government through the National Food Security Mission. This report analyses the relevance and distribution efficiency of Seed Minikits Programme in pulses.

The aim of seed mini-kits programme

Seed Mini-kits are meant for introduction and popularization of latest released / pre released varieties /hybrids not older than 10 years among the farmers free of cost. Central Seed Agencies deliver allotted seed minikits to the destination identified by the beneficiary states within the stipulated time. Seed minikits are distributed for rice, wheat, pulses and nutri-

cereals. The agencies like NSC/HIL/KRIBHCO/NAFED/IFFCO/IFFDC/Central/Multi-state Cooperatives such as NCCF/SSCs etc., are involved in supply of seed minikits at the national level. The price of seed minikits is fixed by the NFSM Mission Director at National level and 100 per cent cost is reimbursed to the agencies on certification of receipt by the state. The allocation of seed minikits is approved by the NFSM-EC before commencement of kharif/rabi/summer seasons.

After receiving the minikits at destination place of the district, proper distribution of minikits within 10 days to the appropriately identified farmers must be ensured by the district level agriculture officer, concerned. The purpose is to ensure, that the identified farmer is capable of raising the crop with care and diligence such that the plot serves as a good demonstration to other farmers. Only one minikit per farmer and not more than 3 minikits in a season and a village are to be distributed.

Distribution of seed minikits in pulses

In order to promote quick spread of new varieties of pulses, minikits of pulses seed varieties not older than 10 years are provided free of cost to farmers. National and state seed producing agencies supply minikits to state government for distribution amongst farmers. Allocation of minikits is made to all farmers in contiguous area of at least 25 hectares. The size of minikits is 16 kg of gram, 8 kg seed of lentil and 4 kg each for moong, urd and pigeon pea. This quantity would be sufficient to plant 0.2 ha. In addition, under this package, state governments are also providing, a pamphlet regarding package of practice (POP) and phosphate solubilizing bacteria (PSB) culture of 100 grams per packet per mini kit to pulse farmers. The price of seed minikits is fixed by National Food Security Mission-Executive Committee (NFSM-EC) and the cost is reimbursed to the agencies on certification of receipt by the state government. The state government is required to educate/provide training to the farmers to multiply seed mini-kits seeds for further use.

Need for the study

As the programme is under progress for last three to four years, it is required to see the various aspects of implementation of this programme. How efficiently the distribution of seeds is taking place. We need to check whether the scheme is relevant and useful from the viewpoint of farmers. It is also important to examine whether seed minikits have any significant impact on productivity and how much area is being cropped under such seeds. Therefore, keeping the importance in mind, the present study was initiated to examine the need, application, pertinence and efficiency in distribution of seed minikits.

Main Objectives

The objectives of the study are as follows:

- To assess the relevance and the requirement of seed mini-kits among the farmers
- To compare the productivity of pulse crops using seed minikits with the control farmers/non users
- To suggest policy measures to address the efficiency issues in application/distribution of seed mini-kits.

Database and Methodology

The study has been carried out in 5 different states of India by the respective Agro Economic Research Centres (AERC'S) using secondary and primary level data. The states selected for the study are Bihar, Karnataka, Madhya Pradesh, Maharashtra and Rajasthan. Agricultural Development and Rural Transformation Centre (ADRTC) Bengaluru carried out the study for Karnataka and also coordinated and prepared the report for consolidated all India. For the selection of sample in each state, two districts were selected, one each from irrigated and dryland conditions based on highest seed minikits distributed during the reference period of 2017-18 and 2018-19. Among the selected districts, a sample of 100 seed minikit beneficiary farmers and 50 control group pulse growing farmers were selected using random sampling method. Thus, the total sample consists of 1000 beneficiaries and 500 non beneficiary farmers at the aggregate in five states. These selected respondents were further categorized into marginal (< 2.5 acres), small (2.5 – 5 acres), medium (5 - 10 acres) and large (> 10 acres) land holding categories. The reference period of survey data was 2018-19, i.e., Kharif (July-Nov 2018), Rabi (Nov 2018 to March 2019) and Summer (March-June 2019).

Main Findings

In secondary data analysis, it was observed that in all the major pulses growing states, while the area indicated signs of fluctuations during the period 1990-91 to 2018-19, the productivity under pulses cultivation in all states increased, except for black gram/urad productivity in Maharashtra and other pulses in Rajasthan while, the trend in both area and productivity under other pulses in Uttar Pradesh was positive. The share of pulses in the gross cropped area increased for all major pulse growing states except Bihar and Uttar Pradesh during the same time period. In the major pulse growing states, Bihar solely depended on bore-well, Karnataka and Rajasthan's net operated area were largely rainfed (61%), while, Madhya Pradesh's net operated area was irrigated by only canals (43.15 per cent) and Maharashtra depended on rainfall as well as water from canals for irrigation.

In terms of aggregate of all crops grown in the study states, Madhya Pradesh had the highest value of output (Rs. 43,209/acre), net returns (Rs. 35,281/acre) and gross farm income from cultivated area per household (Rs. 3,07,227), Rajasthan had the lowest material cost (Rs. 3,219/acre) and Bihar had the lowest labour cost (Rs. 1,895/acre). Taking into account the specific objectives of this study on the efficacy of the pulses seed minikits distribution among farmers, in the first objective, we assessed the relevance and the requirement of seed mini-kits among the farmers. The findings of the study indicated that the largest percentage of SMKs were distributed among the marginal and small farmers who had to commonly produce two documents, viz., Aadhar card and their land record document to avail the scheme. The information on SMK was provided to them by the Agriculture Officers at RSKs and most often distributed by the respective state KVKs and RSK free of cost. The farmers further stated that the criterion for farmer selection was primarily based on interest followed by their land holding size, the category of their household (SC/ST) as well as the gender of the farmer. All the selected farmers from across the study states found the SMK advantageous in their production of pulses and they observed a quality and yield difference. Both in terms of quantity and quality of the seeds in the SMK, a major proportion of the selected farmers opined it was sufficient and superior, respectively. However, it is noteworthy that, although the farmers received the requisite SMK from RSK, yet they spent a comparatively higher cost on transportation. There were also several farmers in Bihar and Karnataka who purchased seeds from private dealers as well as cooperatives.

In terms of the second objective, state-wise figures on productivity of pulse crops using seed minikits with the control farmers/non users or those without SMK showed that

there was a difference in each state's output and net returns. Particularly, in Bihar, the area under pulses and net price obtained per quintal was higher among farmers without SMK, however, the value of output per acre and net returns per acre were higher for farmers with SMK at a lower cultivation cost. While, in Karnataka, the area under pulses, output value, net returns and net price was higher for farmers with SMK, although the cultivation cost was lower for farmers without SMK. In Madhya Pradesh and Maharashtra, the pulses area, output value, net returns and net price were all higher for farmers with SMK at a lower cultivation cost compared to farmers growing pulses without SMK. In Rajasthan, the area under pulses was the same for both farmers with and without SMK. However, the output value and net returns were higher for farmers without SMK. While, the cultivation cost was lower for farmers with SMK and they also obtained a higher net price per quintal.

On the cost front, a majority of pulses growing farmers in the study states who used SMK also indicated that they had a lower total cost of production when measured item-wise. When labour usage by activities measured by person days per acre was considered, there was a slight variation in the total person days per acre for farmers with and without SMK. While, in Bihar and Rajasthan, the selected farmers using SMK utilised lower person days per acre growing respective pulse varieties. However, in the study states of Karnataka, Madhya Pradesh and Rajasthan, selected farmers with SMK used a higher number of person days per acre in the various production activities.

Each study state mentioned a different variety of pulse distributed among them, which they sowed mostly during kharif season. The output produced from the SMK was the highest in Karnataka for red and green gram, Rajasthan for black gram and Bihar for lentils per household. Among these study states, selected farmers also used a certain portion of the output as seed that was the highest for red and green gram in Karnataka, black gram in Madhya Pradesh and lentil in Bihar.

Concluding Remarks and Policy Suggestions

The United Nations, declared 2016 as "International Year of Pulses" to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed at food security and nutrition. In recent times, pulses have been in focus due to the continuous upswing in their prices. Therefore, the Centre embarked on an ambitious programme to increase pulses production in India with the distribution of the SMKs that was almost ten times higher than the number of SMKs distributed in the previous kharif season. Among other initiatives, this scheme aimed at making India self-sufficient in pulses as the current production continues to be supplemented by imports.

One of the causes for low pulses production and yield may be attributed to inadequate seed production. As the seed replacement rate (SRR) of pulses is slow and as per the NITI Aayog Working Group report, SRR for pulses should range from 20 to 100 per cent. In addition, of the 90 varieties released by the Union and state government, it was noted that only a few have met the production requirement. The average yield of all pulses in India is low, at approximately 660 kg / hectare compared to the world average of 909 kg / hectare. Studies have also shown that one of the primary reasons for inadequate seed production is the lack of estimation of the need for the right seed varieties by the states. Farmers do not adopt the new varieties of seeds sent to the states, as these are not the seed varieties demanded by them. Agriculture being a state subject, the government should understand the needs of the farmers and address them rather than merely increasing the production of seeds.

Given the third objective focus on policy suggestions, with particular regard to improving SMK, farmers in this study stated that although they faced no issues in accessing

the SMK scheme, a few farmers suggested augmenting the availability of SMK and its transparent distribution based on the scheme's farmer selection criteria. Other suggestions included introducing short duration, drought and pest resistance varieties of pulses, improved modes of awareness creation and dissemination of information, field demonstrations with full package of practices as well as compulsory seed germination tests prior to sowing among others.

Therefore, given these suggestions provided by the study farmers, SMKs are conclusively advantageous when based on farmer's requirements of seed varieties filtered through credible, robust and timely data and research. Given its positive impact this far, a nuanced version of SMKs taking into account the aforementioned considerations can be one in a basket of supportive policy initiatives that include reorienting trade and price policies, where the government takes on a more comprehensive and concerted farmer centric approach.

Apart from the policy initiative related to seeds via the SMK, other measures can complement the pulses push in India. In this regard, studies suggest that inclusion of pulses under the Public Distribution System (PDS), without a 25 per cent cap of the actual production per year/season, would be a positive policy measure given India's poor nutrition indicators as per the Global Hunger Index (2021). It would help address both; malnutrition as well as encourage farmers to grow more varieties of pulses by creating demand via the PDS. As such, the focus also needs to shift towards encouraging more efficiency, accountability and transparency through ICT in the current pulses value chain rather than only improve facilities that make it conducive for corporate to store and process large quantities of pulses. The prevailing strategy of regulating trade policies through corporate/private investment in the long-run will wipe out domestic stakeholders in the pulses value chain and subsequently their livelihoods, which is counterproductive for a country with a high demographic dividend largely consisting of diverse farming related communities.

Chapter 1

Introduction

1.1 Background

Agriculture continues to be an important sector of the Indian economy because of its strategic importance to food and nutritional security, employment generation and poverty reduction. With the rising importance of secondary and tertiary sectors in the economy the share of agriculture sector has been fast declining and at present its share in the gross value added was measured around 16 per cent in 2018-19 at current prices (GOI, 2019). In fact, among the major individual sectors of the economy, the contribution of agriculture is the highest, both in employment as well as in value added output. The sector still engages more than half of the country's labour force and 54.6 per cent of total employment as per Census 2011, (GOI, 2011). The sector provides raw material for a large number of industries, contributed 12.86 per cent in national exports in 2017-18 and is a significant if not the sole source of livelihood for the smallholders (< 2 ha) who comprised about 86 per cent of total number of farm holdings during 2015-16 (GOI, 2019). While the future of India's food security rests on small farms, the land-based livelihoods are becoming untenable for majority of smallholders not only because of their limited scale but also due to a number of constraints. The roadblocks faced by smallholders are plenty including poor access to markets, inputs, technologies, information and services in their endeavour to enhance their farm income. A modest agricultural growth is a pre-requisite for providing food and nutrition security to burgeoning population in India which now has crossed 1.35 billion in numbers.

Global food and nutrition security is becoming a matter of concern today with ever-increasing food prices resulting from adverse climatic effect on agricultural production, rise in oil prices, increasing use of grains for bio-fuels and relatively less public spending on agricultural sector over the last three decades. At the same time, world has experienced an unprecedented increase in population during the past century, with a billion people added every decade during the last three decades alone. Thus, lack of food availability among vulnerable people, rising commodity prices and new producer–consumer linkages have crucial implications for the livelihood of poor and food-insecure people (Braun, 2007). In fact, global food prices witnessed a very sharp increase in 2007 and they continue to rise. Initially it was thought that the increase in food prices was a part of their cyclical nature, aggravated by the adverse impact of weather on production in some parts of the world. However, the continuing surge and the high level of global food prices seen so far till 2008 make it abundantly clear that the recent trend cannot be attributed to any volatility of international

prices and there are fears that food prices may stay at these levels or may rise even further. The increase has been particularly very sharp for staple foods. During 2007-2011, two rounds of food price hikes have contributed to millions of people being hungry or malnourished (IFPRI, 2011). These increases in prices of staple foods have led to emergencies and rationing in a large number of countries and there are frequent reports of food riots from various parts of the globe (Chand, 2008), particularly in under-developed and developing countries, and the picture is turning gloomier day by day. This is causing worldwide concern.

Pulses play a vital role in the agriculture system and in the diets of people mainly due to its rich protein content particularly in a country like India where most of the people are dependent on agriculture. High quality protein in pulses makes it an ideal crop for achieving food and nutritional security, reducing poverty and hunger. Pulses are essential adjuncts to a predominantly cereal-based diet and enhance the biological value of protein consumed. In India, pulses can be produced with a minimum use of resources and hence, it becomes less costly even than animal protein. In comparison to other vegetables, pulses are rich in protein which are less expensive and can be cultivated as an inter-crop and also as mixed crop. Pulses are mostly cultivated under rainfed conditions and do not require intensive irrigation facility and this is the reason why pulses are grown in areas left after satisfying the demand for cereals/cash crops. Apart from the above, pulses also possess several other qualities such as they improves soil fertility and physical structure of the soil, fit in mixed/inter-cropping system, crop rotations and dry farming and provide green pods for vegetable and nutritious fodder for cattle as well.

Pulses provide high quality protein complementing cereal proteins for pre-dominantly substantial vegetarian population of the country. Pulses are the important sources of phosphorus, carbohydrate, fibre minerals, vitamin C, riboflavin, calcium and essential amino acids (Table 1.1) and are popularly known as “Poor man’s meat” and “rich man’s vegetable”. Pulses are also major sources of carbohydrates with calorific value of 343. Due to increasing awareness about significant nutritional benefits, there has been a soaring demand for pulses in country, especially among the vegetarians. Pulses are crucial for achieving ecological sustainability owing to their key role in improving soil fertility. The major pulse crops grown in India are: gram, urad, moong, kulthi, lentils, fieldpeas, tur, moth keshari and cowpea. Pulses in India are normally consumed as dal which is a major source of plant protein in the Indian diet. Pulses also have medicinal properties and by-products of pulses like leaves, pod coats and bran are being used as dry fodder for animal. Pulse crops like gram, lobia, urdbean and moongbean are fed to animals as green fodder. Moong plants are also used as green manuring which improves soil health and adds nutrient into the soil.

India plays a very important role by its contribution in world food production. It accounts for 10.24 percent of world's total cereals production (rank third next to China and USA) and 21.75 percent of world's total pulses production (rank first) in 2016 (GOI, 2019). India's size in terms of food consumers is also many times larger than the average size of the rest of the countries, except China (Acharya, 2007). India accounts for 16.7 percent of the world's food consumers. Another important dimension of food security in India is that a large number of rural households in India are food grain producers, a fact which has got positive implications for food access (Kalamkar, 2011 and 2011a). Food and nutrition security has remained one of the top priorities of policy planners in the post-Independence India where millions of people suffer from hunger and malnutrition. Due to deep-rooted poverty, rapidly growing population, low agricultural productivity and resultant food and nutritional insecurity during early independence period, country had to give high priority to make country population food secure which in turn mean economic growth. India made significant advances towards achieving its goals of rapid agricultural growth, improving food security, and reducing rural poverty during last four decades. The introduction of Borlaug new seed-fertilizer technology during the mid sixties led to large increases in the yield levels of wheat, rice and later commercial crops like oilseeds and cotton (Bhalla, 2007).

Food grains production has increased more than 5.7 times during last seven decades, i.e., from 50.82 million tonnes (mt) in 1950-51 to about 291.95 mt in 2019-20. The increase in the food grains production was mainly resulted from increase in yield rather than expansion of cultivated area under food grains, which remain stagnant at around 126 million hectares since last four decades (since 1973-74). The country followed a multi-pronged strategy to improve and sustain food and nutrition security. The strategy includes (i) support for raising food production, (ii) stable supply of food (iii) making food available at affordable prices. This strategy embraces several instruments that cover generation and adoption of technology, better availability of inputs, institutional credit, subsidy on farm inputs, improved infrastructure, expansion of irrigation, institutional reforms and mechanism, competitive markets, remunerative prices for farmers/producers, public procurement, system of buffer stocks, open market sales, supply of food through public distribution system, nutrition interventions and trade policy (Chand and Jumrani, 2013).

Table 1.1: Nutritional value of various pulses (mg/100 gm)

Sl. No.	Name of the food stuff	Gram	Urad	Moong	Kulthi	Lentil	Pea	Tur	Moth	Khesari	Cowpea
1	Protein (%)	20	24	25	22	25	22	22	25	31	23
2	Vit. A (IU)	316	64	83	119	450	31	220	16	200	60
3	Vit. C	3	---	---	---	---	---	---	2	---	---
4	Vit. K	0.29	0.19	---	---	0.25	---	---	---	---	---
5	Thiamine	0.30	0.41	0.72	0.42	0.45	0.47	0.45	0.45	0.39	0.50
6	Ribo-flavin	0.51	0.37	0.15	0.20	0.49	0.21	0.51	0.09	0.41	0.48
7	Nieotinic acid	2.1	2.0	2.4	1.50	1.50	3.50	2.60	1.5	2.20	1.30
8	Biotin (g/100 gm)	10	7.5	---	---	13.20	---	7.60	---	7.50	202
9	Choline	194	206	---	---	299	---	183	---	---	---
10	Folic acid (g/100g)	125	144	---	---	107	---	83	---	100	---
11	Inositol	240	90	---	---	130	---	100	---	140	---
12	Pantothenic acid	1.3	3.5	---	---	1.60	---	1.50	---	2.60	---
13	Total No. of Vit./mineral	12	11	5	6	11	5	10	6	9	6

Source: Pulses in India: Retrospect and prospects, (DPD/Pub 1/Vol. 2/2016)

1.2 Production of pulses in India

Pulses cultivated in 29 million hectares during 2018-19 with a production of 22 million tonnes. The average yield of pulses at the country was 757 kgs/ha during this period. The major pulse producing states in India are, Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh, Karnataka, Andhra Pradesh, Jharkhand, Gujarat, Tamil Nadu, Chhattisgarh, Bihar, Telangana, Odisha, West Bengal and Assam (Table 1.2). The available data for TE 2006-07 shows that the area under pulses in India was 22.76 million hectares, which increased to 25.97 million hectares during TE 2016-17, registering an increase of 14.1 per cent. Similarly, the production increased from 13.58 million MTs in TE 2006-07 to 18.87 million MTs during TE 2016-17, accounting an increase of 38.94 per cent. The yield rate during the TE 2006-07 to TE 2016-17 also increased from 597 kg per hectare to 727 kg per hectare (an increase of 21.78 per cent). Above mentioned major pulse growing states occupied about 94 per cent of the country's total pulse area in TE 2006-07, which slightly increased to about 96 per cent during TE 2016-17. Similarly, the production in these major pulse growing states was about 98 per cent during TE 2006-07 as well as during TE 2016-17. However, the yield rates in 8 major pulse growing states were higher than the average of all-India figure during TE 2006-07 and TE 2016-17 as well (Table 1.3). The above mentioned 14 major pulse growing states may be termed as 'Pulse Road of India.

Table 1.2: State wise area, production and productivity of pulses in India (2018-19)

Sl. No.	States/UTs	Area (In'000 Hectare)	Production (In'000 Tonne)	Productivity (In Kg./Hectare)
1.	Madhya Pradesh	6600	6045.41	916
2.	Rajasthan	5907.62	3759.38	636
3.	Maharashtra	4002.23	2682.54	670
4.	Uttar Pradesh	2291	2408.01	1051
5.	Karnataka	3356.66	1773.86	528
6.	Andhra Pradesh	1326	739.59	558
7.	Jharkhand	742.78	735.16	990
8.	Gujarat	661.95	681.33	1029
9.	Tamil Nadu	850.54	551.21	648
10.	Chhattisgarh	745.79	537.47	721
11.	Bihar	479.37	453.46	946
12.	Telangana	511	440.05	861
13.	Odisha	718.15	412.09	574
14.	West Bengal	462.81	368.4	796
15.	Assam	150.23	113.5	756
16.	Haryana	72	82.13	1141
17.	Uttarakhand	60	55.33	922
18.	Himachal Pradesh	27.86	53.99	1938
19.	Nagaland	37.72	46.4	1230
20.	Manipur	31.07	29.51	950
21.	Punjab	29.5	27.67	938
22.	Tripura	25.85	18.91	732
23.	Meghalaya	9.58	13.37	1396
24.	Arunachal Pradesh	13.3	11.99	901
25.	Jammu and Kashmir	19.85	10.62	535
26.	Goa	6.2	6.32	1018
27.	Mizoram	3.77	5.93	1573
28.	Sikkim	5	4.81	961
29.	Dadra and Nagar Haveli	3.85	4.28	1113
30.	Kerala	2.49	2.31	927
31.	Puducherry	1.24	0.66	536
32.	Andaman and Nicobar Islands	0.56	0.15	274
33.	Daman and Diu	0	0	-
34.	Delhi	0	0	2000
	India	**29155.80**	**22075.96**	**757**

Source: Ministry of Agriculture and Farmers Welfare, Govt. of India. (ON2357)

Current pulses scenario in India shows that domestic supply of pulses was not able to meet the rising demand from domestic consumers. This was due to the fact that different parts of the country had dietary preferences for specific type of pulses. An interesting behaviour of consumption that has been observed for pulses in India, is that there is very little substitution among different types of pulses *(Joshi et.al; 2017).* Besides, more than 83 per cent area under pulses is rainfed with limited input requirements, high degree of risks associated with production, such as inadequate price incentives for the farmers to produce pulses *(Verma, 2019).* As a result, government intervention in pulses' production has assumed significance.

Table 1.3: Change in area, production and yield of pulses across different states

State	Area			Production			Yield		
	(In lakh ha)		% change	(In lakh MT)		% change	(Kg/ha)		% change
	TE 2006-07	TE 2016-17		TE 2006-07	TE 2016-17		TE 2006-07	TE 2016-17	
Andhra Pradesh	18.57	13	-29.99	12.57	10.36	-17.58	677	797	17.73
Bihar	6.21	5.35	-13.85	4.51	4.59	1.77	726	858	18.18
Chhattisgarh	9.3	8.73	-6.13	4.38	6.7	52.97	471	768	63.06
Gujarat	8.29	7.03	-15.20	5.4	6.46	19.63	651	919	41.17
Haryana	1.81	0.9	-50.28	1.35	0.67	-50.37	746	744	-0.27
Jharkhand	3.13	6.63	111.82	1.97	6.44	226.90	629	971	54.37
Karnataka	21.52	27.03	25.60	8.83	14.23	61.16	411	526	27.98
Madhya Pradesh	43.04	60.17	39.80	32.88	54.75	66.51	664	910	37.05
Maharashtra	35.48	37.7	6.26	19.91	24.55	23.30	561	651	16.04
Odisha	7.47	7.85	5.09	3.13	4.32	38.02	419	550	31.26
Rajasthan	34.08	41.67	22.27	12.39	23.75	91.69	364	570	56.59
Tamil Nadu	5.33	8.5	59.47	2.38	5.94	149.58	447	699	56.38
Uttar Pradesh	27.6	22.47	-18.59	21.94	20.14	-8.20	795	896	12.70
West Bengal	2.22	2.9	30.63	1.65	2.87	73.94	743	990	33.24
Others	3.55	9.77	175.21	2.42	2.63	8.68	682	269	-60.56
All India	**227.6**	**259.7**	**14.10**	**135.81**	**188.7**	**38.94**	**597**	**727**	**21.78**

Source: Compiled from various issues of Agricultural Statistic at a Glance, MoA& FW, GoI.

Table 1.4: India's import and export of major pulses

(Unit Lakh tons)

Pulses	Import				Export			
	2017-18	Share In Imports (%)	2018-19	Share In imports (%)	2017-18	Share In Exports (%)	2018-19	Share In Exports (%)
Peas (Matar)	28.77	47.98	8.51	33.68	0.04	2.47	0.02	0.72
Chickpea (Chana)	9.81	16.34	1.85	7.35	1.27	70.92	2.28	80.02
Moong/Urad	3.46	8.69	5.74	22.71	0.16	69.33	0.18	6.56
Lentil (Masur)	7.96	12.55	3.48	9.84	0.11	6.24	0.13	4.88
Pigeon pea (Tur)	1.12	10.64	5.30	21.00	0.10	5.87	0.09	3.26
Total	**56.07**	**---**	**25.27**	**---**	**1.79**	**---**	**2.85**	**---**

Source: Department of Commerce, Government of India, Commodity profile for pulses, Sept., 2019.

Pulses are important commodity group of crops after cereals that provide high quality protein complementing cereal proteins. Potential of pulses to help address future global security, nutrition and environmental sustainability has also been acknowledged by the UN declaring the year 2016 as 'International Year of Pulses'. This led to several important interventions in pulses' area and production across the world. As of now, India is the leading producer of pulses in the world and accounts for about 33 per cent of the world production and about 39 per cent of the area under cultivation (GoI, 2017). Though India is the largest pulses' producer in the world, it imports large quantity of pulses from rest of the world. In the recent years, the quantity of pulses imports has been

closer to or more than 50 lakh tones, whereas exports hovered around 2 to 4 lakh tons. India's imports and exports of major pulses during 2017-18 and 2018-19 may be seen from the Table 1.4.

1.3 National Food Security Mission – An origin of Seed Mini Kits Programme

National Food Security Mission was launched in 2007-08 to increase the production of rice, wheat and pulses by 10, 8 and 2 million tonnes, respectively by the end of XI Plan through area expansion and productivity enhancement; restoring soil fertility and productivity; creating employment opportunities; and enhancing farm level economy. The Mission was continued during 12th Five Year Plan with new target of additional production of 25 million tonnes of food grains comprising of 10 million tonnes rice, 8 million tonnes of wheat, 4 million tonnes of pulses and 3 million tonnes of coarse cereals by the end of XII Plan.

During XI Plan, NFSM-Rice was implemented in 144 districts of 16 states, NFSM Wheat in 142 districts of 9 states and NFSM-Pulses in 468 districts of 16 states. From the year 2012-13, six (6) NE states, viz. Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Sikkim have been included under NFSM-Rice and two Hill states, viz., Himachal Pradesh and Uttarakhand under NFSM-Rice and Wheat and J&K under NFSM-Wheat. Thus, the NFSM was implemented during 2012-13 and 2013-14 in 27 states of the country.

From 2014-15 onwards, NFSM-coarse cereals and Commercial crops viz., Cotton, Jute and Sugarcane have been included under revamped NFSM. From 2014-15, NFSM was implemented in 623 districts of 28 states. NFSM-Rice was implemented in 206 districts of 25 states. NFSM-Wheat was implemented in 126 districts of 11 states. NFSM-Pulses was implemented in 622 districts of 27 states and NFSM-Coarse cereals was implemented in 264 districts of 28 states.

From 2015-16 onwards, NFSM is implemented in 623 districts of 28 states. NFSM-Rice is being implemented in 194 districts of 25 states. NFSM-Wheat is being implemented in 126 districts of 11 states. NFSM-Pulses is being implemented in 622 districts of 27 states and NFSM-Coarse cereals is being implemented in 265 districts of 28 states.

From 2016-17 onwards, NFSM is implemented in 638 districts of 29 states. NFSM-Rice is being implemented in 194 districts of 25 states. NFSM-Wheat is being implemented in 126 districts of 11 states. NFSM-Pulses is being implemented in 638 districts of 29 states and NFSM-Coarse cereals is being implemented in 265 districts of 28 states.

During 2016-17, new initiatives like **distribution of seed minikits of newer varieties of pulses** free of cost to farmers, production of quality seed, creation of seed hubs at SAU and KVKs, strengthening of bio-fertilizers and bio agent labs at SAUs/ICAR Institutes, cluster front line demonstration by KVKs and enhancing up breeder seed production at ICAR institutes and SAUs have been included under NFSM during 2016-17 for enhancing pulses production and productivity.

1.4 The aim of Seed Mini-kits Programme

Seed Mini-kits are meant for introduction and popularization of latest released / pre released varieties / hybrids not older than 10 years among the farmers free of cost. Central Seed Agencies deliver allotted seed minikits to the destination identified by the beneficiary states within the stipulated time. Seed minikits are distributed for rice, wheat, pulses and nutri-cereals. The agencies like NSC /HIL / KRIBHCO /NAFED/ IFFCO / IFFDC / Central Multi-state Cooperatives such as NCCF/SSCs etc., are involved in supply of seed minikits at the national level.

The price of seed minikits is fixed by the NFSM Mission Director at National level and 100 per cent cost is reimbursed to the agencies on certification of receipt by the state. The allocation of seed minikits is approved by the NFSM-EC before commencement of Kharif / Rabi / Summer seasons. The cut off dates of delivery of Seed Minikits consignment by the Central Agencies to reach the destination is 15thMay, for kharif season, 1stSeptember for rabi Season, 1stOctober for TRFA rabi season and 31stJanuary for the summer season. Bill submission date for kharif is before 10thMay, 15thOctober for rabi season and TRFA, and 10th February for summer season. The required leaflets on cultural practices should be kept in the seed Minikits along with Rhizobium / PSB culture wherever it is required in the respective seed packet of Minikits. The cultural practices should be printed in Hindi, English and local languages for the respective states. The agencies should deliver the consignment up to District headquarters level of the respective State Governments, beyond which the distribution of Seed Minikits should be taken care by the State Department of Agriculture. After receiving the minikits at destination place of the district, proper distribution of minikits within 10 days to the appropriately identified farmers must be ensured by the District Level Agriculture Officer, concerned. The purpose is to ensure, that the identified farmer is capable of raising the crop with care and diligence such that the plot serves as a good demonstration to other farmers. Only one minikit per farmer and not more than 3 minikits in a season and a village are to be distributed. Regarding re-imbursement of the cost of seed minikits supplied within due date only by Central Seed Agencies will be reimbursed by Crops Division on receipt of original bills supported with utilization certificate and first and final bill certificate proper acknowledgement issued by NFSM State Nodal Officer.

1.5 Implementation of Seed Mini-kits Programme

NFSM-Pulses is one of the components of the centrally sponsored scheme of National Food Security Mission and is under implementation since *Rabi* 2007-08. This component has undergone a number of changes since its inception and finally has taken the shape of sole centrally sponsored scheme on pulses covering all the districts in 14 states by merging all pulses components of the other centrally sponsored scheme namely Integrated Scheme on Oilseeds, Pulses, Oilpalm and Maize (ISOPOM). Ten districts of Assam and 15 districts of Jharkhand have also been included under NFSM-Pulses.

A3P: Accelerated Pulses Production Programme (under NFSM) is another step forward for vigorous implementation of the pulse development under the NFSM-Pulses. A3P has been conceptualized to take up the active propagation of key technologies such as Integrated Nutrient Management (INM) and Integrated Pest Management (IPM) in a manner that creates catalyzing impact by assuring farmers of the higher returns from the identified pulse crops. A3P will have a strong mechanism of monitoring of the programme. Close monitoring of the physical achievements in terms of provision of input minikits, seed minikits and overseeing the activities of the technical assistants is to be done by the District Food Security Mission Executive Committee (DFSMEC). **Directorate of Pulses Development (DPD)** is the nodal agency for allocation and monitoring of supply of pulses minikits to states. However, Commodity Development Directorate in-charge of concerned pulses states provides the information on seed supply position to DPD (NFSM, A3P Operational guidelines).

Eligibility:

- Minikits are distributed to farmers on the basis of priority to Scheduled caste, Schedule tribe, small, marginal and below poverty line farmers.
- 10 per cent of total cost of minikit will be charged as token money from the farmers.
- Minikits are given to Women farmers even if land owner is her husband/father/father in law.
- One minikit is given to only one woman in a family.
- If in a Gram Panchayat, Schedule caste and Schedule tribal farmers are not available or negligible then only minikits are to be distributed to general category women farmers.
- Minikits are distributed to those farmers who were not benefited during last three years.
- Priority will be given to those farmers having irrigation facilities.

Application process

Agriculture supervisor prepares a list of three times more women farmers with the consultation of Gram Panchayat Sarpanch and other elected leaders and minikits will be distributed by lottery system. The time Line is 15 days before sowing and the Dealing Authorities at different levels are given below:

- Gram Panchayat level: Agriculture Supervisor
- Panchayat samiti level: Assistant Agriculture officers.
- Sub District level: Assistant Director Agriculture (Ext).
- District level: Dy. Director Agriculture (Ext).

Distribution of Seed Minikits of Pulses:

In order to promote quick spread of new varieties of pulses, minikits of pulses seed varieties not older than 10 years are provided free of cost to farmers. National and state seed producing agencies supply minikits to State Government for distribution amongst farmers. Allocation of minikits is made to all farmers in contiguous area of at least 25 hectares. The size of minikits is 16 kg of gram, 8 kg seed of lentil and 4 kg each for moong, urd and pigeon pea. This quantity would be sufficient to plant 0.2 ha. In addition, under this package, state governments are also providing, a pamphlet regarding package of practice (POP) and phosphate solubilizing bacteria (PSB) culture of 100 grams per packet per mini kit to pulse farmers. The price of seed minikits is fixed by National Food Security Mission-Executive Committee (NFSM-EC) and the cost is reimbursed to the agencies on certification of receipt by the State Government.

1.6 Studies on cultivation of pulses

Improper sowing time, low seed rate, defective sowing method, insufficient irrigation, inadequate intercultural operations, sowing under area without proper management are major agronomic constraints (Ramakrishna *et al*., 2000 and Reddy, 2009) in cultivation of chickpea. Subsequently plants get comparatively less time to complete their lifecycle which, by and large forces maturity (Ramakrishna et al., 2000). Typically, late sown rabi pulses especially lentil and chick pea undergoes three distinct phases and considerable degrees of phenological modifications are bound to happen. This poses serious threat to realization of yield potential due to cold injuries. This phase is very important for creating source of channelizing the energy at later stage. In the last and most important phase lentil faces heat injury, resulting in early onset of reproductive phase, causing imbalance in resources and inputs, biotic stress and forced maturity (Joshi, 1998; Dixit *et al*. 2009; Reid *et al*., 2011 and Singh and Bhatt, 2013). An earlier study revealed that area under pulses in mostly predetermined, but as the irrigated area increases, pulses are relocated to rainfed areas and

their area is replaced by cereals or some cash crops (Singh *et al*., 1995). In India, the irrigated area under pulses is only 12 per cent, while under wheat and paddy; it is more than 60 per cent of the total area (Reddy and Reddy, 2010).

Poor soil and agro-climatic conditions not only compel late sowing of legumes, leads to reduced length of growing period but also necessitates to sustain cold injuries at early vegetative phase which freeze all biological activities for prolonged period. A sudden rise in temperature after that, not only induces forced maturity but simultaneously invites several biotic stresses viz., diseases and insects pests (Ali *et al*., 2012; Reddy, 2009 and Singh and Singh, 2008). Traditionally rabi pulses sowing were delayed up to last week of November and some time under extreme circumstances it goes up to the first fortnight of December, obviously due to reasons already explained (Singh *et al.*, 2011 and Ramakrishna *et al*., 2000).

1.7 Need for the study

Considering the importance of pulses, the GoI has made sincere efforts through NFSM, which resulted in increase in the area, production and productivity of pulses in India. Recent policy interventions under NFSM, BGREI, Crop Diversification Plan (CDP) involving conduct of large scale cluster demonstrations, creation of 150 seed-hubs for pulses, seed minikit distribution of HYVs, strengthening seed production infrastructure, seed village programme, creation of FPOs and enhanced MSPs coupled with favourable trade policy have earned a place of pride and thus, the government has targeted pulses' output of 26.30 million tons during 2019-20 for making the nation self-sufficient in pulses.

Besides several initiatives, pulses seed minikits (SKMs) distribution was launched during 2016-17 to ensure varietal replacement at a faster rate. The programme is aimed at introduction and popularization of latest released/pre-released HYVs of pulses within 10 years of release. Under the programme, seed minikits were distributed free of cost to the farmers along with a brief guidelines for adoption of cultural practices to enhance capabilities of farmers in raising the crop with all care and diligence. The expectation of such exercise was that the plot serves as a good demonstration to other farmers. As the programme under progress for last three to four years, it is required to see the various aspects of implementation of this programme. How efficiently the distribution of seeds is taking place. It is appropriate to check how the scheme is relevant and useful from the viewpoint of farmers. It is also important to examine whether seed minikits have any significant impact on productivity and how much area is being cropped under such seeds. Therefore, keeping the importance in mind, the present study is proposed to examine the need, application, pertinence and

efficiency in distribution of seed minikits. It is in this context; the present study has been carried out in 5 different states of India by the respective Agro Economic Research Centres (AERCs).

1.8 Objectives of the study

As mentioned earlier, the seed minikits distribution programme of pulses was initiated in 2016-17 with the view to promote quick spread of new varieties of pulses, not older than 10 years. So, it is essential to evaluate and measure the extent, to which the programme and approach have stood up to the expectations. The study would enlighten the policy makers in incorporating necessary corrective measures to make the programme more effective and successful. Given the above broad concept, the study intends to achieve the following specific objectives:

1. To assess the relevance and the requirement of seed mini-kits among the farmers
2. To compare the productivity of pulse crops using seed minikits with the control farmers/non users
3. To suggest policy measures to address the efficiency issues in application/distribution of seed mini-kits.

1.9 Methodology

The study has been carried out in 5 different states of India by the respective Agro Economic Research Centres (AERC'S) using secondary and primary level data. The states selected for the study are Bihar, Karnataka, Madhya Pradesh, Maharashtra and Rajasthan. Agricultural Development and Rural Transformation Centre (ADRTC) Bengaluru Coordinated the project and the Agro Economic Research Centres (AERCS) conducted the study in their respective states are as follows

1. Bihar (AERC, Bhagalpur)
2. Karnataka (ADRTC, Bangalore)
3. Madhya Pradesh (AERC, Jabalpur)
4. Maharashtra (AERC, Pune)
5. Rajasthan (AERC, VV Nagar)

Sampling

For the selection of sample in each state, two districts were selected, one each from irrigated and dryland conditions based on highest seed minikits distributed during the reference period of 2017-18 and 2018-19. Among the selected districts, a sample of 100 seed minikit beneficiary farmers

and 50 control group pulse growing farmers were selected using random sampling method. In this way, a total number of 200 beneficiaries and 100 non beneficiaries were selected in each state. Thus, the total sample consists of 1000 beneficiaries and 500 non beneficiary farmers at the aggregate in five states. These selected respondents were further categorized into marginal (< 2.5 acres), small (2.5 – 5 acres), medium (5 - 10 acres) and large (> 10 acres) land holding categories.

Table 1.5: Selection of sample for the study

Sl. No.	State	District	Beneficiaries	Control group	Total
1	Bihar	Patna	100	50	150
		Muzaffarpur	100	50	150
2	Karnataka	Tumkur	100	50	150
		Mysore	100	50	150
3	Madhya Pradesh	Datia	100	50	150
		Sagor	100	50	150
4	Maharashtra	Ahmednagar	100	50	150
		Yavatmal	100	50	150
5	Rajasthan.	Bundi	100	50	150
		Naguar	100	50	150
Total			1000	500	1500

Data collection and analysis

The primary data was collected using a structured schedule using personal interview method. The secondary data on area, production and productivity of pulse crops and related parameters were collected from various published sources in the respective states. As per the eligibility criteria for this programme, minikits are given to women farmers even if land owner is her husband/father/father-in-laws and one minikit is given to only one woman in a family. Thus, data were collected from the female respondents supported by their male family members (for accuracy of data on cost of cultivation, production and marketing). The collected data was then tabulated and analysed using the relevant statistical methods based on the type of the data.

Limitation of the study

The study doesn't claim its completeness in all aspects and certainly had some limitations. The data related to the objectives of the study were collected from the selected respondents. The information provided by them are based on interview and they don't keep any record of their farming practices. Therefore, the information provided by them is entirely based on their recall memory thus, there is possibility of certain biasness entering in the study.

1.10 Overview of the report

The present report is organized in five chapters. Chapter 1 includes importance of pulses, need for the study, objectives of the study, methodology adopted for the study and overview of the study. Chapter 2 contains details regarding area and production of major crops in India; area, production and yield of pulses in India; growth rate in area and production of pulses in India; growth rate in area and yield of pulses in India; and share of pulses at state level in gross cropped area in India. Chapter 3 discusses in detail about socio-economic characteristics of the beneficiary farmers, characteristics of their operational holdings, sources of irrigation, cropping pattern and production, cost and returns by farm size. Chapter 4 contains details about productivity comparison between beneficiary and non-beneficiary, production cost comparison between beneficiary and non-beneficiary, distribution of seed minikits – socio economic comparisons, efficiency in distribution and usage of seed minikits, awareness about the scheme and farmers perceptions about seed minikits. Chapter 5 contains main findings of the study, concluding Remarks and the policy suggestions.

1.11 Summarizing the chapter

Pulses play a pivotal role in a country like India for all categories of people due to its rich protein content. Pulses are largely cultivated under rainfed conditions (83 per cent). Apart from its rich protein content, pulses are also crucial for achieving ecological sustainability. Although being the largest pulse crop cultivating nation in the world, India's pulses' share in its total food grain production is about 9 per cent. The excess demand is primarily due to slow increases in area and production for last several decades. As a result, per capita net availability of pulses in the country declined sharply over the years. There are six major states (Madhya Pradesh, Rajasthan, Maharashtra, Karnataka, Uttar Pradesh and Andhra Pradesh) which accounted for 80 per cent of the total pulses area and produced nearly 80 per cent of its total production. Gram (chickpea) has the largest area (35.21 per cent of the total pulse crops) followed by urad (18.14 per cent), arhar/tur (14.77 per cent), moong (14.21 per cent), lentil (5.17 per cent) and others (12.5 per cent), which contributed 44.51 per cent, 14.10 per cent, 16.85 per cent, 7.97 per cent, 6.36 per cent and 10.19 per cent of total production of pulses, respectively. Besides several initiatives, pulses seed minikits (SKMs) distribution was launched during 2016-17 to ensure varietal replacement at a faster rate. The programme is aimed at introduction and popularization of latest released/pre-released HYVs of pulses within 10 years of release. Under the programme, seed minikits were distributed free of cost to the farmers along with a brief guidelines for adoption of cultural practices to enhance capabilities of farmers in raising the crop with all care and diligence. The expectation of such exercise was that the plot serves as a good demonstration to other farmers. Given the above broad concept, the study

intends to achieve the following specific objectives: (1) To assess the relevance and the requirement of seed mini-kits among the farmers (2) To compare the productivity of pulse crops using seed minikits with the control farmers/non users and (3) To suggest policy measures to address the efficiency issues in application/distribution of seed mini-kits. The study has been carried out in five different states of India by the respective Agro Economic Research Centres (AERC'S) using secondary and primary level data. The states selected for the study are Bihar, Karnataka, Madhya Pradesh, Maharashtra and Rajasthan. Agricultural Development and Rural Transformation Centre (ADRTC) Bengaluru Coordinated the project and the Agro Economic Research Centres (AERCS) conducted the study in their respective states are as follows 1. Bihar (AERC, Bhagalpur) 2. Karnataka (ADRTC, Bangalore) 3. Madhya Pradesh (AERC, Jabalpur) 4. Maharashtra (AERC, Pune) 5. Rajasthan (AERC, VV Nagar). For the selection of sample in each state, two districts were selected, one each irrigated and dryland condition based on highest seed minikits distributed during the reference period of 2017-18 and 2018-19. Among the selected districts, a sample of 100 seed minikit beneficiary farmers and 50 control group pulse growing farmers were selected using random sampling method. In this way a total number of 200 beneficiaries and 100 non beneficiaries were selected in each state. Thus, the total sample consists of 1000 beneficiaries and 500 non beneficiaries in the country. The primary data was collected using a structured schedule using personal interview method. The secondary data on area, production and productivity of pulse crops and related parameters were collected from various published sources in the respective states. The collected data then tabulated and analysed using the relevant statistical methods based on the type of the data.

Chapter 2

State-wise Pulses Production Scenario in India

2.1 Background

Agriculture still remains backbone of Indian economy as it provides food for more than 1.2 billion people and employment to about 54.6 per cent (Census, 2011) of the population. India is the world's second largest producer of rice, wheat and other cereals and leading producer of pulses. The huge demand for cereals in the global market is creating an excellent environment for the export of Indian cereal products (APEDA). India is by and large vegetarian in dietary habit and heavily depends upon vegetative sources to meet out its daily protein requirements. India is global leader in terms of production and consumption of pulses. India is leading importer of pulses because production of pulses/legume crops has been stagnant over the years (Singh *et.al* 2015) although situation has slightly changed in the recent past. Consequent upon this, there is widening gap between the demand and supply/availability of pulses. About 20 per cent of the total pulses demand is met by imports alone.

Pulses are leguminous plants and belong to the Fabaceae family. Pulses are also an excellent feed and fodder for livestock. Endowed with the unique ability of biological nitrogen fixation, carbon sequestration, soil amelioration, low water requirement (250 to 300 mm) and capacity to withstand harsh climate, pulses have remained an integral component of sustainable crop production system, especially in the dry areas. Pulses are the primary sources of protein (22 per cent) for the poor and the vegetarians (40 per cent). According to Crops Division, Ministry of Agriculture & Farmers Welfare Government of India Report in 2019, during 2018-19, pulses were cultivated over > 29 million ha (Mha) of area and recorded the highest ever production of 25.42 million tonnes (Mt) at a productivity level of 853 kg/ha. Twelve states were the major producers contributing > 90 per cent pulses. These were Madhya Pradesh (> 8 Mt), Rajasthan (>3 Mt), Maharashtra (>3 Mt) Uttar Pradesh (>2 Mt), Karnataka (2 Mt) and Andhra Pradesh (>1 Mt) followed by Gujarat, Jharkhand, Tamil Nadu, and Chhattisgarh producing <1.0 Mt each. Karnataka yields 645 kg/hectare of total pulses with an area of 3.02 Million hectares and 1.95 Million tonnes of production (Agriculture Statistics at a Glance 2019). Gram, Urad, Arhar (Tur), Moong and Lentil are the major pulses produced and consumed in India. Gram (chickpea) is the most dominant pulse with an average share of around 45 per cent in total pulse production during 2018-19.

2.2 Cropping pattern in major pulse growing states

The details of cropping pattern of major pulse growing states during 2018-19 are presented in Table 2.1. As pulses are food grain crops, on average around 65 to 70 per cent cultivated area was under all food grain crops in these states, with the states of Maharashtra having only 45 per cent area under food grain, Andhra Pradesh having 56 per cent and Rajasthan 64 per cent area under food grains, while other states like Karnataka and Madhya Pradesh each having 74 per cent, Uttar Pradesh 77 per cent and Bihar 83 per cent area covered by food grain crops. Looking at area covered by pulses out of total cultivated area, the proportion was less than 6 per cent in Bihar, 9 per cent in Uttar Pradesh, 17 per cent in Andhra Pradesh and Maharashtra each, and around 24 per cent in Rajasthan and highest, 27 per cent each in Karnataka and Madhya Pradesh. Rice and wheat cycle in kharif and rabi crops was found predominating in Bihar and Uttar Pradesh with a share of around 60 per cent. Coarse cereals dominated in Karnataka and Rajasthan with a share of around 25 per cent of the total cultivated area, while in Maharashtra 14 per cent of the cultivated area was occupied by coarse cereals. In other states, coarse cereals occupied less than 10 per cent area. Oilseeds occupied highest 11 per cent of the cultivated area in Andhra Pradesh, 4 per cent area in Rajasthan and Karnataka. Sugarcane was a dominant crop in Uttar Pradesh with a share of around 8.5 per cent followed by Maharashtra 5 per cent and Karnataka 4 per cent of the cultivated area in the respective states. Horticultural crops were dominant crops in southern states namely, Andhra Pradesh and Karnataka with 20 and 17 per cent share of the cultivated area under horticultural crops, while in Bihar horticultural crops occupied 14 per cent share of cultivated area. In other pulse dominating states, around 5 to 10 per cent of the area was occupied by horticultural crops. Thus, among pulse growing states, Madhya Pradesh and Rajasthan had the highest area under pulses, 66 lakh and 59 lakh hectares, respectively, followed by Maharashtra 40 lakh hectares, Karnataka, 34 lakh hectares, Uttar Pradesh 23 lakh hectares, Andhra Pradesh 13 lakh hectares and Bihar 5 lakh hectares. It would be interesting to see area under individual pulse crops in pulse dominating states, the analysis for which is presented in the forthcoming sections.

Table 2.2 presents comparative share of pulses in gross cropped area for the last three decades from triennium ending 1990-91 up to triennium ending 2018-19 in the pulse dominating states. Looking at the percentage share of pulses crops to gross cropped area, it is discernible that except in Bihar and Uttar Pradesh share of pulses in gross cropped area increased in all other states. In the highest pulse growing state namely Madhya Pradesh, area under pulses as a percentage of gross cropped area decreased from around 20 per cent in TE 1990-91 to 18 per cent in TE 2000-01 but increased again to 23 per cent in TE 2005-06 which further soared to 26 per cent in TE 2018-19.

Table 2.1 Cropping pattern in major pulse growing states of India during 2018-19
(Area in lakh hectare)

Crop	Andhra Pradesh	Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan	Uttar Pradesh	Sum Total
Rice	22.08	31.6	11.39	23.91	14.65	1.98	57.48	163.09
Wheat	-	21.57	1.5	55.2	8.34	28.8	95.4	210.81
Maize	2.66	6.69	13.4	12.67	9.27	8.45	7.33	60.46
Coarse cereals	4.89	7	30.13	18.41	33.2	58.26	19.14	171.03
Pulses	13.26	4.79	33.57	66.00	40.02	59.08	22.91	239.63
Food grains (Sub total)	42.89	71.65	89.99	176.19	105.48	156.56	202.26	845.02
Groundnut	7.48	0.01	5.15	2.23	2.44	6.73	1.01	25.05
Ginger	0.48	0.02	0.24	2.48	0.39	2.42	3.27	9.3
Sunflower	0.13	0.07	-	-	0.38	-	0.01	-
Castor	0.37	0	0.03	0.01	0.13	1.41	-	-
Oilseed (Sub total)	8.46	0.1	5.42	4.72	3.34	10.56	4.29	36.88
Sugarcane	1.02	2.26	4.71	1.08	11.63	0.05	22.24	42.99
Cotton	0.06	-	0.07	0.06	0.42	0.06	-	-
Tobacco	0.83	0.11	0.95	-	-	-	0.23	-
Chilli	1.58	-	1.58	0.88	0.06	0.08	0.14	-
Vegetables	2.6	8.73	4.31	8.98	6.5	1.78	12.56	45.45
Fruits	7.19	3.14	3.96	3.57	7.57	0.62	4.81	30.85
Horticulture Crops	15.55	12.12	21.15	19.65	16.89	15.89	22.87	124.12
Other crops	7.56	0.00	0.00	36.08	96.98	61.83	9.77	204.56
Sum Total	76.37	86.24	122.29	237.78	234.74	244.95	261.66	1253.57
Percentage Share								
Rice	28.91	36.64	9.31	10.06	6.24	0.81	21.97	13.01
Wheat	-	25.01	1.23	23.21	3.55	11.76	36.46	16.82
Maize	3.48	7.76	10.96	5.33	3.95	3.45	2.80	4.82
Coarse cereals	6.40	8.12	24.64	7.74	14.14	23.78	7.31	13.64
Pulses	17.36	5.55	27.45	27.76	17.05	24.12	8.76	19.12
Food grains (Sub total)	56.16	83.08	73.59	74.10	44.93	63.92	77.30	67.41
Groundnut	9.79	0.01	4.21	0.94	1.04	2.75	0.39	2.00
Ginger	0.63	0.02	0.20	1.04	0.17	0.99	1.25	0.74
Sunflower	0.17	0.08	-	-	0.16	-	0.00	-
Castor	0.48	0.00	0.02	0.00	0.06	0.58	-	-
Oilseed (Sub total)	11.08	0.12	4.43	1.99	1.42	4.31	1.64	2.94
Sugarcane	1.34	2.62	3.85	0.45	4.95	0.02	8.50	3.43
Cotton	0.08	-	0.06	0.03	0.18	0.02	-	-
Tobacco	1.09	0.13	0.78	-	-	-	0.09	-
Chilli	2.07	-	1.29	0.37	0.03	0.03	0.05	-
Vegetables	3.40	10.12	3.52	3.78	2.77	0.73	4.80	3.63
Fruits	9.41	3.64	3.24	1.50	3.22	0.25	1.84	2.46
Horticulture Crops	20.36	14.05	17.29	8.26	7.20	6.49	8.74	9.90
Other crops	9.90	0.00	0.00	15.17	41.31	25.24	3.73	16.32
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 2.2: Share of pulses in gross cropped area in major pulse growing states in India

Sl. No.	Area under cultivation of pulses ('000 hectares)	Gross cropped area ('000 hectares)	Percentage of pulses to gross Cropped area (%)
Andhra Pradesh			
TE 1990-91	1564.33	13942	**11.22**
TE 2000-01	1711.37	12862.7	**13.30**
TE 2005-06	1923.5	12155.3	**15.82**
TE 2018-19	1975.33	7637.33	**18.10**
Bihar			
TE 1990-91	1173	10703	**10.96**
TE 2000-01	825.3	10057.3	**08.21**
TE 2005-06	925.4	8972.5	**10.31**
TE 2018-19	1262.84	7639.33	**16.53**
Karnataka			
TE 1990-91	1631.33	11880	**13.73**
TE 2000-01	1929.07	11996.3	**16.08**
TE 2005-06	1987.1	10412.7	**19.08**
TE 2018-19	3115.35	12167.7	**25.60**
Madhya Pradesh			
TE 1990-91	4723.67	23708	**19.92**
TE 2000-01	4505.17	25520.3	**17.65**
TE 2005-06	5409.33	23909	**22.62**
TE 2018-19	7720.73	23778	**32.47**
Maharashtra			
TE 1990-91	3292.33	19636.0	**16.77**
TE 2000-01	3551.5	21596.3	**16.44**
TE 2005-06	3420.7	22146.0	**15.45**
TE 2018-19	4189.84	23474.0	**17.85**
Rajasthan			
TE 1990-91	3186.33	19464	**16.37**
TE 2000-01	3163.97	20896.7	**15.14**
TE 2005-06	3625.53	19735.3	**18.37**
TE 2018-19	5502.84	24494.7	**22.47**
Uttar Pradesh			
TE 1990-91	2984.33	25406.0	**11.75**
TE 2000-01	2729.2	26148.0	**10.44**
TE 2005-06	2799.33	17865.3	**15.66**
TE 2018-19	2418.00	26165.7	**09.24**

In absolute terms, area under pulses in Madhya Pradesh increased from 47 lakh hectares in TE 1990-91 to 77 lakh hectares in TE 2018-19, an increase in the area at a growth rate of around 1.8 per cent per annum during this period of last three decades. In the next highest pulse growing state namely Rajasthan, area under pulses increased from 16 per cent of the gross cropped area during TE 1990-91 to 22.5 per cent in TE 2018-19 although there were wide fluctuations in the middle years. The area under pulses increased in Rajasthan from 32 lakh hectares in TE 1990-91 to 55 lakh hectares in TE 2018-19. Thus the rise in area under pulses in Rajasthan recorded a growth rate of almost 2 per cent per annum for a period of three decades. In Maharashtra, the share of pulses in gross cropped area has more or less remained constant. The share was around 16.8 per cent in TE 1990-91 which

declined to 15.5 per cent in TE 2005-06 but increased to 17.9 per cent in TE 2018-19. The absolute area increased from 33 lakh hectares in TE 1990-91 to 42 lakh hectares in TE 2018-19 observing per annum growth rate of 0.86 per cent per annum during the above mentioned period. In Karnataka, the pulses share in gross cropped area increased incessantly every decade for the entire period from 1990-91 onwards up to 2018-19. The share of pulses was 14 per cent in TE 1990-91 which increased to 16 per cent in TE 2000-01, and further to 19 per cent in TE 2005-06 and 25.6 per cent in TE 2018-19. The area in absolute terms increased from 16 lakh hectares in TE 1990-91 to 20 lakh hectares in TE 2005-06 which further increased by leap and bound to 31 lakh hectares in TE 2018-19. Thus the entire period growth rate was an impressive 2.3 per cent per annum for this entire period of three decades.

In Uttar Pradesh, both share of pulses in gross cropped area as well as absolute area under pulses declined during the period of last three decades. The decline in area under pulses occurred mostly in the last one decade in the state. The share of pulses was 11.8 per cent in TE 1990-91 which declined to 10.4 per cent in TE 2000-01 but increased to 15.7 per cent in TE 2005-06 but again declined to 9.2 per cent in TE 2018-19. The area under pulses was around 30 lakh hectares in TE 1990-91 which declined to 27 lakh hectares in TE 2000-01, remained stagnant at that level in TE 2005-06 but declined to 24.2 lakh hectares in TE 2018-19. The area plummeted at -0.75 per cent per annum during the period from TE 1990-91 to TE 2018-19. In Andhra Pradesh, like in the case of Karnataka, area under pulses increased persistently during the study period. The percentage of pulses area to gross cropped area increased from 11 per cent in TE 1990-91 to 18 per cent in TE 2018-19. Absolute area under pulses increased from 15.6 lakh hectares in TE 1990-91 to 19.8 lakh hectares in TE 2018-19 observing a growth rate of 0.8 per cent per annum during the above mentioned period.

In Bihar, the area under pulses observed opposite trends to most of other states. Area under pulses declined during the decades of 1990s and 2000s but observed increasing trends in the last decade of 2010. Percentage of gross cropped area under pulses declined from almost 11 per cent in TE 1990-91 to 8.2 per cent in TE 2000-01 but increased to 10.3 per cent in TE 2005-06 which further increased to 16.5 per cent in TE 2018-19. In absolute terms, area under pulses in Bihar was 11.7 lakh hectares in TE 1990-91, which declined to 8.3 lakh hectares in TE 2000-01, slightly increased to 9.25 lakh hectares and then jumped to 12.6 lakh hectares in TE 2018-19. Overall, area under pulses observed a slight growth rate of 0.26 per cent per annum during the entire period of 1990-91 to 2018-19.

Thus, except, Uttar Pradesh all other states observed enhancement in area under pulses from 1990-91 onwards seemingly because of hike in prices of pulses as well as government

encouragement towards pulses through various pulse incentive programmes, like ISOPOM, Food Security Mission etc., to meet the increasing deficit in demand and supply within the country.

2.3 Area, production and yield of individual pulses in major pulse growing states

In India mainly five pulse crops are grown, known as Bengal gram (chana or chickpea), Tur (arhar or red gram), moong (green gram), urad (black gram) and masur (lentil), in addition to few other minor pulse crops. It is important to look at the composition of these individual pulses grown in major pulse growing states. Table 2.3 presents area, production and yield of four major pulse crops grown in pulse growing states. These four pulse crops are also the crops for which seed mini-kits are distributed by respective state government of our selected states. Table 2.4 presents the percentage share of these individual pulses in the gross area and production of pulses in the respective states. Trends in area, production and yield of these individual pulse crops are presented in the following paragraphs.

Looking at statistics in these tables, it is observed that share of these crops varied in different states. Whereas in Madhya Pradesh, Bengal gram and urad occupied dominant place, in Maharashtra, Karnataka and Andhra Pradesh, it was red gram and Bengal gram which were major pulse crops grown. In Bihar and Rajasthan on the other hand, green gram (moong) dominated in pulses area. In the total area under pulses during TE 2018-19, Bengal gram occupied 38 per cent in total pulses area and 50 per cent of total pulses production. Bengal gram was followed by urad (black gram) which occupied 19 per cent share in total area and 14 per cent in production of total pulses. Green gram (moong) occupied 16 per cent share in area but only 9.8 per cent share in production while tur occupied 12 per cent share in area and 13 per cent share in production. The lentil including other minor pulses occupied 15 per cent share in area and 13 per cent share in production in the total pulses grown in the country.

Looking at absolute area under these pulse crops during TE 2018-19, the highest area was occupied by Bengal gram in major states with 33 lakh hectares in Madhya Pradesh, 18 lakh hectares in Maharashtra, 16 lakh hectares in Rajasthan and around 5 lakh hectares in Uttar Pradesh and Andhra Pradesh, each. Similarly, urad had highest area of 18 lakh hectares in Madhya Pradesh and tur occupied 13 lakh hectares in Maharashtra during TE 2018-19. Other pulses including lentils occupied highest area of 12 lakh hectares in Rajasthan during the same time period. Area under all other individual pulses was less than 10 lakh hectares in the major states. Out of total production of around 170 lakh tonnes of pulses in major states during TE 2018-19, Bengal gram alone contributed

around 85 lakh tonnes with remaining share of 24 lakh tonnes of urad (black gram), 17 lakh tonnes of moong (green gram) and 22 lakh tonnes each of tur and other pulses. Among different states Madhya Pradesh alone contributed 40 lakh tonnes in Bengal gram, 11 lakh tonnes in urad and 6 lakh tonnes in tur production. Similarly, Maharashtra and Rajasthan had Bengal gram production of around 16.5 lakh tonnes, each during the same time period. Maharashtra also contributed around 12 lakh tonnes of red gram (tur) production during TE 2018-19.

Table 2.3: Area, production and productivity of pulses in major pulse producing states in India
(Area in 000 ha, Production in 000 tonnes and Productivity in kg/ha)

Year	Tur			Bengal Gram			Green gram			Urad			Other pulses		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Andhra Pradesh															
TE 1990-91	339	64	189	66	40	595	491	145	295	487	379	789	140	42	308
TE 2000-01	446	181	405	170	151	871	468	194	416	482	316	651	97	31	314
TE 2005-06	498	196	494	386	476	1229	507	157	414	429	237	553	68	28	412
TE 2018-19	293	99	331	465	404	867	131	81	618	407	337	852	57	22	476
Bihar															
TE 1990-91	68	83	1168	162	140	864	221	118	534	98	58	595	599	435	696
TE 2000-01	59	80	1363	94	98	1033	186	111	597	58	40	682	411	382	863
TE 2005-06	37	45	1845	71	65	905	185	98	994	25	19	1272	324	260	1369
TE 2018-19	21	33	2706	60	70	2347	173	122	1486	11	10	1656	221	226	1986
Karnataka															
TE 1990-91	182	381	440	214	69	320	244	93	376	89	25	286	387	118	304
TE 2001-02	234	443	312	390	232	595	355	76	223	146	53	362	325	155	480
TE 2005-06	244	598	322	449	208	473	399	76	180	128	27	208	276	109	396
TE 2018-19	873	750	517	1132	650	573	412	131	318	103	52	501	150	52	323
Madhya Pradesh															
TE 1990-91	440	467	1059	2285	1629	710	221	97	384	651	187	287	1164	457	377
TE 2000-01	344	276	796	2405	2206	910	94	20	196	512	153	295	1128	555	450
TE 2005-06	323	234	1298	2702	2503	1664	87	27	587	545	197	644	810	405	965
TE 2018-19	517	601	1652	3308	4049	2292	405	281	1093	1837	1119	955	811	717	1416
Maharashtra															
TE 1990-91	895	615	700	656	367	559	767	316	412	439	198	454	396	148	408
TE 2000-01	1048	779	747	837	504	595	687	331	484	562	276	493	250	96	401
TE 2005-06	1077	710	664	882	531	594	640	222	419	543	263	478	163	53	337
TE 2018-19	1283	1153	871	1841	1650	878	452	207	348	352	153	436	-	-	-
Rajasthan															
TE 1990-91	26	15	534	1360	896	663	188	109	236	145	58	402	1238	368	1141
TE 2000-01	25	20	769	1488	1050	674	422	102	133	135	40	296	920	162	1125
TE 2005-06	19	11	736	1078	653	608	795	202	352	175	71	379	1423	429	1155
TE 2018-19	13	14	1015	1572	1646	1046	1941	925	474	689	402	589	1188	392	953
Uttar Pradesh															
TE 1990-91	488	621	1245	1301	1086	834	113	53	470	278	99	358	804	763	1002
TE 2000-01	416	517	1243	847	752	888	97	45	457	355	139	391	1011	908	791
TE 2005-06	380	376	1023	747	707	1835	80	37	475	543	199	367	1002	1005	1576
TE 2018-19	290	322	2035	545	644	2041	90	51	566	608	331	544	821	916	2056
Sum Total - Major States															
TE 1990-91	2256	1865	827	5830	4158	713	2001	838	419	2098	979	467	4341	2213	510
TE 2000-01	2338	1853	793	5841	4761	815	1954	803	411	2104	964	458	3817	2134	559
TE 2005-06	2334	1572	674	5866	4935	841	2294	743	324	2260	986	436	3790	2180	575
TE 2018-19	2417	2222	919	7791	8463	1086	3192	1667	522	3904	2352	602	3098	2273	734

Looking at the share of individual pulses in total pulses area and production, the share of area of Bengal gram increased from around 35 per cent in TE 1990-91 to 38 per cent in TE 2018-19 while its production share increased from 41 per cent to 50 per cent during the same time period. The share of urad area also increased from 13 per cent to 19 per cent while production share increased from 10 per cent to 14 per cent during the same time period. In a similar way, area and production share of

green gram also increased from 12 and 8 per cent during TE 1990-91 to 16 and 10 per cent, respectively in TE 2018-19. On the opposite, share of area and production declined for tur and other pulses during the same time period. Tur area and production share declined from 14 per cent and 19 per cent, in TE 1990-91 to 12 per cent and 13 per cent, respectively in TE 2018-19. Similarly, area and production share of other pulses declined from 26 and 22 per cent to 15 and 13 per cent, respectively during the same time period.

Table 2.4 Share of individual pulses to area and production of total pulses in major pulse growing states of India

	Tur		Bengal Gram		Green gram		Urad		Other pulses		Sum total	
Year	Area	Prodn	Area	Prodn	Area	Prodn	Area	Prodn	Area	Prodn	Area	Prodn
Andhra Pradesh												
TE 1990-91	21.67	9.32	4.20	5.75	31.41	21.01	31.11	54.98	8.95	6.13	9.22	6.66
TE 2000-01	26.08	20.29	9.93	16.93	27.37	21.74	28.15	35.33	5.67	3.47	10.36	8.30
TE 2005-06	25.91	16.15	20.05	39.32	26.34	12.96	22.30	19.53	3.52	2.34	11.41	10.50
TE 2018-19	31.19	23.16	28.64	37.79	12.01	10.21	22.99	25.46	5.17	3.38	6.63	5.55
Bihar												
TE 1990-91	5.83	9.87	13.81	16.55	18.81	14.02	8.35	6.87	51.07	51.54	6.95	8.30
TE 2000-01	7.15	11.11	11.43	13.57	22.54	15.42	6.97	5.54	49.75	53.02	5.03	6.76
TE 2005-06	5.55	9.14	11.00	13.21	28.52	19.98	3.77	3.75	49.70	52.77	3.88	4.68
TE 2018-19	3.91	6.82	12.02	14.71	35.85	26.58	2.01	1.89	45.46	49.28	2.38	2.72
Karnataka												
TE 1990-91	29.04	26.33	13.12	9.95	14.96	13.53	5.46	3.67	23.74	17.05	6.75	6.82
TE 2001-02	27.06	30.41	20.20	27.27	18.39	8.97	7.57	6.23	16.83	18.22	9.03	9.12
TE 2005-06	28.43	31.44	22.58	26.84	20.06	9.85	6.45	3.46	13.87	14.06	9.04	9.77
TE 2018-19	38.33	47.94	36.34	35.69	13.24	7.20	3.30	2.83	4.81	2.88	13.09	9.63
Madhya Pradesh												
TE 1990-91	9.31	16.62	48.38	57.93	3.50	1.77	13.79	6.65	24.65	16.27	28.81	28.22
TE 2000-01	7.64	8.34	53.38	66.65	2.31	0.94	8.48	4.62	25.04	16.78	27.92	30.53
TE 2005-06	7.21	6.91	60.49	73.94	1.95	0.80	12.19	5.82	18.03	11.91	27.00	32.32
TE 2018-19	7.47	8.81	47.80	59.35	5.84	4.12	26.55	16.41	11.69	10.50	33.71	39.86
Maharashtra												
TE 1990-91	27.17	37.56	19.92	22.43	23.29	19.33	13.34	12.12	12.04	9.04	19.08	16.35
TE 2000-01	29.51	38.32	23.58	24.81	19.35	16.28	15.83	13.57	7.05	4.74	21.08	18.89
TE 2005-06	31.48	37.84	25.77	28.28	18.72	11.81	15.88	14.04	4.76	2.82	19.98	17.08
TE 2018-19	30.61	35.29	43.95	50.52	10.80	6.35	8.40	4.68	0.00	0.00	19.25	18.63
Rajasthan												
TE 1990-91	0.83	1.00	42.67	59.78	5.91	7.27	4.54	3.87	38.85	24.52	17.89	14.38
TE 2000-01	0.80	1.45	47.03	77.43	13.34	7.55	4.26	2.98	29.08	11.93	18.62	13.07
TE 2005-06	0.52	0.73	29.74	43.40	21.92	13.40	4.82	4.72	39.24	28.53	21.10	13.11
TE 2018-19	0.24	0.40	28.57	47.73	35.27	26.82	12.52	11.65	21.59	11.36	26.48	19.90
Uttar Pradesh												
TE 1990-91	16.35	23.77	43.61	41.54	3.80	2.04	9.30	3.80	26.96	29.17	18.06	26.08
TE 2000-01	15.25	21.90	31.05	31.84	3.55	1.91	13.00	5.87	37.04	38.45	16.98	22.45
TE 2005-06	13.80	16.10	27.14	30.26	2.91	1.57	19.75	8.52	36.42	43.00	16.63	22.31
TE 2018-19	12.33	14.23	23.15	28.45	3.84	2.26	25.84	14.61	34.83	40.45	11.54	13.34
Sum Total - Major States												
TE 1990-91	13.65	18.55	35.28	41.36	12.11	8.34	12.70	9.74	26.27	22.01	100	100
TE 2000-01	14.56	17.62	36.38	45.28	12.17	7.64	13.11	9.17	23.78	20.29	100	100
TE 2005-06	14.11	15.09	35.46	47.38	13.87	7.13	13.66	9.47	22.91	20.93	100	100
TE 2018-19	11.85	13.09	38.19	49.85	15.65	9.82	19.14	13.85	15.18	13.39	100	100

Analysis of share of major states in total pulses area and production in all India brings out interesting facts. Among the 7 major pulse producing states, pulses area and production share increased in three states, viz., Karnataka, Madhya Pradesh and Rajasthan, while in other three states the share declined, viz., Andhra Pradesh, Bihar and Uttar Pradesh and the share remained constant in one state, i.e., Maharashtra, from TE 1990-91 to TE 2018-19. In Madhya Pradesh the pulses area

share in all India increased from 29 per cent in TE 1990-91 to 34 per cent in TE 2018-19 while production share increased from 28 per cent to 40 per cent during the same time period. Rajasthan's share of pulses in area and production in all India increased from 18 and 14 per cent in TE 1990-91 to 26.5 and 20 per cent, respectively in TE 2018-19. During the same time period Karnataka share in area increased from 7 to 13 per cent and production share increased from 7 to 9.6 per cent. On the opposite, Uttar Pradesh's share in area declined from 18 per cent to 11.5 per cent and production share declined from 26 per cent to 13 per cent during the period of three decades. Similarly, Andhra Pradesh contributed 9 and 7 per cent share in all India area and production under pulses in TE 1990-91 which came down tgo 6.7 and 5.6 per cent in TE 2018-19. Bihar also saw a decline in share of pulses in area and production from 7 and 8 per cent, respectively in TE 1990-91 to 2.4 and 2.7 per cent in TE 2018-19. Maharashtra almost continued its 19 per cent share in area under pulses while its production share slightly increased from 16.4 per cent to 18.6 per cent during the period from TE 1990-91 to TE 2018-19.

Table 2.5: Growth rate in area and production of individual pulses during TE 1990-91 to TE 2018-19 (per cent per annum)

	Tur		Bengal Gram		Green gram		Urad		Other pulses	
	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod
Andhra Pradesh	-0.52	1.57	7.22	8.61	-4.61	-2.06	-0.64	-0.42	-3.16	-2.28
Bihar	-4.11	-3.24	-3.49	-2.45	-0.87	0.12	-7.51	-6.09	-3.50	-2.31
Karnataka	5.76	2.45	6.13	8.34	1.89	1.23	0.52	2.65	-3.33	-2.88
Madhya Pradesh	0.58	0.91	1.33	3.31	2.19	3.87	3.77	6.60	-1.28	1.62
Maharashtra	1.29	2.27	3.75	5.52	-1.87	-1.50	-0.79	-0.92	-	-
Rajasthan	-2.45	-0.25	0.52	2.20	8.69	7.94	5.72	7.16	-0.15	0.23
Uttar Pradesh	-1.84	-2.32	-3.06	-1.85	-0.81	-0.14	2.83	4.40	0.07	0.65

Table 2.5 presents compound growth rate in area and production of individual pulses in major pulse growing states during the period of TE 1990-91 to TE 2018-19. Growth pattern of pulse crops shows that Bengal gram observed negative growth in area and production only in Bihar and Uttar Pradesh whereas all other states observed positive and high growth rate. Highest positive growth was observed in Karnataka and Andhra Pradesh with around 7 per cent per annum growth in area and more than 8 per cent per annum growth in production during this period of last three decades. Maharashtra, Madhya Pradesh and Rajasthan also observed around 2-3 per cent growth in area and 3-5 per cent growth in production during this period. Green gram (moong) observed around 8 per cent growth in area and production in Rajasthan. Similarly, urad (black gram) observed 5 to 7 per cent growth in area and production in Rajasthan and Madhya Pradesh. Red gram (tur) observed 6 per cent growth in area and 2.5 per cent growth in production in the state of Karnataka. Highest negative

growth rate of more than 6 per cent was observed in urad for both area and production in Bihar. Thus the above analysis presents three decades of history of various pulse crops grown in major pulse growing states.

2.4 Summary of the chapter

- As pulses are food grain crops, on average around 65 to 70 per cent cultivated area was under all food grain crops in the major pulse growing states. Madhya Pradesh and Rajasthan had the highest area under pulses, 66 lakh and 59 lakh hectares, respectively, followed by Maharashtra 40 lakh hectares, Karnataka, 34 lakh hectares, Uttar Pradesh 23 lakh hectares, Andhra Pradesh 13 lakh hectares and Bihar 5 lakh hectares. Except Uttar Pradesh, all other states observed enhancement in area under pulses from 1990-91 onwards seemingly because of hike in prices of pulses as well as government encouragement towards pulses through various pulse incentive programmes, like ISOPOM, Food Security Mission etc., to meet the increasing deficit in demand and supply within the country.
- Among individual pulses, in Madhya Pradesh, Bengal gram and urad occupied dominant place, in Maharashtra, Karnataka and Andhra Pradesh, it was red gram and Bengal gram which were major pulse crops grown. In Bihar and Rajasthan on the other hand, green gram (moong) dominated in pulses area. The share of area of Bengal gram increased from around 35 per cent in TE 1990-91 to 38 per cent in TE 2018-19 while its production share increased from 41 per cent to 50 per cent during the same time period. The share of urad area also increased from 13 per cent to 19 per cent while production share increased from 10 per cent to 14 per cent during the same time period. In a similar way, area and production share of green gram also increased from 12 and 8 per cent during TE 1990-91 to 16 and 10 per cent, respectively in TE 2018-19. On the opposite, share of area and production declined for tur and other pulses during the same time period. Tur area and production share declined from 14 per cent and 19 per cent, in TE 1990-91 to 12 per cent and 13 per cent, respectively in TE 2018-19. Similarly, area and production share of other pulses declined from 26 and 22 per cent to 15 and 13 per cent, respectively during the same time period.
- Analysis of share of major states in total pulses area and production in all India brings out interesting facts. Among the 7 major pulse producing states, pulses area and production share increased in three states, viz., Karnataka, Madhya Pradesh and Rajasthan, while in other three states the share declined, viz., Andhra Pradesh, Bihar and Uttar Pradesh and the share remained constant in one state, i.e., Maharashtra, from TE 1990-91 to TE 2018-19.

Chapter 3

Socio Economic Characteristics and Cropping Pattern of Selected Households

Main objective of this study is to evaluate the programme of promotion of pulses production through Seed Mini-kits Programme in Pulses. As has been described in chapter one, the latest varieties not older than 10 years are popularized through distribution of seed minikits free of cost to the farmers. The purpose is to ensure, that the identified farmer is capable of raising the crop with care and diligence such that the plot serves as a good demonstration to other farmers. This study looks into various aspects of implementation of this programme like how efficiently the distribution of seeds is taking place; to what extent scheme is relevant and useful from the viewpoint of farmers; and whether seed minikits have any significant impact on productivity. The present study examines the need, application, pertinence and efficiency in distribution of seed minikits.

The study has been carried out in 5 different states of India namely, Karnataka, Bihar, Madhya Pradesh, Maharashtra and Rajasthan. For the selection of sample in each state, two districts were selected, one each from irrigated and dryland conditions based on highest seed minikits distributed during the reference period of 2017-18 and 2018-19. Among the selected districts, a sample of 100 seed minikit beneficiary farmers and 50 control group pulse growing farmers were selected using random sampling method. In this way, a total number of 200 beneficiaries and 100 non beneficiaries were selected in each state. Thus, the total sample consists of 1000 beneficiaries and 500 non beneficiary farmers at the aggregate in five states. These selected respondents were further categorized into marginal (< 2.5 acres), small (2.5 – 5 acres), medium (5 - 10 acres) and large (> 10 acres) land holding categories.

In order to select households, the seed minikits distribution list was collected for the year 2017-18 and 2018-19. While selecting the households, the sample was included for both these years. We avoided those farmers who received seed minikits distributed in the year 2019-20 as at the time of survey it would not be feasible to check the replication and reproductive use of seed minikits received during 2019-20. During the field survey, we collected information on area sown, productivity and resources used for seed minikits pulse crops as well as the reproduced seed pulse crops. In order to capture authentic data, efforts were made to interview the heads of households. The reference period of survey data was 2018-19, i.e., Kharif (July-Nov 2018), Rabi (Nov 2018 to March 2019) and Summer (March-June 2019).

3.1 Demographic profile of selected household farmers

The profile of the selected farmers who have been both; user and non-users of the pulses seed mini kits (SMK) are summarized in **Table 3.1**. They come from families having an average household size of 5.5 members, with the largest in Bihar with 7.2 members per family, while Karnataka's

household size among the sampled farmers was 2.63 members. Although, this study involved distribution and comparison of the efficacy of the mini kits among women farmers in the prime pulse growing regions of the country, a majority of those interviewed were male members in the age group of 30-60 years. Only in the case of Rajasthan, 76 per cent of the responded belonged to female category, in Bihar female respondent were less than 20 per cent and in Madhya Pradesh 10 per cent whereas in Karnataka and Bihar their percentage was miniscule only 7 and 2 per cent, respectively. A majority of the respondents in Bihar, Karnataka and Maharashtra were educated up to matriculation (10^{th} standard) and above, while 72 per cent of the farmers selected in Madhya Pradesh completed their primary education and 56.7 per cent of those in Rajasthan were illiterate. Within the selected farmer households, a higher average number of members in Rajasthan were practicing farming, compared to the other study States. While, Bihar had the highest average family size of over 7 members, only around 1.3 members among them where practicing farming. The highest number of family members practicing farming was found in Rajasthan 3.6, Maharashtra and Madhya Pradesh slightly above 3 while Karnataka average was 2.3 members. Respondents from Madhya Pradesh had the highest years of experience in farming (34.2 years) followed by those in Karnataka (29.1 years) and Bihar (26.5 years). A majority of the selected farmers in four of the five States were OBC households, while a majority of the farmers from Karnataka were from the General category. The main occupation of these farmers was agriculture and allied activities followed by contributing agriculture labour during off-season or lean seasons in their farming cycle. The subsidiary occupation also included the agriculture and non-agriculture related labour. A few farmers in Karnataka (29 per cent) ran their own business/service as their subsidiary activity. The average annual income per farm was highest in Maharashtra (Rs. 248 thousand) followed by Rajasthan (Rs. 118 thousand), Madhya Pradesh (Rs. 113 thousand), Karnataka (Rs. 111 thousand) and the lowest farm income was found in Bihar (Rs. 29 thousand) only. Average earnings from non agricultural sources averaged at Rs 97 thousand in Maharashtra, Rs 47 thousand in Karnataka, Rs 36 thousand in Rajasthan, Rs 31 thousand in Madhya Pradesh and lowest Rs 9 thousand in Bihar.

3.2 Land Holding & Irrigation attributes

The owned holding size of the selected farmers varied from 1.74 acres to 6.0 acres among the five selected states (**Table 3.2**). While, a few farmers leased in land, which was mostly less than an acre, except for a few medium and large farmers in Madhya Pradesh who on average leased in 2.14 and 7.15 acres, respectively. On average, the rental value to lease an acre of land was almost double in Madhya Pradesh, Rs 6400 per acre compared to other selected state where lease amount averaged around Rs 3000 to 3200 except Maharashtra where no leasing was observed among the selected farmers. The rental value was possibly highest in Madhya Pradesh as among the selected states, Madhya Pradesh had higher area irrigated which supported double cropping in the leased land. Amidst various farm size holdings, there was large fluctuation in rental value across different states. Nevertheless, only a miniscule area among selected states was observed uncultivable.

Comparing the average operated area among selected states, Rajasthan had the highest net operated area of 6.11 acres, followed by Maharashtra 5.62 acres, Karnataka 4.14 acres, Madhya Pradesh 4.1 acres and Bihar 2.61 acres. Correspondingly the net and gross irrigated area in these States also followed the similar order. The cropping intensity among the marginal and medium farmers of Bihar was the highest among the study states at 209 and 208, respectively indicating that net sown area by all cultivated farmers in the state were having double cropping, i.e., all operated area being sown during both kharif and rabi seasons. Bihar was followed by farmers across all land holding sizes in Madhya Pradesh where it hovered around 197 to 199 and the lowest among large farmers in Karnataka (104.80) indicating that large farmers in Karnataka were sowing only one season crop in a year.

Table 3.1: Profile of the selected farmers (% of households)

Particulars	Details	Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
No. of Households		300	342	300	300	300
Average size of HH		7.22	2.63	6.19	5.01	6.06
Gender of Respondent (%)	Male	81.00	93.27	90.00	98.00	24.00
	Female	19.00	6.73	10.00	2.00	76.00
Age of the Respondent (%)	<30	4.00	5.84	6.00	10.33	8.67
	30-60	90.33	71.34	77.66	74.33	80.67
	>60	5.67	22.80	16.34	15.33	10.67
Education status of Respondent, number of years of education (%)	Illiterate	---	19.88	11.33	14.33	56.67
	Up to Primary (5)	---	15.20	72.00	16.67	20.33
	Up to Middle (8)	32.33	14.62	6.67	13.00	10.00
	Up to Matric (10)	44.00	26.90	4.33	23.00	6.00
	Up to + 2	17.33	13.16	3.33	19.00	4.00
	Up to graduate	6.34	5.56	1.00	10.67	3.00
	Above graduate	---	4.68	1.33	3.33	0.00
Average members of family doing farming		1.11	2.28	3.00	3.12	3.58
Average years of farming experience		26.51	29.14	34.19	26.60	24.26
Caste (% of households)	SC	5.00	14.91	28.67	9.00	37.67
	ST	---	8.48	7.67	28.00	9.67
	OBC	71.00	19.88	40.00	42.33	48.67
	General	24.00	56.73	23.67	20.67	4.00
Main occupation of respondent (%)	Agriculture and allied	82.67	99.71	98.81	100.00	74.33
	Agricultural labour	16.67	0.29	1.19	-	20.00
	Non-agricultural labour	---	0.00	0	-	1.33
	Self business/ services	0.33	0.00	0	-	2.33
	Salaried/pensioners	0.33	0.00	0	-	2.00
	Others	---	0.00	0	-	0.00
Subsidiary occupation of respondent (%)	Agriculture and allied	11.00	9.72	2.49	-	25.67
	Agricultural labour	2.00	26.39	40.94	4.00	35.67
	Non-agricultural labour	7.33	20.83	13.80	2.00	8.00
	Self business/ services	3.67	29.16	19.84	4.67	7.00
	Salaried/pensioners	---	9.72	12.68	4.67	0.67
	Others	---	4.17	10.12	-	0.00
Average Annual Income (Rs.) Per Farm	Agriculture and allied	28721	110827	112740	247722	118383
	Non-agricultural Sources	9005	46836	30876	96593	35597

Table 3.2: Characteristics of operational holdings (acres per household)

States	Farm size	Owned land	Non cultivable	Leased- in	Leased -out	Average Rental (Rs/acre)	NOA	Net Irrigated area	GCA	Cropping intensity
Bihar	Marginal	1.34	--	0.19	0.11	8078	1.43	1.43	2.99	209
	Small	1.95	--	1.35	0.02	3748	3.29	3.27	5.96	181
	Medium	2.91	--	2.87	---	2349	5.78	5.70	12.02	208
	Large	---	--	---	---	---	---	---	---	---
	Total	**1.74**	**--**	**0.93**	**0.06**	**3792**	**2.61**	**2.60**	**5.06**	**194**
Karnataka	Marginal	1.95	0.03	0	0.03	10857	1.89	0.56	2.84	150.65
	Small	3.75	0.01	0.09	0.02	5471	3.81	1.44	4.97	130.29
	Medium	7.09	0.12	0.12	0.02	3471	7.07	2.84	8.30	117.34
	Large	16.83	0.00	0.56	0.00	2400	17.38	10.13	18.22	104.80
	Total	**4.12**	**0.04**	**0.08**	**0.02**	**5074**	**4.14**	**1.64**	**5.23**	**126.39**
Madhya Pradesh	Marginal	1.79	0.00	0.01	0.00	6250	1.80	1.64	3.54	197
	Small	3.53	0.01	0.16	0.00	6594	3.68	3.40	7.3	198
	Medium	4.84	0.01	2.41	0.00	6428	7.24	6.74	14.41	199
	Large	8.11	0.00	7.15	0.00	6386	15.26	13.42	30.28	198
	Total	3.30	0.01	0.81	0.00	6420	4.10	3.74	8.12	198
Maharashtra	Marginal	1.92	0.04	-	-	-	1.88	1.42	2.79	148.36
	Small	4.10	0.06	-	-	-	4.04	2.42	4.91	121.55
	Medium	7.73	0.52	-	-	-	7.21	4.25	11.64	162.13
	Large	16.46	0.49	-	-	-	15.97	10.47	19.24	121.00
	Total	**5.80**	**0.19**	**-**	**-**	**-**	**5.62**	**3.52**	**7.44**	**133.57**
Rajasthan	Marginal	1.63	0.00	0.12	0.00	3245	1.74	1.24	2.94	168.66
	Small	4.01	0.14	0.13	0.00	6000	4.00	1.81	5.73	143.48
	Medium	7.26	0.08	0.16	0.00	3245	7.33	3.00	10.27	140.08
	Large	17.09	0.05	0.48	0.00	2500	17.52	5.02	22.22	126.80
	Total	**6.00**	**0.07**	**0.18**	**0.00**	**3245**	**6.11**	**2.42**	**8.43**	**137.97**

Note: NOA: Net Operated Area; GCA: Gross Cropped Area

Table 3.3: Source of irrigation of net operated area (%)

States	Farm size	Only canal	Bore well	Dug well	Tank	Others	Rain fed area	Actual Water Charges (Rs/acre)	Total operated area
Bihar	Marginal	--	100.00	--	--	--	---	746	100
	Small	--	100.00	--	--	--	0.03	761	100
	Medium	--	100.00	--	--	--	0.08	844	100
	Large	--	--	--	--	--	--	--	100
	Total	**--**	**100.00**	**--**	**--**	**--**	**0.02**	**763**	100
Karnataka	Marginal	9.57	18.29	1.15	0.00	0.58	70.41	949	100
	Small	10.03	27.03	0.51	0.26	0.00	62.18	1332	100
	Medium	9.19	30.96	0.00	0.00	0.00	59.85	170	100
	Large	16.30	41.99	0.00	0.00	0.00	41.71	84	100
	Total	**10.38**	**28.62**	**0.39**	**0.11**	**0.09**	**60.42**	**698**	100
Madhya Pradesh	Marginal	32.74	37.82	13.51		7.06	9.10	1864	100
	Small	31.54	36.26	19.02		5.61	7.75	1672	100
	Medium	53.7	33.05	1.01		5.27	6.97	1593	100
	Large	60.22	12.33	10.79		4.63	12.03	1619	100
	Total	**43.15**	**30.7**	**12.00**		**5.56**	**8.69**	**1687**	**100**
Maharashtra	Marginal	4.95	17.14	36.60	4.88	12.15	24.29	1184	100
	Small	0.00	4.07	40.24	6.74	8.97	39.99	-	100
	Medium	0.00	3.59	37.12	5.20	13.03	41.06	-	100
	Large	0.00	11.09	32.82	0.00	21.65	34.44	-	100
	Total	**0.31**	**7.11**	**36.80**	**4.01**	14.35	**37.40**	**1000**	**100**
Rajasthan	Marginal	19.7	37.3	5.4	--	8.8	28.7	3125	100
	Small	14.5	23.8	0.0	--	7.1	54.8	3125	100
	Medium	13.9	16.8	0.0	--	10.3	59.1	3125	100
	Large	5.5	19.3	0.0	--	3.9	71.3	3125	100
	Total	**11.2**	**20.8**	**0.5**	**--**	**7.1**	**60.4**	**3125**	**100**

In terms of irrigation (**Table 3.3**), the selected farmers indicated that the net operated area in Bihar was solely depended on water from bore wells, with the actual water charges at Rs.763 per acre. In Karnataka, bore wells accounted for 28.6 per cent of the irrigation, while a major proportion of the operated area was rain fed (60 per cent). In Madhya Pradesh, farmers sourced their water for irrigation from canals (43 per cent) and bore wells (30.7 per cent). In Maharashtra, sources of irrigation were shared between dug well (36.8 per cent) and other irrigation sources (26 per cent) while rain fed farms share was around 37 per cent. Most of the net operated area in Rajasthan for the selected farmers of the study was rain fed (60.4 per cent), although Rajasthan had the highest actual water charges among the study states at Rs.3125 per acre followed by Madhya Pradesh (Rs.1687/acre) and Maharashtra (Rs.1000/acre).

3.3 Cropping pattern

During the reference year 2018-19, Paddy and other crops cumulatively (66.5 per cent) accounted for a major percentage of the irrigated GCA in Bihar. In Karnataka, Paddy (6.6 per cent) and others (5.6 per cent) were the two major crops under irrigation, while under rain fed crops, 20 per cent of the GCA was under ragi, followed by green gram (8.4 per cent), red gram (8.3 per cent) and other pulses (8.1 per cent). Coconut accounted for 12.3 per cent of the GCA under perennial crops in this State.

Other Pulses (18.5 per cent) were major irrigated crops in Madhya Pradesh followed by commercial crops (17 per cent), with only a small percentage of crops that were rain fed, namely others pulses (4 per cent), Oilseeds (3.6 per cent) and Black gram (1.3 per cent) to highlight a few. Similarly, in Maharashtra, there were a significant number of irrigated crops, viz., commercial crops (22.4 per cent), Others (20.9 per cent), other pulses (11.2 per cent) and approximately 8 per cent were rainfed such as oilseeds and commercial crops.

The cropping pattern in Rajasthan indicated that over 67 per cent of commercial crops were irrigated, while Green gram (28 per cent) and other cereals (10.4 per cent) were among the crops that were rainfed. The cropping pattern was worked out based on gross cropped area (GCA) in these study States, starting with largest area, Rajasthan with a GCA of 2529.05 acres, followed by Karnataka (1790.58 acres), Bihar (1517.73 acres), Maharashtra (1371.22 acres) and Madhya Pradesh (2436.01 acres) as given in **Table 3.4**.

3.4 Value of output, cost and net returns – aggregate all crops

Comparison of value of output per acre (including both main outputs, as well as by products) of all the crops at the aggregate which also indicates value of productivity per acre for the selected households makes an interesting comparison among the selected five states. Value of productivity was highest in Madhya Pradesh, Rs 43 thousand, followed by Karnataka, Rs 34 thousand, Maharashtra, Rs 30 thousand, Rajasthan Rs 21.5 thousand and it was lowest in Bihar, Rs 16 thousand per acre. However, against the trends of highest productivity in Madhya Pradesh, the cost

per acre was lowest in Madhya Pradesh Rs 7.8 thousand per acre, followed by Bihar Rs 7.9 thousand, Maharashtra Rs 10 thousand, Rajasthan Rs 11 thousand and highest in Karnataka Rs 16 thousand.

Table 3.4: Cropping pattern of selected farmers Bihar (% of GCA for the reference year 2018-19)

Name of the crop	Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
Irrigated crops					
Red gram	-	1.95	-	7.07	-
Green gram	-	1.69	1.30	0.07	2.17
Black gram	-	2.32	14.33	0.07	10.52
Paddy	17.22	6.56	12.03		0.34
Commercial crops	-	1.99	17.02	22.43	10.79
Other Pulses	-	2.84	18.52	11.22	7.7
Ragi	-	3.29	-	-	-
Wheat	-	-	24.26	-	6.53
Others	49.3	5.57	2.83	30.95	14.97
Rainfed crops					
Ragi	-	20.00	-	-	-
Other cereals	-	2.98	0.72	5.86	10.44
Red gram	-	8.31	-	4.72	
Green gram	-	8.40	0.04	-	28
Black gram	-	6.07	1.30	-	0.59
Other Pulses	24.52	8.09	4.04	1.39	1.37
Others	-	0.52	-	-	2.88
Commercial crops	-	5.03	-	8.13	3.26
Oilseeds	8.96	0.89	3.62	8.53	0.48
Perennial crops					
Coconut	-	12.34	-	-	-
Areca nut	-	1.17	-	-	-
Gross cropped area	-	100.00	100	100	-
Gross cropped area (acres)	**1517.73**	**1790.58**	**2436.01**	**1371.22**	**2529.05**

Given the above comparison of value of productivity and cost of cultivation, the net returns/profits, i.e., the value of output after subtracting cost of cultivation provides us actual returns obtained by farmers from farming a piece of land during a particular period. Per acre net returns during the reference year were highest Rs 35 thousand per acre in Madhya Pradesh, followed by Rs 19 thousand in Maharashtra, Rs 18.5 thousand in Karnataka, Rs 11 thousand in Rajasthan and only Rs 8 thousand in Bihar. Aggregate income from farming per household also had the similar trends. Madhya Pradesh once again topped in household income with average value of Rs 144 thousand per household, followed by Maharashtra Rs 109 thousand, Karnataka Rs 77 thousand, Rajasthan Rs 66 thousand and Bihar Rs 21 thousand only.

Comparing across various farm size holdings, in Bihar the selected farmers revealed that in terms of production cost, the material cost was the highest among the marginal farm holders at Rs 7 thousand per acre, while labour cost accounted for only Rs 2 thousand per acre. Their value of output both; main and by products included was the highest among the marginal farmers (Rs16,7 thousand/acre), while the net return was the highest for small farmers (Rs 8.8 thousand/acre) and the

gross farm income from cultivated land was the highest for medium farmers in Bihar (Rs 41 thousand/household).

Table 3.5: Value of output, cost and net returns for the survey year – aggregate of all crops (Rs)

States	Farm Size	Production (Qtl/acre)			Value of output (main + by-product) (Rs/acre)	Cost of production (Rs/acre)		Net returns (Farm business income) (Rs/acre)	Gross Farm income from cultivated area (Rs) per HH
		Irrigated	Rainfed	Total		Material cost	Labour cost		
Bihar	Marginal	10.91	5.71	9.07	16748	7109	2001	7638	10922
	Small	10.50	5.42	8.83	15981	5372	1849	8760	28820
	Medium	9.61	3.87	7.77	15276	6322	1863	7091	40986
	Large	--	--	--	--	--	--	--	--
	Total	**10.43**	**5.20**	**8.68**	**16053**	**6068**	**1895**	**8090**	**21115**
Karnataka	Marginal	-	-	-	32639	9895	5976	16769	31611
	Small	-	-	-	34203	10183	5811	18209	69441
	Medium	-	-	-	34022	9362	5456	19205	135833
	Large	-	-	-	37245	10780	6015	20450	355462
	Total	-	-	-	**34240**	**9938**	**5743**	**18559**	**76866**
Madhya Pradesh	Marginal	7.49	5.12	7.30	42898	4252	3943	34703	62465
	Small	7.71	4.69	7.48	41600	3804	3689	34107	125514
	Medium	8.24	4.23	7.97	43589	4218	4020	35351	255941
	Large	8.81	3.25	8.16	44748	3917	3869	36963	564040
	Total	8.03	4.25	7.71	42966	4004	3850	35112	143810
Maharashtra	Marginal	22.77	3.72	19.71	29183	4698	5537	18948	35633
	Small	37.62	5.22	26.64	32464	4699	5101	22664	91652
	Medium	42.24	8.65	31.09	29543	5462	6114	17967	129545
	Large	31.50	4.74	24.92	27340	4784	5257	17299	276261
	Total	35.41	6.11	26.76	29724	4932	5461	19331	108575
Rajasthan	Marginal	13.00	0.84	13.84	27766	3822	8743	15201	26450
	Small	10.14	1.60	11.74	24106	3553	8408	12144	48576
	Medium	6.57	1.95	8.52	20278	3035	7131	10112	74121
	Large	3.34	2.58	5.92	19552	3048	7218	9286	162691
	Total	**6.75**	**1.99**	**8.74**	**21520**	**3219**	**7569**	**10732**	65573

In Karnataka, the overall crop production in the state among the selected farmers was Rs 34 thousand and was the highest among large farmers Rs 37 thousand per acre and lowest among marginal farmers Rs 33 thousand per acre. The material cost of production was highest among large farmers Rs 10.8 thousand per acre and the labour cost Rs 6 thousand per acre among the large farmers. The net return was also highest Rs 20 thousand per acre among large farmers and the gross income per household was Rs 3.6 lakh among large farmers in comparison to Rs 32 thousand among the marginal farmers in the state.

In Madhya Pradesh, whereas the value of output was highest among large farmers (Rs 45 thousand/acre), the average production cost was highest for medium farmers (Rs 8 thousand per acre including material and labour cost), yielding highest net returns for large farmers (Rs 37 thousand per acre) and an average gross farm income of Rs 5.6 lakh per household.

In Maharashtra, the small farmers obtained the highest output value (Rs 32 thousand/acre) across all land sizes by using the least production costs, viz., material cost (Rs 4.7 thouand/acre) and labour cost (Rs.5 thousand/acre) and earned net returns of Rs 23 thousand per acre with a gross farm income from cultivated land of Rs 92 thousand per household.

Among all the study states, the above three study states namely, Maharashtra, Madhya Pradesh and Karnataka earned the highest gross farm income from cultivated land with large farmers in Madhya Pradesh (Rs 5.64 lakh per household) followed by large farmers in Karnataka (Rs 3.55 lakh per household) and Maharashtra (Rs 2.76 lakh per household). In Rajasthan, marginal farmers received the highest output value (Rs 28 thousand/acre) and net returns (Rs 15 thousand/acre), while the medium farmers spent the least on material and labour cost and the gross farm income from cultivated land per household was the highest among large farmers, Rs 1.63 lakh per household.

3.5 Summary of the Chapter

- All the selected farmers come from families with an average household size of 5.53 members and a significant number of the selected farmers surveyed were male members in the age group of 30-60 years coming from largely OBC households.
- Although, this study involved distribution and comparison of the efficacy of the mini kits among women farmers in the prime pulse growing regions of the country, a majority of those interviewed were male members in the age group of 30-60 years. Only in the case of Rajasthan, 76 per cent of the responded belonged to female category. Comparing the average operated area among selected states, Rajasthan had the highest net operated area of 6.11 acres, followed by Maharashtra 5.62 acres, Karnataka 4.14 acres, Madhya Pradesh 4.1 acres and Bihar 2.61 acres. Cropping intensity was highest in Madhya Pradesh
- As a source of irrigation, Bihar solely depended on bore-wells, Karnataka and Rajasthan's net operated area were largely rainfed (61 per cent), Madhya Pradesh's net operated area was irrigated by only canals (43.15 per cent) and Maharashtra depended on rainfall as well as used water from canals for irrigation.
- Among study states, Maharashtra, Madhya Pradesh and Karnataka earned the highest gross farm income from cultivated land with large farmers in Madhya Pradesh (Rs 5.64 lakh per household) followed by large farmers in Karnataka (Rs 3.55 lakh per household) and Maharashtra (Rs 2.76 lakh per household). In Rajasthan, marginal farmers received the highest output value (Rs 28 thousand/acre) and net returns (Rs 15 thousand/acre), while the medium farmers spent the least on material and labour cost and the gross farm income from cultivated land per household was the highest among large farmers, Rs 1.63 lakh per household.

Chapter 4

Distribution Efficiency of Seed-minikits of Pulses Comparisons between Users/Non-Users

4.1 Distribution pattern of SMK

Government of India intended distributing over 20 lakh mini-kits of seeds worth Rs 82.01 crore as part of its strategy to boost pulses production and productivity in the kharif season of 2021-22 crop year (July-June). Under this programme, seeds that are available either with the Central Seed Agencies or with States Agencies are distributed free of cost to increase area through inter-cropping and through sole pulse crops. This push to increase distribution is evident, with the doubling of the number of mini-kits distributed during the reference years (**Table 4.1)** in the selected states under study.

During the year 2018-19 in Bihar, a majority of SMKs were distributed among marginal (39 per cent) and small farmers (51 per cent), with the remaining amount allocated to medium farmers. In Madhya Pradesh, over 83 per cent of the SMKs were distributed to the marginal and small farmers, while medium and large farmers received only 17 per cent of the remaining kits distributed during the year 2018-19. Respondents classified as small farmers in Maharashtra received 50 per cent of the kits distributed in 2017-18. While in Rajasthan, 37.5 and 31 per cent of the minikits were distributed among the marginal and small farmers, respectively. Thus, given the objective of distribution of seed mini kits among the smaller size holdings being the marginalized groups, the objective seems to be achieved at the aggregate of distribution of kits largely among marginal and small farmers.

4.2 State-wise productivity and net returns of pulses among user and non user of SMK

This section provides details of production and net returns related to various pulses grown by selected farmers in the selected states tabulated based on the four farm sizes.

***Bihar*:**

In Bihar, selected farmers were growing two pulse crops namely red gram and lentils using the seed provided under seed mini-kits as well as those who were not provided any seed kits (i.e., the control group farmers). The aggregate data shows that area under red gram with SMK was 0.03 acres per household while control group was growing 011 acres per household. In the case of lentils, area under SMK was 0.68 acres compared to control group of 0.87 acres per household. Comparing the value of output per acre among the two crops, in both the cases, productivity was higher for SMK as compared to the control group. The value of output and net returns were higher at Rs 17844 per acre and Rs 13,689 per acre, respectively for farmers with SMK compared to Rs 16719 and Rs 8870 per

acre for the control group for the aggregate average of the above mentioned two crops. However, there was no significant difference in net price received by SMK and control farmers. For red gram, the net price obtained by SMK farmers was Rs 3117 per quintal compared to Rs 3109 per quintal by control group. Similarly, for lentils, net price obtained was Rs 3128 and Rs 3140 for the two groups, respectively. Sorting the data based on land holding size, medium farmers with SMK obtained the highest net returns Rs 16192 compared to control farmers of Rs 11506 for the aggregate of these two crops. Crop wise for red gram growing farmers, the cost of production was the least for marginal farmers at Rs 4285 per acre and the difference of net returns among SMK and without SMK (i.e., SMK - Without SMK) was the highest at Rs 3752, whereas, the net price obtained per quintal for farmers using SMK and non-users of SMK was only marginally different at Rs 3083 and Rs 3071, respectively. In terms of lentil, the cost of production for selected farmers with SMK was the least for medium farmers and they earned the highest net returns of Rs 16,494 per acre, while a lentil farmer without SMK faced the highest production cost of Rs 8456 per acre among the different land sizes and obtained much less returns of Rs 12760 per acre (**Table 4.2**).

Karnataka:

There were three pulse crops grown in Karnataka, namely red gram (tur), black gram (urad) and green gram (moong). On average, the area under pulses was more among the selected farmers without SMK at 1.09 acres per household compared to 0.9 acre among the SMK farmers in Karnataka. The value of output was higher at Rs. 16,514 per acre for those with SMK and Rs. 12,738 per acre for those farmers without SMKs. Although, the cost of production was more for farmers using SMKs at Rs. 6458 per acre as compared to Rs. 6168 per acre for farmers without SMK, the net returns were much higher for farmers using SMK at Rs. 10,094 per acre compared to Rs 6843 and the net price obtained per quintal was also higher (Rs. 5398/qtl.) compared to control (Rs 5201/qtl). Among those with SMK, the small farmers with SMK were observed to have the least production costs at Rs. 6223 per acre and reaped a net return of Rs. 9475 per acre. They also received the highest net price of Rs. 5445 per quintal, above the State's study average of Rs 5398.

Red gram producers with SMK had a lower cost of production at Rs. 6738 per acre and earned a net return of Rs. 11241 per acre when compared with farmers without SMK, who earned only Rs.7672 per acre. These farmers also obtained a higher net price of Rs. 5404/quintal using SMK. Among the land holding classes, the marginal red gram farmers with SMK earned the highest net returns of Rs. 10,758/acre with production cost of Rs. 6585 per acre and on an area of 0.87 acres per household, less than the aggregate area of 0.98 acres under pulses in the State. However, marginal farmers without SMK obtained a higher net price of Rs. 6430/quintal but earned only Rs 7864 due to partly higher cost and partly due to low per acre value of output compared to SMK

farmers. Surprisingly, the net returns among large farmers using SMK was very low (Rs.441/acre) as compared with those without SMK at Rs.21433 per acre.

Table 4.1: Number of Seed minikits distributed among selected farmers

States	Farmers	2017		2018	
		Numbers	%	Numbers	%
Bihar	Marginal	-	-	81	38.57
	Small	-	-	107	50.96
	Medium	-	-	22	10.47
	Large	-	-	-	-
	Total	-	-	210	100
	Percentage of selected of total Beneficiaries in State	-	-	59999	0.35
Karnataka	Marginal	23	8.65	58	21.80
	Small	25	9.40	90	33.83
	Medium	16	6.02	46	17.29
	Large	2	0.75	6	2.26
	Total	66	24.81	200	75.19
	Percentage of selected of total Beneficiaries in State	33550	0.20	62100	0.32
Madhya Pradesh	Marginal	14	48.28	71	41.52
	Small	14	48.28	73	42.69
	Medium	1	3.45	17	9.94
	Large	0	0	10	5.85
	Total	29	100	171	100
	Percentage of selected of total Beneficiaries in State	-	-	-	-
Maharashtra	Marginal	45	22.50	-	-
	Small	100	50.00	-	-
	Medium	37	18.50	-	-
	Large	18	9.00	-	-
	Total	200	100.00	-	-
	Percentage of selected of total Beneficiaries in State	-	-	-	-
Rajasthan	Marginal	-	-	75	37.50
	Small	-	-	62	31.00
	Medium	-	-	48	24.00
	Large	-	-	15	7.50
	Total	-	-	200	100.00
	Percentage of selected of total Beneficiaries in State	-	-	147566	0.14

Table 4.2: Productivity and net returns from pulses with and without Seed minikits- Bihar

Farm Size	Area under pulses (acres/HH)		Value of Output (Rs/acre)		Cost of Production (Rs/acre)		Net Returns (Rs/acre)		Net price obtained (Rs/quintal)	
	SMK	Without	SMK	Without	SMK	Without	SMK	Without	SMK	Without
Red gram										
Marginal	0.05	0.06	11713	10176	4285	6499	7429	3677	3083	3071
Small	0.02	0.16	11617	10189	4713	6615	6904	3574	3117	3129
Medium	0.02	0.60	11025	12890	4820	4937	6205	7953	3150	3150
Large	--	--	--	--	--	--	--	--	--	--
Total	0.03	0.11	11631	10642	4437	6079	7194	4563	3117	3109
Lentil										
Marginal	0.65	0.71	17179	15246	4668	8215	12511	7031	3135	3150
Small	0.68	1.13	16488	15992	4809	7734	11679	8258	3124	3150
Medium	0.79	1.70	20687	21216	4193	8456	16494	12760	3125	3120
Large	--	--	--	--	--	--	--	--	--	--
Total	0.68	0.87	18118	17485	4143	8072	13975	9413	3128	3140
Aggregate										
Marginal	0.70	0.77	16767	14877	4576	8090	12191	6787	3109	3111
Small	0.70	1.28	16387	15288	4807	7586	11580	7702	3121	3140
Medium	0.81	2.30	20403	19044	4211	7538	16192	11506	3138	3135
Large	--	--	--	--	--	--	--	--	--	--
Total	0.71	0.98	17844	16719	4155	7849	13689	8870	3123	3125

Table 4.3: Productivity and net returns from pulses with and without Seed minikits- Karnataka

Farm Size	Area under pulses (acres/HH)		Value of Output (Rs/acre)		Cost of Production (Rs/acre)		Net Returns (Rs/acre)		Net price obtained (Rs/quintal)	
	SMK	Without	SMK	Without	SMK	Without	SMK	Without	SMK	Without
Red gram										
Marginal	0.87	0.78	17343	15584	6585	7720	10758	7864	5464	6430
Small	0.91	1.02	19502	12382	7115	6919	8497	5463	5394	5283
Medium	1.26	1.40	16928	15900	6190	6269	10738	9630	5389	4929
Large	1.00	1.50	9075	10667	8634	7233	441	21433	4840	2133
Total	0.98	1.01	17978	13819	6738	7012	11241	7672	5404	5185
Black gram										
Marginal	0.72	0.88	16344	15900	6525	6577	9819	9323	5718	5690
Small	0.87	1.16	16264	14271	5788	6811	10476	7459	5736	5697
Medium	0.82	1.75	16689	13510	7302	5411	9387	8099	5535	5419
Large	0.85	1.00	10464	10000	6715	9000	3749	1000	5594	5000
Total	0.81	1.19	16080	14313	6362	6422	9718	7891	5679	5610
Green gram										
Marginal	0.82	1.06	12425	10592	5750	5308	6674	5284	2705	5006
Small	0.96	0.97	14805	10948	5153	5963	9652	5020	5047	4901
Medium	1.04	1.58	16490	11234	6959	4589	9547	6645	4859	4999
Large	1.00	2.00	10000	22100	9600	3550	400	18550	5000	5200
Total	0.93	1.10	14308	11128	6056	5434	8428	5694	4938	4964
Aggregate										
Marginal	0.80	0.92	15732	13089	6348	6281	9384	6808	4572	5610
Small	0.91	1.03	17343	12230	6223	6478	9475	5767	5445	5235
Medium	1.04	1.57	16764	13299	6688	5333	10080	7965	5312	5093
Large	0.91	1.50	10017	14367	7642	6300	2374	17067	5301	3380
Total	0.90	1.09	16514	12738	6458	6168	10094	6843	5398	5201

On average, the area under black gram was 0.81 acres and 1.19 acres per household for farmers with SMK and without SMK, respectively. The value of output, net returns and net price was higher for farmers using SMK whereas cost of production was not found significantly different among the two categories. Among various farm size holdings, the small farmers with SMK received the highest net returns of Rs. 10,476 per acre compared to Rs 9819 received by marginal farmers among the non SMK group. Green gram growers in Karnataka, on average, spent Rs. 6056 per acre on production costs, more than farmers without SMK, whose expenditure was Rs. 5434 per acre. However, the net returns were higher for farmers with SMK at Rs. 8428 per acre compared to Rs 5694 by non SMK farmers. Large farmers without SMK were observed to earn a higher value of output and net return of Rs. 22,100 and Rs.18,550 per acre, respectively (**Table 4.3**) whereas large farmers among SMK earned the least among all farm categories and all the three crops Rs 400 per acre only, possibly because of lowest value of output and highest cost of production among all green gram growers.

Madhya Pradesh:

On average, farmers without SMK had devoted more area under chickpea (1.43 acres) compared with farmers with SMK (1.24 acres). The overall value of output of chickpea in Madhya Pradesh for SMK farmers was noted as Rs 24193 that was much higher compared to without SMK of Rs 19936. The difference in net returns among SMK (Rs 20050) and non SMK (Rs 14402) was even more, because of lower cost of production among SMK compared to the control group farmers. Comparing various farm size categories, net returns were highest for small farmers for chickpea for both SMK and non SMK farmers, i.e., Rs 20536, and Rs 15191, respectively. Once again the price difference among SMK and non SMK farmers was almost nonexistent among all categories of farmers without any exception.

Lentil growers with SMK grew pulses on an area of 0.18 acres and those without SMK grew these pulses on 0.39 acres. Like chickpea, in lentil also the value of output and net returns were much higher for SMK growers compared to the control group of growers growing pulses without andy seedminikits. Whereas SMK farmers obtained per acre value of output of Rs 24010 per acre, the without category farmers obtained only Rs 18460 per acre. Similarly, net returns obtained by with and without farmers was Rs 19572 and Rs 14121 per acre, respectively. While the value of output was highest among medium farmers with SMK (Rs. 27027/acre), the lowest was marginal farmers without SMK (Rs. 14886 per acre). In terms of net returns, the medium farmers with SMK received the highest net returns on lentil of Rs. 20569 per acre whereas highest net returns among without SMK was obtained by large farmers Rs 15883. Nonetheless, marginal farmers with SMK were

observed to obtain the highest net price of Rs.4,211 per quintal. While, across the land holding sizes, the total net price obtained for selected farmers with SMK was Rs.4,166 per quintal.

The total area under black gram was 1.27 acres for selected farmers with SMK and 1.46 acres without SMK and the large farmers accounted for a substantial acreage under black gram with SMK at 6.12 acres and 3.04 acres without SMK. However, in terms of value of output per acre, the small farmers with SMK obtained the highest value of output at Rs. 21,286 per acre while without SMK, highest productivity was observed among marginal farmers Rs 11452 per acre. At the aggregate, productivity under SMK was almost double compared to non SMK in black gram in Madhya Pradesh, i.e., Rs 20712 (SMK) compared to Rs 10268 (without SMK). The cost of production was the lowest for large farmers without SMK (Rs. 3498/qtl.) and highest for medium farmers with SMK (Rs. 5370/qtl). Nevertheless, the net returns were much higher for SMK farmers compared to without SMK, not only at the aggregate but also across all farm size classes. At the aggregate, net returns for black gram averaged at Rs 16546 for SMK in comparison to Rs 9105 for without SMK. Unlike other pulse crops and other states, price obtained in Madhya Pradesh for black gram by SMK farmers was significantly much higher compared to the control group, possibly because of better quality produce. The SMK farmers received average price of Rs.4,291 per quintal compared to Rs 3211 per quintal by the non SMK farmers **(Table 4.4).**

Table 4.4: Productivity and net returns from pulses with and without Seed minikits- Madhya Pradesh

Farm Size	Area under pulses (acres)		Value of Output (Rs/acre)		Cost of Production (Rs/qtl.)		Net Returns (Rs/acre)		Net price obtained (Rs/quintal)	
	SMK	Without	SMK	Without	SMK	Without	SMK	Without	SMK	Without
Chickpea										
Marginal	0.65	0.75	23888	20445	4740	6965	19765	14232	4440	4394
Small	1.08	0.95	24800	20908	4780	6415	20536	15191	4545	4413
Medium	2.28	1.97	24564	20616	4674	6184	20424	15072	4388	4454
Large	5.80	5.29	23238	17811	4473	5203	19183	13041	4447	4180
Total	1.24	1.43	24193	19936	4679	6110	20050	14402	4473	4366
Lentil										
Marginal	0.06	0.11	25226	14886	6602	4415	19983	11173	4211	3776
Small	0.22	0.43	23244	17589	4619	4709	19368	13153	4157	3989
Medium	0.42	0.53	27027	19671	6721	6281	20569	15472	4190	3946
Large	0.45	0.93	20867	20323	4124	5435	17000	15883	4093	3926
Total	0.18	0.39	24010	18460	5273	5262	19572	14121	4166	3947
Black Gram										
Marginal	0.72	0.80	20819	11452	4090	3881	16846	10265	4194	3491
Small	1.13	1.46	21286	9808	4321	3576	17112	8639	4291	3042
Medium	1.85	1.88	20478	9656	5370	4016	15369	8532	4332	3102
Large	6.12	3.04	19815	11371	4085	3498	15972	10051	4128	3547
Total	1.27	1.46	20712	10268	4349	3748	16546	9105	4234	3211

Maharashtra:

In Maharashtra, farmers in the SMK scheme grew two main pulse crops namely, red gram and Bengal gram. At the aggregate, area under these two pulses averaged at only 0.59 acres per

household with SMK and 0.95 acres without SMK, with large farmers growing highest area of 1.24 acres among SMK and 1.09 acres without SMK. At the aggregate, value of output for the two crops averaged at Rs 28951 for SMK farmers while it was only Rs 23013 for non SMK farmers. The value of output for medium land holding size farmers with SMK was the highest at Rs. 30,945 per acre with net returns of Rs. 22,220 per acre, accounting for the highest among the land size holding categories and these farmers also had a low cost of production (Rs. 8,724/acre). However, the same medium farmers without SMK spent the highest production costs (Rs. 11,615/acre). The net price obtained by the medium farmers with SMK was the highest at Rs.5,280 per quintal and the lowest net price was obtained by large farmers without SMK (Rs. 4,798/qtl.).

Among the Bengal gram producers, area under this pulse was 0.30 acres among farmers with SMK and 0.48 acres among farmers without SMK per household. Average value of output and net returns obtained by SMK farmers were higher Rs 27027 and Rs 17845 compared to that obtained by control farmers Rs 23554 and Rs 12988, respectively. Large farmers with SMK had a substantial output value of Rs. 30,532 per acre as well as a high net return (Rs. 18,624/acre) and spent a comparatively high amount on cost of production (Rs 11,909/acre). On the other hand, the small farmer with SMK spent the least in terms of production costs (Rs. 7,986/acre) and obtained a net return (Rs.18,084 per acre) that was almost close to the large farmer's net returns. Similarly, the large and small farmer with SMK obtained a nearly similar net price of Rs. 4,992 and Rs. 4,957 per quintal, respectively. While, the same land size farmers without SMK obtained a reduced net price of Rs. 4,181 and Rs.4,779 per quintal.

In terms of red gram producers, per household area under this pulse was 0.29 acres among farmers with SMK and 0.47 acres among farmers without SMK per household. The value of output among SMK farmers averaged at Rs 30860 that was much higher compared to without SMK farmers Rs 22455. Similarly, net returns also compared as Rs 22003 and Rs 13517 among SMK and without SMK farmers clearly indicating that SMK translated much better profitability to the seedminikits users. Among various farm size categories, the value of output was the highest among the medium farmers with SMK (Rs. 35,764/acre) as well as high net returns of Rs. 27,809 per acre. The lowest output value was among small farmers without SMK at Rs. 19,838 per acre. The cost of production statistics indicated that large farmers among SMK had the lowest production costs at Rs. 6,939 per acre. On the other hand, medium farmers with SMK earned the highest net return (Rs. 27,809/acre) and obtained the highest net price of Rs. 5,708 per quintal. The same land size group of farmers without SMK earned Rs. 15,435 per acre as net returns and obtained 5,118 per quintal as net price during the same time period (**Table 4.5).**

Table 4.5: Productivity and net returns from pulses with and without Seed minikits- Maharashtra

Farm Size	Area under pulses (acres/HH)		Value of Output (Rs/acre)		Cost of Production (Rs/acre)		Net Returns (Rs/acre)		Net price obtained (Rs/quintal)	
	SMK	Without	SMK	Without	SMK	Without	SMK	Without	SMK	Without
Red gram										
Marginal	0.12	0.28	20883	20927	9764	8871	11118	12056	4888	5055
Small	0.30	0.51	30677	19838	9827	9298	20850	10540	5085	5156
Medium	0.30	0.36	35764	25070	7955	9635	27809	15435	5708	5118
Large	0.68	0.60	31078	27966	6939	7561	24139	20405	4974	5717
Total	0.29	0.47	30860	22455	8857	8938	22003	13517	5109	5340
Bengal gram										
Marginal	0.28	0.70	26142	23383	9173	9494	16969	13889	4957	4779
Small	0.23	0.40	26070	23068	7986	8816	18084	14252	4400	4354
Medium	0.37	0.57	27022	24981	9350	12870	17672	12111	4954	4613
Large	0.56	0.49	30532	23095	11909	13039	18624	10056	4992	4181
Total	0.30	0.48	27070	23554	9225	10566	17845	12988	4813	4648
Aggregate										
Marginal	0.39	0.97	24601	22687	9346	9318	15255	13370	5098	5032
Small	0.53	0.91	28676	21262	9027	9085	19649	12177	4803	4885
Medium	0.67	0.93	30945	25016	8724	11615	22220	13401	5280	5089
Large	1.24	1.09	30831	25779	9191	10020	21640	15759	4816	4798
Total	0.59	0.95	28951	23013	9043	9765	19908	13249	4959	4942

Rajasthan:

In Rajasthan, four pulse crops namely, lentils, black gram, green gram and Bengal gram were grown under seedminikits scheme. The aggregate area under these four pulses per household averaged at 2.21 acres with SMK and 4.43 acres without SMK. The large farmers cultivated the highest area under these pulses with 6.57 acres per household in the case of SMK and 9.83 acres without SMK. At the aggregate, value of output of SMK farmers was found slightly less than that of without SMK farmers and thus Rajasthan was found an exception among the all the five selected states wherein all other states SMK farmers had edge over control farmers in terms of productivity as well as profitability. In terms of net returns also the similar was the case. The value of output per acre was averaged at Rs 18360 among SMK farmers and Rs 20579 among without SMK. Similarly, the net returns averaged at Rs 9470 for SMK farmers compared to Rs 10410 for the control group. However, cost of production was found lower for SMK farmers (Rs 8890 per acre) compared to non SMK farmers (Rs 10170 per acre). Among various farm size categories, the small farmers with SMK had the highest value of output at Rs. 22,587 per acre while marginal farmers without SMK indicated highest value of output of Rs 20885 per acre. In terms of production costs, the large farmers with SMK borne the least cost (Rs 8,144 per acre) and reaped the second highest net returns on aggregate (Rs. 12,349/acre), while the medium farmers without SMK incurred the highest cost of production (Rs. 10,881/acre) and lowest net return of Rs. 5,253 per acre. Net price obtained per quintal was highest for marginal farmers followed by large farmers, both with SMK at Rs. 4,988 and Rs. 4,983 per quintal, respectively.

Table 4.6: Productivity and net returns from pulses with and without Seed minikits- Rajasthan

Farm Size	Area under pulses (acre)		Value of Output (Rs/ acre)		Cost of Cultivation (Rs/ acre)		Net Returns (Rs/ acre)		Net price obtained (Rs/quintal)	
	SMK	Without	SMK	Without	SMK	Without	SMK	Without	SMK	Without
Lentil										
Marginal	0.77	0.54	10061	29563	7737	13920	2325	15643	3995	3964
Small	0.75	1.04	23681	22081	11552	13291	12129	8790	4079	3966
Medium	0.66	1.18	21248	24659	11032	12977	10217	11682	4083	3923
Large	0.09	0.36	47532	30701	12262	12172	35270	18529	4000	4000
Total	0.69	0.83	17634	25261	9838	13067	7796	12194	4058	3947
Black gram										
Marginal	2.00	1.77	27707	12385	9724	6974	17983	5411	4619	4719
Small	0.83	2.76	31458	21820	11003	9757	20455	12062	4644	4675
Medium	0.78	3.12	4125	25483	5722	11063	-1597	14420	4200	4631
Large	1.98	0.00	8217	-	6220	-	1997	-	4500	-
Total	1.34	2.01	22980	22566	9023	10110	13957	12456	4613	4649
Green gram										
Marginal	0.80	0.50	19084	20100	8509	8495	10575	11605	6337	5346
Small	2.89	0.91	15214	19141	7726	8985	7488	10156	5876	5756
Medium	6.69	6.20	17201	14396	8322	8602	8878	5793	5928	5738
Large	13.06	20.49	17627	16468	8824	9237	8802	7231	6432	5797
Total	3.78	7.94	16990	15949	8326	9035	8664	6914	6081	5774
Bengal gram										
Marginal	0.53	1.55	25283	21491	11802	8470	13481	13021	5000	5000
Small	1.28	2.77	19995	12642	10262	9532	9733	3110	4720	5000
Medium	0.62	0.00	16294	-	9106	-	7187	-	4833	-
Large	6.59	3.04	8596	21491	5270	7754	3326	13737	5000	5000
Total	1.24	1.58	15837	18541	8373	8466	7464	10075	4863	5000
Aggregate										
Marginal	1.01	0.80	20534	20885	9443	9465	11091	11420	4988	4757
Small	1.74	1.37	22587	18921	10136	10391	12451	8530	4830	4849
Medium	3.33	3.89	14717	16134	8546	10881	6171	5253	4761	4764
Large	6.57	9.83	20493	17165	8144	7291	12349	9874	4983	4932
Total	2.21	4.43	18360	20579	8890	10170	9470	10410	4904	4843

With respect to the pulse-wise segregation, Bengal gram producing farmers with SMK grew on average 1.24 acres per household and those without SMK cultivated 1.58 acres per household under Bengal gram. Both value of output per acre and net returns were found lower for SMK farmers compared to control group. Whereas SMK farmers value of productivity was found Rs 15837 per acre compared to Rs 18541 by the without SMK farmers and net returns per acre were found Rs 7464 and 10075, respectively for the two groups. Comparing various farm size holdings, the value of output among marginal farmers with SMK secured Rs. 25,283 per acre. The cost of production column showed that although the marginal farmer with SMK spent the highest (Rs. 11,802/acre), they were also able to earn the highest net return (Rs. 13,481/acre) and obtained a net price of Rs.5000 per quintal among the four land holding size categories.

In the case of green gram, farmers without SMK grew this pulse on an average at 3.78 acres per household with large farmers accounting for a major share of this area. The control group farmers devoted much larger area of 7.94 acres per household to green gram. Unlike Bengal gram, the value of output and profitability was found higher for SMK farmers compared to control group in this particular case in Rajasthan. Although value of output per acre was higher among SMK farmers (Rs 16990) compared to control group (Rs 15949) but the difference was not as large as has been found in most of the pulses in other states. Net returns also compared well with value of Rs 8664 per acre among SMK and Rs 6914 among control group. Comparing holdings size, the marginal farmers without SMK had the highest value of output of Rs. 20,100 per acre and net returns of Rs. 10,575 per acre with the least production cost (Rs. 8,495/acre) when compared to other land holding sizes. Nonetheless, on the net price, the large farmers with SMK producing green gram obtained the highest price of Rs. 6,432/qtl.

The average area under black gram for all farmers surveyed with SMK was 1.34 acres and without SMK was 2.01 acres. There was hardly any difference in per acre productivity as well as profitability among SMK and control group in the case of black gram. Per acre productivity was Rs 22980 in the case of SMK farmers and Rs 22566 for the control group. Similarly, the net returns per acre were Rs 13957 for SMK and Rs 12456 for the non SMK farmers. However, productivity and profitability varied across different size of holdings significantly. The value of output was highest among small farmers with SMK (Rs. 31,458/acre) vis-a-vis non SMK observed highest productivity of Rs 25483 among medium farmers. The medium farmers with SMK spent the least amount on production cost (Rs. 5,722/acre) and the same land holding size farmer without SMK incurred almost double the production cost of Rs. 11,063 per acre. The small farmer with SMK earned the highest net return of Rs. 20,455 per acre and obtained a net price of Rs. 4,644 per quintal, however the marginal farmers without SMK indicated a higher net price (Rs. 4,719/qtl).

The average area under lentils for all farmers surveyed with SMK was 0.69 acres per household and those without SMK was 0.83 acres per household. Like Bengal gram, value of output and net returns were less for SMK farmers compared to control group in lentils as well. The value of output and net returns were Rs 17634 and Rs7796 per acre for SMK farmers in comparison to Rs 25261 and Rs 12194 for the control group farmers. Across the holding size, the value of output was highest for large lentil farmers with SMK at Rs. 47,532 per acre and the lowest Rs. 22,081 per acre among small farmers without SMK. Although the cost of cultivation was the highest for large farmers with SMK (Rs. 12,262/acre), the net returns earned by them was also high (Rs. 35,270/acre) while, the medium farmers with SMK obtained a higher net price per quintal of Rs. 4,083 **(Table 4.6).**

To conclude, the productivity and net returns were much higher for those farmers who used seeds obtained under the seedminikit programme as compared to farmers using seed either home grown or bought from the market. This was true in almost all pulse crops for which seeds were provided under the programme in all the selected states. The only exception was found in Rajasthan in the case of Bengal gram and lentils, while productivity and profitability was found higher in Rajasthan also in the case of black gram and green gram.

4.3 Item-wise cost of production

This section presents item wise comparison of different components of cost of cultivation among SMK and control farmers. Starting with the selected farmers who produced black gram, in terms of cost on various agricultural activities, statistics in **Table 4.7** revealed that the total cost per acre was lower for farmers with SMK in the study states of Karnataka and Rajasthan while it was higher in Madhya Pradesh. In Karnataka, farmers indicated that the land preparation, Farm Yard Manure (FYM), organic/bio-fertilizers, nutrients, labour charges and bagging, transportation and marketing costs were lower for those producing black gram without SMK. The activities such as seed, other fertilizers, plant protection chemicals, weeding measures, harvesting and threshing were lower for those with SMK. Nonetheless, cumulatively, farmers with SMK incurred lower costs (Rs. 6361/acre) compared to those without SMK (Rs. 6422/ acre) in Karnataka.

In Madhya Pradesh, 28.93 per cent of the costs in black gram were incurred on land preparation that accounted for a major cost component followed by harvesting and threshing (20.26 per cent) and other fertilizers (15.07 per cent). Black gram farmers from Rajasthan, indicated that the total cost was lower for farmers with SMK (Rs. 9023/acre) as compared with farmers without SMK (Rs. 10,110 per acre). However, the harvesting and threshing (28.9 per cent), land preparation (27.05 per cent) and labour charges (23.71 per cent) were significantly high cost components for Rajasthan farmers with SMK (**Table 4.7**).

The cost components for states producing Green Gram by selected farmers, namely, Karnataka and Rajasthan has been tabulated in **Table 4.8**. The total cost per acre was higher for farmers with SMK (Rs. 5880) compared to without SMK (Rs 5434) in Karnataka, while the total cost in Rajasthan for the selected farmers with SMK was lower (Rs. 8326) when compared with farmers without SMK (Rs 9035). A significant proportion of the costs indicated by the selected farmers with SMK was on labour charges (49.55 per cent) followed by FYM, organic/bio-fertilizers (21.24 per cent) and land preparation (17.74 per cent). The green gram farmers with SMK saved significantly on the seed cost component (1.22 per cent), while 15.59 per cent of the cost was incurred on it for those without SMK. In Rajasthan, the green gram farmers without SMK were

spending on harvesting and threshing (37.28 per cent) followed by land preparation costs (27.12 per cent), while the labour charges were higher for farmers with SMK (22.23 per cent) as well as on costs linked to land preparation (29.10 per cent).

Table 4.7: Cost details item-wise – Black Gram (%)

Activity	SMK/Without	Karnataka	Madhya Pradesh	Rajasthan
		Total	Total	Total
Land Preparation	SMK	20.01	28.93	27.05
	Without SMK	14.63	-	22.97
Seed	SMK	1.38	9.35	4.29
	Without SMK	13.38	-	6.67
Inter crop	SMK	0.00	-	0
	Without SMK	0.00	-	0
FYM, Organic/Bio-fertiliser	SMK	18.43	8.99	0
	Without SMK	15.91	-	0.07
Major and minor nutrients	SMK	1.68	-	0
	Without SMK	0.47	-	0
Other fertiliser	SMK	1.59	15.07	5.67
	Without SMK	6.52	-	5.48
Irrigation charges	SMK	0.00	3.85	0
	Without SMK	0.00	-	0
Plant protection chemicals	SMK	2.72	2.01	7.03
	Without SMK	3.52	-	6.84
Labour Charges	SMK	47.45	-	23.71
	Without SMK	39.35	-	17.13
Weeding and plant protection measures	SMK	2.41	7.20	0
	Without SMK	2.49	-	0
Harvesting and Threshing	SMK	1.01	20.26	28.9
	Without SMK	1.10	-	38.17
Bagging, transportation and marketing cost	SMK	3.31	4.84	3.15
	Without SMK	2.63	-	2.45
Others	SMK	0	-	0.21
	Without SMK	0	-	0.22
Sum Total	SMK	100.0	100.0	100.0
	Without SMK	100.0	-	100.0
Total cost (Rs per acre)	SMK	6361	4349	9023
	Without SMK	6422	3748	10110

In the study states growing Red gram, the total cost per acre was lower for those selected farmers with SMK than those without SMK at Rs. 4437 per acre in Bihar, Rs. 6738 per acre in Karnataka and Rs. 8857 per acre in Maharashtra (**Table 4.9**). This table also indicated that selected farmers with SMK in Bihar spent a significant proportion of their production costs on land preparation (37.75 per cent) and labour charges (31.17 per cent), which was more than the amount spent by farmers without SMK. However, farmers not using SMK incurred a high percentage of cost on harvesting and threshing (46.06 per cent) followed by land preparation (27.19 per cent).

In Karnataka, production costs related to labour (45.91 per cent) followed by FYM, organic/bio-fertilizers (18.68 per cent) was higher for the selected farmers with SMK. While, the seed procurement cost was the lowest for farmers with SMK (0.82 per cent) and multiple times

higher at 12.32 per cent for farmers without SMK. In Maharashtra, red gram farmers selected for the survey indicated that labour charges were over 55 per cent of the production costs for farmers without SMK and higher for farmers with SMK (62.36 per cent). However, a lower amount was spent on land preparation by farmers with SMK (18.75 per cent) and farmers without SMK (20.31 per cent) and those who were beneficiaries of the SMK scheme did not incur any costs on procurement of seeds.

Table 4.8: Cost details item-wise – Green Gram (%)

Activity	**SMK/Without**	**Karnataka**	**Rajasthan**
		Total	**Total**
Land Preparation	SMK	17.74	29.10
	Without SMK	15.13	27.12
Seed	SMK	1.22	5.77
	Without SMK	15.59	5.87
Inter crop	SMK	0.00	0.00
	Without SMK	0.00	0.00
FYM, Organic/Bio-fertiliser	SMK	21.24	0.08
	Without SMK	18.43	0.43
Major and minor nutrients	SMK	0.84	0.00
	Without SMK	1.27	0.00
Other fertiliser	SMK	3.00	5.88
	Without SMK	5.46	5.41
Irrigation charges	SMK	0.00	0.00
	Without SMK	0.00	0.30
Plant protection chemicals	SMK	0.76	4.56
	Without SMK	0.25	5.89
Labour Charges	SMK	49.55	22.23
	Without SMK	40.23	15.54
Weeding and plant protection measures	SMK	2.24	0.00
	Without SMK	1.39	0.00
Harvesting and Threshing	SMK	1.22	28.44
	Without SMK	0.93	37.23
Bagging, transportation and marketing cost	SMK	2.19	3.23
	Without SMK	1.33	1.53
Others	SMK	0	0.70
	Without SMK	0	0.68
Sum Total	SMK	100.0	100.0
	Without SMK	100.0	100.0
Total cost (Rs per acre)	**SMK**	5880	8326
	Without SMK	5434	9035

With regard to the cost details of producing other pulses (**Table 4.10**), it is evident selected farmers indicated that those who used SMK incurred lower total per acre costs on various agriculture activities when compared with those without SMK in the study states of Bihar, Madhya Pradesh, Maharashtra and Rajasthan. Among the lentil producers in Bihar, over 50 per cent of the costs were incurred in procuring seeds by those who were non-beneficiaries of SMK followed by land preparation (17.52 per cent) and harvesting (14.08 per cent). Those with SMK, stated that land preparation (38.57 per cent) and labour charges (38.55 per cent) were a significant component of

production costs. However, in terms of total cost per acre, those with SMK incurred Rs. 4143 per acre on production costs and farmers without SMK, approximately incurred double the production costs at Rs 8072 per acre.

Table 4.9: Cost details item-wise – Red Gram (%)

Activity	SMK/Without	Bihar	Karnataka	Maharashtra
		Total	Total	Total
Land Preparation	SMK	37.75	17.42	18.75
	Without SMK	27.19	15.20	20.31
Seed	SMK	--	0.82	-
	Without SMK	5.59	12.32	2.87
Inter crop	SMK	--	0.00	-
	Without SMK	--	0.00	-
FYM, Organic/Bio-fertiliser	SMK	--	18.68	-
	Without SMK	--	14.38	-
Major and minor nutrients	SMK	--	1.35	-
	Without SMK	--	1.68	-
Other fertiliser	SMK	2.52	2.66	2.02
	Without SMK	2.39	5.20	2.54
Irrigation charges	SMK	--	0.00	1.38
	Without SMK	--	0.00	1.25
Plant protection chemicals	SMK	--	7.52	3.09
	Without SMK	--	5.56	4.46
Labour Charges	SMK	31.17	45.91	62.36
	Without SMK	14.66	38.77	55.73
Weeding and plant protection measures	SMK	3.76	1.59	-
	Without SMK	4.11	3.05	-
Harvesting and Threshing	SMK	24.79	0.82	10.25
	Without SMK	46.06	1.30	10.52
Bagging, transportation and marketing cost	SMK	--	3.23	2.15
	Without SMK	--	2.54	2.31
Others	SMK	--	0.00	-
	Without SMK	--	0.00	-
Sum Total	SMK	100.0	100.0	100.0
	Without SMK	100.0	100.0	100.0
Total cost (Rs per acre)	SMK	4437	6738	8857
	Without SMK	6079	7012	8938

In Madhya Pradesh, farmers using SMK for lentil and Bengal gram mentioned that land preparation was a significant cost component followed by harvesting and threshing. Both, Bengal gram farmers, with and without SMK in Maharashtra stated that labour charges were over 50 per cent of production costs followed by land preparation cost that was in the range of 24-25 percent.

Yet, on calculating the total cost per acre, farmers without SMK spent Rs. 10,566 per acre and those with SMK spent Rs. 9225 per acre.

Selected farmers in Rajasthan incurred costs on seed purchased for lentil and Bengal gram, unlike those who benefited from the SMK scheme where the seeds were distributed free of cost to targeted farmers. However, farmers without SMK indicated lower land preparation and harvesting and threshing costs. Nevertheless, the total cost for SMK users was Rs. 8373 per acre, while for those pulse producers without SMK was Rs. 8466 per acre in Rajasthan.

Table 4.10: Cost details item-wise – Others (%)

Activity	SMK/Without	Bihar (Lentil)	Madhya Pradesh		Maharashtra (Bengal gram)	Rajasthan	
		Total	Lentil	Bengal gram	Total	Lentil	Bengal gram
Land Preparation	SMK	38.57	29.76	26.65	25.08	22.37	42.55
	Without SMK	17.52	--	--	24.43	19.35	29.87
Seed	SMK	--	14.62	7.52	-	5.33	3.58
	Without SMK	50.17	--	--	2.5	8.59	30.86
Inter crop	SMK	--	--	--	-	0	0.00
	Without SMK	--	--	--	-	0	0.00
FYM, Organic/Bio-fertiliser	SMK	--	10.53	13.16	-	0	0.00
	Without SMK	--	--	--	-	0	0.00
Major and minor nutrients	SMK	--	--	--	-	0	0.00
	Without SMK	--	--	--	-	0	0.00
Other fertiliser	SMK	3.86	8.48	12.35	4.27	5.52	3.70
	Without SMK	2.33			4.16	4.74	2.69
Irrigation charges	SMK	--	10.14	10.47	1.5	6.58	0.00
	Without SMK	--			1.14	7.74	0.00
Plant protection chemicals	SMK	4.83	5.27	1.60	3.01	7.35	2.42
	Without SMK	2.13	--	--	3.71	5.1	2.49
Labour Charges	SMK	38.55	--	--	52.1	22.94	25.45
	Without SMK	13.76	--	--	53.26	25.12	21.65
Weeding and plant protection measures	SMK	--		5.57	-	0	0.00
	Without SMK	--	--	--	-	0	0.00
Harvesting and Threshing	SMK	14.19	15.93	16.07	11.64	28.51	14.09
	Without SMK	14.08			8.95	27.12	7.47
Bagging, transportation and marketing cost	SMK	--	5.27	6.63	2.4	1.38	3.54
	Without SMK	--	--	--	1.86	2.24	2.49
Others	SMK	--	--	--	-	0.02	4.67
	Without SMK	--	--	--	-	0	2.49
Sum Total	SMK	100.0	100.0	100.0	100.0	100.0	100.0
	Without SMK	100.0	-	-	100.0	100.0	100.0
Total cost (Rs per acre)	SMK	4143	5273	4679	9225	9838	8373
	Without SMK	8072	5262	6110	10566	13067	8466

On the overall, cost analysis revealed that land preparation, fertilizer and nutrients, harvesting and threshing and labour charges were the main components of cost of cultivation for the SMK farmers. In the case of without SMK (non beneficiary) farmers, in addition to the above components, they had to bear seed cost as additional charges for the pulses grown and in few cases the cost of

seed was quite exorbitant which in the case of SMK beneficiary farmers was obtained free of cost under the seedminikits programme.

4.4 Use of labour in selected pulses crop production

In our previous analysis we have seen that the labour use was one of the most important components of cost of production as sowing, harvesting as well as weeding activities are generally manual in the case of pulses. Moreover, pulses in India are generally produced in the states where agriculture is still done more manually. The statistics in Table 4.11 shows that the use of labour for the specified agricultural activities encompassing production of pulses with and without SMK indicated that the highest number of person days per acre was utilized by the study states of Madhya Pradesh and Maharashtra followed by Bihar. The selected farmers producing Bengal gram in Maharashtra without SMK accounted for the highest number of person days per acre (41). The labour was mostly utilized for two activities viz., weeding and plant protection measures and harvesting and threshing. These two activities also involved more number of person days across all states and different pulses under study. However, in the case of weeding and plant protection measures, farmers without SMK spent less time on this activity in the study states except Rajasthan in which case farmers used 3.47 person days per acre, while farmers with SMK used 3.31 person days per acre. In particular, farmers producing chickpea in Madhya Pradesh involved more labourers on manure and FYM (4 person days per acre) and another noticeable fact was that the selected farmers, both with and without SMK from Maharashtra used 6.5 person days per acre on land preparation unlike other pulse growers in the study states that involved less than two person days per acre on this activity (**Table 4.11**).

4.5 Sowing pattern

Regarding method of sowing of pulses followed by our selected farmers (**Table 4.12**), our filed survey information revealed that the selected farm households across farm size in Bihar adopted mostly broad-casting (above 80 per cent) with only 9 per cent undertaking line sowing. In Karnataka, 88.02 per cent of the households adopted line sowing followed by broad-casting (11.41 per cent) and drill sowing (0.59 per cent), although, the marginal and small farmers among them preferred drill sowing (50 per cent). In Madhya Pradesh, selected farmers across all farm sizes preferred line sowing (over 68 per cent). Among the three sowing patterns, half of the respondent farmers in Maharashtra adopted drill sowing (50.5 per cent), followed by line sowing (30 per cent) and broad casting (19.5 per cent). In Rajasthan all category farmer followed line sowing alone without any exception.

Table 4.11: Use of Labour by activities (man days per acre)

Activity	SMK / Without	Bihar			Karnataka				Madhya Pradesh				Maharashtra			Rajasthan				
		Lentil	Red gram	Total	Black gram	Green gram	Red gram	Total	Black gram	Chickpea	Lentil	Total	Bengal gram	Red gram	Total	Black gram	Green gram	Red gram	Bengal gram	Total
Land Preparation	SMK	2	2	2.00	0.83	0.68	0.62	0.71	2	2	2	2	5	8	6.5	0	0	0	0.03	0.0075
	Without SMK	2	1.55	1.78	0.72	0.78	0.73	0.75	2	2	2	2	7	6	6.5	0	0	0	0	0
Sowing	SMK	0.25	0.25	0.25	0.91	1.02	1.12	1.02	2	2	2	2	1	1	1	0.73	0.36	0.7	0.81	0.65
	Without SMK	0.25	0.82	0.54	0.85	0.85	0.78	0.83	1	2	1	1	1	1	1	0.45	0.31	0.92	0.63	0.57
Manure & FYM	SMK	2	---	2.00	1.04	1.06	1.12	1.08	3	3	3	3	-	-	---	0.86	0.37	1.38	1.01	0.9
	Without SMK	2	---	2.00	0.90	0.86	0.83	0.86	3	4	3	3.33	-	-	---	0.67	0.3	1.2	0.42	0.64
Major and minor nutrients	SMK	---	---	---	0.07	0.07	0.12	0.09	1	2	1	1.33	-	-	---	0	0	0	0	0
	Without SMK	---	0.73	0.73	0.06	0.09	0.07	0.08	1	2	1	1.33	-	-	---	0	0	0	0	0
Other Fertilizers	SMK	1	---	1.00	0.11	0.26	0.18	0.17	---	---	---	---	1	1	1	0.17	0	1.72	0	0.47
	Without SMK	1	---	1.00	0.26	0.19	0.14	0.19	---	---	---	---	3	1	2	0	0	2.29	0	0.57
Inter cultural operations	SMK	---	---	---	0.00	0.00	0.00	0.00	---	---	---	---	1	1	1	0	0	0	0	0
	Without SMK	---	---	---	0.00	0.00	0.00	0.00	---	---	---	---	1	1	1	0	0	0	0	0
Plant protection	SMK	---	---	---	0.37	0.16	0.64	0.44	2	3	2	2.33	1	2	1.5	1.23	0.98	2.17	0.34	1.18
	Without SMK	---	---	---	0.25	0.03	0.39	0.20	2	2	2	2	2	2	2	1.07	0.5	2.17	0.42	1.04
Weeding and plant protection measures	SMK	1	---	1.00	2.33	2.51	2.38	2.39	2	4	3	3	6	7	6.5	4.72	3.32	2.03	3.17	3.31
	Without SMK	1	0.91	0.96	2.01	1.54	2.01	1.80	3	3	2	2.67	10	8	9	4.05	2.61	3.85	3.37	3.47
Harvesting and Threshing	SMK	10	5.45	7.73	3.14	3.10	2.68	2.93	12	14	12	12.67	10	11	10.5	0	0	0	0	0
	Without SMK	18	9.82	13.91	2.72	2.33	3.13	2.68	10	12	10	10.67	14	11	12.5	0	0	0	0	0
Bagging, Transporting	SMK	1	1	1.00	0.00	0.00	0.00	0.00	4	5	4	4.33	3	5	4	1.52	1.38	2.13	1.75	1.69
	Without SMK	1	---	1.00	0.00	0.00	0.00	0.00	3	4	3	3.33	3	3	3	1.12	1.07	2.37	1.26	1.45
Total	SMK	17.25	8.70	12.98	8.80	8.87	8.86	8.84	30	39	31	33.33	28	36	32	9.23	6.49	10.14	7.08	8.23
	Without SMK	25.25	13.83	19.54	7.78	6.68	8.08	7.38	27	34	26	29	41	33	37	7.38	4.85	12.8	6.11	7.78

Table 4.12: Method of Sowing followed by Selected Households in reference year (%)

States	Farm size	Broad casting	Drill sown	Line sown
Bihar	Marginal	88.73	-	11.27
	Small	94.34	-	5.66
	Medium	82.61	-	17.39
	Large	-	-	-
	Total	91.00	-	9.00
Karnataka	Marginal	14.80	0.90	84.30
	Small	13.50	0.60	85.80
	Medium	4.60	0.00	95.40
	Large	0.00	0.00	100.00
	Total	11.40	0.60	88.00
Madhya Pradesh	Marginal	31.03	-	68.97
	Small	29.37	-	70.63
	Medium	21.95	-	78.05
	Large	11.76	-	88.24
	Total	28.00	-	72.00
Maharashtra	Marginal	4.44	48.89	46.67
	Small	23.00	52.00	25.00
	Medium	18.92	48.65	32.43
	Large	38.89	50.00	11.11
	Total	19.50	50.50	30.00
Rajasthan	Marginal	-	-	100.0
	Small	-	-	100.0
	Medium	-	-	100.0
	Large	-	-	100.0
	Total	-	-	100.0

4.6 Awareness about the distribution of SMK

One of the objectives of the study was to see whether the distribution of seed mini kits among the beneficiary farmers was judicious or not and whether the targeted farmers received these kits. In order to monitor the distribution efficiency, we enquired with the farmers surveyed a few related questions. The information received from farmers is analysed in this and next sections. The pulse growing respondent farmers stated that they were informed about the SMK scheme through awareness drives conducted by the Agriculture Officer in Raitha Samparka Kendras (RSKs) in Karnataka (79.1 per cent), Maharashtra (70 per cent) and Rajasthan (100 per cent). However, inBihar only 8.27 per cent were provided information about the scheme by the Agriculture officer (RSK) and instead the pulse farmers stated that the Farmer Facilitators (59.02 per cent) and fellow farmers (26.69 per cent) in the area enlightened them about the distribution of SMKs (**Table 4.13**). The selected farmers observed that the distribution of SMK was undertaken by both; the agriculture departments (54.76 per cent) and others (45.24 per cent) in Bihar. While in Karnataka, a significant number of farmers stated that the agriculture department (96.97 per cent) and KVK (3.04 per cent) distributed the SMK (**Table 4.14**). In the study states of Madhya Pradesh, Maharashtra and

Rajasthan, the entire distribution process was handled by the agriculture departments of the respective States.

Table 4.13: Awareness of distribution of Seed minikits (%)

Source	Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
	Total	Total	Total	Total	Total
Agriculture Officer (RSK)	8.27	79.10	89.66	70.00	100
Farmer Facilitator	59.02	15.17	6.47	-	---
Fellow Farmer	26.69	5.74	3.87	30.00	---
Print & Visual media	6.02	0.00	---	---	---
Total	100.00	100.00	100.00	100.00	100.00

Table 4.14: Distribution of Seed minikits (Numbers)

Agency	Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
KVK	---	3.04	0.0	---	---
Agricultural Departments	54.76	96.97	100	100	100
Others	45.24	---	0.0	---	---

To access these SMK's, a majority of the selected farmers indicated that they had to produce two documents, namely the Aadhar card and their land record (Pahani) document in Karnataka and Maharashtra. In Madhya Pradesh, most of the farmers submitted the Aadhaar card, but they were also asked to submit their bank passbook. In Bihar, a majority of the farmers stated that they produced other documents (85 per cent) without giving details to access the SMK. The Rajasthan farmers who were selected for the survey indicated that they only submitted the Aadhar card to avail the SMK (**Table 4.15**).

On our enquiry of what criteria was followed in farmer selection for distribution of seedminikits? Most of the farmers in Bihar indicated that the distribution of kits was based on farmers' interest and all those farmers who were provided SMK were largely those who showed interest in the scheme. Among other states, 68 per cent in Karnataka, 11 per cent in Madhya Pradesh and 33.5 per cent in Maharashtra pointed out the criteria based on farmers interest as selection basis for the distribution of kits. A few farmers in Karnataka (11.26 per cent), Madhya Pradesh (31 per cent), Maharashtra (14.5 per cent) and Rajasthan (23.76 per cent) also noted that the other criterion was their ST/SC status. The land holding size was also mentioned as a point of reference for accessing the SMK and 49 per cent of selected farmers from Madhya Pradesh mentioned this criterion as well as 19.91 per cent in Karnataka, 10 per cent in Maharashtra and 31 per cent in Rajasthan disclosed the same. Cumulatively, 30 per cent of the farmers in Maharashtra indicated that all the combinations of all the three aforementioned criteria were used to choose farmers who were provided the SMK. Only in Rajasthan, did 45.25 per cent of selected farmers indicate that women

farmers were particularly targeted for this scheme (**Table 4.16**). All the farmers selected as beneficiaries of the SMK confirmed that under this scheme, the minikits were provided free of cost except the case of Rajasthan. Table 4.17 shows that in all the four crops in Rajasthan for which seed kits were distributed an amount of Rs 184 was charged for Bengal gram for 16 kg seed, Rs 45 for green gram for 4 kg of seed and Rs 50 was charged for 8 kg of lentil and 4 kg of black gram. The beneficiary farmers confirmed that the amount was paid by them and there was no reimbursement for the amount paid for seed kits in Rajasthan (**Table 4.17**).

Table 4.15: Documents submitted to avail Seed minikits (Numbers)

Documents	Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
	Total	Total	-	Total	Total
1	7.50	99.57	83.50	19.50	100
2	7.50	98.71	-	0.00	---
3	---	36.8	16.50	0.00	---
1,2	---	---	---	51.00	---
1,2,3	---	---	---	16.00	---
1,3	---	---	---	8.00	---
2,3	---	---	---	5.50	---
Others	85.0	5.2	---	---	---

Note: Code Note: 1=Aaadhar Card, 2= Pahani (land records), 3= Bank Passbook

Table 4.16: Criteria for farmer selection

Farmers	Bihar		Karnataka		Madhya Pradesh		Maharashtra		Rajasthan	
	Number	%	Number	%	Number	%	Number	%	Number	%
1	200	100	159	68.83	22	11	67	33.50	-	-
2	---	---	26	11.26	62	31	29	14.5	105	23.76
3	---	---	46	19.91	98	49	20	10.00	137	31.00
4	---	---	0	0.00	2	1	24	12.00	0	0.00
5	---	---	1	0.43	16	8	-	-	200	45.25
6	---	---	0	0.00	---	---	-	-	0	0.00
1,2	---	---	---	---	---	---	12	6.00	---	---
1,2,3	---	---	---	---	---	---	22	11.00	---	---
2,3	---	---	---	---	---	---	26	13.00	---	---
Others	---	---	---	---	---	---	-	-	---	---
Total	200	100	231	100	200	100	200	100	442	100

Note: 1=Any Interested Farmer, 2= SC/ST Farmer, 3= Small. Marginal Farmer, 4=BPL Farmer,
5=Women, 6=Lottery among applications

Table 4.17: Financial details of Seed minikits (Rajasthan)

States	Farm Size	Amount Charged (Rs/kit)				Amount Reimbursed (Rs/Kit)
		Bengal Gram (16 kg)	Green Gram (4 kg)	Lentil (8 kg)	Black Gram (4 kg)	
Rajasthan	Marginal	184	45	50	50	0
	Small	184	45	50	50	0
	Medium	184	45	50	50	0
	Large	184	45	50	50	0
	Total	184	45	50	50	0

4.7 Contents of the seed minikits

In **Table 4.18** the details of SMK quantity used for area sown, output produced and output used as seed for further sowing these crops by the beneficiary farmers for the selected crops namely red gram, green gram, black gram and Bengal gram are provided for the selected states. In Bihar, for red gram WBL-77 and KLB-320 variety, 16 kg per household of seed was distributed among the selected farmers during rabi season which was used for sowing one acre per household by the beneficiary farmers. This produced an output of 7.91 quintals per household. The farmers used 13.67 kg as seed out of total production of 7.91 quintal.

In Karnataka, 4.12 kg per household of the *BRG-2, BRG-4* and *T9* varieties of red gram was distributed during kharif season for slightly less than one (0.98) acre per household. This produced an output of 3.59 quintals per household, of which 17.53 kgs per household was ploughed back into the farm as seed. In the case of green gram, Karnataka farmers received 4.36 kg per household and sowed 0.93 acres per household during kharif season. They produced an output of approximately 2.87 quintals per household, of which 18.18 kg was used as seed. The third crop, viz., black gram 4.40 kgs was sown on 0.81 acres per household during kharif season and beneficiary households produced 2.47 quintals per household and 15.94 kg was ploughed back in the production system as seed.

In Madhya Pradesh, black gram farmers in this state obtained *PU-1 PU-31, Shekar P-1/AZAD* varieties at 4 kg per household that was sown on an area of 0.5 acres per household. They obtained an output of 2.12 quintals per household and 1.10 kg was used as seed in the next production cycle. The chickpea producers in the state received the *JG-14, JG-16 JG-64 JG-73* varieties at 16 kg per household with an output of 2.45 quintals, of which 0.76 kg was used as seed per household. Red gram farmers in Maharashtra obtained *BDN 711* variety of 4 kg per household and this was sown on an area of 0.29 acres during the kharif season. The output produced from the SMK was 3.13 quintals per household and from this output 16 kg was ploughed back as seed by each household. In the same State, Bengal gram farmers obtained the Jackey variety of 8 kg per household that was sown on an area of 0.30 acres per household during Rabi season.

Table 4.18: Details of Seed minikits provided for pulse crops - 2017-18/2018-19

Farm Size		Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
Crop 1: Red gram						
Variety		WBL-77 KLB-320	Variety: BRG - 2, BRG - 4 & T9	-	BDN 711	Variety: PL-8*
Quantity (kgs/hh)		16	4.12	-	28.0	8.0*
Area Sown (acres)		-	101.3 (0.98 acres per hh)	-	0.29	0.69*
Season(acres)	Kharif		-	-	0.29	
	Rabi	1	-	-	-	0.69*
	Summer		-	-	-	
Output Produced from seed minikits (Quintals per hh)		7.91	3.59	-	3.13	2.64*
Output used as seed (kgs per hh)		13.67	17.53	-	16	0.33*
Crop 2: Green gram						
Variety		-	Variety: Rashmi	-		Variety: IPM-02/03 & MH-421
Quantity (kgs/hh)		-	4.36	-		4
Area Sown (acres)		-	50.92 (0.93 acres per hh)	-		3.78
Season (acres)	Kharif	-	-	-	3.78	-
	Rabi	-	-	-	-	-
	Summer	-	-	-	-	-
Output Produced from seed mini kits (Quintals per hh)		-	2.87	-		-
Output used as seed (kgs per hh)		-	18.18	-		-
Crop 3 – Black gram						
Variety		-	Variety: IPU – 0243 & IPU - 044	PU-31; P1-azad	-	Variety: PU-31 & Pratap 1
Quantity (kgs/hh)		-	4.40	4	-	4
Area Sown (acres)		-	82.30 (0.81 acres per hh)	0.5	-	1.34
Season(acres)	Kharfi	-	0.81	-	-	1.34
	Rabi	-		-	-	-
	Summer	-		-	-	-
Output Produced from seed mini kits (Quintals per hh)		-	2.47	2.12	-	5.88
Output used as seed (kgs per hh)			15.94	1.10	-	0.47
Crop 4 – Bengal gram						
Variety		-	-	JG-14	Jackey	Variety-CSJ-515
Quantity (kgs/hh)		-	-	16	32	16
Area Sown (acres)		-	-	0.5	0.30	0.17
Season(acres)	Kharfi	-	-	-	-	
	Rabi	-	-	-	0.30	0.17
	Summer	-	-	-	-	
Output Produced from seed mini kits (Quintals per hh)		-	-	2.45	3.08	4.21
Output used as seed (kgs per hh)		-	-	0.76	15	0.29

* Lentil crop and not red gram

The output produced from using the SMK was 3.08 quintals per household and from this output, the respondent farmers used 15 kg per household as seed. In Rajasthan the respective varieties of seeds in the SMK were obtained by selected farmers, lentil *PL-8* variety, green gram *IPM-02/03* and *MH-421* varieties, black gram *PU-1, Pratap-1* varieties and Bengal gram *CSJ-515* variety. Among them, the most quantity was obtained by Bengal gram farmers per household (16 kg), the largest area was sown by green gram farmers (3.78 acres per household) that produced an output of 9.39 quintals per household. Of all the four pulses, output from black gram was among the highest ploughed back as seed into the production system (0.47 kg/hh).

The package of seedminikits also mandates providing, a pamphlet regarding package of practice (POP) and phosphate solubilizing bacteria (PSB) culture and Rhizobium of 100 grams per packet per mini kit to pulse farmers. In our sample, we tried to investigate whether farmers were being provided these additional items or not. In Bihar, approximately over half of the small farmers (53.68 per cent), 31.58 per cent of the marginal farmers and 14.74 per cent of the medium farmers noted that Rhizobium was present in the SMKs. In Karnataka, over 90 per cent of the marginal, small and medium farmers noted the presence of POP and Rhizobium and all farmers irrespective of land size categories stated that PSP culture was present in their SMK. A majority of the small farmers asserted the presence of Rhizobium (97 per cent) in Maharashtra and less than 8 per cent of the selected farmers stated that the kit contained PSP culture and only a few farmers (less than 5) noted the presence of both PSP and Rhizobium in the SMK distributed **(Table 4.19).** In Madhya Pradesh, however, kits did not include any of these facilities. In other words, Madhya Pradesh made exception as only seed was being provided without any package of practice or any other nutrients unlike other states.

The various sources of seed purchased by the selected farmers are tabulated in **Table 4.20 & 4.20.1**. In Bihar, selected farmers sourced 2 kg of red gram per household from the agriculture department, which were at a distance of less than 5 km from their farms free of cost under the programme. While in Bihar lentil which was not supplied through the programme worth of 24 kg per household was bought from private dealers at a cost of Rs 3280 per household. In Karnataka, all three varieties of pulses (red, black and green) of 5 kg each were obtained free of cost entirely from the RSK. These agriculture offices were at a distance in the range of 7-9 km from their respective farms. In terms of transportation cost, each selected farmer in Karnataka incurred a cost of approximately Rs. 20 per kit as transport freight. Under the SMK scheme in Madhya Pradesh, among the three pulses, 68.5 per cent of farmers sourced 16 kg of chickpea from the RSK, while only a small percentage of lentil and black gram farmers sourced these pulses from the RSK. All these farmers incurred a cost of Rs. 20 per kit as transport freight.

Table 4.19: Contents of the Seed minikits (%)

States	Farm Size	POP	PSP culture (100gms)	Rhizobium (100gms)	PSP and Rhizobium	Others
Bihar	Marginal	---	---	31.58	---	31.58
	Small	---	---	53.68	---	53.68
	Medium	---	---	14.74	---	14.74
	Large	---	---	---	---	---
	Total	---	---	100.00	---	100.00
Karnataka	Marginal	95.83	100.00	97.22	---	---
	Small	94.17	100.00	92.23	---	---
	Medium	93.88	100.00	93.88	---	---
	Large	85.71	100.00	100.00	---	---
	Total	94.37	100.00	94.37	---	---
Madhya Pradesh	Marginal	nil	nil	nil	nil	nil
	Small	nil	nil	nil	nil	nil
	Medium	nil	nil	nil	nil	nil
	Large	nil	nil	nil	nil	nil
	Total	nil	Nil	nil	nil	nil
Maharashtra	Marginal	-	4.44	84.44	11.11	---
	Small	-	2.00	97.00	1.00	---
	Medium	-	8.11	89.19	2.70	---
	Large	-	5.56	83.33	11.11	---
	Total	-	4.00	91.50	4.50	---

Table 4.20: Seed purchased by the farmer for the reference year through Seed minikits

States	Crop	Qty in kgs	Price (Rs/ kit)	Source of purchase (%)				Distance from farm (kms)	Transportation Cost (Rs/Kit)
				KVK	RSK	Private Dealer	Agriculture Dept		
Bihar	Red Gram	2.0	free				4.76	2-5	-
	Black Gram	-	-	-	-	-	-	-	-
	Green Gram	-	-	-	-	-	-	-	-
	Lentil	24	3280			45.24		2-8	-
Karnataka	Red Gram	4.12	free		100	-	-	8.58	19.83
	Black Gram	4.30	free		100	-	-	7.23	18.89
	Green Gram	4.36	free		100	-	-	8.03	20.59
	Others					-	-		
Madhya Pradesh	Chickpea	16	0		68.5	-	-	12	20
	Lentil	8	0		10	-	-	11	20
	Black Gram	4	0		21.5	-	-	12	20
Maharashtra	Red Gram	4	-	-	100	-	-	8.26	12.05
	Bengal Gram	8	-	-	100	-	-	17.53	13.55
Rajasthan	Lentil	8	500	-	100	-	-	-	-
	Black Gram	4	500	-	100	-	-	-	-
	Green Gram	4	450	-	100	-	-	-	-
	Bengal Gram	16	1840	-	100	-	-	-	-

Note: KVK: Krishi Vignan Kendra; RSK: Raitha Samparka Kendra

Table 4.20.1: Seed purchased by the farmer from other sources in the reference year

States	Crop	Qty in kgs	Avg Price (Rs/ kg)	Source of purchase (%)				Distance from farm (kms)	Transportation Cost (Rs/Kg)
				RSK	Private Dealer	Co-op society	Own retained seed		
Karnataka	Red Gram	5.52	91.15	-	39.39	21.21	39.39	9.5	18.75
	Black Gram	5.58	92.08	-	25.00	50.00	25.00	10.33	17.91
	Green Gram	6.31	80.09	-	42.86	45.24	11.90	8.38	17.40
Madhya Pradesh	Chickpea	55	62	-	35	-	65	10	32
	Lentil	25	51	-	40	-	60	8	28
	Black Gram	16	93	-	44	-	49	10	23
Maharashtra	Red Gram	5.89	68.89	-	72.22	27.78	-	7.11	4.95
	Bengal Gram	23.25	73.91	-	62.86	37.14	-	12.97	2.37
Rajasthan	Red Gram	8	500	-	25.42	-	74.58	0	-
	Black Gram	4	500	-	27.08		72.92	0	-
	Green Gram	23.59	108	-	60.15	3.76	36.09	0.08	0.08
	Bengal Gram	33.33	132	-	50	-	50	1	1.67

Note: KVK: Krishi Vignan Kendra; RSK: Raitha Samparka Kendra
*Own seed

All the selected farmers in Maharashtra sourced their respective quantities of red gram (4 kg) and Bengal gram (8 kg) seeds entirely from the RSK. Although the distance of the RSK from the farms was farthest for Bengal gram farmers they incurred the least in terms of transportation cost (Rs. 12-14/kit). In Rajasthan, seed for all four pulses grown were bought from RSK with Bengal gram being the largest quantity (16 kg) bought at the price of Rs. 1840 per kit, followed by lentil (8 kg) and black at Rs. 500 per and green gram at Rs 450 for each kit. Among the other sources of seed purchases, farmers in Karnataka sourced three varieties of pulses from either private dealers or cooperative societies and others. Individually, red gram farmers purchased 5.52 kg per household at the price of Rs. 91.15 per kg from private dealers (39 per cent), cooperative societies (21.21 per cent) and others (39.3 per cent) with approximate cost of Rs. 16 per kg in terms of transportation. Black gram farmers in Karnataka bought 5.58 kg per household at Rs. 92.8 per kg mostly from the co-operative societies (50 per cent) and spent approximately Rs. 17.91 per kg on transportation cost. Similarly, green gram seeds were sourced in equal measures from both private dealers (42.86 per cent) and co-operative societies (45.24 per cent).

In Maharashtra, 5.89 kg of red gram at the average price of Rs. 68.89 per kit from private dealers (72.22 per cent) and Co-operative societies (27.78 per cent) that were located at a distance of 7.11 km from the farm and transportation cost per kg worked out to Rs. 4.95 per kg. Similarly, a few farmers from Maharashtra also purchased 23.25 kg of Bengal gram seeds at the cost of Rs. 73.91 per kit from both private dealers (62.86 per cent) and co-operative societies (37.14 per cent) which were at a distance of 12.97 km from the farm with transportation cost to the farmer at Rs. 2.37/kg. In

Rajasthan and Madhya Pradesh, a majority of farmers used own retained seed while others bougth through private dealers among the other sources of seed procurement by the selected farmers.

4.8 Marketing channels

Each of the selected study state has a host of channels for marketing the pulses they produced. In Karnataka, around 65 per cent of the respondent farmers producing black, green and red gram sold their produce at wholesale markets and remaining approximately 35 per cent sold their produce to merchants or pre-arranged contracts with buyers of these pulses. Although it may be noted that large farmers producing green gram preferred to sell their entire produce at the whole sale market. Chickpea and lentil producers in Madhya Pradesh sold 50 per cent of their produce to village farmers, while black gram producing farmers in the State distributed their marketing channels almost equally among village farmers (30.23 per cent), hat market (30.23 per cent) and APMC (37.21 per cent) with only a small percentage (2.33 per cent) marketing their produce with village traders. In Maharashtra, the Bengal gram and red gram growers among the respondent farmers sold their produce primarily to the APMC/ whole sale market followed by a small percentage dealing with intermediaries at the farm gate. In Rajasthan, merchants or buyers based on pre-arranged contracts was the primary channel used by selected farmers growing green gram (51.85 per cent), black gram (58.33 per cent), Bengal gram (66.67 per cent) and 72.22 per cent of the farmers growing lentils. The next marketing channel used by these farmers was the APMC or wholesale markets across the four varieties of pulses marketed in the State (**Tables 4.21-4.24**).

Table 4.21: Marketing channels through which pulses sold by the selected households – Karnataka (percentage of output)

Farm Size	Wholesale market	Local market	Village directly	Co-operative	Govt Agencies	Intermediar at farm ga	Merchant or pre-Contract	Others	Aggregate
Crop 1 – Black gram									
Marginal	55.81	-	-	-	-	-	44.19	0.00	100.00
Small	59.99	-	-	-	-	-	38.90	1.11	100.00
Medium	74.53	-	-	-	-	-	25.47	0.00	100.00
Large	62.63	-	-	-	-	-	37.37	0.00	100.00
Total	62.79	-	-	-	-	-	36.66	0.55	100.00
Crop 2 – Green Gram									
Marginal	66.06	-	-	-	-	-	33.94	0.00	100.00
Small	62.50	-	-	-	-	-	37.50	0.00	100.00
Medium	78.31	-	-	-	-	-	21.69	0.00	100.00
Large	100.00	-	-	-	-	-	0.00	0.00	100.00
Total	68.36	-	-	-	-	-	31.64	0.00	100.00
Crop 3 – Red Gram									
Marginal	56.43	-	-	-	-	-	43.57	0.00	100.00
Small	69.70	-	-	-	-	-	28.75	1.54	100.00
Medium	52.49	-	-	-	-	-	47.51	0.00	100.00
Large	78.18	-	-	-	-	-	21.82	0.00	100.00
Total	61.56	-	-	-	-	-	37.79	0.65	100.00

Table 4.22: Marketing channels through which pulses sold by the selected households –Madhya Pradesh (percentage of output)

Particulars	Village farmers	Nearby Hat	Village Traders	APMC
Chickpea				
Marginal	50.00	40.38	0.00	9.62
Small	55.74	31.15	0.00	13.11
Medium	50.00	37.50	0.00	12.50
Large	50.00	12.50	0.00	37.50
Total	52.55	34.31	0.00	13.14
Lentil				
Marginal	30.00	10.00	40.00	20.00
Small	66.67	11.11	22.22	0.00
Medium	0.00	0.00	0.00	0.00
Large	100.00	0.00	0.00	0.00
Total	50.00	10.00	30.00	10.00
Black Gram				
Marginal	34.78	34.78	4.35	26.09
Small	23.53	29.41	0.00	47.06
Medium	50.00	0.00	0.00	50.00
Large	0.00	0.00	0.00	100.00
Total	30.23	30.23	2.33	37.21

Table 4.23: Marketing channels through which pulses sold by the selected households -Maharashtra (percentage of output)

Farm Size	Wholesale market	Local market	Village directly	Co-operative	Government agencies	Intermediaries at farm gate	Merchant or pre-arranged Contract	Others	Aggregate
Bengal gram									
Marginal	82.10	-	-	-	-	17.90	-	-	100
Small	83.91	-	-	-	-	16.09	-	-	100
Medium	83.33	-	-	-	-	16.67	-	-	100
Large	86.17	-	-	-	-	13.83	-	-	100
Total	83.63	-	-	-	-	16.37	-	-	100
Red Gram									
Marginal	80.69	-	-	-	-	19.31	-	-	100
Small	89.83	-	-	-	-	10.17	-	-	100
Medium	85.33	-	-	-	-	14.67	-	-	100
Large	86.86	-	-	-	-	13.14	-	-	100
Total	87.50	-	-	-	-	12.50	-	-	100

Table 4.24: Marketing channels through which pulses sold by the selected households -Rajasthan (percentage of output)

Farm Size	Wholesale market (APMC)	Local market	Village directly	Co-operative	Government Agencies	Intermediaries at farm gate	Merchant or pre- arranged Contract	Not sale	Aggregate
Green Gram (Moong)									
Marginal	41.18	-	-	-	-	-	58.82	0.00	100
Small	27.78	-	-	-	-	-	69.44	2.78	100
Medium	48.98	-	-	-	-	-	51.02	0.00	100
Large	69.70	-	-	-	-	-	30.30	0.00	100
Total	47.41	-	-	-	-	-	51.85	0.74	100
Black Gram (Urad)									
Marginal	21.95	-	-	-	-	-	68.29	9.76	100
Small	36.36	-	-	-	-	-	54.55	9.09	100
Medium	71.43	-	-	-	-	-	14.29	14.29	100
Large	100.00	-	-	-	-	-	0.00	0.00	100
Total	31.67	-	-	-	-	-	58.33	10.00	100
Bengal Gram (Gram)									
Marginal	0.00	-	-	-	-	-	100.00	0.00	100
Small	28.57	-	-	-	-	-	71.43	0.00	100
Medium	50.00	-	-	-	-	-	50.00	0.00	100
Large	33.33	-	-	-	-	-	33.33	33.33	100
Total	26.67	-	-	-	-	-	66.67	6.67	100
Lentil									
Marginal	16.13	-	-	-	-	-	74.19	9.68	100
Small	25.93	-	-	-	-	-	74.07	0.00	100
Medium	25.00	-	-	-	-	-	71.43	3.57	100
Large	50.00	-	-	-	-	-	50.00	0.00	100
Total	23.33	-	-	-	-	-	72.22	4.44	100

4.9 Farmers' perspectives on SMK distribution, quality and other indicators

In order to monitor farmers' satisfaction with the programme, we asked participating farmers in the seed kits scheme, various qualitative and quantitative questions regarding distribution of kits, timely delivery, quantity of seed distributed and the quality of seeds and so on. The farmers responses are analysed in the following paragraph.

Almost all selected beneficiary farmers from across the study states observed SMK advantageous in their production of pulses and a quality and yield difference in the seeds distributed apart from these seeds yielding better productivity and profitability. A majority of farmers in Bihar, Madhya Pradesh and Rajasthan observed that there was a difference of quality and yield which ensured better profitability for the farmers. Similarly, more than 90 per cent beneficiaries in Karnataka observed better yield. In Madhya Pradesh in addition to better quality, all selected beneficiary farmers also pointed out that those seeds also ensured shorter crop duration which leaves the farmers with more time for planning the next crop. A majority of the selected farmers were satisfied with the quantity of seeds supplied in the SMK except Rajasthan where all farmers pointed

out that the quantity distributed was less and desired that more quantity of seeds should be distributed. Among farmers who were not satisfied with the quantity distributed, around 37 per cent in Bihar wanted around 20 kg seeds in the minikits; around 40 per cent in Karnataka wanted 10 to 20 kgs; around 22 per cent in Maharashtra desired 15-20 kg and all farmers in Rajasthan desired 8 kg green gram and black gram each, 16 kg lentils and 20 kg Bengal gram (**Tables 4.25.1 and 4.25.2**).

Table 4.25.1: Farmers opinion regarding distribution of Seed minikits for the reference year (%)

Opinion		Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
a. Is seed minikit distribution advantageous	Yes	100	96.97	-	91.5	100
	No	0.00	3.04	-	8.50	0
1		27.00	91.97	74.00	46.50	100
2		25.50	56.7	73.00	2.50	100
3		47.50	10.27	64.00	5.50	-
4		-	0.9	100.00	0.50	-
5		-	1.34	-	8.50	-
1, 2		-	-	-	20.50	-
1,2,3		-	-	-	4.00	-
1,3		-	-	-	10.50	-
2,3		-	-	-	1.50	-

Code: Yield difference = 1; Quality difference = 2; More profitable = 3; Short duration crop = 4; Any other = 5

Table 4.25.2: Farmers Opinion regarding quantity of seed supplied in Seed minikits for the reference year

Sufficient in Quantity (%)	Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
1. Yes	63.5	59.31	100	78.50	0
2. No	36.5	40.70	0	21.50	100
Opinion –how much quantity in kgs should be distributed					
1-5 kgs		10.82	-	5.50	Green gram = 8 kgs
5-10 kgs		22.08	-	-	Bengal gram=20 kg
10-15 kgs		2.60	-	-	Black gram=8 kgs
15-20 kgs		3.03	-	11.0	Lentil=16kgs
> 20 kgs	36.5	2.16	-	5.00	-
Total	36.5	40.7	0.0	21.50	-

Regarding participants' opinion about the quality of seeds distributed though seed kits, around 56 per cent farmers in Bihar, 82 percent farmers in Maharashtra, 84 per cent in Karnataka, 89 per cent in Rajasthan and all farmers in Madhya Pradesh expressed satisfaction in the seed quality distributed and indicated that the quality of the seeds in the SMK were superior to those available in the market, particularly with regard to yield and germination (**Tables 4.25.3 and 4.25.4**). However, there were a few farmers from Maharashtra who sought drought resistant varieties of seeds and a majority in Bihar who indicated poor germination of distributed seeds. To the question of timely

distribution of seeds, almost 90 per cent of the beneficiary farmers were satisfied with the timing of distribution of seed in the selected states except the case of Bihar where almost 90 per cent farmers pointed out that the seeds were not distributed on time.

Table 4.25.3: Farmers opinion regarding quality of seed supplied in Seed minikits for the reference year

Quality better than seed available in market (%)		Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
1.	Yes	55.5	83.99	100	81.5	88.5
	No	44.5	16.02	0.00	19.5	44.0
Opinion –Provide reasons for yes						
Good quality and yield		-	36.36	65.50	-	56.0
Good Germination		-	23.81	54.50	-	-
Good grain size and grain quality		-	9.09	33.00	-	-
Drought and disease resistance		-	14.72	61.00	-	-
Certified and tested seed given		70.27	-	-	-	-
Good yield		29.73	-	-	-	-
Opinion –Provide reasons for no						
- Disease occurrence increased		-	-	-	16.22	-
- Use of pesticides & insecticides increased		-	-	-	16.22	-
- More HYV seeds required		-	-	-	40.54	-
- Drought resistance variety is required		-	-	-	27.03	-
Low germination		66.29	-	-	-	-
Low yield		33.71	-	-	-	-

Table 4.25.4: Farmers opinion regarding timeliness of distribution of Seed minikits for the reference year

Timely distribution of Kit (%)	Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
1. Yes	11.5	89.18	-	83.50	95.0
2. No	88.5	10.83	-	16.50	5.0
On time distribution	-	86.15	-	-	
Advance distribution	-	2.6	-	-	-
Delayed by 1-2 weeks	-	2.6	-	-	-
Delayed by 1-2 months	-	5.63	-	-	-
Higher distance of farm to Gram Panchayat supplying information about kit	-	-	-	15.15	-
Lack of information about documents required for the kit	-	-	-	54.55	-
Information spread about the scheme is very low	-	-	-	30.30	-

A significant number of respondent farmers in Karnataka stated that they faced no issues (90.48 per cent) in accessing the scheme. However in Bihar, around 81 per cent respondent pointed out that the seed kits were distributed among kith and kin of the officials alone. Around 19 per cent pointed out that use of mobile based OTP procedures hindered them from accessing these kits. In Madhya Pradesh, around 27 per cent beneficiary farmers pointed out that there was shortage of seeds

while other 73 per cent expressed that seed supplied were inadequate and need more quantity to be distributed. In Maharashtra, more than 80 per cent beneficiaries recommended for more publicity and awareness to be provided about the programme. In Rajasthan (100 per cent), Madhya Pradesh (73 per cent) and Bihar (40.5 per cent) farmers indicated limited availability of SMK (**Tables 4.26 and 4.27**) and also mentioned that the distribution was among farmers and their acquaintances rather than a non-biased distribution based on the scheme's target beneficiaries. Owing to this several farmers in Bihar stated that eligibility criteria for distribution of SMK should be adhered to in a transparent manner. Along these lines, there should also be checks and balances to ensure no proxy distribution of seeds.

Table 4.26: Major issues faced by farmers in availing the Seed minikits (%)

Sl. No.	Issues	Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
1	No issues	-	90.48	-	5.00	-
2	Documentations and procedural issues	-	6.93	-		-
3	Poor quality and shortage of seeds	-	3.90	27.00		-
4	Provision of seed minikits to all farmers instead of some selected farmers	-	-	-	3.50	-
5	Seed supplied is inadequate	-	-	73.00	4.00	-
6	Lack of creation of awareness about minikit	-	-	-	81.00	-
7	No Comments	-	-	-	6.50	-
8	Use of mobile OTP hinders distribution	19.0	-	-	-	-
9	Distribution to kith and kin	81.0	-	-	-	-

Table 4.27: Major problems faced by farmers in availing the Seed minikits (%)

Sl. No.	Issues	Bihar	Karnataka	Maharashtra	Rajasthan
1	No problem	-	86.58	83.50	-
2	Time consuming	-	2.16	-	-
3	Untimely distribution	-	2.16	-	-
4	Procedural problem	-	9.09	-	-
5	Lack of creation of awareness among farmers	-	-	2.00	-
6	No provision of on farm/ door step delivery of kits	-	-	3.00	-
7	Many documents demanded to avail kits	-	-	1.50	-
8	Random selection/ distribution of kits	-	-	10.00	-
9	Less supply	-	-	-	100
10	Poor quality	-	-	-	2.5
11	No suitable variety	-	-	-	0.5
12	Untimely availability	-	-	-	3.5
13	Availability of limited numbers	40.5	-	-	-
14	Procedural pre condition	22.00	-	-	-
15	Delay in reimbursement of assistance	22.5	-	-	-
16	Absence of timely information	15.0	-	-	-

Majority of selected farmers in Rajasthan and Karnataka stated that augmenting the supply of SMK and timely distribution in line with the cropping seasons in the respective pulses growing regions of the States would be a constructive effort towards improving the effectiveness of the scheme. Farmers from three study states also stressed the need for the provision of pulse seeds with characteristics such as short duration, drought and pest resistant. A majority of farmers in Karnataka suggested that wider publicity (36.3 per cent) of the scheme is more likely to help enhance the scheme's uptake (**Tables 4.28 and 4.29**).

Table 4.28: Measures to improve the effectiveness of the Scheme (%)

Sl. No.	Measures	Bihar	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan
		-	-	-	-	-
1	Technical guidance	-	11.86	-	-	-
2	increase the supply and timely distribution of seeds	-	30.93	-	-	-
3	include a greater number of crops	-	27.32	-	-	-
4	Improved Variety	-	10.31	-	-	-
5	ICT and Market information	-	4.64	-	-	-
6	Create awareness	26.0	14.95	-	7.50	-
7	Short duration variety	-	-	12.50		-
8	More Advertisement	-	-	23.50		-
9	Field demonstration with full packages of practices of pulses production	-	-	39.50		-
10	Seed Germination test should be compulsory	-	-	24.50		-
11	The market/ support price for pulses should increase	-	-	-	13.00	-
12	Supply the variety of the seed suitable for local conditions	-	-	-	4.50	-
13	Need to conduct workshop/ training programme for proper guidance about usage of minikit	-	-	-	1.00	-
14	Provision of fertilizer, pesticides, etc. along with minikit at subsidized rates	-	-	-	12.00	-
15	Provision of seed suitable for early and late sowing of crops	-	-	-	30.50	-
16	Wider coverage/distribution of seed minikits – inclusion of all the farmers	-	-	-	1.50	-
17	No Comments	-	-	-	28.00	-
18	Supply according to deman	-	-	-	-	2.5
19	Suitable variety	-	-	-	-	60
20	Timely availability	-	-	-	-	3.5
21	Government purchasing	-	-	-	-	7.5
22	Draught resistant variety	-	-	-	-	50.5
23	Pest resistant variety	-	-	-	-	50.5
24	All farmers to be covered	-	-	-	-	44.5
25	Application of seed ensured	32.5	-	-	-	-
26	Real time supervision	29.5	-	-	-	-
27	Reimbursement may be linked with confirmation of sowing	12.0	-	-	-	-
28	No Problem	-	-	-	2.00	
29	More supply	-	-	-		100

Table 4.29: Farmers suggestions to improve the reach of the Scheme (%)

Sl. No.	Suggestions	Karnataka	Madhya Pradesh	Maharashtra
1	Publicity	38.96	-	-
2	Increase the beneficiary	14.72	-	-
3	Increase the quantity of seed	8.23	-	-
4	Conduct meetings and demonstration	19.48	-	-
5	Impart training and information	25.97	-	-
6	Disseminate the Knowledge about latest available varieties of pulses and their sources of availability	-	21.68	-
7	Minikits should be supply at Minimum rate	-	25.78	-
8	Monitoring/Supervision after sowing	-	20.08	-
9	Enhanced advertisement among the respondents of the scheme	-	17.74	-
10	Produce of the Beneficiaries should be distributed among respondents	-	14.72	-
11	Creation of more awareness about the scheme through various means	-	-	21.5
12	Distribution of minikits to all pulse growing farmers	-	-	10.00
13	Appointment of more skilled and trained agril. officer/ assistants for proper dissemination of information	-	-	1.5
14	Provision of seed varieties as per soil and weather conditions	-	-	3.00
15	Provision of seed minikits for other crops in addition to pulses	-	-	1.00
16	Provision of higher quantity of seed in minikit	-	-	1.00
17	Rise in market/ support prices for pulse crops	-	-	1.50
18	Demonstration should be given before distributing the Seed minikit	-	-	47.00
19	No Problem	-	-	6.00
20	No Suggestions	-	-	7.50

This was also noticed by several farmers particularly in Maharashtra, who indicated lack of awareness as an issue for not having access to the kits and therefore, improvising the various modes of awareness creation for the scheme. In addition, in Maharashtra (47 per cent) and Madhya Pradesh (40 per cent) of the selected farmers indicated that there should be field demonstrations with full package of practices before sowing as well as compulsory seed germination testing, which was emphasized by 24.5 per cent of the selected farmers in Madhya Pradesh. Real time supervision from sowing to harvesting was also a suggestion made by selected farmers in Madhya Pradesh (20.08 per cent) and Bihar (29.5 per cent) as well as an increase in the market/support price. In addition, conducting training programmes and dissemination of information about the scheme can increase its reach that could benefit a larger number of farmers.

4.10 Summary of the chapter

- The largest percentage of SMK were distributed among the marginal and small farmers in the study states

- In Bihar, the area under pulses and net price obtained per quintal was higher among farmers without SMK, however, the value of output per acre, net returns per acre were higher for farmers with SMK at a lower cultivation cost.
- In Karnataka, the area under pulses, output value, net returns and net price was higher for farmers with SMK, although the cultivation cost was lower for farmers without SMK.
- In MP and Maharashtra, the pulses area, output value, net returns and net price were all higher for farmers with SMK at a lower cultivation cost compared to farmers growing pulses without SMK.
- In Rajasthan, the area under pulses was the same for both farmers with and without SMK. However, the output value and net returns were higher for farmers without SMK. While, the cultivation cost was lower for farmers with SMK and they also obtained a higher net price per quintal. Among all five states, only in Rajasthan both value of output and net returns were higher for without SMK compared to SMK farmers unlike other states where SMK farmers had both higher value of output as well better returns.
- Similarly, all selected farmers growing other varieties of pulses using SMK in Bihar, MP, Maharashtra and Rajasthan stated that they had lower total cost when measured item-wise.
- In terms of sowing pattern, Bihar mostly adopted broad casting, Karnataka and MP farmers preferred line sowing and half of the selected farmers in Maharashtra adopted drill sowing.
- Across all the study states, a majority of the selected farmers learnt about the distribution of SMK from the Agriculture Officers at RSKs.
- The criteria for farmer selection in the scheme was primarily based on the farmers interest and approaching the authorities, primarily among marginal and small farmers. The other selection criteria were their SC/ST status or based on gender of the farmer.
- Each study state distributed different varieties of pulses which farmers mostly sowed during kharif season. Among these study states, selected farmers also used a certain portion of the output as seed that was highest for red and green gram in Karnataka, black gram in MP and lentil in Bihar.
- All the selected farmers from across the study states found the SMK advantageous in their production of pulses and they observed a quality and yield difference. Both in terms of quantity and quality of the seeds in the SMK, a major proportion of the selected farmers opined it was sufficient and superior in quality, respectively.

- Although, all selected farmers stated that they faced no issues in availing the SMK scheme, a few farmers suggested augmenting the availability of SMK and its transparent distribution based on the scheme's farmer selection criteria.
- Other suggestions included introducing short duration, drought and pest resistance varieties of pulses, improved modes of awareness creation and dissemination of information, field demonstrations with full package of practices as well as compulsory seed germination tests prior to sowing among others.

Chapter 5

Summary of Findings and Policy Suggestions

Agriculture accounts for a considerable amount of India's economic development, as it provides food for more than 1.2 billion people and employment to about 54.6 per cent (Census, 2011) of the population. India is the world's second largest producer of rice, wheat and other cereals. The huge demand for cereals in the global market is creating an excellent environment for the export of Indian cereal products (APEDA). India is by and large vegetarian in dietary habit and heavily depends upon vegetative source to meet out its daily protein requirement. India is global leader in terms of production and consumption of pulses. India is leading importer of pulses because production of pulse/ legume crops has been stagnant over the years (Singh *et.al* 2015) although situation has slightly changed in the recent past. Consequent upon this, there is widening gap between demand and supply/availability of pulses. About 20 per cent of the total pulses demand is met by imports only. Therefore, to raise the domestic production of pulses the Central and state governments have initiated various programme oriented at raising production of pulses though enhancement in area as well as productivity of pulses. NFSM, ISOPOM and several other programmes are implemented since the beginning of the Century. Seed Minikits is another such programme. This report analyses the relevance and distribution efficiency of seed minikits programme in pulses.

5.1 The aim of seed mini-kits programme

Seed Mini-kits are meant for introduction and popularization of latest released / pre released varieties /hybrids not older than 10 years among the farmers free of cost. Central Seed Agencies deliver allotted seed minikits to the destination identified by the beneficiary states within the stipulated time. Seed minikits are distributed for rice, wheat, pulses and nutri-cereals. The agencies like NSC /HIL / KRIBHCO /NAFED/ IFFCO / IFFDC / Central Multi-state Cooperatives such as NCCF/SSCs etc., are involved in supply of seed minikits at the national level. The price of seed minikits is fixed by the NFSM Mission Director at National level and 100 per cent cost is reimbursed to the agencies on certification of receipt by the state. The allocation of seed minikits is approved by the NFSM-EC before commencement of kharif/rabi/summer seasons.

The required leaflets on cultural practices should be kept in the seed minikits along with rhizobium /PSB culture wherever it is required in the respective seed packet of minikits. The cultural practices should be printed in Hindi, English and local languages for the respective states. The agencies should deliver the consignment up to district headquarters level of the respective state

governments, beyond which the distribution of seed minikits should be taken care by the state department of agriculture.

After receiving the minikits at destination place of the district, proper distribution of minikits within 10 days to the appropriately identified farmers must be ensured by the district level agriculture officer, concerned. The purpose is to ensure, that the identified farmer is capable of raising the crop with care and diligence such that the plot serves as a good demonstration to other farmers. Only one minikit per farmer and not more than 3 minikits in a season and a village are to be distributed. Following are the eligibility criteria for receiving seed minikits by the farmers:

- Minikits are distributed to farmers on the basis of priority to Scheduled caste, Schedule tribe, small, marginal and below poverty line farmers.
- 10 per cent of total cost of minikit will be charged as token money from the farmers.
- Minikits are given to Women farmers even if land owner is her husband/father/father-in- laws.
- One minikit is given to only one woman in a family.
- If in a Gram Panchayat, Schedule caste and Schedule tribal farmers are not available or negligible then only minikits are to be distributed to general category women farmers.
- Minikits are distributed to those farmers who were not benefited during last three years.
- Priority will be given to those farmers having irrigation facilities.

5.2 Distribution of seed minikits in pulses

In order to promote quick spread of new varieties of pulses, minikits of pulses seed varieties not older than 10 years are provided free of cost to farmers. National and state seed producing agencies supply minikits to state government for distribution amongst farmers. Allocation of minikits is made to all farmers in contiguous area of at least 25 hectares. The size of minikits is 16 kg of gram, 8 kg seed of lentil and 4 kg each for moong, urd and pigeon pea. This quantity would be sufficient to plant 0.2 ha. In addition, under this package, state governments are also providing, a pamphlet regarding package of practice (POP) and phosphate solubilizing bacteria (PSB) culture of 100 grams per packet per mini kit to pulse farmers. The price of seed minikits is fixed by National Food Security Mission-Executive Committee (NFSM-EC) and the cost is reimbursed to the agencies on certification of receipt by the state government. The state government is required to educate/provide training to the farmers to multiply seed mini-kits seeds for further use.

5.3 Need for the study

As the programme is under progress for last three to four years, it is required to see the various aspects of implementation of this programme. How efficiently the distribution of seeds is taking

place. We need to check whether the scheme is relevant and useful from the viewpoint of farmers. It is also important to examine whether seed minikits have any significant impact on productivity and how much area is being cropped under such seeds. Therefore, keeping the importance in mind, the present study was initiated to examine the need, application, pertinence and efficiency in distribution of seed minikits.

5.4 Objectives of the study

The objectives of the study are as follows:

- To assess the relevance and the requirement of seed mini-kits among the farmers
- To compare the productivity of pulse crops using seed minikits with the control farmers/non users
- To suggest policy measures to address the efficiency issues in application/distribution of seed mini-kits.

5.5 Data and methodology

The study has been carried out in 5 different states of India by the respective Agro Economic Research Centres (AERC'S) using secondary and primary level data. The states selected for the study are Bihar, Karnataka, Madhya Pradesh, Maharashtra and Rajasthan. Agricultural Development and Rural Transformation Centre (ADRTC) Bengaluru carried out the study for Karnataka and also coordinated and prepared the report for consolidated all India. For the selection of sample in each state, two districts were selected, one each from irrigated and dryland conditions based on highest seed minikits distributed during the reference period of 2017-18 and 2018-19. Among the selected districts, a sample of 100 seed minikit beneficiary farmers and 50 control group pulse growing farmers were selected using random sampling method. Thus, the total sample consists of 1000 beneficiaries and 500 non beneficiary farmers at the aggregate in five states. These selected respondents were further categorized into marginal (< 2.5 acres), small (2.5 – 5 acres), medium (5 - 10 acres) and large (> 10 acres) land holding categories. The reference period of survey data was 2018-19, i.e., Kharif (July-Nov 2018), Rabi (Nov 2018 to March 2019) and Summer (March-June 2019).

5.6 Major findings

Pulses are a primary source of protein for a majority of Indians. As an inexpensive, non-animal source of protein, pulses hold a prominent position in Indian diets, and the country is currently the

largest producer, consumer and importer of pulses in the world. Its positive externalities such as nitrogen fixation, lower water and chemical consumption, make it an ideal crop for domestic production by small farmers in dry regions. However, a 2010 report titled '*Overcoming the Pulses Crisis*' by the Confederation of Indian Industry, stated that the production of pulses grew only by 45 per cent from 1951 to 2008, while wheat production grew by 320 per cent and rice by 230 per cent.

Although the production of pulses has risen in the past decade by 65 per cent between 2009-10 and 2020-21, as per the Third Advance Estimate given by the Ministry on May 2021, over-all growth was not sufficient to meet the domestic demand, which has been met by imports since 1981. This heavy import bill on the exchequer has been due to the stagnant productivity coupled with declining availability, which has created a substantial demand-supply gap. Several reasons have been cited for this decline, such as climatic factors, improvement in irrigation facilities that led to a shift in cropping pattern, ineffective procurement, high variation in procurement prices, while others quote the poor yield and limited access to high-yield varieties of seeds among others.

Looking ahead, the demand for pulses by 2030 is estimated to be 32.64 million tonnes with an annual required growth rate of 2.64 per cent. In view of this forecast, interventions such as the agricultural price policy in the form of minimum support price (MSP), subsidies for inputs, investments in yield increasing technology and infrastructure such as roads and irrigation and direct market procurement have all endeavoured to improve supply responses. Among these interventions, one of the key strategies were to improve productivity and the reach of time-tested high-yielding pulse varieties. The latter was operationalized with the launch of a Seed Minikit Programme that aimed to distribute high-yielding varieties of seeds of oilseeds and pulses to farmers. They were provided by the Central agencies NAFED, National Seeds Corporation (NCS), and Gujarat State Seeds Corporation and the wholly funded by the government through the National Food Security Mission.

In our secondary data analysis, we observed that in all the major pulses growing states, while the area indicated signs of fluctuation during the period 1990-91 to 2018-19, the productivity under pulses cultivation in all states increased, except for black gram/urad productivity in Maharashtra and other pulses in Rajasthan while, the trend in both; area and productivity under other pulses in Uttar Pradesh was positive. The share of pulses in the gross cropped area increased for all major pulse growing states except Bihar and Uttar Pradesh during the same time period.

In the major pulse growing states, Bihar solely depended on bore-well, Karnataka and Rajasthan's net operated area were largely rainfed (61%), while, Madhya Pradesh's net operated area was

irrigated by only canals (43.15 per cent) and Maharashtra depended on rainfall as well as used water from canals for irrigation. As a percentage of GCA, among the study states, in Bihar and Karnataka, paddy and other crops were mostly irrigated. While, in Madhya Pradesh, Maharashtra and Rajasthan, commercial crops and other pulses were covered under irrigated crops. As rainfed crops, other pulses and oil seeds were grown in Bihar, while ragi, green gram and other pulses were rainfed crops in Karnataka, other pulses and oilseeds in Madhya Pradesh, commercial crops and oil seeds were rainfed crops in Maharashtra and green gram and other cereals were rainfed crops in Rajasthan.

In terms of aggregate of all crops grown in the study states, Madhya Pradesh had the highest value of output (Rs. 43,209/acre), net returns (Rs. 35,281/acre) and gross farm income from cultivated area per household (Rs. 3,07,227), Rajasthan had the lowest material cost (Rs. 3,219/acre) and Bihar had the lowest labour cost (Rs. 1,895/acre).

Taking into account the specific objectives of this study on the efficacy of the pulses seed minikits distributed among farmers, in the first objective, we assess the relevance and the requirement of seed mini-kits among the farmers. The findings of the study indicated that the largest percentage of SMKs were distributed among the marginal and small farmers who had to commonly produce two documents, viz., Aadhar card and their land record document to avail the scheme. The information on SMK was provided to them by the Agriculture Officers at RSKs and most often distributed by the respective state KVKs and RSK free of cost. The farmers further stated that the criterion for farmer selection was primarily based on interest followed by their land holding size, the category of their household (SC/ST) as well as the gender of the farmer. All the selected farmers from across the study states found the SMK advantageous in their production of pulses and they observed a quality and yield difference. Both in terms of quantity and quality of the seeds in the SMK, a major proportion of the selected farmers opined it was sufficient and superior respectively. However, it is noteworthy that, although the farmers received the requisite SMK from RSK, yet they spent a comparatively higher cost on transportation. There were also several farmers in Bihar and Karnataka who purchased seeds from private dealers as well as cooperatives.

In terms of the second objective, state-wise figures on productivity of pulse crops using seed minikits with the control farmers/non users or those without SMK showed that there was a difference in each state's output and net returns. Particularly, in Bihar, the area under pulses and net price obtained per quintal was higher among farmers without SMK, however, the value of output per acre, net returns per acre were higher for farmers with SMK at a lower cultivation cost. While, in Karnataka, the area under pulses, output value, net returns and net price was higher for farmers with SMK, although the cultivation cost was lower for farmers without SMK. In Madhya Pradesh and

Maharashtra, the pulses area, output value, net returns and net price were all higher for farmers with SMK at a lower cultivation cost compared to farmers growing pulses without SMK. And, in Rajasthan, the area under pulses was the same for both farmers with and without SMK. However, the output value and net returns were higher for farmers without SMK. While, the cultivation cost was lower for farmers with SMK and they also obtained a higher net price per quintal.

On the cost front, a majority of pulses growing farmers in the study states who used SMK also indicated that they had a lower total cost of production when measured item-wise. When labour usage by activities measured by person days per acre was considered, there was a slight variation in the total person days per acre for farmers with and without SMK. While, in Bihar and Rajasthan, the selected farmers using SMK utilised lower person days per acre growing respective pulse varieties. However, in the study states of Karnataka, Madhya Pradesh and Rajasthan, selected farmers with SMK used a higher number of person days per acre in the various production activities.

Each study state mentioned a different variety of pulse distributed among them, which they sowed mostly during kharif season. The output produced from the SMK was the highest in Karnataka for red and green gram, Rajasthan for black gram and Bihar for lentils per household. Among these study states, selected farmers also used a certain portion of the output as seed that was the highest for red and green gram in Karnataka, black gram in Madhya Pradesh and lentil in Bihar.

5.7 Concluding Remarks and Policy Suggestions

The United Nations, declared 2016 as “International Year of Pulses” to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed at food security and nutrition. In recent times, pulses have been in focus due to the continuous upswing in their prices. Therefore, the Centre embarked on an ambitious programme to increase pulses production in India with the distribution of the SMKs that was almost ten times higher than the number of SMKs distributed in the previous kharif season. Among other initiatives, this scheme aimed at making India self-sufficient in pulses as the current production continues to be supplemented by imports.

One of the causes for low pulses production and yield may be attributed to inadequate seed production. As the seed replacement rate (SRR) of pulses is slow and as per the NITI Aayog Working Group report, SRR for pulses should range from 20 to 100 per cent. In addition, of the 90 varieties released by the Union and state government, it was noted that only a few have met the production requirement. The average yield of all pulses in India is low, at approximately 660 kg /

hectare compared to the world average of 909 kg / hectare[1]. Studies have also shown that one of the primary reasons for inadequate seed production is the lack of estimation of the need for the right seed varieties by the states. Farmers do not adopt the new varieties of seeds sent to the states, as they are not the seeds demanded by them. Agriculture being a state subject, the government should understand the needs of the farmers and address them rather than merely increasing the production of seeds[2].

Given the third objectives focus on policy suggestions, with particular regard to improving SMK, farmers in this study stated that although they faced no issues in accessing the SMK scheme, a few farmers suggested augmenting the availability of SMK and its transparent distribution based on the scheme's farmer selection criteria. Other suggestions included introducing short duration, drought and pest resistance varieties of pulses, improved modes of awareness creation and dissemination of information, field demonstrations with full package of practices as well as compulsory seed germination tests prior to sowing among others.

Therefore, given these suggestions provided by the study farmers, SMKs are conclusively advantageous when based on farmer's requirements of seed varieties filtered through credible, robust and timely data and research. Given its positive impact this far, a nuanced version of SMKs taking into account the aforementioned considerations can be one in a basket of supportive policy initiatives that include reorienting trade and price policies, where the government takes on a more comprehensive and concerted farmer centric approach.

Apart from the policy initiative related to seeds via the SMK, other measures can complement the pulses push in India. In this regard, studies suggest that inclusion of pulses under the Public Distribution System (PDS), without a 25 per cent cap of the actual production per year/season, would be a positive policy measure given India's poor nutrition indicators as per the Global Hunger Index (2021)[3]. It would help address both; malnutrition as well as encourage farmers to grow more varieties of pulses by creating demand via the PDS. As such, the focus also needs to shift towards encouraging more efficiency, accountability and transparency through ICT in the current pulses value chain rather than only improve facilities that make it conducive for corporate to store and process large quantities of pulses. The prevailing strategy of regulating trade policies

[1] https://www.downtoearth.org.in/blog/agriculture/why-pulse-production-in-india-needs-better-incentives-78914 accessed on 22-10-2021

[2] https://www.downtoearth.org.in/coverage/agriculture/cover-story-pulse-tales-import-reliant-india-79840 accessed on 10-10-2021

[3] https://www.globalhungerindex.org/india.html accessed on 24-10-2021

through corporate/private investment in the long-run will wipe out domestic stakeholders in the pulses value chain and subsequently their livelihoods, which is counterproductive for a country with a high demographic dividend largely consisting of diverse farming related communities.

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ANNEXURE 5.1

Reply to the Referee Comments

(I) Comments on the Methodology:

If some farmers were growing pulses earlier also, why before and after impact was not seen, besides farmers with and without minikits. Why only Rajasthan SMK farmers have lower value of output and net returns than those without SMK needs some explanation.

Answer: The study compares the yield rate of SMK farmers with that of control farmers who are growing pulses without obtaining any seed though SMK programme. As has been mentioned in the methodology, for the treatment farmers the SMK distribution data was available from the year 2017-18 onwards. As we preferred sampling for the year 2017-18 and 2018-19 to ensure whether the output obtained from seed mini kits was used as seed for the next season cropping or not. The memory period for sampling was already past three years and going back pre and post would have needed memory data for the last five years. Farmers' information without maintaining written records would not be credit worthy for such a long period. Therefore for sampling we preferred only with and without methodology. Regarding lower value of output and net returns in Rajasthan for SMK farmers, there are plenty of reasons and the detailed analysis can be found in the state report submitted by the concerned AERC.

(II) Comments on the Presentation, Get up etc.

Table 1.2, title says season wise also but data not given.
Answer: The appropriate corrections are done in the title of the table.

Table 1.5, some district names are missing.
Answer: Appropriate corrections are made in the final report.

Table 3.5 has mix up of yields and value of output.
Answer: Appropriate corrections are made in the final report.

Table 4.13 can do with just 5 rows
Answer: Appropriate corrections are made in the final report.

Table 4.14. with three rows.
Answer: Appropriate corrections are made in the final report.

Tables 4.21 and 4.24 can do with just 5 columns and
Answer: Appropriate corrections are made in the final report.

Table 4.23 with just four columns.
Answer: Appropriate corrections are made in the final report.

(III) Overall View on Acceptability of the Report:

Acceptable after incorporation of the above comments.