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Relevance and Distribution Efficiency of Seed Minikits in Pulses in Bihar

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Preface

The study was undertaken at the instance of Knowledge and Innovation Hub, NITI Aayog; sponsored by the Directorate of Economics & Statistics, Ministry of Agriculture & Farmers Welfare, Government of India and Co-ordinated by ADRTC, ISEC, Bengaluru; with a sample of 200 beneficiary and 100 non-beneficiary pulse growing farmers. Distribution of seed minikits (SMKs) of pulses was launched in 2016-17 to ensure varietal replacement at faster rates, basically meant for introduction and popularization of latest released or pre-released varieties of pulses, not older than 10 years and their propagation among the farmers free of cost.

The study finds positive impression by way of reduced per acre cost of production and increased returns with SMK farmers. No doubt, per quintal net price received by with SMK and without SMK farmers was almost similar, which might be directly related to the prevailing market prices and due to using same marketing channels for the pulse crops in the study area. Further, the study suggests transparency in selection criteria; check on proxy distribution, real time field level supervision, ensuring application of SMKs in the field, extending awareness programme at large, etc.

Since this is the outcome of a team work and co-operation of various sources at different levels, so we deem it our duty to appreciate and acknowledge them. First of all, we are grateful to the RAC (Research Advisory Council) of MoA & FW, GoI headed by the Hon'ble Secretary, DAC & FW for assigning this study in the work plan year 2019-20. We express our deep gratitude to Sri PC Bodh, Former Adviser (AER Division) and Sri Anil Kumar Sharma, Adviser (AER Division) for their kind guidance in completion of this study. We are extremely grateful to the Nodal department (NFSM Cell), State Department of Agriculture and their colleagues at the respective districts and blocks level for their wholehearted support.

We are particularly indebted to our two former Vice-Chancellors, Prof. A K Roy and Prof. Ajoy Kumar Singh, and the present Hon'ble Vice-Chancellor, Prof. Sanjay Kumar Choudhary for providing all necessary support in completion of the study. We also express our sincere thanks to the members of the project team. We will be failing in our duty, if we do not thank the respondents for sparing their valuable time and providing required information and data.

We do hope that findings of the study will be highly useful for the policy makers, professionals and researchers in understanding the impact of the scheme and, making desirable corrections.

Ranjan Kumar Sinha
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Dated: 7th December, 2020

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EXECUTIVE SUMMARY

Considering the importance of pulses for nutritional security of the people and self-reliant of nation in pulses, the GoI has taken several initiatives in recent past, and out of these, the distribution of Seed Minikits of Pulses is one, which was launched in 2016-17 with a view to ensure varietal replacement of HYV pulses within 10 years of its release. Since the programme is completing almost 3-4 years of its launching, so its impact study is inevitable for further success of the programme. With this background in view, this study was entrusted to the Agro-Economic Research Centre, T M Bhagalpur University, Bhagalpur (Bihar) by the Ministry of Agriculture & Farmers Welfare, Government of India under the co-ordination of ADRTC, ISEC, Bengaluru.

The following objectives were addressed in this study:

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

The present study relied on both the primary and secondary data. Primary data, have been collected with a sample of 300 farmers comprising 200 beneficiaries and 100 non-beneficiaries/control farmers selected from 2 sample districts viz., Patna (irrigated) & Muzaffarpur (dry land) on highest seed minikits distributed during the reference period of 2017-18/2018-19.

Major Findings

- Bihar has 4.79 lakh ha of total pulses' area with production of 4.53 lakh tones during 2018-19, which were 1.62 and 1.85 percent of the country's total area and production of pulses.

- The secondary data based results indicate that after bifurcation of the State in November, 2000, the area and production of total pulses decreased by about 47 per cent and 29 per cent respectively during the TE 2000-01 to 2016-17.
- Area and production under total pulses in the state decreased by 18.93 percent and 4.36 percent respectively in TE 2016-17 over TE 2006-07. State's total lentil area and production increased to 4.17 percent and 15.45 percent respectively in TE 2016-17 over TE 2006-07. Except lentil, arhar and gram showed negative growth in regard to area and production both during the same period.
- The yield rates of total pulses increased till 2013-14 and thereafter it fell substantially. Across pulses, moong's yield rate was found to have increased in recent years only. Other pulses' yield rates are still gloomy in the state.
- About 83 percent of the total respondents were dependent on agriculture and allied activities for their livelihood followed by mainly agricultural labourer (7%). Average annual income of the total respondents was recorded at about Rs. 42608 constituting 78.6 per cent from agricultural & allied activities and 21.4 per cent from non-agricultural sources.
- The average GCA & NOA of the total respondents were at 5.06 acres and 2.61 acres respectively. Average rental value per acre of land was found at Rs. 3792 and their cropping intensity was recorded at 194 percent. Above 99 percent of NOA was found irrigated. Bore well irrigation highly prevailed in the study areas, and the average cost of irrigation was indicated at Rs. 763/acre.
- Average productivity of the rain-fed crops for all respondents was calculated at 5.20 quintals per acre and in regard to irrigated crops, it was recorded at 10.43 qts per acre. The value of output of main plus by-product for total respondents was at Rs. 16053 per acre.
- Net returns for total respondents were estimated at Rs. 8090 per acre. Gross farm income per household from cultivated area for total respondents was calculated at Rs. 21115 and for marginal, small and medium farmers was at Rs. 10922, Rs. 28820 and Rs.40986 respectively.

- In regard to per acre cost of production and net return among the aggregate average of SMK farmers, positive impression was created by way of reduced per acre cost of production and increased returns over the with SMK farmers. Although per quintal net price received by both the categories of farmer was almost similar, might be directly related to the prevailing market prices and using almost same marketing channels for the pulse crops in the study area.
- Online registration on department's portal for availing the benefits of seed minikits was the major instrument adopted by the selected households.
- Of the total beneficiaries in the state in 2018, sample households availed only 0.35 per cent of kits, which were largely distributed by the state agriculture department without any charge.
- About 59 per cent of the farmers received the information relating to distribution of minikits from farmer facilitators, such as SMS & KS. It is important to note here that cent per cent sample farmers opined that the scheme is advantageous mainly because of fetching more profit, better quality and high yield. Although it's sufficient or desirable quantities are not disbursed, besides untimely disbursement.
- Major issues/ problems as perceived by the sample farmers were distribution to Kith & Kin (81%), limited availability (40.5%), delay in re-imbursement of the charged amount (22.5%), procedural complexities (22%), OTP relating hindrances (19%).
- Suggested measures for improvement were transparency is absent in the criteria (65%), check on proxy distribution (35%), real time field level supervision (29.5%), ensuring application of seed minikit in the field (32%), extending awareness programme at large (26%), etc.

Policy Suggestions

Policy suggestions have been drawn based on the findings of the study. These have been imprinted hereunder:

- ❖ In order to achieve full benefits of Seed Minikit for Pulses, awareness should be created among farmers regarding its core objectives for realizing maximum

value of output by way of adopting optimal package of practices for growing and use of recent HYVs of pulse crops.

- In place of any interested farmers, the distribution of seed minikits should be based on mapping of respective crop fields and identification of respective crop growers, following the mandated criteria, so that realization of the programme could be made with equity aspect.
- A Help Desk for online registration on department's portal at block/tehsil level should be instituted to help the poor or needy farmers.
- Reimbursement of seed minikit value to the respective beneficiaries should be made immediately after verification of the sowing plot, preferably during the mid-period of the respective crop. It is desired for better and timely application of inputs.
- Special efforts on the part of the government are needed for ensuring timely distribution of seed minikits, as expressed by the sample farmers.
- To ensure multiplication of seeds, field visits of the KVK Scientists are needed for extending field level advices to the beneficiary farmers along with capacity building of the field level staff.
- There is need to address the concerns raised by the beneficiary farmers about inadequacy. Kith & Kin approach of distribution, OTP hindrance, untimely distribution etc. should be avoided by proper monitoring of the concerned.

CHAPTER – I

INTRODUCTION

1.1 Importance of Pulses

Pulses play an important role, particularly in a country like India, mainly due to its rich protein content and thus, pulses are said as "the poor men's meat." Since India is the largest producer (25 % of the World's production), consumer (27% of the World's consumption) and importer (14%) of pulses in the world *(Srivastava, et.al 2010).* The production of pulses was steadily increasing for the last several decades. Main reasons for this poor performance are area under pulses is rainfed and mainly grown as a residual crop on marginal lands *(Sekhar & Bhatt, 2012).* Pulses accounted for 23.51 per cent of the area under food grains (127.56 million hectares) and contributed around 8.86 per cent of the total food grains' production (285 MT) in 2018-19. Pulses are grown in kharif (46.95%), rabi and summer (53.05%) seasons. As a result of stagnant pulse production and continuous increase in population, the per capita availability of pulses has decreased considerably. Per capita per day availability of pulses in 1951 was 60 grams that dwindled down to a level of 52.09 grams in 2017. This proves that increase in population growth affects pulses availability on per capita basis.

The vital role played by pulses in the agriculture system and in the diets of people, 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. The nutritional content of various pulses is depicted in table 1.1.

Table 1.1: Nutritional Value of Various Pulses (mg/100 gm)

Name of the food stuff	Gram	Urad	Moong	Kulthi	Lentil	Pea	Tur	Moth	Khesari	Cow Pea
Protein (%)	20	24	25	22	25	22	22	25	31	23
Vit. A (IU)	316	64	83	119	450	31	220	16	200	60
Vit. C	3	---	---	---	---	---	---	2	---	---
Vit. K	0.29	0.19	---	---	0.25	---	---	---	---	---
Thiamine	0.30	0.41	0.72	0.42	0.45	0.47	0.45	0.45	0.39	0.50
Ribo-flavin	0.51	0.37	0.15	0.20	0.49	0.21	0.51	0.09	0.41	0.48
Nieotinic acid	2.1	2.0	2.4	1.50	1.50	3.50	2.60	1.5	2.20	1.30
Biotin (g/100 gm)	10	7.5	---	---	13.20	---	7.60	---	7.50	202
Choline	194	206	---	---	299	---	183	---	---	---
Folic acid (g/100g)	125	144	---	---	107	---	83	---	100	---
Inositol	240	90	---	---	130	---	100	---	140	---
Pantothenic acid	1.3	3.5	---	---	1.60	---	1.50	---	2.60	---
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).

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 the rest of the world. In recent years, the quantity of pulses imports comes closer to 50 or 50 plus lakh tones, whereas exports hovered around 2 to 4 lakh tons. India's imports and exports of major pulses during 2017-18 to 2018-19 may be seen from the table 1.2.

Table 1.2: India's import and export of major pulses

(Unit Lakh tons)

	Import				**Export**			
Pulses	2017-18	%Share intotal pulses import	2018-19	% of Share in total pulses import	2017-18	%Share intotal pulses import	2018-19	% of Share in total pulses import
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 Imports/ Exports	**56.07**	**---**	**25.27**	**---**	**1.79**	**---**	**2.85**	**---**

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

The area under pulses in India in 1950-51 was 19.09 million hectares, which increased to 29.99 million hectares in 2017-18 (i.e., an increase of about 57%). Total production of pulses was 8.41 million tons in 1950-51, which increased to 25.23 million tons in 2017-18 showing an increase of about 200%. The yield rates also increased from 441 kg/ha in 1950-51 to 841 kg/ha in 2017-18 (an increase of around 91%). During 2018-19, the country produced 23.40 million tons of pulses, which was short of annual domestic demand to 26-27 million tons. However, during the current year, the Government is targeting pulses output of 26.30 MT. The country still faced huge shortage, but now the situation has little bit improved (ET 2020). Moreover, Indian Institute of Pulses Research (IIPR) has estimated, for the projected population of 1.55 billion, total requirement to be 25.39 MTs (GoI, 2009). The country's 80 per cent of total area under pulse production was from six states, viz., Madhya Pradesh (24.94%), Rajasthan (17.77%), Maharashtra (14.51%), Karnataka (10.07%), Uttar Pradesh (7.56%) and Andhra Pradesh (4.69%), which produced nearly 80 per cent of the total pulses production in 2017-18. 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 2017-18. Based on available data for 2017-18 (table 1.3), the share of area under gram to total pulses area was 35.21per cent followed by urad (18.14%), tur/arhar (14.77%), moong (14.21%), lentil (5.17%) and other pulses accounted for (12.50%), (Govt. of India, 2018).

Table 1.3: Area and Production of Major Pulses in India during 2017-18.

Pulses	Area (MH)	% of Area	Production (MMT)	% of Production
Gram	10.56	35.21	11.23	44.51
Urad	5.44	18.14	3.56	14.10
Arhar/Tur	4.43	14.77	4.25	16.85
Moong	4.26	14.21	2.01	7.97
Lentil	1.55	5.17	1.61	6.36
Others	3.75	12.50	2.57	10.19
Total	29.99	100.00	25.23	100.00

Source: Compiled by the author from various publications/reports of MoA& FW, GoI.

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.

The available data for TE 2006-07 shows that the area under pulses in India was 227.60 lakh hectares, which increased to 259.70 lakh hectares during TE 2016-17, registering an increase of 14.10 per cent. Similarly, the production increased from 135.81 lakh MTs in TE 2006-07 to 188.70 lakh 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%). Major pulse growing states (Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Karnataka, Andhra Pradesh, Chhattisgarh, Gujarat, Odisha, Bihar, Tamil Nadu, Jharkhand, West Bengal and Haryana) 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 the TE 2016-17. Similarly, the production in these major pulse growing states was about 98 per cent during TE 2006-07 and 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 1.4). These 14 major pulse growing states may be termed as 'Pulse Road of India.'

Table 1.4: Area, Production and Yield of Pulses in India and across the States.

State	Area (In lakh ha)		Production (In lakh MT)		Yield (Kg/ha)	
	TE	TE	TE	TE	TE	TE
	2006-07	2016-17	2006-07	2016-17	2006-07	2016-17
Andhra Pradesh	18.57	13.00	12.57	10.36	677	797
Bihar	**6.21**	**5.35**	**4.51**	**4.59**	**726**	**858**
Chhattisgarh	9.30	8.73	4.38	6.70	471	768
Gujarat	8.29	7.03	5.40	6.46	651	919
Haryana	1.81	0.90	1.35	0.67	746	744
Jharkhand	3.13	6.63	1.97	6.44	629	971
Karnataka	21.52	27.03	8.83	14.23	411	526
Madhya Pradesh	43.04	60.17	32.88	54.75	664	910
Maharashtra	35.48	37.70	19.91	24.55	561	651
Odisha	7.47	7.85	3.13	4.32	419	550
Rajasthan	34.08	41.67	12.39	23.75	364	570
Tamil Nadu	5.33	8.50	2.38	5.94	447	699
Uttar Pradesh	27.60	22.47	21.94	20.14	795	896
West Bengal	2.22	2.90	1.65	2.87	743	990
Others	3.55	9.77	2.42	2.63	682	269
All India	**227.60**	**259.70**	**135.81**	**188.70**	**597**	**727**

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

Due to increasing in awareness about significant nutritional benefits, there has been a soaring demand for pulses in Bihar, especially among the vegetarians. Not only does it form an important component of nutrition, but it is also crucial for achieving ecological sustainability owing to their key role in improving soil fertility. In Bihar, pulses are also largely grown under rainfed conditions and therefore, are prone to high fluctuations in yield. Thus, the yield rates of pulses varied largely across the districts of the state. During 2018-19, it varied from 492 kg/ha to 1374 kg/ha across the districts (GoB, 2020). The percentage share of the state's total pulses' area and production of all-India figures may be seen from the table 1.5.

Table 1.5: Percentage share of Area and Production of total Pulses in Bihar vis—vis India

(Area in lakh ha & production in lakh metric tons)

India			Bihar		% Share of Bihar's Pulses to the Nation	
Year	Area	Prodn.	Area	Prodn.	Area	Prodn.
2000-01	203.5	110.8	7.17	6.21	3.53	5.60
2005-06	223.9	133.8	5.97	4.47	2.67	3.34
2010-11	262.8	182.4	6.05	5.56	2.30	3.05
2013-14	252.1	197.8	5.00	5.22	1.98	2.64
2014-15	231.0	171.6	5.06	4.29	2.19	2.50
2015-16	249.1	163.5	4.98	4.21	1.99	2.57
2016-17	294.4	231.3	4.97	4.65	1.69	2.01
2017-18	299.9	245.1	4.76	4.55	1.62	1.86
2018-19	290.3	234.0	4.79	4.53	1.65	1.94

Source: Compiled from various issues of Agricultural Statistics at a Glance, GoI& Economic Survey of Bihar, GoB

Production of pulses stood at 4.53 lakh tones in 2018-19, growing at a rate of 1.89 per cent per annum during 2014-15 to 2018-19. Much of this increase was due to rabi pulses, mainly contributed by lentil (36.5%) followed by summer moong (26.3%) and gram (16%). The production of rabi pulses grew at a rate of 2.7 per cent, with an average productivity of 897 kg/hectare over the five years' period of 2014-15 to 2018-19. In case of kharif pulses, there was an increase in production i.e., from 22.01 lakh tones in 2017-18 to 23.22 lakh tones in 2018-19, while its productivity stood atan average of 843.2 kg/ha during the same period . To streamline pulses' production in the state, the state government has undertaken various initiatives to minimize incidences of pest attack, increase yield and enhance price realization to the farmers (GoB, 2020).

1.2 Need of the Study

The Food Security Act, 2013 mandatorily envisages the right to nutritional security. Pulses are important group of food crops that can play vital roles to address national food and nutritional security, and also to tackle environmental challenges. The share of pulses to total food grain basket is around 9 percent and is critical and inexpensive source of plant-based proteins, vitamins and minerals. Yet their nutritional value is not generally recognized and their consumption has remained under the required level. 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 continued for the last 3-4 years, so it required to examine different aspects of its implementation and impact on areas, production and productivity of such seed. Obviously, it is important for addressing the efficiency issue of the programme. It is in this context; the present study has been carried out in Bihar, which was assigned to Agro-Economic Research Centre for Bihar & Jharkhand, T M Bhagalpur University, Bhagalpur, Bihar under the work plan year 2019-20 along with other four states by the respective Agro-Economic Research Centre(s) under the Co-ordination of ADRTC, ISEC, Bengaluru.

1.3 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 was 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:

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

1.4 Data and Methodology

The study is based on primary and secondary data both with reference period being 2018-19. For selection of sample, two districts one irrigated and another dry land, based on distribution of highest seed minkits during the period of 2017-18/2018-19 were selected. Under irrigated category, Patna and dry land based category, Muzaffarpur district were selected. From each of the selected districts, a sample of 100 seed minikit of pulses 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 the state.

In order to select the beneficiary farmers, due care was given for proportionate representation in the sample in terms of number, social group, gender issue, etc. Despite eligibility norms, the distribution of seed minikits for pulses was made to only such farmers, who were interested in obtaining the benefits and thus, the sample could be devoid of beneficiaries like women and large sized farmers.

Moreover, on the basis of the list of the beneficiary farmers for 2018-19, the sample was drawn. As regards the selection of pulse crops is concerned, it is to be made clear here that during 2018-19, minikits of pulse crop were distributed for two pulses, viz., lentil and red-gram. So, the sample beneficiary farmers were chosen from these two pulse crops, despite moong having the 2nd highest area and production in the state. Sample distribution is as follows:

Table 1.6: Sample Distribution by Districts and Farms

Farm Size	Patna District (Irrigated)		Muzaffarpur District (Dry Land)		Total	
	Beneficiary	Non-beneficiary	Beneficiary	Non-beneficiary	Beneficiary	Non-beneficiary
Marginal	42	34	34	34	76	68
Small	54	14	49	13	103	27
Medium	4	2	17	3	21	05
Large	---	---	---	---	---	---
Total	100	50	100	50	200	100

1.5 Overview

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%). 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, produced nearly 80 per cent of its total production. Gram (chickpea) has the largest area (35.21% of the total pulse crops) followed by urad (18.14%), arhar/tur (14.77%), moong (14.21%), lentil (5.17%) and others (12.50%), 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 total pulses respectively. The shares of Bihar in terms of area and production of the country were meager of 1.65 per cent and 1.94 per cent respectively in 2018-19. Considering the importance of pulses, the GoI has taken several initiatives in recent past, and out of these, the distribution of Seed Minikits of Pulses is one, which was launched in 2016-17 with a view to ensure varietal replacement of HYV pulses within 10 years of its release. Since the programme is completing almost 3-4 years of its launching, so its impact study is inevitable for further success of the programme. With this backdrop, this study was assigned to the Agro-Economic Research Centre, T M Bhagalpur University, Bhagalpur under the work plan year 2019-20 by the Ministry of Agriculture & Farmers Welfare, Government of India. It has been undertaken with a sample of 300 farmers comprising 200 beneficiaries and 100 non-beneficiaries/control farmers selected from 2 sample districts viz., Patna & Muzaffarpur.

CHAPTER – II

PRODUCTION OF PULSES IN BIHAR

2.1 Pulses Production in Bihar

Bihar is one of the most important pulses' growing and consuming states in India. It had 4.79 lakh ha of total pulses area with 4.53 lakh tones of total pulses' production during 2018-19, which were 1.62 and 1.85 percent to national pulses' pool respectively. During the year, the yield rate was 946 kg/ha, which was higher as compared to national average (806 kg/ha). In Bihar, pulses are largely grown under rainfed conditions and therefore, are prone to high fluctuations in yield. In 2018-19, the productivity of pulses was as high as 1374 kg/ha and to the lowest of 492 kg/ha. The compound annual growth rates of total pulses' production and productivity during 2014-15 to 2018-19 were 1.89 and 3.47 percent respectively.

Besides pulses, the area and production of rice during TE 1990-91 were recorded to 53.28 lakh ha and 98.17 lakh tones respectively, which were declined to 32.79 lakh ha and 77.61 lakh tones during TE 2016-17, whereas in case of maize and wheat, it surged. Moreover, total area and production of pulses in the state were recorded to 9.59 lakh ha and 6.59 lakh tones during TE 1990-91and these were drastically declined to 5.01 lakh ha and 4.39 lakh tones respectively during TE 2016-17. The area and production of oilseeds in the state were recorded at 2.30 lakh ha and 1.36 lakh tones respectively during TE 1990-91. Later on, area under oilseeds was recorded almost half (1.19 lakh ha) during TE 2016-17, but no change was found in the production of oilseeds. Despite reduction in the area of moong, no decline was recorded in the production of moong. This may be due to increase in the productivity after adoption of hybrid seeds by the farmers. Decline status in arhar's area and production were recorded as 0.20 lakh ha and 0.33 lakh tones respectively during TE 2016-17, which were 0.70 lakh ha and 0.82 lakh tones during TE 1990-91. It may be due to less interest of farmers towards as a matter of facts arhar the crop being a long duration one, and availability of less upland area in the state.

Table 2.1: Area and production of major crops in the state (Area in lakh hectares & production in lakh tones)

Year	Rice		Maize		Wheat		Pulses		Oilseeds		Arhar		Gram		Moong		Masoor	
	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.
TE 90-91	53.28	98.17	6.84	10.95	20.22	34.63	9.59	6.59	2.30	1.36	0.70	0.82	1.62	1.40	2.20	1.18	1.80	1.46
TE 91-92	52.42	88.33	6.83	11.60	19.79	34.75	9.41	6.70	2.35	1.52	0.69	0.89	1.63	1.46	2.21	1.27	1.84	1.52
TE 92-93	50.02	74.79	6.82	7.03	19.75	35.35	8.83	6.40	2.26	1.44	0.66	0.78	1.49	1.39	2.12	1.23	1.79	1.54
TE 93-94	47.78	72.52	7.03	12.87	20.09	38.03	8.17	5.54	2.27	1.42	0.69	0.77	1.37	1.33	2.03	1.17	1.77	1.41
TE 94-95	46.53	79.60	7.23	13.45	20.30	40.31	7.85	5.47	2.26	1.38	0.71	0.72	1.30	1.31	1.98	1.08	1.75	1.54
TE 95-96	44.08	78.00	6.90	13.53	18.76	39.75	7.72	5.25	2.09	1.34	0.64	0.66	1.28	1.10	1.93	1.04	1.77	1.65
TE 96-97	44.28	72.46	7.09	14.35	18.56	38.36	7.58	5.31	2.05	1.37	0.62	0.67	1.23	1.09	1.91	1.05	1.74	1.77
TE 97-98	44.39	58.81	6.90	13.41	18.58	38.37	7.45	8.16	2.03	1.43	0.58	0.64	1.16	1.07	1.88	1.05	1.73	1.57
TE 98-99	47.36	62.19	7.27	14.57	20.48	42.72	7.33	6.13	2.30	1.70	0.67	0.72	1.10	1.35	1.87	1.06	1.77	1.59
TE 99-00	43.41	55.68	6.80	13.76	20.72	44.87	7.20	6.37	2.06	1.59	0.58	0.75	0.97	1.15	1.86	1.07	1.80	1.55
After bifurcation of the State (In November, 2000)																		
TE 00-01	39.75	56.62	6.57	14.85	20.90	44.55	9.54	6.21	1.84	1.46	0.53	0.71	0.86	0.97	1.86	1.08	1.79	1.68
TE 01-02	36.02	53.98	6.18	14.71	20.89	42.57	7.08	5.97	1.52	1.22	0.43	0.54	0.75	0.75	1.84	1.08	1.75	1.53
TE 02-03	35.98	52.44	6.07	14.45	20.67	38.22	7.03	5.77	1.45	1.19	0.41	0.50	0.72	0.72	1.87	1.11	1.75	1.55
TE 03-04	32.72	52.46	6.05	14.38	20.34	32.64	6.91	5.55	1.41	1.17	0.40	0.47	0.73	0.72	1.88	1.06	1.74	1.51
TE 04-05	34.50	43.87	6.16	14.38	20.31	34.17	6.16	5.30	1.39	1.15	0.38	0.47	0.75	0.71	1.87	1.00	1.76	1.49
TE 05-06	33.39	53.90	6.35	14.95	20.25	32.64	6.41	4.94	1.39	1.25	0.36	0.48	0.72	0.67	1.83	0.95	1.69	1.32
TE 06-07	33.01	38.22	6.45	15.88	20.47	37.07	6.18	4.59	1.39	1.31	0.36	0.47	0.69	0.60	1.79	0.95	1.68	1.23
TE 07-08	34.20	44.38	6.43	16.70	20.78	40.07	5.95	4.60	1.41	1.40	0.35	0.45	0.66	0.61	1.80	0.98	1.61	1.22
TE 08-09	34.35	49.82	5.70	15.36	21.22	45.61	5.92	4.63	1.41	1.41	0.33	0.41	0.65	0.60	1.81	0.99	1.63	1.25
TE 09-10	33.51	44.85	5.68	14.72	21.42	46.46	5.77	4.67	1.37	1.41	0.28	0.38	0.62	0.59	1.72	0.91	1.63	1.38
TE 10-11	31.18	40.31	5.79	15.96	21.43	46.61	5.63	4.65	1.41	1.41	0.28	0.35	0.62	0.58	1.63	0.87	1.67	1.50
TE 11-12	31.28	49.80	6.57	20.46	21.45	53.43	5.43	4.83	1.36	1.53	0.29	0.38	0.63	0.65	1.55	0.83	1.69	1.64
TE 12-13	31.56	65.41	6.74	24.50	21.71	59.33	5.26	5.10	1.34	1.67	0.28	0.43	0.62	0.74	1.58	0.90	1.66	1.72
TE 13-14	32.89	77.20	6.89	27.16	21.87	62.80	5.16	5.29	1.31	1.72	0.28	0.47	0.62	0.78	1.57	0.87	1.60	1.87
TE 14-15	32.68	77.38	7.00	27.13	21.91	52.93	5.10	4.97	1.27	1.56	0.24	0.42	0.60	0.71	1.58	0.89	1.62	1.73
TE 15-16	32.46	72.32	7.04	26.34	21.58	48.14	5.04	4.56	1.23	1.37	0.23	0.39	0.60	0.62	1.60	0.90	1.65	1.58
TE 16-17	32.79	77.61	7.11	29.48	21.24	47.64	5.01	4.39	1.19	1.27	0.20	0.33	0.61	0.61	1.66	1.04	1.75	1.42

Source: Different issues of Economic Survey of Bihar.

After bifurcation of the state in November, 2000, the area under gram was recorded to be 0.86 lakh ha with production of 0.97 lakh tones in 2000-01. Later, these decreased to 0.61 lakh ha and 0.61 lakh tones during TE 2016-17. It may be due to shifting of gram's area to other cereal crops, like; wheat and maize. Despite bifurcation, a little reduction was recorded in the area of lentil to 1.75 lakh ha with production of 1.42 lakh tones during TE 2016-17. During TE 1990-91, the total area under lentil was 1.80 lakh ha with production of 1.46 lakh tones. Lentil is the only pulse crops, area under which remained more or less stagnant over the years with some fluctuations. So, it is one of such pulse crops of the area of which and production can be easily improved with better agro technology management and policy improvements. In fact, a substantial area of lentil is sown under late sown conditions in rice fallow-fields. However, farmers have been facing various constraints, like; relative profitability and risk involved in production of pulses, and competing crops in the state, which need an assessment. The main competing crops for pulses in Bihar are cereals, both where they gained and lost in regard to areas. Lentil is the only pulse crop, which has been maintaining its area and production, and gained as compared to gram in the state.

2.2 Share of Pulses at District Level in GCA in Bihar

Bihar, with a geographical area of 93.6 lakh ha, is divided by river Ganges into two parts, the north Bihar with an area of 53.3 lakh ha and the south Bihar, having an area of 40.3 lakh ha, based on soil's nature, rainfall, temperature and terrain. The state has four main agro-climatic zones, identified as zone-I (North West Alluvial Plain), zone-II (North- East Alluvial Plain), zone –III (A) south and - III(B) south alluvial plain. All these agro-climatic zones have vast and huge potential for raising productivity of food grain crops. Across the state, soil texture varies from sandy loam to heavy clay. However, majority of the soil belongs to loamy category, which is good for crop cultivation. Rainfall varied from 990 to 1700 mms, mostly received during of July to September, and soil pH varied from 6.5 to 8.4. There are three crop seasons, that is kharif, rabi and zaid. Rice, wheat and pulses are grown almost in all the districts; however, the choice of crops and crop rotation varied largely across the agro-climatic zones.

An analysis of table 2.2 based on total geographical area (TGA) reveals that Gaya is the largest district of Bihar with 4.93 lakh ha of land followed by West-Champaran and East-Champaran with 4.84 and 4.31 lakh ha of land respectively. East-Champaran had the largest area under cultivation with 2.98 lakh ha, which is 69.14 percent of its TGA, followed by West-Champaran and Rohtas with 2.80 and 2.54 lakh ha respectively during TE 2006-07. Almost similar picture of cultivable area under same districts was found during TE 2016-17. An analysis of percentage share of cultivable area to total geographical area shows that Kishanganj district has largest share with 91 percent to its geographical area, followed by Buxar and Nalanda with 84.33 and 78.01 percentages respectively during TE 2006-07, but different scenario was viewed during TE 2016-17, which may be seen in table 2.2. The percentage share of total pulses area to gross cultivable area in the state was recorded to be 7 percent during TE 2006-07, which increased to 9.28 percent during TE 2016-17.

Table 2.2: District wise Geographical, Cultivable and Pulses Crop Areas in the State (lakh hectares)

District	Geogra Phical area	Cultivable area during		% age cultivable area to geographical area		Area under Pulse crops		% age Pulses area to cultivable area	
		TE	TE	TE	TE	TE	TE	TE	TE
		2006-07	2016-17	2006-07	2016-17	2006-07	2016-17	2006-07	2016-17
Araria	2.71	1.82	1.36	67.15	50.18	0.10	0.10	5.49	7.35
Arwal	0.63	0.40	0.42	63.49	66.66	0.07	0.06	17.50	14.28
Aurangabad	3.30	2.00	1.93	60.60	58.48	0.35	0.33	17.50	17.09
Banka	3.05	1.52	1.18	49.83	38.68	0.06	0.07	3.94	5.93
Begusarai	1.88	1.17	1.13	62.23	60.10	0.02	0.04	1.70	3.53
Kaimur	3.42	1.56	1.46	46.61	42.69	0.19	0.12	12.17	8.21
Bhagalpur	2.54	1.41	1.27	55.51	50.00	0.11	0.14	7.80	11.02
Bhojpur	2.37	1.83	1.79	77.21	75.52	0.20	0.18	10.92	10.05
Buxar	1.66	1.40	1.42	84.33	85.54	0.18	0.09	12.85	6.33
Darbhanga	2.54	1.66	1.52	65.35	59.84	0.04	0.11	2.40	7.23
E Champaran	4.31	2.98	2.81	69.14	65.19	0.10	0.11	3.35	3.91
Gaya	4.93	1.70	1.65	34.48	33.46	0.16	0.20	9.41	12.12
Gopalganj	2.03	1.47	1.43	72.41	70.44	0.02	0.02	1.36	1.39
Jamui	3.05	0.66	0.67	21.63	21.96	0.03	0.10	4.54	14.92
Jehanabad	0.94	0.64	0.46	68.08	48.93	0.12	0.15	18.75	32.60
Katihar	2.91	1.65	1.63	56.70	56.01	0.04	0.09	2.42	5.52
Khagaria	1.49	0.82	0.89	55.03	59.73	0.02	0.08	2.43	8.98
Kishanganj	1.89	1.72	1.02	91.00	53.96	0.02	0.09	1.16	8.82
Lakhisarai	1.28	0.62	0.49	48.43	38.28	0.15	0.11	24.19	22.44
Madhepura	1.79	1.26	1.28	70.39	71.50	0.04	0.21	3.17	16.40
Madhubani	3.53	2.21	2.32	62.60	65.72	0.09	0.18	4.07	7.75
Munger	1.39	0.49	0.44	32.25	31.65	0.01	0.03	2.04	6.81
Muzaffarpur	3.15	2.00	2.04	63.49	64.76	0.04	0.27	2.00	13.23
Nalanda	2.32	1.81	1.68	78.01	72.41	0.26	0.19	14.36	11.30
Patna	3.17	2.05	1.61	64.66	50.78	0.56	0.47	27.31	29.19
Purnea	3.13	2.09	1.68	66.77	53.67	0.05	0.07	2.39	4.16
Rohtas	3.90	2.54	2.48	65.12	63.58	0.23	0.10	9.05	4.03
Saharsa	1.64	1.07	0.97	65.24	59.14	0.04	0.20	3.73	20.61
Samastipur	2.62	1.84	1.71	70.22	65.26	0.04	0.17	2.17	9.94
Saran	2.65	1.92	1.62	72.45	61.13	0.02	0.03	1.04	1.85
Sheikhpura	0.62	0.34	0.47	54.38	75.80	0.07	0.04	20.58	8.51
Sheohar	0.43	0.26	0.24	55.81	55.81	0.09	0.06	34.61	25.0
Sitamarhi	2.21	1.21	1.30	54.75	58.82	0.01	0.02	0.82	1.53
Siwan	2.24	1.63	1.66	72.76	74.10	0.06	0.06	3.68	3.61
Supaul	2.38	1.45	1.46	60.92	61.34	0.03	0.04	2.06	2.73
Vaishali	2.01	1.26	1.22	62.68	60.69	0.06	0.29	4.76	23.77
W Champaran	4.84	2.80	2.53	57.85	52.27	0.02	0.08	0.71	3.16
Nawada	2.48	0.96	1.13	38.70	45.56	0.22	0.11	22.91	9.73
State Total	**93.60**	**55.98**	**52.33**	**59.80**	**55.90**	**3.92**	**4.86**	**7.00**	**9.28**

Source: Different issues of Economic Survey of Bihar.

2.3 Share of Individual Pulses in Major Districts to Total Pulses in Bihar.

Data in table 2.3 reveals that area under total pulses in the state was recorded at 6.18 lakh hectare with production of 4.59 lakh tone during TE 2006-07. Out of the total area under pulses and production in the state, Patna district had highest area (0.57 lakh hectares) with production of 0.67 lakh tonnes accounting for 9.22 and 14.60 percent respectively of the state's totals, these were followed by Aurangabad with 5.99 percent area and 5.88 percent production, and Nalanda with 4.37 percent area and 4.14 percent production. Pulse wise analysis shows that total area under lentil was 1.68 lakh hectares with production of 1.23 lakh tones, which were 27.18 and 26.80 percent of total area and production under pulses in the state. Patna had also highest area of lentil (0.27 lakh ha) with production of 0.33 lakh tonnes, which were 16.08 and 26.83 percent respectively to the area and production of lentil in the state followed by West-Champaran and Aurangabad districts. Total area under arhar in the state was found 0.36 lakh hectares with 0.47 lakh ton of production, which were 5.83 and 10.24 percent respectively to its state total. Across the districts, West-Champaran had the highest area followed by Siwan, East-Champaran, Gaya and Kaimur. The percentage share of gram's area and production to the total pulses in the state were recorded to be 11.17 percent and 13.08 percent respectively. Patna had the highest percentage of area and production of gram, recorded at 14.50 percent and 18.34 percent to state's total area and production followed by Aurangabad, Kaimur and Rohtas. Moreover, above analysis reveals that Patna district had the highest share of area and production of total pulses to the state's total pulses area and production. Except red gram, pulse wise area and production of all other pulses in Patna district were found to be the highest across the districts of Bihar.

Table 2.3: Area and production of major crops at districts level in State (TE 2006-07) (Area in lakh hectares, production in lakh tones)

District	Rice		Maize		Wheat		Pulses		Lentil		Arhar (Red Gram)		Chana (Gram)	
	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.
Patna	0.62	1.42	0.12	0.22	0.61	1.32	0.57	0.67	0.27	0.33	0.01	0.01	0.10	0.11
Nalanda	0.98	0.54	0.05	0.08	0.83	1.35	0.27	0.19	0.12	0.08	0.01	0.01	0.05	0.03
Bhojpur	0.96	1.55	0.04	0.07	0.60	1.39	0.21	0.20	0.07	0.06	0.01	0.02	0.04	0.06
Buxar	0.69	1.21	0.04	0.05	0.59	1.25	0.19	0.22	0.08	0.10	0.02	0.02	0.03	0.03
Rohtas	1.91	4.91	0.01	0.01	1.27	2.86	0.24	0.21	0.07	0.06	0.02	0.02	0.07	0.07
Kaimur	1.05	2.36	0.01	0.01	0.65	1.28	0.20	0.19	0.07	0.06	0.03	0.03	0.07	0.07
Gaya	0.97	0.92	0.08	0.13	0.58	0.85	0.18	0.12	0.06	0.04	0.03	0.03	0.06	0.06
Jehanabad	0.43	0.46	0.01	0.02	0.22	0.44	0.14	0.10	0.06	0.04	0.01	0.01	0.02	0.02
Arwal	0.28	0.41	0.02	0.02	0.13	0.28	0.08	0.07	0.03	0.03	0.01	0.01	0.01	0.01
Nawada	0.54	0.58	0.03	0.06	0.45	0.62	0.08	0.06	0.04	0.02	0.01	0.01	0.03	0.02
Aurangabad	1.33	2.03	0.01	0.02	0.52	0.81	0.37	0.27	0.13	0.10	0.10	0.10	0.07	0.05
Saran	0.83	1.04	0.29	0.58	0.92	1.83	0.03	0.03	0.01	0.01	0.02	0.02	0.01	0.01
Siwan	1.10	1.11	0.19	0.34	0.63	1.74	0.04	0.06	0.01	0.01	0.03	0.06	0.01	0.01
Gopalganj	0.91	1.03	0.18	0.35	0.85	1.57	0.04	0.04	0.01	0.01	0.02	0.03	0.01	0.01
Muzaffarpur	1.44	0.96	0.31	0.71	0.90.	1.26	0.05	0.07	0.02	0.03	0.02	0.04	0.00	0.00
East Champaran	1.84	1.75	0.19	0.58	0.97	1.57	0.11	0.08	0.09	0.06	0.03	0.03	0.01	0.01
West Champaran	1.64	1.84	0.16	0.34	0.80	1.40	0.23	0.20	0.15	0.09	0.07	0.10	0.00	0.00
Sitamadhi	0.83	0.65	0.04	0.08	0.46	0.73	0.08	0.05	0.05	0.03	0.01	0.01	0.01	0.01
Sheohar	0.25	0.13	0.02	0.04	0.14	0.15	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01
Vaishali	0.62	0.43	0.34	0.75	0.43	0.69	0.03	0.03	0.01	0.01	0.02	0.02	0.02	0.01
Darbhanga	0.92	0.82	0.13	0.26	0.70	0.98	0.06	0.05	0.04	0.03	0.01	0.01	0.01	0.01
Madhubani	1.72	1.05	0.03	0.05	0.88	0.68	0.11	0.06	0.07	0.03	0.01	0.01	0.01	0.01
Samastipur	0.78	0.37	0.42	0.92	0.53	0.83	0.05	0.04	0.02	0.02	0.02	0.03	0.01	0.01
Munger	0.06	0.38	0.13	0.20	0.21	0.35	0.03	0.02	0.01	0.01	0.01	0.01	0.02	0.01
Begusarai	0.26	0.20	0.61	1.19	0.54	0.94	0.04	0.04	0.01	0.01	0.02	0.02	0.00	0.00
Sheikhpura	0.21	0.22	0.02	0.03	0.19	0.31	0.10	0.10	0.05	0.04	0.01	0.01	0.03	0.02
Lakhisarai	0.31	0.31	0.08	0.12	0.23	0.39	0.16	0.15	0.08	0.08	0.01	0.01	0.05	0.04
Jamui	0.47	0.33	0.08	0.07	0.15	0.18	0.04	0.04	0.02	0.01	0.01	0.02	0.02	0.02
Khagaria	0.22	0.16	0.54	1.56	0.40	0.65	0.04	0.03	0.01	0.01	0.01	0.01	0.01	0.01
Bhagalpur	0.45	0.45	0.47	0.94	0.45	0.64	0.12	0.09	0.04	0.03	0.01	0.02	0.04	0.03
Banka	0.90	1.11	0.14	0.26	0.27	0.38	0.08	0.06	0.02	0.02	0.01	0.01	0.04	0.04
Saharsa	0.85	0.91	0.30	0.95	0.44	0.60	0.05	0.04	0.02	0.01	0.00	0.00	0.00	0.00
Supaul	0.18	1.50	0.11	0.36	0.57	0.71	0.07	0.04	0.02	0.01	0.00	0.00	0.00	0.00
Madhepura	0.79	1.03	0.41	1.44	0.39	0.50	0.05	0.04	0.02	0.01	0.00	0.00	0.00	0.00
Purnea	1.19	1.38	0.42	0.91	0.53	0.55	0.06	0.05	0.04	0.02	0.00	0.00	0.01	0.01
Kishanganj	1.03	1.07	0.02	0.03	0.27	0.27	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Araria	1.21	1.21	0.18	0.44	0.53	0.43	0.11	0.08	0.03	0.02	0.02	0.02	0.03	0.02
Katihar	1.19	1.34	0.42	0.99	0.43	0.42	0.05	0.04	0.02	0.01	0.01	0.01	0.03	0.03
State's Total	**33.01**	**38.22**	**6.45**	**15.88**	**20.47**	**37.07**	**6.18**	**4.59**	**1.68**	**1.23**	**0.36**	**0.47**	**0.69**	**0.60**

Source: Compiled from various issues of Economic Survey, GoB, & Bihar through figures, DoE & S, Bihar, Patna

Analysis of table 2.4 reveals that total pulses' area and production in the state were recorded to be 5.01 lakh hectares and 4.39 lakh tons during TE 2016-17, which were lower than respective figures of TE 2006-07 found to be 18.94 percent and 4.36 percent respectively. Across the districts, like; TE 2006-07,Patna had the highest pulses' area and production with 0.47 lakh hectares and 0.60 lakh tons respectively, that accounted for 9.39 percent and 13.67 percent of the state's total pulses' area and production followed by Aurangabad and Nalanda. Pulse wise analysis shows that area and production of lentil were 1.75 lakh hectares and 1.42 lakh tonnes respectively, which were 34.93 percent and 32.35 percent to the state's total pulses' area and production. Out of the total area and production of lentil in the state, Patna had the highest 0.28 lakh hectare with production of 0.35 lakh tonnes, which were 16.00 percent and 24.65 percent of the state's total lentil area and production. These were followed by Aurangabad and Nalanda. Major arhar producing districts in the state were Jamui, Gaya, Darbhanga and Kaimur, contributing together around 40.00 percent and 33.34 percent of the state's total arhar area and production respectively. Total area and production of gram in the state were 12.18 percent and 13.90 percent to the state's total pulses' area and production respectively. The districts of Patna, Nalanda, Bhojpur, Kaimur, Gaya and Aurangabad together contributed 57.38 percent and 49.18 percent of the state's total area and production of gram. Across the districts, Patna had the highest area of gram (11.48 %) and production (13.12 %) to the state's total area and production, followed by Aurangabad and Bhojpur. Based on above analysis, it can be said that Patna ranked 1st in terms of total pulses' area and production during both the TEs 2006-07 & 2016-17 and it also retained 1st position across the pulses' area and production of the state except arhar crop.

Table 2.4: Area and production of major crops at districts level in State (TE 2016-17) (Area in lakh hectares & production in lakh tones)

District	Rice		Maize		Wheat		Pulses		Lentil		Arhar		Chana	
	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.
Patna	0.63	1.81	0.07	0.18	0.61	1.72	0.47	0.60	0.28	0.35	0.01	0.01	0.07	0.08
Nalanda	1.02	2.95	0.07	0.26	0.86	2.21	0.25	0.26	0.13	0.14	0.01	0.01	0.05	0.06
Bhojpur	0.96	2.84	0.05	0.11	0.67	1.62	0.19	0.18	0.08	0.07	0.01	0.01	0.06	0.06
Buxar	0.85	2.58	0.01	0.03	0.85	2.17	0.09	0.08	0.03	0.03	0.01	0.01	0.02	0.02
Rohtas	1.96	7.41	0.00	0.00	1.40	3.52	0.10	0.13	0.03	0.03	0.01	0.02	0.03	0.03
Kaimur	1.10	2.94	0.00	0.00	0.82	1.81	0.13	0.14	0.05	0.07	0.02	0.02	0.05	0.04
Gaya	1.02	3.02	0.06	0.19	0.72	1.85	0.20	0.21	0.07	0.07	0.02	0.03	0.05	0.05
Jehanabad	0.36	1.08	0.01	0.02	0.23	0.59	0.16	0.16	0.06	0.06	0.01	0.01	0.02	0.02
Arwal	0.31	1.12	0.01	0.03	0.13	0.28	0.06	0.06	0.04	0.04	0.01	0.01	0.01	0.01
Nawada	0.71	0.16	0.02	0.05	0.47	1.04	0.10	0.08	0.04	0.03	0.01	0.01	0.02	0.02
Aurangabad	1.67	5.97	0.01	0.03	0.73	1.60	0.34	0.27	0.14	0.11	0.01	0.02	0.07	0.06
Saran	0.73	1.31	0.27	0.93	0.87	2.22	0.03	0.03	0.01	0.01	0.01	0.01	0.00	0.00
Siwan	0.92	1.71	0.18	0.58	0.90	2.05	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01
Gopalganj	0.84	1.24	0.14	0.37	0.77	1.70	0.02	0.02	0.00	0.00	0.01	0.01	0.00	0.00
Muzaffarpur	1.26	1.88	0.40	1.13	0.87	1.71	0.28	0.15	0.02	0.02	0.01	0.01	0.01	0.01
East Champaran	1.93	2.78	0.49	0.98	1.23	1.70	0.12	0.09	0.09	0.04	0.01	0.03	0.00	0.00
West Champaran	1.49	3.09	0.08	0.23	0.66	1.27	0.12	0.09	0.09	0.07	0.01	0.01	0.00	0.00
Sitamadhi	0.97	1.61	0.05	0.21	0.88	2.12	0.06	0.05	0.03	0.02	0.01	0.01	0.00	0.00
Sheohar	0.23	0.30	0.02	0.06	0.15	0.27	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00
Vaishali	0.44	0.77	0.32	1.28	0.43	1.05	0.09	0.06	0.01	0.01	0.01	0.01	0.00	0.00
Darbhanga	0.79	1.30	0.15	0.78	0.60	1.38	0.12	0.12	0.02	0.02	0.02	0.01	0.00	0.00
Madhubani	2.07	3.00	0.01	0.02	0.91	1.26	0.19	0.14	0.08	0.06	0.01	0.01	0.00	0.00
Samastipur	0.93	1.92	0.61	2.09	0.51	1.37	0.18	0.13	0.01	0.01	0.01	0.01	0.00	0.00
Munger	0.25	0.66	0.19	0.46	0.14	0.27	0.03	0.03	0.01	0.01	0.00	0.00	0.01	0.01
Begusarai	0.03	0.51	0.39	1.16	0.59	1.45	0.05	0.05	0.01	0.01	0.01	0.01	0.00	0.00
Sheikhpura	0.25	0.87	0.01	0.03	0.23	0.54	0.07	0.08	0.03	0.04	0.01	0.01	0.01	0.02
Lakhisarai	0.35	1.16	0.05	0.08	0.03	0.76	0.12	0.12	0.04	0.04	0.01	0.01	0.04	0.04
Jamui	0.44	0.94	0.04	0.11	0.37	0.65	0.11	0.12	0.02	0.02	0.02	0.05	0.03	0.03
Khagaria	0.23	0.41	0.60	2.63	0.30	0.69	0.08	0.08	0.01	0.01	0.01	0.01	0.01	0.01
Bhagalpur	0.66	0.83	0.44	1.76	0.47	1.20	0.15	0.11	0.02	0.01	0.01	0.01	0.04	0.04
Banka	0.95	3.22	0.11	0.43	0.28	0.59	0.08	0.07	0.01	0.02	0.01	0.01	0.02	0.02
Saharsa	0.73	1.53	0.30	1.35	0.50	1.16	0.20	0.10	0.01	0.01	0.00	0.00	0.00	0.00
Supaul	1.06	1.98	0.13	0.58	0.53	0.94	0.29	0.17	0.01	0.01	0.00	0.00	0.00	0.00
Madhepura	0.79	1.78	0.43	1.96	0.25	0.67	0.21	0.11	0.01	0.01	0.00	0.00	0.00	0.00
Purnea	0.98	2.25	0.38	1.80	0.34	0.68	0.07	0.06	0.01	0.01	0.01	0.01	0.01	0.01
Kishanganj	0.78	1.76	0.04	0.15	0.16	0.32	0.09	0.09	0.01	0.01	0.00	0.00	0.01	0.01
Araria	1.20	2.49	0.47	2.32	0.34	0.68	0.10	0.09	0.01	0.01	0.01	0.01	0.01	0.01
Katihar	1.07	2.47	0.61	5.34	0.28	0.60	0.10	0.10	0.02	0.02	0.00	0.00	0.01	0.01
Total	**32.79**	**77.61**	**7.11**	**29.48**	**21.24**	**47.64**	**5.01**	**4.39**	**1.75**	**1.42**	**0.20**	**0.33**	**0.61**	**0.61**

Source: Compiled from various issues of Economic Survey, GoB.

2.4 Area, Production and yield of Pulses in Bihar

Data in table 2.5 reveals that area under total pulses in the state decreased by 18.93 per cent in TE 2016-17 over TE 2006-07. Production also decreased by 4.36 percent during the same periods of times. Across the districts, Muzaffarpur has gained the highest (460%) of total area under pulses followed by Madhepura, Supaul, Saharsa and Samastipur with gains of 320 per cent, 314 per cent, 300per cent, and 260 per cent respectively. But most of the districts witnessed declines in their pulses' area. Similarly, Kishanganj had obtained the highest increase in pulses' production growth with 350 percent followed by Supaul, Samastipur, Vaishali and Jamui by of 325 per cent, 225 per cent, 200per cent and 200 per cent respectively, while most of the districts witnessed decreases in their pulses production. It means that area of pulses had shifted to other crops. An analysis of individual pulses reveals that total production of lentil increased by 15.45 percent during TE 2006-07 to TE 2016-17 at the state level and its area also showed positive growth by 4.17 percent. Except lentil, arhar and gram also showed negative growth in its total area and production. Across the districts, Rohtas witnessed the highest growth of 57.14 percent in the area of lentil, but its production showed negative growth of 50 percent followed by Darbhanga. Similarly, Rohtas witnessed decrease in its production, but obtained positive growth in lentil's area. Arwal, Bhojpur, Nalanda, Gaya, Madhubani and Patna showed positive growth in both area and production of lentil. Katihar, Jamui & Madhubani have obtained 100per cent growth in lentil production followed by Nalanda, Gaya and Nawada with growth of 75per cent, 75per cent and 50per cent respectively. Out of 38 districts of Bihar, only three districts namely Jamui, Munger and Bhojpur witnessed positive growth each by 50per cent in the area of gram and remaining districts show negative growth in its area. Whereas, Nalanda and Jamui witnessed positive growth by 100% and 50 % in production front respectively while others districts shows negative growth. The area of arhar shows positive growth of 100%, 100% and 50% in Jamui, Darbhanga and Saran respectively, while remaining districts witnessed negative growth. Similarly, only two districts, namely; Jamui and Aurangabad obtained positive growth in arhar's production, and others witnessed negative growth.

Based on above analysis, we can say that hill or up land districts of Bihar have no possibility of tubewell for irrigation of crops. These are fully dependent on rainfall for cultivation it monsoon do not come on time and adequate then possibility of rainfed crops are there.

Table 2.5: Growth rate in Area and production of major crops at districts level in State % (TE 2006-07 to TE 2016-17)

District	Rice		Maize		Wheat		Pulses		Lentil		Arhar		Gram	
	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.	Area	Prodn.
Patna	1.62	27.47	41.67	-18.19	0.00	30.30	-17.54	-10.44	3.70	6.06	0.00	0.00	-30.00	-27.27
Nalanda	4.09	446.30	40.00	225.00	3.61	63.70	-7.40	36.84	8.33	75.00	0.00	0.00	0.00	100.00
Bhojpur	0.00	425.93	25.00	57.15	11.66	16.54	-9.52	-10.00	14.28	16.66	0.00	-50.00	50.00	0.00
Buxar	23.19	113.23	-75.00	-40.00	44.06	73.60	-52.63	-63.63	-62.50	-70.00	-50.00	-50.00	-33.33	-33.33
Rohtas	2.62	50.92	-100.00	-100.00	10.23	23.07	-58.33	-38.09	57.14	-50.00	-50.00	0.00	-57.14	-57.14
Kaimur	4.77	24.58	-100.00	-100.00	26.15	41.40	-35.00	-26.31	-28.57	16.66	-33.33	-33.00	-28.57	-42.85
Gaya	5.16	228.26	-25.00	46.16	24.13	117.64	11.11	75.00	16.66	75.00	-33.33	0.00	-16.66	-16.66
Jehanabad	-16.28	134.79	0.00	0.00	13.63	34.09	14.28	60.00	0.00	50.00	0.00	0.00	0.00	0.00
Arwal	10.72	173.17	-50.00	50.00	0.00	0.00	-25.00	-14.28	33.33	33.33	0.00	0.00	0.00	0.00
Nawada	31.49	-72.42	-33.34	-16.67	4.44	67.74	25.00	33.33	0.00	50.00	0.00	0.00	-33.33	0.00
Aurangabad	25.57	-194.09	0.00	50.00	40.38	97.53	-8.10	0.00	7.69	10.00	0.00	100.00	0.00	20.00
Saran	-12.05	25.97	-6.90	60.35	-5.43	21.31	0.00	0.00	0.00	0.00	50.00	50.00	-100.00	-100.00
Siwan	-16.37	54.06	-5.27	70.59	42.85	17.81	0.00	-33.33	0.00	0.00	-66.66	-83.33	0.00	0.00
Gopalganj	-7.70	20.39	-22.23	5.72	-9.41	8.28	-50.00	-50.00	-100.00	-100.00	-50.00	-66.66	-100.00	-100.00
Muzaffarpur	12.50	95.84	29.04	59.16	-3.33	35.71	460.00	114.28	0.00	-33.33	-50.00	-75.00	0.00	0.00
East Champaran	4.90	58.46	157.90	68.97	26.80	8.28	9.09	12.50	0.00	-33.33	-66.66	0.00	-100.00	-100.00
West Champaran	-9.15	67.94	-50.00	-32.36	-17.50	-9.28	-47.82	-55.00	-40.00	-22.22	-85.71	-90.00	0.00	0.00
Sitamadhi	16.87	147.70	25.00	162.50	91.30	190.41	-25.00	0.00	-40.00	-33.00	0.00	0.00	-100.00	-100.00
Sheohar	-8.00	130.77	0.00	50.00	7.14	80.00	0.00	0.00	-50.00	0.00	0.00	0.00	-100.00	-100.00
Vaishali	-29.04	-19.07	-5.89	70.66	0.00	52.17	200.00	200.00	0.00	0.00	-50.00	-50.00	-100.00	-100.00
Darbhanga	-14.13	58.54	15.49	200.00	-14.28	40.81	216.66	180.00	50.00	-33.33	100.00	0.00	-100.00	-100.00
Madhubani	20.13	185.72	-66.67	-60.00	3.40	85.29	72.72	133.33	14.28	100.00	0.00	0.00	-100.00	-100.00
Samastipur	19.23	418.92	45.24	127.17	-3.77	65.06	260.00	225.00	-50.00	-50.00	-50.00	-66.66	-100.00	-100.00
Munger	31.66	73.69	46.16	130.00	-33.33	-22.85	0.00	50.00	0.00	0.00	-100.00	-100.00	50.00	0.00
Begusarai	-88.46	155.00	-36.06	-252.10	9.25	54.25	25.00	25.00	0.00	0.000	-50.00	-50.00	0.00	0.00
Sheikhpura	19.04	295.45	-50.00	0.00	21.05	58.82	-30.00	-20.00	-40.00	0.00	0.00	0.00	-66.66	0.00
Lakhisarai	12.90	274.19	-37.50	-33.33	-86.95	94.87	-25.00	-20.00	-50.00	-50.00	0.00	0.00	-20.00	0.00
Jamui	-6.38	184.84	-50.00	57.14	146.66	306.25	175.00	200.00	0.00	100.00	100.00	150.00	50.00	50.00
Khagaria	4.54	156.25	11.11	68.58	-25.00	6.15	100.00	166.66	0.00	0.00	0.00	0.00	0.00	0.00
Bhagalpur	46.66	84.44	-6.38	87.23	4.44	87.50	25.00	22.22	-50.00	-66.66	0.00	-50.00	0.00	33.33
Banka	5.55	190.09	-21.42	65.38	3.70	55.26	0.00	16.66	-50.00	0.00	0.00	0.00	-100.00	-100.00
Saharsa	-14.11	68.13	0.00	42.10	13.63	93.33	300.00	150.00	-50.00	0.00	0.00	0.00	0.00	0.00
Supaul	488.88	32.00	18.18	61.11	-7.01	32.39	314.28	325.00	-50.00	0.00	0.00	0.00	0.00	0.00
Madhepura	0.00	72.81	4.87	36.11	-35.89	34.00	320.00	175.00	-50.00	0.00	0.00	0.00	0.00	0.00
Purnea	17.64	63.04	-9.52	97.80	-35.84	23.63	16.66	20.00	-75.00	-50.00	0.00	0.00	0.00	0.00
Kishanganj	-24.27	64.48	100.00	400.00	-40.74	18.51	200.00	350.00	-50.00	0.00	0.00	-100.00	0.00	0.00
Araria	-0.82	105.78	161.11	427.27	-35.84	58.13	-9.09	12.50	-66.66	-50.00	-50.00	-50.00	-66.66	-50.00
Katihar	10.08	84.32	45.23	439.39	-34.88	42.85	100.00	150.00	0.00	100.00	-100.00	-100.00	-66.00	-66.00
Total	**(-)0.67**	**103.06**	**10.23**	**85.64**	**3.76**	**28.51**	**(-) 18.93**	**(-) 4.36**	**4.17**	**15.45**	**(-) 44.44**	**(-) 29.29**	**(-) 11.59**	**(-) 1.67**

Source: Compiled from tables 2.4 & 2.5.

Further, to assess the growth in area and yield rates of major crops, data presented in table 2.6 may be seen, which have been classified in different slabs of period. Right from 1990-91 to 2016-17, three periods of time slabs were there, and from 2012-13 year to year growth have been calculated till 2016-17. During these slabs, positive growth in area of rice was found during 2010-11 to 2016-17 (0.49%), besides the higher growth in 2012-13 to 2013-14(4.04%). During 2015-16, growth in rice area was also noted, though it was by 1.01 percent only. Growth in yield rates was positive in all the slabs, except 1990-91 to 1999-2000. In case of maize crop, the area grew at around less than 2 percent, except negative growth during 2000-01 to 2009-10. Yield rates also marginally grew during 2000-01 to 2009-10(1.44%), substantial increased was found during 2010-11 to 2016-17(7.27%) and further by 8.44 percent during 2015-16 to 2016-17.

It honoured the State, by winning 'Krishi Karman Award' for maize yield during 2016-17. In case of wheat, the State also won 'Krishi Karma Award' for its yield during 2017-18, but across the given slabs, no significant increase in area and yield were noticed, except during the year 2012-13 to 2013-14. Pulses' area have continuously fallen across the slabs, however, its yield rate increased during the periods 2000-01 to 2009-10(8.63%), 2010-11 to 2016-17(7.15%) and 2012-13 to 2013-14(5.67%). Across the pulses, the areas under gram, moong and lentil were noticed to have marginally increased during recent years, which led to increase in yields also, but consistent growth is still far away.

Based on the above analysis, it can be said that hilly or up-land districts of Bihar have least possibility of tubewell for irrigation of crops. These districts are fully dependent on rainfall for cultivation, if, monsoon does not come on time and adequate rainfall is not then possibility of rainfed crops.

Table 2.6: Growth rate in area and yield rate of major crops in the state (%)

Period	Rice		Maize		Wheat		Pulses		Oilseed		Arhar		Gram		Moong		Masoor	
	Area	Yield	Area	Yield	Area	Yield	Area	Yield	Area	Yield	Area	Yield	Area	Yield	Area	Yield	Area	Yield
1990-91 to 1999-00	-2.15	-3.01	1.23	-10.04	0.16	2.35	-2.93	-4.32	-1.28	3.06	-2.19	1.34	-5.34	4.66	-1.70	1.54	-0.01	0.81
2000-01 to 2009-10	-1.83	0.19	-1.55	1.44	0.24	-4.91	-5.61	8.63	-3.16	2.67	-6.81	0.25	-3.42	-1.88	-0.80	-0.89	-0.95	-0.89
2010-11 to 2016-17	0.49	9.69	1.96	7.27	-0.13	0.47	-1.68	7.15	-2.45	1.23	-3.01	4.25	-0.24	-2.35	0.22	1.45	0.62	-3.06
2012-13 to 2013-14	4.04	13.94	2.18	8.44	0.73	5.08	-1.93	5.67	-2.29	5.37	0.00	9.30	0.00	5.36	-0.63	-2.80	-3.75	12.83
2013-14 to 2014-15	-0.64	0.25	1.57	-1.67	0.18	-18.87	-1.17	-4.87	-3.14	-6.47	-16.66	4.22	-3.33	-5.96	0.63	1.62	1.23	-8.63
2014-15 to 2015-16	-0.68	-5.91	0.56	-3.60	-1.52	-7.65	-1.19	-7.17	-3.25	-9.28	-4.34	-3.08	0.00	-12.67	1.25	0.00	1.81	-10.29
2015-16 to 2016-17	1.01	6.23	0.98	10.82	-1.60	0.53	-0.59	-3.20	-3.36	-4.21	-15.00	-2.71	1.63	-3.19	3.61	11.36	5.71	-15.34

NB: Growth rates are based on annual averages.

2.5 Summary of the Chapter

- Bihar has 4.79 lakh ha of total pulses' area with production of 4.53 lakh tones during 2018-19, which were 1.62 and 1.85 percent of the country's total area and production of pulses.

- Area and production of rice in the state (united Bihar) were recorded at 53.28 lakh ha and 98.17 lakh tones respectively during TE 1990-91, which declined after bifurcation of Bihar in 2000 to 32.79 lakh ha and 82.55 lakh tones respectively during TE 2016-17. In case of maize and wheat, it surged during the same period of time. Total area and production of pulses were recorded to be 9.59 lakh ha and 6.59 lakh tones during TE 1990-91, which declined to 5.01 lakh ha and 4.39 lakh tones respectively during TE 2016-17.The area and production of oilseed were found to be 2.30 lakh ha and 1.36 lakh tones during TE 1990-91. Area and production under oilseeds were1.84 lakh ha and 1.46 lakh tones during TE 2000-01, which fell to 1.19 lakh ha and 1.27 lakh tones respectively during TE 2016-17.

- Bihar has total geographical area of 93.6 lakh ha and divided by river Ganges in two parts, north Bihar with an area of 53.3 lakh ha and south Bihar with 40.3 lakh ha. Based on TGA, Gaya is the largest district of the state with 4.93 lakh ha of land followed by West-Champaran and East-Champaran with 4.84 lakh ha and 4.13 lakh ha of land areas respectively. East-Champaran had the largest area of 2.98 lakh ha under cultivation, which was 69.14 percent of its TGA, followed by West-Champaran and Rohtas districts with 2.80 lakh ha and 2.54 lakh ha of area under cultivation respectively during TE 2006-07. Almost similar trends were found in same districts during TE 2016-17.

- Kishanganj district has the largest percentage share (91.0%) of cultivable area to TGA, followed by Buxar and Nalanda with 84.33 percent and 78.01 percent respectively during TE 2016-17. The percentage share of the total pulses' area to gross cultivable area was recorded to be 7 percent during TE 2006-07, but it increased to 9.29 percent during TE 2016-17.

- Total area under pulses in the state was recorded at 6.18 lakh ha with production of 4.59 lakh tones during TE 2006-07. Out of the total area under pulses and production in the state, Patna district had the highest area under it that was 0.57 lakh ha with production of 0.67 lakh tones. These accounted for 9.23 percent and 14.50 percent of the state's total pulses' area and production respectively followed by Aurangabad and Nalanda. Total area under lentil was calculated to be 1.68 lakh ha with production of 1.23 lakh tones, which were 27.19 percent and 26.80 percent of the state's total pulses area and production. Across the districts, Patna had the highest area under lentil (0.27 lakh ha) with production of 0.33 lakh tones, which were 16.08 percent and 26.83 percent of the state's total lentil area and production during TE 2006-07 followed by West-Champaran and Aurangabad districts.

- Total area under arhar in the state was found at 0.36 lakh ha with production of 0.47 lakh tones, which were 5.83 percent and 10.24 percent of the state's total pulses' area and production respectively. These were followed by West-Champaran and Siwan during TE 2006-07. The percentage share of gram's area and production to the state's total pulses area and production were recorded to be 11.17 percent and 13.08 percent respectively. Across the districts, Patna had the highest percentage share of area and production under gram of the state's total gram's area and production, which were recorded at 21.28 percent and 18.34 percent respectively during TE 2006-07.

- Total pulses' area and production in the state were recorded at 5.01 lakh ha and 4.39 lakh tones respectively during TE 2016-17. Across the districts, Patna had the highest pulses' area of 0.47 lakh ha with production of 0.60 lakh tones, which accounted for 9.39 percent and 13.67 percent of the state's total pulses' area and production respectively. These were followed by Aurangabad and Nalanda districts during same period of time.

- The area and production of lentil were recorded at 1.75 lakh ha and 1.42 lakh tones respectively, which were 34.93 percent and 32.35 percent of the state's total pulses' area and production during TE 2016-17. Across the districts,

Patna had the highest percentage share in area and production of lentil to the state's total lentil area and production during the same period of time.

- Major arhar producing districts in the state were Jamui, Gaya, Darbhanga and Kaimur which together, contributed about 40 percent and 33.34 percent of the state's total arhar's area and production respectively during TE 2016-17.

- Total area and production of gram in the state were calculated to be 12.18 percent and 13.90 percent of the state's total pulses area and production respectively. Across the districts, Patna had the highest gram area (11.48%) and production (13.12%) of the state's total gram area and production followed by Aurangabad and Bhojpur districts during TE 2016-17.
- Area and production under total pulses in the state decreased by 18.93 percent and 4.36 percent respectively in TE 2016-17 over TE 2006-07. Across the districts, Muzaffarpur had gained the highest growth (460%) of state's total pulse area followed by Madhepura and Supaul with growth of 320 percent and 314 percent respectively during the same period. Similarly, Kishanganj had obtained the highest growth of pulses production with 350 percent followed by Supaul, Samastipur , Vaishali and Jamui with growth of 325 percent, 225 percent , 200 percent and 200 percent respectively.
- State's total lentil area and production increased to 4.17 percent and 15.45 percent respectively in TE 2016-17 over TE 2006-07. Besides lentil, arhar and gram showed negative growth in regard to area and production both. Across the districts, Rohtas had the highest growth of 57.14 percent in the area of lentil, but production showed negative growth of 50 percent followed by Dharbhanga.
- Area and production of gram in the state decreased to 11.59 and 1.67 percent respectively in TE 2016-17 over TE 2006-07. Across the districts, only Jamui, Munger and Bhojpur showed negative growth during the same period. Nalanda and Jamui witnessed positive growth of 100 per cent and 50 per cent in production respectively, while other districts witnessed negative growth.

- The area and production of arhar in the state decreased by 44.44 percent and 29.79 percent respectively during TE 2016-17 over TE 2006-07. The area and production of arhar in few districts of the state had shown positive growth, but most of the districts showed negative growth during the same period of time.
- In regard to growth in area and yield of major crops in the state during different periods, the growth in area across the crops was either stagnant or had diminished, except maize crop. In case of yield rates, it increased in case of rice after bifurcation of the state in 2000. Maize yield rates did also significantly increased barring two year slabs of 2013-14 to 2014-15 and 2014-15 to 2015-16. It again increased by 10.82 percent during 2015-16 to 2016-17. As regards pulses, the yield rates increased till 2013-14 and thereafter it fell substantially. Across pulses, moong's yield rate was found to have increased in recent years only. Other pulses' yield rates are still gloomy in the state.

CHAPTER – III

HOUSEHOLD CHARACTERISTICS, CROPPING PATTERN AND VALUE OF OUTPUT OF SELECTED FARMERS

To understand the household socio-economic characteristics, cropping pattern and value of output of beneficiary farmers, the information collected through field survey, has been briefly analyzed in this Chapter. These characteristics play important role in determining the benefits of the seed minikits programme in the state. The analysis includes 200 sample beneficiary farm households and 100 sample non-beneficiary farm households. This way the analysis is based on 300 sample farm households.

3.1 Socio-Economic Characteristics of the Selected Farmers

The analysis includes covers eleven variables such as; number of the households & its size gender, age, educational qualifications, annual income etc. Related data of these variables are presented in table 3.1. It is evident from the table that out of the 300 sample marginal, small and medium farm households were 48 per cent, 43.33 per cent and 8.67 per cent respectively. Average size of households was 7.79 persons. Across the farms, these were 8.19, 7.33 and 7.85 persons with respect to marginal, small and medium respectively. Among the total respondents, the percentage of male and female respondents was 81 and 19 percent respectively. About 90.33 percent of the total respondents were in the age group of 30-60 years followed by 5.67 percent in above 60 age group and 4.00 percent under 30 years of age group. About 44 percent of the total respondents obtained education up to matric level followed by middle (32.33%), up to plus two education level 17.33 per cent and only 6.34 percent attained education up to graduation level. Average number of member out of the total respondents engaged in farming was 1.12 persons and their average farming experience was 28.37 years. Out of the total respondents, 71.00 percent households were from OBC group, followed by general castes with 24.00 percent and Scheduled Castes group (5%). More than 82 percent of the total respondents

Table 3.1: Demographic profile of the selected farmers (% of households)

Characteristics		Marginal	Small	Medium	Large	Total
No of HH (%)		144	130	26	--	300
Household size (numbers)		8.19	7.33	7.85	--	7.79
Gender of Respondent (%)	Male	78.47	81.54	92.31	--	81.00
	Female	21.53	18.46	7.69	--	19.00
Age of the Respondent (%)	<30	4.86	3.85	---	--	4.00
	30-60	87.50	91.54	100.00	--	90.33
	>60	7.64	4.61	---	---	5.67
Education status of Respondent, number of years of education (%)	Illiterate	---	---	---	---	---
	Up to Primary (5)	---	---	---	---	---
	Up to Middle (8)	34.72	30.00	30.77	--	32.33
	Up to Matric (10)	41.67	46.92	42.31	--	44.00
	Up to + 2	16.67	18.46	15.38	---	17.33
	Up to graduate	6.94	4.62	11.54	--	6.34
	Above graduate	---	---	---	---	---
Average members of family doing farming		1.11	1.12	1.15	---	1.12
Average years of farming experience		29.23	28.43	23.31	--	28.37
Caste (% of households)	SC	4.86	3.85	11.54	--	5.00
	ST	---	---	---	---	---
	OBC	70.83	71.54	69.23	---	71.00
	General	24.31	24.61	19.23	--	24.00
Main occupation of respondent (%)	Agriculture and allied	79.86	82.31	100.00	--	82.67
	Agricultural labour	19.45	16.92	---	--	16.67
	Non-agricultural labour	---	---	---	---	---
	Self business/ services	---	0.77	---	---	0.33
	Salaried/pensioners	0.69	---	---	---	0.33
	Others	---	---	---	---	---
Subsidiary occupation of respondent (%)	Agriculture and allied	13.89	10.00	---	---	11.00
	Agricultural labour	1.39	3.08	---	---	2.00
	Non-agricultural labour	7.64	8.46	---	---	7.33
	Self business/ services	4.86	3.08	---	---	3.67
	Salaried/pensioners	---	---	---	--	---
	Others	---	---	---	---	---
Average Annual Income(Rs.) Per Farm	Agriculture and allied	26027	37008	57281	---	33495
	Non-agricultural Sources	11007	8577	1308	---	9113

Note: (i) Marginal farmer: 0-2.5 acres; Small Farmers: 2.51-5.00 acres; Medium: 5.01-10.00 acres; Large:>10 acre (ii) Percentage has been considering total number of surveyed households. Source: Field Survey Data

were mainly dependent on agriculture and allied activities for their livelihood followed by occupation in the agricultural labourer with 16.67 percent and less than 1.00 percent each in business and salaried categories. So far as the secondary occupation of the sample beneficiaries is concerned, only 11.00 percent of them adopted agriculture and allied activities for their livelihood followed by non-agricultural labourer with 7.33 percent and 3.67 percent in businesses. Average annual income of all respondents from agriculture and allied activities was estimated at Rs. 33495/- per farm (78.61%), and from non-agricultural sources it was Rs. 9113/- per farm (21.39%). Taking together, it was a lump-sum of Rs. 42608/- per farm. Moreover; farm-wise analysis shows that average total annual incomes of marginal, small and medium households were Rs. 37034, Rs. 45585/- and Rs. 58589/- per farm respectively.

3.2 Characteristics of Operational Land Holdings

Details of operational land holdings of the sample beneficiaries are presented in table 3.2. The table indicates that per farm GCA and NOA of total respondents were 5.06 acres and 2.61 acres respectively. Of the net operated area, owned and leased-in areas were recorded at 1.74 acres and 0.93 acres respectively. In case of leased-out, small area (0.06 per farm) was found to have been shared by the sample farmers. Farm size analysis reveals that average GCA and NOA of medium farmers were 12.02 acres and 5.78 acres respectively. Out of NOA of medium farm households, owned and leased-in areas were calculated at 2.91 acres and 2.87 acres respectively. Similarly, average GCA and NOA of small farmers were 5.96 acres and 3.29 acres respectively. Out of NOA of small farm households, owned and leased-in areas were 1.95 acres and 1.35 acres respectively, whereas average GCA and NOA of marginal farmers were 2.99 acres and 1.43 acres respectively. Out of NOA of marginal farms, owned and leased- in areas were recorded at 1.34 acres and 0.19 acres respectively, while area of leased-out land was 0.11 acres, which was a little lower than the leased-in area.

Out of the average NOA of total respondents, 99.29 percent area was found irrigated. Almost similar trend was found in case of all farm size groups in terms of

area irrigated. The average rental value of total respondents was found Rs. 3792/- per acre and the value of per acre of land (rent) was between Rs. 2349/- to Rs. 8078/- found across farm size groups. In fact, the value of land depends up on fertility of the soil and availability of irrigation. The cropping intensity of total respondents was found 194 percent, while across the farm sizes, These were as high as 209 percent in case of marginal farmers followed by medium farmers (208%) and small farmers (181%).

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

Farm size	Owned land	Non cultivable	Leased-in	Leased - out	Average Rental (Rs/acre)	NOA	Net Irrigated area	GCA	Cropping intensity (%)
	1	2	3	4	5	6	7	8	9
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**

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

Source: Field Survey Data

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3.3 Sources of Irrigation

Irrigation is considered to be one of the foremost inputs in agricultural practices. Incidences of crop failures in many parts occur due to lack of irrigation water. In Bihar, major source of irrigation is borewell. It can also be seen from the table 3.3, which reveals that borewell was the only source of irrigation in the study area also. Further, in the study area, more than 99 percent of the NOA is irrigated and less than one percent (0.02 acre) is rainfed. Average water charge for irrigation was calculated at about Rs. 763/ acre.

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

Farm size	Only canal	Bore well	Dug well	Tank	Others	Rain fed area (In acre)	Average Water Charges (Rs/acre)	Total operated area
	1	2	3	4	5	6	7	8
Marginal	--	100.00	--	--	--	---	746	100.00
Small	--	100.00	--	--	--	0.03	761	100.00
Medium	--	100.00	--	--	--	0.08	844	100.00
Large	--	--	--	--	--	--	--	100.00
Total	**--**	**100.00**	**--**	**--**	**--**	**0.02**	**763**	**100.00**

Source: Field Survey Data

3.4 The Cropping Patterns of the Sample Farmers

Analysis of data put in table 3.4 reveals that maize had highest share of 32.97 percent of GCA of the total respondents followed by paddy and wheat with 17.22 percent and 16.33 percent respectively in irrigated conditions, while lentil itself shared highest percentage (15.58%) to the average GCA of the total sample farmers in case of rain-fed crops. Out of the gross cropped area (GCA) of total respondents (1517.73 acres), the percentage of gross cropped area of small farmers was found highest with 51.04 percent (774.59 acres), whereas the share of marginal and medium farmers were 28.37 per cent and 20.59 per cent respectively.

Farm wise analysis reveals that out of the total GCA of marginal farmers, maize had highest percentage of area 27.65 per cent followed by paddy and lentil with 22.26 percent and 19.93 percent respectively. Most of the sample marginal farmers preferred to grow maize and paddy in irrigated areas, and in rain-fed areas, they preferred to grow lentil, gram and oilseeds mainly due to the fact that these crops require less irrigation. In case of small farmers, maize had also highest percentage (34.91%) of GCA in case of irrigated crops followed by wheat with 17.02 percent and paddy by 15.09 per cent and among the rain-fed crops, lentil had highest area (15.58%) followed by oilseeds (8.76%) and gram (8.64%) crops. Similarly, medium farmers preferred to grow maize (35.50%) as compared to other irrigated crops followed by wheat with 16.86 percent, which was a little more than paddy's area (15.57%). Among the rain-fed crops, they preferred to grow equally gram (11.24%) and oilseeds (11.24%) as compared to lentil areas (9.59%). On the basis of above analysis it can be said that most of the sample farmers preferred to grow maize in all the three seasons due to high demand in its dynamic market with possibility of more value addition. It was one of the main competitive crops of wheat as maize has become commercial and cash crop particularly since 90s. Now-a-days, maize can add value in the forms of fine flours, grits, ugali, fuba, separated in flakes or shack grits and animal feeds for making it more profitable than other food crops. So, the consumption demand of maize products has increased by both rural and urban consumers along with shifting to higher quality products and processed products in urban regions particularly.

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

Name of the crop	Marginal	Small	Medium	Large	Total
Irrigated crops					
Paddy	22.26	15.09	15.57	---	17.22
Maize	27.65	34.91	35.50	---	32.97
Wheat	14.70	17.02	16.86	---	16.33
Rainfed crops					
Lentil	19.93	15.58	9.59	---	15.58
Gram	7.80	8.64	11.24	---	8.94
Oilseeds	7.66	8.76	11.24	---	8.96
Perennial crops					
--	--	--	--	--	--
--	--	--	--	--	--
Gross cropped area (%)	100.00	100.00	100.00	---	100.00
Gross cropped area (acres)	430.56	774.59	312.58	---	1517.73

Source: - Field Survey Data

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3.5 Production, Cost and Returns by Farm Size

Analysis of data mentioned in table 3.5 shows that average productivity of the total respondents for rain-fed crops was calculated at 5.20 quintals/acre, and that of irrigated crops, it was calculated at 10.43 quintals/acre. Across farm sizes, marginal farmers obtained maximum productivity of 10.91 quintals/acre for irrigated crops followed by small farmers with 10.50 quintals/acres and medium farmers (9.61 qtls/acre). In case of rain-fed crops, marginal farmers also obtained maximum productivity of 5.71 quintals/acre followed by small farmers with 5.42 quintals/acre and medium farmers (3.87qtls/acre). Almost similar trends were found in aggregate of all crops in case of marginal, small and medium farmers. The value of output of total respondents were at Rs. 16053 per acre and that received by marginal, small and medium farm households, were calculated at Rs. 16748, Rs. 15981and Rs. 15276 per acre respectively. Material and labour costs of total respondents were estimated at Rs. 6068/acre and Rs. 1895/acre respectively which were Rs. 7963/acre in total. Material and labour cost taken together for marginal, small and medium farmers were calculated at Rs. 9110, Rs. 7221 and Rs. 8185 per acre respectively. Per acre net return of total respondents was estimated at Rs. 8090. For marginal, small and medium farmers, these were found to be Rs. 7638, Rs. 8760 and Rs. 7091 respectively.

Across farm sizes, small farmers obtained maximum net return followed by small and medium farmers. Gross farm income of the total respondents was calculated at Rs. 21115 per household and that for marginal, small and medium farmers, were calculated at Rs. 10922, Rs. 28820 and Rs. 40986 respectively.

Table 3.5: Value of output, Cost and Net Returns for the survey year – aggregate of all crops (Rs)

Farm Size	Production (quintals/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		
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

Source: - Field Survey Data

3.6 Summary of the Chapter

- Total selected respondents were 300 farmers with 81 per cent male and 19 per cent female. Out of it, marginal, small and medium farm households were 48 per cent, 43.33 per cent and 8.67 per cent respectively. Average household size of the total respondents was 7.79 persons. About 90.33 percent of the total respondents belonged to age group of 30-60 yrs followed by in the more than 60 years of age group (5.67%) and less than 30 years age group (4.00%). About 44 percent of the total respondents obtained education up to matriculation followed by middle class level (32.33%), and only 6.34 percent respondents had obtained education up to graduation level. Average number of members of total respondents engaged in farming was found 1.12 persons and their farming experience was 28.37 years. Out of the total respondents, 71.00 percent belong to OBC group followed by general caste (24%) and scheduled castes (5%). More than, 82 percent of the total respondents were dependent on agriculture and allied activities for their livelihood followed by mainly agricultural labourer (16.67%). Average annual income of the total respondents was

recorded at about Rs. 42608 constituting 78.61 per cent from agricultural & allied activities and 21.39 per cent from non-agricultural sources.

- The average GCA & NOA of the total respondents were at 5.06 acres and 2.61 acres respectively. Out of the total NOA, average owned and leased-in areas were at 1.74 acres and 0.93 acre respectively, while, in case of lease-out, it was almost negligible among the sample farmers. Average rental value per acre of land was found at Rs. 3792 and their cropping intensity was recorded at 194 per cent.
- Above 99 percent of NOA was found irrigated. Bore well irrigation highly prevailed in the study areas, and the average cost of irrigation was indicated at Rs. 763/acre.
- Among the irrigated crops, maize had the highest share (32.97%) with respect to GCA of the total respondents followed by paddy (27.22%) and wheat (16.33%).Among rain-fed crops, lentil had highest share of (15.58%) to the GCA of the total respondents followed by oilseeds (8.96%) and gram (8.94).
- Average productivity of the rain-fed crops for all respondents was calculated at 5.20 quintals per acre and in regard to irrigated crops, it was recorded at 10.43 qts per acre. The value of output of main plus by-product for total respondents was at Rs. 16053 per acre and the value received by marginal, small and medium farm households were calculated at Rs. 16748, Rs. 15981 and Rs. 15276 per acre respectively. Material and labour costs of the produce for total respondents were estimated at Rs. 6068 per acre and Rs. 1895 per acre respectively. Net returns for total respondents were estimated at Rs. 8090 per acre for marginal, small and medium farmers, these were Rs. 7638, Rs. 8760 and Rs. 7091 per acre respectively. Gross farm income per household from cultivated area for total respondents was calculated at Rs. 21115 and for marginal, small and medium farmers was at Rs. 10922, Rs. 28820 and Rs. 40986 respectively.

CHAPTER – IV

EFFICIENCY OF SEED MINIKIT IN BIHAR

Participation of farmers in any of the programmes is determined by the efficiency of the programme. With this view in mind, this chapter mainly deals with the efficiency of seed minikit in pulses in Bihar by analyzing productivity cost socio-economic comparisons in regard to seed minikit distribution between beneficiary and non-beneficiary farmers, efficiency in distribution and usage of seed minikits, farmers awareness, perception about the scheme along with major issues and problems faced by the farmers in availing the seed minikit. Measures for improving the effectiveness of the scheme have also been discussed.

4.1 Productivity Composition between Beneficiaries and Non-Beneficiaries

Before analyzing the table, it is to be made clear here that SMK was distributed for two pulse crops only during 2018-19 i.e., red gram and lentil and cultivation of both the pulses was made by SMK farmers, and without SMK farmers both. The data presented in table 4.1 reveals that total area under pulses at aggregate of SMK farmers was 0.711 acre per farm, while it was 0.983 acre per farm for non-beneficiary farmers. Aggregate average value of total output for beneficiary farmers was calculated at Rs. 17844 per acre, while it was Rs. 16719 per acre for non-beneficiary farmers. It reveals that the value of output at SMK farmers was about 6.73 higher as compared to without SMK farmers. Across farm size, beneficiary farmers got higher aggregate average value of output per acre as compared to non-beneficiary farmers. The aggregate average cost of production in case of SMK farmers was calculated to be Rs. 4155 per acre, while it was Rs. 7849 per acre for without SMK farmers. Indicating Rs. 3694 per acre higher for without SMK farmers as compared to SMK farmers which may be due to addition of price paid for purchase of seeds and higher harvesting and threshing cost. Almost similar difference in cost of production was found across farm sizes. The aggregate average net return was Rs. 13689 per acre for beneficiary farmers, while it was Rs. 8870 per acre for non-beneficiary farmers. It

further reveals that the net returns at SMK farmers were higher (54.3%) as compared to without SMK farmers. Almost similar trend of net returns was fetched across SMK farm households. In case of net price obtained at aggregate average level, it was Rs. 3123 per quintal on SMK farmers, while it was Rs. 3125 per qtl for non-beneficiary farmers. Above analysis clearly reveals that the value of output and net returns on total SMK farmers at aggregate average level was much higher as compared to non-beneficiary farmers.

Table 4.1: Productivity and net returns from pulses with and without Seed-Minikits

Farm Size	Area under pulses (acres)		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 average										
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

Note: SMK: Seed Minikit.
Source: Field Survey.

4.2 Production Cost comparisons between Beneficiaries and Non-beneficiaries.

Cost details of lentil and red gram are depicted in tables 4.2 and 4.3 respectively. Analysis of table 4.2 reveals that total costs on lentil pulses among beneficiary and non-beneficiary farmers were Rs. 4143 per acre and Rs. 8072 per acre respectively. Beneficiary respondents had spent Rs. 3929 per acre (94.8%) which was higher than non-beneficiary farmers for growing lentil. Out of the total expenditures made by beneficiary farmers, 38.57 per cent were on land preparation followed by expenditure on labour charges (38.55%), harvesting and threshing (14.19%), plant protection measures (4.83%) and fertilizers (3.86%). In case of non-beneficiary farmers, significant proportion of expenditure was made on purchasing of seed,

which accounted for 50.17 per cent followed by expenditures on land preparation (17.52%), harvesting and threshing of crops (14.08%), labour payments (13.76%) and other items (4.46%). It was found from above analysis that beneficiary farmers spent more amounts on land preparation and labour charges, whereas non-beneficiary farmers spent nearly half of the total cost on purchasing of seed alone.

Table 4.2: Cost details item-wise - Lentil (%)

Activity	SMK/Without	Marginal	Small	Medium	Large	Total
land Preparation	SMK	33.25	34.14	36.92	--	38.57
	Without SMK	17.11	18.48	16.63	--	17.52
Seed	SMK	--	--	--	--	--
	Without SMK	49.19	52.88	46.71	--	50.17
Inter crop	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
FYM, Organic/Bio-fertiliser	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Major and minor nutrients	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Other fertiliser	SMK	4.18	3.78	4.21	--	3.86
	Without SMK	2.43	2.52	2.34	--	2.33
Irrigation charges	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Plant protection chemicals	SMK	3.53	3.70	4.17	--	4.83
	Without SMK	1.95	2.13	1.92	--	2.13
Labour Charges	SMK	35.56	34.27	28.33	--	38.55
	Without SMK	16.01	9.37	15.77	--	13.76
Weeding and plant protection measures	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Harvesting and Threshing	SMK	23.48	24.10	26.16	--	14.19
	Without SMK	13.30	14.61	16.63	--	14.08
Bagging, transportation and marketing cost	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Others	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Total cost (Rs per acre)	**SMK**	**4668 (100.00)**	**4809 (100.00)**	**4193 (100.00)**	**--**	**4143 (100.00)**
	Without SMK	**8215 (100.00)**	**7734 (100.00)**	**8456 (100.00)**	**--**	**8072 (100.00)**

Note: SMK: Seed Minikit
Source: Field Survey

Analysis of data depicted in tale 4.3 reveals that total cost of red gram was Rs. 4437 per acre on SMK farmers while Rs. 6079 per acre on without SMK farmers, accounting 37 per cent higher on without SMK farmers. Out of total cost borne by SMK farmers, 37.75 per cent were spent on land preparation followed by labour

charges (31.17%) and harvesting & threshing of the crop (24.79%). Out of total cost borne by without SMK farmers the expenditures on land preparation and labour payments were lower as compared to SMK farmers, while it was higher in case of harvesting & threshing activities. Almost similar trend of expenditures was found across different farm sizes. Further, it was surprising to observe that both the categories of farms devoted loser pulse area under red gram. Since red gram is long duration pulse crop and grown mainly on up-lands, so they mainly concentrated on lentil pulse.

Table 4.3: Cost details item-wise – Red Gram (%)

Activity	SMK/Without	Marginal	Small	Medium	Large	Total
land Preparation	SMK	39.38	36.07	31.12	--	37.75
	Without SMK	25.27	27.18	30.38	---	27.19
Seed	SMK	--	--	--	--	--
	Without SMK	5.32	5.22	6.75	---	5.59
Inter crop	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
FYM, Organic/Bio-fertiliser	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Major and minor nutrients	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Other fertiliser	SMK	1.98	2.40	6.64	--	2.52
	Without SMK	1.98	1.99	3.79	--	2.39
Irrigation charges	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Plant protection chemicals	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Labour Charges	SMK	30.63	36.07	20.75	--	31.17
	Without SMK	16.60	15.35	10.13	--	14.66
Weeding and plant protection measures	SMK	2.33	2.82	16.60	--	3.76
	Without SMK	3.45	4.20	5.06	--	4.11
Harvesting and Threshing	SMK	25.68	26.64	24.90	--	24.79
	Without SMK	47.38	46.06	43.89	--	46.06
Bagging, transportation and marketing cost	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Others	SMK	--	--	--	--	--
	Without SMK	--	--	--	--	--
Total cost (Rs per acre)	**SMK**	**4285 (100.00)**	**4713 (100.00)**	**4820 (100.00)**	**--**	**4437 (100.00)**
	Without SMK	**6499 (100.00)**	**6515 (100.00)**	**4937 (100.00)**	**--**	**6079 (100.00)**

Note: SMK: Seed Minikit

Source: Field Survey.

4.3 Distribution of Seed Minikits-Socio Economic Comparisons

To understand the socio-economic comparisons between the SMK and without SMK farmers, activity wise use of human labour is one of the important variables. The data presented in table 4.4 reveals that SMK farmers received seed minikits for two pulse crops i.e., lentil & red gram and cultivated both the pulses, similarly 'without SMK farmers' also cultivated both pulses in their fields. While cultivating lentil and red gram SMK farmers used 17.25 and 8.70 human labour per acre respectively in their fields whereas, without SMK farmers used per acre 25.25 human labour for lentil and 13.83 human labour for red gram crop. In aggregate terms of both the pulses, 12.98 human labour per acre was used by SMK farmers, whereas without SMK farmers used 19.54 human labour per acre for lentil. It indicates that without SMK farmers used per acre more human as compared to SMK farmers for both the pulse crops.

Table 4.4: Use of human labour by activities (man days per acre)

Activity	SMK / Without	Lentil	Red gram	Total
Land Preparation	SMK	2	2	2.00
	Without SMK	2	1.55	1.78
sowing	SMK	0.25	0.25	0.25
	Without SMK	0.25	0.82	0.54
Manure & FYM	SMK	2	---	2.00
	Without SMK	2	---	2.00
Major and minor nutrients	SMK	---	---	---
	Without SMK	---	0.73	0.73
Irrigation	SMK	1	---	1.00
	Without SMK	1	---	1.00
Inter cultural operations	SMK	---	---	---
	Without SMK	---	---	---
Plant protection	SMK	---	---	---
	Without SMK	---	---	---
Weeding and plant protection measures	SMK	1	---	1.00
	Without SMK	1	0.91	0.96
Harvesting and Threshing	SMK	10	5.45	7.73
	Without SMK	18	9.82	13.91
Bagging, Transporting	SMK	1	1	1.00
	Without SMK	1	---	1.00
Total	**SMK**	17.25	8.70	12.98
	Without SMK	25.25	13.83	19.54

Note: SMK: Seed Minikit
Source: Field Survey.

As regards the method of sowing is concerned, the data available in table 4.5 shows that of the total respondents, 91 per cent applied broadcasting method of sowing during cultivation of pulses and remaining 9 per cent followed line sowing method. Almost similar trends with very little differences were found across the farms.

Table 4.5: Method of Sowing followed by Selected Households in reference year (%)

Method	Marginal	Small	Medium	Large	Total
Broadcasting	88.73	94.34	82.61	---	91.00
Drill sown	---	---	---	---	---
Line Sown	11.27	5.66	17.39	---	9.00
Total	100.00	100.00	100.00	---	100.00

Source: Field Survey.

While making queries relating to types of documents, which were submitted to avail the seed minikits, the data presented in table 4.6 reveals that out of the total respondents, 85 per cent farmers availed seed minikit facility through online registration at department portal and remaining (15%) farmers availed such facility by submitting Aadhar Card (7.5%) and land records (7.5%). Across farm sizes, majority of farmers availed seed minikits by online registration followed by Aadhar Card and land records. Moreover, minikit was mainly distributed to those farmers, who were interested in cultivation of such pulses, as is evident from table 4.7.

Table 4.6: Documents Submitted to Avail Seed Minikit (Numbers)

Documents	Marginal	Small	Medium	Large	Total
Aadhar Card	04 (5.26)	10 (9.71)	01 (4.76)	---	15 (7.5)
Pahani (Land records)	04 (5.26)	10 (9.71)	01 (4.76)	---	15 (7.5)
Bank Passbook	---	---	---	---	---
Others (registration on Departmental portal)	68 (89.48)	83 (80.58)	19 (90.48)	---	170 (85.0)
Total	**76 (100.00)**	**103 (100.00)**	**21 (100.00)**	**---**	**200 (100.00)**

Note: Figures in brackets are percentage of the respective total

Source: Field Survey.

Table 4.7: Criteria for Farmer Selection

Farmers	Number	%
Any Interested Farmers	200	100.00
SC/ST	---	---
Small/Marginal	---	---
BPL	---	---
Women	---	---
Lottery among applications	---	---
Others	---	---
Total	200	100.00

Source: Field Survey.

As regards financial details involved in seed minikits, data available in table 4.8 shows that minikit of lentil was given to any interested farmers, who applied for it on their field. As informed that the value of per minikit was Rs. 3280. As per the provision, only one kit was given to each of the beneficiary farmer for one acre of land and after verification of sowing plot, cent per cent reimbursement is made in to their respective bank accounts. It generally took 6-8 months time in completion of the whole process.

Table 4.8: Financial details of Seed Minikit (for demonstration) Lentil

Farm Size	Amount Charged (Rs/Kit)	Amount Reimbursed (Rs/Kit)	Reimbursed Through (Rs/Kit)		Duration of Reimbursement (months)
			Cash	Bank	
Marginal	3280	3280	---	3280	6-8
Small	3280	3280	---	3280	6-8
Medium	3280	3280	---	3280	6-8
Large	---	---	---	---	--
Total	3280	3280	---	3280	6-8

Source: Field Survey.

4.4. Efficiency in Distribution and Usage of Seed Minikits

Total number of seed minikits distributed in the state was 13,500 and 59,999 in the year of 2017 and 2018 respectively. Out of the total seed minikits distributed during 2018, 210 were distributed among selected farmers accounting for 13.35 per cent only of the state's figure, which may be seen from table 4.9.

Table 4.9: Number of Seed Minikit distributed among selected farmers

Farmers	2018	
	Numbers	%
Marginal	81	38.57
Small	107	50.96
Medium	22	10.47
Large	---	---
Total	210	100.00
Percentage of selected of total Beneficiaries in State	**59999**	**0.35**

Source: Field Survey.

As stated in table 4.9, altogether 210 seed minikits comprising pulses and oilseeds were distributed among the sample farmers. The details of distributed seed minikits across the farms have been displayed in table 4.10.The table reveals that of the total

210 seed minikits distributed among farmers were given free of cost by the agriculture department, while 95 minikits given by private agency was on payments basis for demonstration purpose. Across farm sizes, 81 seed minikits (38.57%) were distributed among marginal farmer and out of it, 51 was provided as free of cost by the agriculture department and 30 for demonstration purpose by other private agencies. Similarly, 107 minikits (50.96%) were given to small farmers and of it, 56 was made available free of cost and 51 for demonstration purposes. 22 seed minikits (10.47%) were distributed among medium farmers including 8 as free of cost and 14 for demonstration purposes.

Table 4.10: Distribution of Seed Minikit (Numbers)

Agency	Marginal	Small	Medium	Large	Total
KVK	---	---	---	---	---
Agricultural Departments (free of cost)	51 (62.96)	56 (52.34)	8 (36.38)	---	115 (54.76)
Gram Panchayat	---	---	---	---	---
Others Private Agency (On payment basis)	30 (37.04)	51 (47.66)	14 (63.64)	---	95 (45.24)
Total	**81 (38.57)**	**107 (50.96)**	**22 (10.47)**	**---**	**210 (100.00)**

Note: Figures in brackets are percentage of the respective total Source:
Source: Field Survey.

The details of seed minikit provided for pulses' crop during 2018-19 are presented in table 4.11. Its analysis reveals that 16 kgs of seed for lentil per household were distributed among each of the selected farmers for one acre of land for demonstration purpose. It was given to any interested farmers on payment of the prescribed charges i.e., Rs. 3280/- which after site verification were reimbursed to the respective beneficiaries in their bank accounts. The total average output produced from provided seed minikit was 7.91 quintals/acre/household. It varied from 7.89 qtls to 8.03 qtls across marginal, small and medium households. However, average output used as seed was 13.67 kgs per household. Output used as seed varied from 12 kgs to 17 kgs across farm size groups. Similarly, 8 kgs of lentil seed per household were distributed free of cost among selected farmers for half acre of land. It produced 3.96 qtls on total farms. Across the farms, these were 3.94 qtl, 3.96 qtls and 4.02 qtls per household meant for marginal, small and medium respectively. Moreover, 2 kgs of red gram seed per household were also distributed among

selected farmers for half acre of land. Output produced from such seed minikit varied from 2.3 qtls to 4.4 qtls in case of selected farmers.

Table 4.11: Details of Seed Minikit provided for Pulses Crop 2018-19

Farm Size		Marginal	Small	Medium	Large	Total
Crop 1 – Lentil (on payment basis) N - 95						
Variety		WBL – 77	KLB – 320			
Quantity (kgs/hh)		16	16	16	---	16
Area Sown (acre/ Hh) Season						
	Kharfi					
	Rabi	1	1	1	---	1
	Summer					
Output Produced from seed minikits (Quintals per hh)		7.89	7.91	8.03	---	7.91
Output used as seed (kgs per hh)		12.10	12.23	16.67	---	13.67
Crop 2 – Lentil (Free of Cost) N-93						
Variety						
Quantity (kgs/hh)		8	8	8	---	8
Area Sown (acre/ Hh) Season						
	Kharfi					
	Rabi	0.50	0.40	0.42	---	0.44
	Summer					
Output Produced from seed mini kits (Quintals per hh)		3.94	3.96	4.02	---	3.96
Output used as seed (kgs per hh)		6.05	6.12	8.34	---	6.84
Crop 3 – Red Gram (Free of Cost) N-12						
Variety	Narendra Arhar - 2					
Quantity (kgs/hh)		2	2	2	---	2
Area Sown (acre/ Hh) Season						
	Kharfi					
	Rabi					
	Summer	0.50	0.50	0.50	---	0.50
Output Produced from seed minikits (Quintals per hh)		2.33	4.40	3.5	---	3.29
Output used as seed (kgs per hh)		0.00	0.00	0.00	---	0.00

Source: Field Survey.

Analysis of data available in table 4.12 shows that 2 kgs of Tori seed per household was distributed among selected farmers for 1 acre of land. Total average output produced from seed minikits was recorded at 4.05 quintals per household. The output of marginal and medium farmers was almost similar (> 4 qtls) and small farmers (< 4 qtls). Moreover, output used as seed at total farms level was 10 kgs per household and across the farms these were 8.16 kgs, 10.29 kgs and 15.24 kgs meant for marginal, small and medium farmers respectively.

Table 4.12: Details of Seed Minikit provided for Cereals or Oilseeds Crop 2018-19

		Marginal	Small	Medium	Large	Total
	Crop 1 –Oil Seed (Tori), free of cost					
Variety					---	
Quantity (kgs/hh)		2 kg	2 kg	2 kg	---	2 kg
Area Sown (acre/ Hh) Season					---	
	Kharfi	---	---	---	---	---
	Rabi	1	1	1	---	1
	Summer	---	---	---	---	---
Output Produced from seed minikits (Quintals per hh)		4.14	3.92	4.21	---	4.05
Output used as seed (kgs per hh)		8.16	10.29	15.24	---	10.00

Source: Field Survey.

The Rhizobium culture and other strains like carbendazim, mancozeb and imidacloprid were distributed with demonstration minikit among the sample farmers. Rhizobium culture is generally used as seed treatment before sowing it and carbendazim and mancozeb are used for controlling the fungus, and imedacloprid is used as insecticide only. Out of the total 95 demonstration farmers, marginal, small and medium farmers were 31 per cent, 54 per cent and 15 per cent respectively. However, these facilities were only provided to those, who received the seed for demonstration purpose on payment basis. It may be seen from (table 4.13).

Table 4.13: Content of the Seed Minikit (%)

Farm Size	POP	PSP culture (100gms)	Rhizobium (100gms)	Others	None
Marginal	---	---	31.58	31.58	---
Small	---	---	53.68	53.68	---
Medium	---	---	14.74	14.74	---
Large	---	---	---	---	---
Total	---	---	100.00	100.00	---

Note: Given only to Demonstration farmers.

Source: Field Survey.

Out of the total 210 seed minikits, 115 seed minikits were distributed through agriculture department and 95 kits through private agency, which accounted for 54.76 per cent and 45.24 per cent respectively. All free of cost kits were distributed by the agriculture department. On payment basis, kits made available by the private agencies. It may be seen in (table 4.14).

Table 4.14: Seed purchased by the farmer for the reference year through seed minikits

Crop	Quantity (kgs)	Price (Rs/ kit)	Source of purchase (%)				Distance from farm (kms)	Transportation Cost (Rs/Kit)
			KVK	Agril Dept.	Private Dealer	Co-op society		
Red Gram	2	Free	---	4.76	---	---	2-5	NA
Lentil	8	Free		50.0	---	---	2-7	NA
Lentil	16	3280	---	---	45.24	---	2-8	NA
Others	---	---	---	---	---	---	---	---

Note: KVK: Krishi VignanKendra;
NB: Lentil @ 8 kg/farmer free, Lentil @16 kg/farmer Demonstration, Red Gram @ 2 kg/farmer
Source: Field Survey.

4.5 Awareness about the Scheme

It would be important to know about the awareness of the scheme among the selected sample households review the involvement of agricultural extension staff controlled by the local offices of State Department of Agriculture. In this regard, it has been observed that several awareness programmes were organized by the department for the farmers to educate and provide them training for multiplying seed minikits for further use. Moreover, analysis of the data available in table 4.15 shows that out of the total respondents, 59.02 per cent were able to be aware about seed minikit from farmer facilitators, 26.69 per cent by fellow farmers, remaining 8.27 per cent and 6.02 per cent by Agriculture Officer and print & visual media respectively. Similarly, across farm size groups, more than 65 per cent farmers received information from farmer facilitator followed by fellow farmers. It reveals that farmer facilitators have played key role in extending awareness about the programme among the sample households.

Table 4.15: Awareness of distribution of Seed Minikit (%)

Source	Marginal	Small	Medium	Large	Total
Agriculture Officer	6.35	11.21	4.17	---	8.27
Farmer Facilitator (SMS & KS)	60.32	56.03	66.67	---	59.02
Fellow Farmer	26.98	27.59	20.83	---	26.69
Print & Visual media	6.35	5.17	8.33	---	6.02
Wall writing	---	---	---	---	---
KVK official	---	---	---	---	---
Agricultural University	---	---	---	---	---
Others	---	---	---	---	---
Total	100.00	100.00	100.00	---	100.00

Source: Field Survey. SMS – Subject Matter Specialist, KS – Kisan Salahkar

4.6 Farmers' Perceptions about Seed Minikits

In regard to farmers' perceptions, the survey tried to get reply from the sample farmers that whether the distribution of minikits was advantageous for them or not? In reply to this query, all the sample farmers belonging to all farm sizes were in favour of the reply as 'advantageous.' Further it was asked that how do they differentiate seeds from minikits over seeds, which they were using previously? Replying to this particular query, 47.5 per cent told that application of seeds given under minikits gave them higher profits followed by yield difference (27%) and quality difference (25.5%) over the seeds, which were being used by them previously. Almost similar trend was observed across the farm sizes (table 4.16).

Table 4.16: Farmers Opinion regarding distribution of Seed Minikit for the reference year (%)

Opinion		Marginal	Small	Medium	Large	Total
1.Is seed minikit distribution advantageous	Yes	100.00	100.00	100.00	---	100.00
	No	---	---	---	---	---
a. Yield Difference	26.30	30.09	14.28	---	---	27.00
b. Quality difference	30.27	24.28	14.29	---	---	25.50
c. More profitable	43.43	45.63	71.43	---	---	47.50
d. Short duration of crop	---	---	---	---	---	---
e. Other	---	---	---	---	---	---

Source: Field Survey.

Subsequently, farmers' opinion regarding quantity of seeds supplied in seed minikits during the reference year and its adequacy were also captured. Responding to this query, 63.5 per cent said that it was adequate. Those who told inadequate (36.5%), and desired to get 21.5kgs per acre on total farms. Besides, they were almost satisfied with the quantity of seed minikits for lentil crop given to them. However, they desired to get more quantity for arhar besides oilseeds (table 4.17). In fact they were received @ 16 kgs per acre for lentil, 4 kgs per acre for arhar and 2 kgs per acre of oilseeds during the reference year.

Table 4.17: Farmers Opinion regarding Quantity of seed supplied in Seed Minikit for the reference year

Sufficient in Quantity (%)	Marginal	Small	Medium	Large	Total
1. Yes	53.95	66.02	85.71	---	63.5
2. No	46.05	33.98	14.29	---	36.5
Opinion –how much quantity in kgs should be distributed					
Quantity (kg)	18.5	24.8	17.3	---	21.5

Source: Field Survey.

Table 4.18 presents farmers' opinion regarding the quality of seed supplied in seed minikits. It can be clearly seen from the tale that 55.56 per cent of the total farms were of the opinion that the quality of distributed seeds was better, while 44.44 per cent opined that it was not good. Those who were satisfied with the quality of supplied seeds, told that these seeds were certified and fetched good yield, and those who were dissatisfied narrated that due to low rate of germination, good yield could not be fetched.

Table 4.18: Farmers Opinion regarding Quality of seed supplied in Seed Minikit for the reference year

Quality better than seed available in market (%)	Marginal	Small	Medium	Large	Total
1. Yes	53.95	54.37	66.67	---	55.5
2. No	46.05	45.63	33.33	---	44.5
Opinion –Provide reasons					
1 (a) Certified and tested seeds were given.	56.10	55.36	64.29	---	70.27
(b) On the basis of good yield	43.90	44.64	35.71	---	29.73
2.(a) Low rate of germination	68.57	57.45	57.14	---	66.29
(b) Low yield	31.43	42.55	42.46	---	33.71

Source: Field Survey.

In regard to timeline issues of distribution of seed minikits information regarding which were also collected, data have been presented in table 4.19. The table reveals that only 11.5 per cent of the total farm households were of the opinion that distribution was timely, while 88.5 per cent told that the seed was not distributed in sowing time. Main reason for untimely distribution was top-down delivery mechanism using online application and thereby after receiving OTP on beneficiaries' mobile they are entitled to receive the minikits packet.

Table 4.19: Farmers Opinion regarding timeliness of distribution of Seed Minikit for the reference year (%)

Timely distribution of Kit (%)	Marginal	Small	Medium	Large	Total
1. Yes	9.22	13.59	9.52	---	11.5
2. No	90.78	86.41	90.48	---	88.5
Opinion – Provide reasons					
Top-down delivery delay in Distribution.	100.00	100.00	100.00	---	100.00

Source: Field Survey.

4.7 Major Issues/Problems faced by the Farmers

Present survey also tried to understand the issues faced by the farmers in availing seed minikits. In response to it, sample beneficiary households narrated two major issues, which are presented in table 4.20. The table reveals that distribution of seed minikits was mainly made to kith and kin farmers (81%) since its availability was limited and many times, they faced network hindrances in receiving the OTP on their respective mobiles (19%). It also hinders them to be familiar in using the same. Across the farms, the related issue was raised in similar manner.

Table 4.20: Major Issues Faced by Farmers in availing the Seed Minikit (%)

Sl No.	Issues	Marginal	Small	Medium	Large	Total
1.	Use of Mobile OTP hinders .the distribution	18.42	18.45	23.81	---	19.00
2.	Distribution is made to Kith and Ken due to limited availability.	81.58	81.55	76.19	---	81.00

Source: Field Survey.

In course of the study, a good number of some major problems were also faced by the farmers in availing the seed minikits, which are depicted in tale 4.21. The table reveals that limited availability of seed minikits (40.5%) was the major problem followed by delay in re-imbursement of the assistance (22.5%), procedural pre-conditions (22%) and lack of timely information about the scheme (15%).

Table 4.21: Major Problems faced by farmers in availing the Seed Minikit (%)

Sl No.	Problems	Marginal	Small	Medium	Large	Total
1.	Availability of limited minikits	36.84	42.72	42.86	---	40.5
2.	Procedural pre-condition	21.05	20.33	23.81	---	22.0
3.	Delay in reimbursement of assistance	27.63	16.50	33.33	---	22.5
4.	Absence of timely information about the scheme	14.48	18.45	0.00	---	15.0

Source: Field Survey.

4.8 Major Suggestions for Improving the Effectiveness or reach of the Scheme

To overcome the major issues/problems faced by the sample beneficiary farm households, suggestions were also sought from them, which are presented in tables 4.22 & 4.23. Table 4.22 reveals that application of seed minikits should be ensured (32.5%), was the major issue to make the scheme more effective and useful followed by 'real time supervision and monitoring' (RTSMP) by the local officials (29.5%), extending awareness among the beneficiaries in regards to its core purpose (26%),

and further ensuring timely re-imbursement by way of linking the confirmation of sowing of seeds issue in the fields (12%). Further, to improve the reach of the scheme, following the eligibility criteria in transparent manner (65%) was largely endorsed by the sample beneficiary farmers followed by check and balance on proxy distribution of seed minikits (35%) also figured prominently.

Table 4.22: Measures to improve the effectiveness of the Scheme (%)

Sl No.	Measures	Marginal	Small	Medium	Large	Total
1.	The purpose of the scheme may be explained to the farmers at large	36.84	42.72	42.86	---	26.0
2.	Application of seed should be ensured	21.05	22.33	23.81	---	32.5
3.	Real time supervision since sowing to harvesting should be ensured	27.63	16.50	23.33	---	29.5
4.	Reimbursement may be linked with confirmation of sowing of seeds	14.48	18.45	0.00	---	12.0

Source: Field Survey.

Table 4.23: Farmers suggestions to improve the reach of the Scheme (%)

Sl No.	Suggestions	Marginal	Small	Medium	Large	Total
1.	Check and balance on proxy distribution of seed may be ensured	30.99	45.83	40.0	---	35.0
2.	Eligibility criteria should be followed in transparent manner	69.01	54.17	60.0	---	65.0

Source: Field Survey.

4.9 Summary of the Chapter

- Based on results, it appears that in regard to per acre cost of production and net return among the aggregate average of SMK farmers, positive impression was created by way of reduced per acre cost of production and increased returns over the 'with SMK farmers.' Although per quintal net price received by both the categories of farmer was almost similar, might be directly related to the prevailing market prices and almost using same marketing channels for the pulse crops in the study area.

- The cost of production of lentil crop for SMK farmers was just half as compared to without SMK farmers. It was mainly due to zero expenses on purchase of seeds by SMK farmers as compared to about 50 per cent of the total expenses made on purchase of seeds by without SMK farmers. However, in case of red-gram it was nearly 37 per cent lesser on SMK farmers as compared to without SMK farmers.

- Considering human labour was one of the critical components for agricultural practices, which usually revealed 14-38 percentage of the total expenses made by both the categories of farmers in case of both the pulses (lentil and red gram). SMK farmers used 12.98 mandays per acre, while without SMK farmers used 19.54 mandays per acre.
- Method of sowing followed by selected households largely prevailed in case of broadcasting method.
- Online registration on department's portal for availing the benefits of seed minikits was the major instrument adopted by the selected households. Besides, existence of provision to avail the benefits by any of the interested farmers was also significant issues.
- Of the total beneficiaries in the state in 2018, sample households availed only 0.35 per cent of kits, which were largely distributed by the state agriculture department without any charge.
- About 59 per cent of the farmers received the information relating to distribution of minikits from farmer facilitators, such as Agriculture Co-ordinators and Kisan Salahkar (KS).
- It is important to note here that cent per cent sample farmers opined that the scheme is advantageous mainly because of fetching more profit, better quality and high yield. Although it's sufficient or desirable quantities are not disbursed, besides untimely disbursement also.
- Major issues/ problems as perceived by the sample farmers were distribution to Kith & Kin (81%), limited availability (40.5%), delay in re-imbursement of the charged amount (22.5%), procedural complexities (22%), OTP relating hindrances (19%).
- Suggested measures for improvement were transparency is absent in the criteria (65%), check on proxy distribution (35%), real time field level supervision (29.5%), ensuring application of seed minikit in the field (32%), extending awareness programme at large (26%), etc.

CHAPTER – V

CONCLUSION & POLICY SUGGESTIONS

5.1 Background

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%). 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, produced nearly 80 per cent of its total production. Gram (chickpea) has the largest area (35.21% of the total pulse crops) followed by urad (18.14%), arhar/tur (14.77%), moong (14.21%), lentil (5.17%) and others (12.50%), 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 total pulses respectively. The shares of Bihar in terms of area and production of the country were meager of 1.65 per cent and 1.94 per cent respectively in 2018-19. Considering the importance of pulses, the GoI has taken several initiatives in recent past, and out of these, the distribution of Seed Minikits of Pulses is one, which was launched in 2016-17 with a view to ensure varietal replacement of HYV pulses within 10 years of its release. Since the programme is completing almost 3-4 years of its launching, so its impact study is inevitable for further success of the programme. With this backdrop, this study was assigned to the **Agro-Economic Research Centre, T M Bhagalpur University, Bhagalpur (Bihar) under the work plan year 2019-20 by the Ministry of Agriculture & Farmers Welfare, Government of India under the co-ordination of ADRTC, ISEC, Bengaluru.**

The specific objectives of the study are as under:

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

The study relied on both the primary and secondary data. Primary data, have been collected with a sample of 300 farmers comprising 200 beneficiaries and 100 non-beneficiaries/control farmers selected from 2 sample districts viz., Patna (irrigated) & Muzaffarpur (dry land) on highest seed minikits distributed during the reference period of 2017-18/2018-19.

5.2 Main Findings

5.2.1 Production of Pulses in Bihar

Bihar has 4.79 lakh ha of total pulses' area with production of 4.53 lakh tones during 2018-19, which were 1.62 and 1.85 percent of the country's total area and production of pulses. Area and production of rice in the state (united Bihar) were recorded at 53.28 lakh ha and 98.17 lakh tones respectively during TE 1990-91, which declined after bifurcation of Bihar in 2000 to 32.79 lakh ha and 82.55 lakh tones respectively during TE 2016-17. In case of maize and wheat, it surged during the same period of time. Total area and production of pulses were recorded to be 9.59 lakh ha and 6.59 lakh tones during TE 1990-91, which declined to 5.01 lakh ha and 4.39 lakh tones respectively during TE 2016-17. The area and production of oilseed were found to be 2.30 lakh ha and 1.36 lakh tones during TE 1990-91. Area and production under oilseeds were1.84 lakh ha and 1.46 lakh tones during TE 2000-01, which fell to 1.19 lakh ha and 1.27 lakh tones respectively during TE 2016-17.

Bihar has total geographical area of 93.6 lakh ha and divided by river Ganges in two parts, north Bihar with an area of 53.3 lakh ha and south Bihar with 40.3 lakh ha. Based on TGA, Gaya is the largest district of the state with 4.93 lakh ha of land

followed by West-Champaran and East-Champaran with 4.84 lakh ha and 4.13 lakh ha of land areas respectively. East-Champaran had the largest area of 2.98 lakh ha under cultivation, which was 69.14 percent of its TGA, followed by West-Champaran and Rohtas districts with 2.80 lakh ha and 2.54 lakh ha of area under cultivation respectively during TE 2006-07. Almost similar trends were found in same districts during TE 2016-17. Kishanganj district has the largest percentage share (91.0%) of cultivable area to TGA, followed by Buxar and Nalanda with 84.33 percent and 78.01 percent respectively during TE 2016-17. The percentage share of the total pulses' area to gross cultivable area was recorded tobe 7 percent during TE 2006-07, but it increased to 9.29 percent during TE 2016-17.

Total area under pulses in the state was recorded at 6.18 lakh ha with production of 4.59 lakh tones during TE 2006-07. Out of the total area under pulses and production in the state, Patna district had the highest area under it that was 0.57 lakh ha with production of 0.67 lakh tones. These accounted for 9.23 percent and 14.50 percent of the state's total pulses' area and production respectively followed by Aurangabad and Nalanda. Total area under lentil was calculated to be 1.68 lakh ha with production of 1.23 lakh tones, which were 27.19 percent and 26.80 percent of the state's total pulses area and production. Across the districts, Patna had the highest area under lentil (0.27 lakh ha) with production of 0.33 lakh tones, which were 16.08 percent and 26.83 percent of the state's total lentil area and production during TE 2006-07 followed by West-Champaran and Aurangabad districts. Total area under arhar in the state was found at 0.36 lakh ha with production of 0.47 lakh tones, which were 5.83 percent and 10.24 percent of the state's total pulses' area and production respectively. These were followed by West-Champaran and Siwan during TE 2006-07. The percentage share of gram's area and production to the state's total pulses area and production were recorded to be 11.17 percent and 13.08 percent respectively. Across the districts, Patna had the highest percentage share of area and production under gram of the state's total gram's area and production, which were recorded at 21.28 percent and 18.34 percent respectively during TE 2006-07.

Total pulses' area and production in the state were recorded at 5.01 lakh ha and 4.39 lakh tones respectively during TE 2016-17. Across the districts, Patna had the highest pulses' area of 0.47 lakh ha with production of 0.60 lakh tones, which accounted for 9.39 percent and 13.67 percent of the state's total pulses' area and production respectively. These were followed by Aurangabad and Nalanda districts during same period of time. The area and production of lentil were recorded at 1.75 lakh ha and 1.42 lakh tones respectively, which were 34.93 percent and 32.35 percent of the state's total pulses' area and production during TE 2016-17. Across the districts, Patna had the highest percentage share in area and production of lentil to the state's total lentil area and production during the same period of time. Major arhar producing districts in the state were Jamui, Gaya, Darbhanga and Kaimurwhich together, contributed about 40 percent and 33.34 percent of the state's total arhar's area and production respectively during TE 2016-17. Total area and production of gram in the state were calculated to be 12.18 percent and 13.90 percent of the state's total pulses area and production respectively. Across the districts, Patna had the highest gram area (11.48%) and production (13.12%) of the state's total gram area and production followed by Aurangabad and Bhojpur districts during TE 2016-17.

Area and production under total pulses in the state decreased by 18.93 percent and 4.36 percent respectively in TE 2016-17 over TE 2006-07. Across the districts, Muzaffarpur had gained the highest growth (460%) of state's total pulse area followed by Madhepura and Supaul with growth of 320 percent and 314 percent respectively during the same period. Similarly, Kishanganj had obtained the highest growth of pulses production with 350 percent followed by Supaul, Samastipur , Vaishali and Jamui with growth of 325 percent, 225 percent , 200 percent and 200 percent respectively. State's total lentil area and production increased to 4.17 percent and 15.45 percent respectively in TE 2016-17 over TE 2006-07. Besides lentil, arhar and gram showed negative growth in regard to area and production both. Across the districts, Rohtas had the highest growth of 57.14 percent in the area of lentil, but production showed negative growth of 50 percent followed by Dharbhanga. Area and production of gram in the state decreased to 11.59 and 1.67 percent respectively in TE 2016-17 over TE 2006-07. Across the districts, only Jamui, Munger and Bhojpur

showed negative growth during the same period. Nalanda and Jamui witnessed positive growth of 100 per cent and 50 per cent in production respectively, while other districts witnessed negative growth. The area and production of arhar in the state decreased by 44.44 percent and 29.79 percent respectively during TE 2016-17 over TE 2006-07. The area and production of arhar in few districts of the state had shown positive growth, but most of the districts showed negative growth during the same period of time.

In regard to growth in area and yield of major crops in the state during different periods, the growth in area across the crops was either stagnant or had diminished, except maize crop. In case of yield rates, it increased in case of rice after bifurcation of the state in 2000. Maize yield rates did also significantly increased barring two year slabs of 2013-14 to 2014-15 and 2014-15 to 2015-16. It again increased by 10.82 percent during 2015-16 to 2016-17. As regards pulses, the yield rates increased till 2013-14 and thereafter it fell substantially. Across pulses, moong's yield rate was found to have increased in recent years only. Other pulses' yield rates are still gloomy in the state.

5.2.2 Household Characteristics, Cropping Pattern and Value of Output of Selected Farmers

The number of total respondents was 300 farmers (B: 200 Hh + NB 100 Hh) with 81 per cent male and 19 per cent female. Out of it, marginal, small and medium farm households were 48 percent, 43.30 percent and 8.70 percent respectively. Average household size of the total respondents was 7.79 persons. About 90.33 percent of the total respondents belonged to age group of 30-60 yrs followed by in the more than 60 years of age group (5.67%) and less than 30 years age group (4 %). About 44.00 percent of the total respondents obtained education up to matriculation followed by middle class level (32.33%), up to plus two (17.33) and only 6.34 percent respondents had obtained education up to graduation level. Average number of members of total respondents engaged in farming was found 1.14 persons and their farming experience was 28.37 years. Out of the total respondents, 71.00 percent belong to OBC group followed by general caste (24%) and scheduled castes (5.5%).

More than, 82 percent of the total respondents were dependent on agriculture and allied activities for their livelihood followed by mainly agricultural labourer (16.67%). Average annual income of the total respondents was recorded at about Rs. 42608 constituting 78.61 per cent from agricultural & allied activities and 21.39 per cent from non-agricultural sources.

The average GCA & NOA of the total respondents were at 5.06 acres and 2.61 acres respectively. Out of the total NOA, average owned and leased-in areas were at 1.74 acres and 0.93 acre respectively, while, in case of lease-out, it was almost negligible among the sample farmers. Average rental value per acre of land was found at Rs. 3792/- and their cropping intensity was recorded at 194 percent. Above 99 percent of NOA was found irrigated. Bore well irrigation highly prevailed in the study areas, and the average cost of irrigation was indicated at Rs. 763/acre. Among the irrigated crops, maize had the highest share (32.79%) with respect to GCA of the total respondents followed by paddy (17.22%) and wheat (16.33%). Among rain-fed crops, lentil had highest share of (15.5%) to the GCA of the total respondents followed by oilseeds (8.96%) and gram (8.94%).

Average productivity of the rain-fed crops for all respondents was calculated at 5.20 quintals per acre and in regard to irrigated crops, it was recorded at 10.43 qts per acre. The value of output of main plus by-product for total respondents was at Rs. 16053/- per acre and the value received by marginal, small and medium farm households were calculated at Rs. 16748/-, Rs. 15981/- and Rs. 15276/- per acre respectively. Material and labour costs of the produce for total respondents were estimated at Rs. 6068/- per acre and Rs. 1895/- per acre respectively. Net returns for total respondents were estimated at Rs. 8090/- per acre and for marginal, small and medium farmers, these were Rs. 7683/-, Rs. 8760/- and Rs. 7091/- per acre respectively. Gross farm income per household from cultivated area for total respondents was calculated at Rs. 21115/- and for marginal, small and medium farmers was at Rs. 10922/-, Rs. 28820/- and Rs. 40986/- respectively.

5.2.3 Efficiency of Seed Minikit in Bihar

Based on results, it appears that in regard to per acre cost of production and net return among the aggregate average of SMK farmers, positive impression was created by way of reduced per acre cost of production and increased returns over the with SMK farmers. Although per quintal net price received by both the categories of farmer was almost similar, might be directly related to the prevailing market prices and almost using same marketing channels for the pulse crops in the study area. The cost of production of lentil crop for SMK farmers was just half as compared to without SMK farmers. It was mainly due to zero expenses on purchase of seeds by SMK farmers as compared to about 50 per cent of the total expenses made on purchase of seeds by without SMK farmers. However, in case of red-gram it was about 37 per cent lower on SMK farmers as compared to without SMK farmers. Considering human labour was one of the critical components for agricultural practices, which usually revealed 14-38 percentage of the total expenses made by both the categories of farmers in case of both the pulses (lentil and red gram), SMK farmers, used 12.98 mandays per acre, while without SMK farmers used 19.54 mandays per acre. Method of sowing followed by selected households largely prevailed in case of broadcasting method. Online registration on department's portal for availing the benefits of seed minikits was the major instrument adopted by the selected households. Besides, existence of provision to avail the benefits by any of the interested farmers was also significant issues. Of the total beneficiaries in the state in 2018, sample households availed only 0.35 per cent of kits, which were largely distributed by the state agriculture department without any charge. About 59 per cent of the farmers received the information relating to distribution of minikits from farmer facilitators, such as Agriculture Co-ordinator & Kisan Salahkar. It is important to note here that cent per cent sample farmers opined that the scheme is advantageous mainly because of fetching more profit, better quality and high yield. Although it's sufficient or desirable quantities are not disbursed, besides untimely disbursement also.

Major issues/ problems as perceived by the sample farmers were distribution to Kith & Kin (81%), limited availability (40.5%), delay in re-imbursement of the charged

amount (22.5%), procedural complexities (22%), OTP relating hindrances (19%).Suggested measures for improvement were transparency is absent in the criteria (65%), check on proxy distribution (35%), real time field level supervision (29.5%), ensuring application of seed minikit in the field (32%), extending awareness programme at large (26%), etc.

5.3 Concluding Remarks

Recognizing the importance of pulses in ensuring nutritional security and achieving self reliance in pulses, the Government of India has made efforts to increase pulses' production through various policy interventions, such as; NFSM, BGREI, Crop Diversification Plan (CDP), seed minikit distribution of HYVs, strengthening seed production infrastructure, Seed Village Programme, Creation of FPOs and enhanced MSPs with favourable trade policy. Seed minikits (SMK) Programme was launched during 2016-17 to ensure varietal replacement at a faster rate. As the programme is under progress for the last 3 to 4 years, hence this study was undertaken to examine the need, application, pertinence and efficiency in distribution of seed minikits in Bihar.

Based on secondary information, it is observed that after bifurcation of the state in November, 2000, total area under pulses fell from 9.54 lakh hectares in TE 2000-01 to 5.01 lakh hectares in TE 2016-17. Similarly, production also decline from 6.21 lakh tons in TE 2000-01 to 4.39 lakh tons in TE 2016-17, accounting for fall in area by about 47 per cent, and production by about 29 per cent during the TE 2000-01 to 2016-17. Results of primary survey suggest that both the value of output and net returns on with SMK farmers' were higher as compared to without SMK farmers. Besides, net prices obtained per quintal on both the categories of farmers were almost the same. In nutshell, benefits of the programme have created positive impression. However, lack of awareness among the farmers relating to core objective of the programme and emphasis on achieving the targets at the implementation level are the major bottlenecks, which led to violation of eligibility criteria of the beneficiaries.

5.4 Policy Suggestions

Policy suggestions have been drawn based on the findings of the study. These have been imprinted hereunder:

- In order to achieve full benefits of Seed Minikit for Pulses, awareness should be created among farmers regarding its core objectives for realizing maximum value of output by way of adopting optimal package of practices for growing and use of recent HYVs of pulse crops.
- In place of any interested farmers, the distribution of seed minikits should be based on mapping of respective crop fields and identification of respective crop growers, following the mandated criteria, so that realization of the programme could be made with equity aspect.
- A Help Desk for online registration on department's portal at block/tehsil level should be instituted to help the poor or needy farmers.
- Reimbursement of seed minikit value to the respective beneficiaries should be made immediately after verification of the sowing plot, preferably during the mid-period of the respective crop. It is desired for better and timely application of inputs.
- Special efforts on the part of the government are needed for ensuring timely distribution of seed minikits, as expressed by the sample farmers.
- To ensure multiplication of seeds, field visits of the KVK Scientists are needed for extending field level advices to the beneficiary farmers along with capacity building of the field level staff.
- There is need to address the concerns raised by the beneficiary farmers about inadequacy. Kith & Kin approach of distribution, OTP hindrance, untimely distribution etc. should be avoided by proper monitoring of the concerned.

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Annexure - I : Coordinator's Comments on the Draft Report

"Relevance and Distribution Efficiency of Seed Minikits of Pulses in Bihar"
Submitted by

Agro-Economic Research Centre, T M Bhagalpur University, Bhagalpur - Bihar

1. Title of the draft report examined

Relevance and Distribution Efficiency of Seed Minikits of Pulses in Bihar

2. Date of receipt of the Draft report : 27th August 2020

3. Date of dispatch of the comments : 3rd September 2020

4. Comments on the Objectives of the study

The objectives of the study as proposed have been addressed albeit calculation mistakes need to be corrected.

5. Comments on the methodology
The common methodology proposed for collection of primary data and tabulation of results has been followed.

6. Comments on analysis, organization, presentation etc.

- For this study in Bihar two crops namely, red gram and lentil have been selected and surveyed although moong had the 2nd highest area and production after lentil but red gram was preferred and need to be justified why red gram was preferred over moong. The sampling was not done carefully as in the selected sample no large farmers (10 acres and above) have been selected. In addition, for red gram, no control farmers are selected. This defeats the very purpose of evaluation scheme. Without having control group for this crop how the cost and revenue estimates were compared is beyond understanding. The prime reason for not getting control farmer may be the selection of the crop as red gram has minimum area while gram and moong had much higher area but they were ignored in sampling and a crop which had less area was preferred. So the sampling of red gram becomes redundant given the fact that the beneficiaries cannot be compared in terms of productivity, cost and profitability with the control group.

- As per our sampling procedure, 200 beneficiaries and 100 non beneficiaries are to be selected for this study. Table 1.6 in your report indicates a sample of 300 households selected. However, Chapter 3 is written keeping only 200 beneficiaries into account while the 100 control households have not been included and ignored. Tables in chapter 3 should include all the selected households, beneficiary and non beneficiaries clubbed together. Therefore the entire chapter 3 needs to be reworked including 200 beneficiaries and 100 control group farmers. Table 3.1, demographic profile accounts only 200 beneficiaries and need to rework for all the selected 300 households. Only 4.5% SC beneficiary farmers have been selected in the sample whereas seed-mini-kits is meant mainly for SC, ST and Women farmers. In the description of the table you need to clarify that the Scheme was meant for reserved category farmers but while distributing kits the criteria followed was anybody interested was given the kits and that is why very few SC farmers and women farmers got the kits.

- Table 3.2 characteristic of operational holdings have to be recalculated with respect to beneficiary and control – 300 households as presently table is calculated only for 200 beneficiary farmers. For medium farmers there has been interchange of gross cropped area and net irrigated area that needs correction.

- Tables 3.3, 3.4 and 3.5 needs to be recalculated for all the 300 selected farmers. While calculating aggregate, please do not take simple averages. The value of output and other figures worked out at the aggregate in Table 3.5 are all wrong. For example value of output calculated is 16260 whereas if you take aggregate output of the operated area and divide by the operated area at the aggregate, the actual figure will be 15633, similarly material cost instead of 5651 would be 5612, labour cost instead of 1886 it would be 1883 and net returns instead of 8722 would be 8138. So kindly recalculate all these table for the aggregate of 300 households and the sum total should be by dividing total value by total area or total number of households and not the simple average of marginal, small and medium farmers.

- Chapter 3 with revised tables needs to be rewritten.

- Chapter 4, Similar mistake in the calculation of aggregate is made in Table 4.1 in chapter 4. The following are the mistake indicated in yellow highlight and correct data is given below table with highlight in red colour.

Table 4.1: Productivity and net returns from pulses with and without Seed-minikits

Farm Size	Area under pulses (acres)		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	0.0	8633	--	4284	--	4349	--	3083	--
Small	0.02	0.0	9350	--	4713	--	4637	--	3117	--
Medium	0.02	0.0	11025	--	4820	--	6205	--	3150	--
Large	--	--	--	--	--	--	--	--	--	--
Total	0.03	0.0	9669	--	4437	--	5232	--	3117	--
Lentil										
Marginal	0.65	0.68	17179	15246	4668	8215	12511	7031	3135	3150
Small	0.68	1.27	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 average										
Marginal	0.70	0.68	12906	15246	4476	8215	8430	7031	3109	3150
Small	0.70	1.27	12919	15992	4761	7734	8158	8258	3121	3150
Medium	0.81	1.70	15856	21216	4507	8456	11350	12760	3176	3120
Large	--	--	--	--	--	--	--	--	--	--
Total	0.71	0.87	13894	17485	4290	8072	9604	9413	3123	3140

Farm Size	Area under pulses (acres)		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	0.0	8633	--	4284	--	4349	--	3083	--
Small	0.02	0.0	9350	--	4713	--	4637	--	3117	--
Medium	0.02	0.0	11025	--	4820	--	6205	--	3150	--
Large	--	--	--	--	--	--	--	--	--	--
Total	0.09	0.0	9324	--	4498	--	4825	--	3117	--
Lentil										
Marginal	0.65	0.68	17179	15246	4668	8215	12511	7031	3135	3150
Small	0.68	1.27	16488	15992	4809	7734	11679	8258	3124	3150
Medium	0.79	1.70	20687	21216	4193	8456	16494	12760	3125	3120
Large	--	--	--	--	--	--	--	--	--	--
Total	2.12	3.65	18265	18286	4536	8160	13728	10126	3128	3140
Aggregate average										
Marginal	0.7	0.68	16569	15246	4641	8215	11928	7031	3109	3150
Small	0.7	1.27	16284	15992	4806	7734	11478	8258	3121	3150
Medium	0.81	1.7	20448	21216	4208	8456	16240	12760	3176	3120
Large									--	--
Total	2.21	3.65	17900	18286	4535	8160	13366	10126	3123	3140

- The accuracy of Table 4.2 and 4.3, I cannot check as figures are given in % terms.

- Table 4.11: Details of Seed Minikit provided for Pulses Crop 2018-19 shows that total area sown under seed mini kits with payment or free of cost was 1.5 acres each for marginal, small and medium farmers. However, actually it was .65, .68 and .79 acres, respectively for these three categories for lentil. Similarly for red gram it was 0.05, 0.02 and 0.02 acres for these three categories but table 4.11 shows 0.5 acres for each of these categories. Similarly, output produced from seed minikits was 7.91 quintals (first case of lentil) and out of that how much was used as seed is given as 13.687 quintals. For second category of lentil production was 3.96 quintals but usage as seed was 6.84 quintals. How can usage as seed be double of the production.

Specific Comments

- The explanation/ justification part of the report is very weak and in some cases tables aren't explained at all. Improve the overall presentation of the report.

7. Overall view on acceptability of report

The draft report cannot be accepted for consolidation. You are therefore recommended to rewrite chapter 3 as control group farmers have been completely ignored in the present chapter. Take care of other comments and make correction and resubmit the report for our consideration. Once revised draft is accepted it will be used for further consolidation purpose and submission to the ministry. The revisions should be in accordance with the comments/suggestions. The soft copy of the revised report and revised excel data can be sent to us at the earliest as it helps in consolidating the state reports.

Sd/-

(Parmod Kumar)

Professor, ADRTC, ISEC, Bengaluru

Annexure – II

Agro-Economic Research Centre for Bihar & Jharkhand
T M Bhagalpur University, Bhagalpur – 812 007

Action Taken Report

1.	Title of the Draft Report	:	**Relevance and Distribution Efficiency of Seed Minikits of Pulses in Bihar**
2.	a. Date of Dispatch of the Draft Report	:	27th August, 2020
	b. Date of Dispatch of the Revised Draft Report	:	14th September, 2020
3.	Date of Receipt of the Comments	:	3rd September, 2020
4.	Comments on the Objectives of the Study	:	Calculation mistakes corrected.
5.	Comments on the Methodology	:	No action is required.

6. Comments on Analysis, Organization, Presentation, etc.:

- As regards the selection of pulse crops is concerned, it is to be made clear here that as per the list of SMK beneficiaries for 2018-19, made available for SMK farmers was for two pulse crops only i.e., lentil and red-gram. So, the sample beneficiary farmers were chosen for these two pulse crops, despite moong occupied the second highest area and production in the state.

  In order to select the beneficiary farmers, due care was given for proportionate representation of the sample in terms of number, social groups, gender issues etc. Despite given eligibility norms, the distribution of SMK farmers was made only to such farmers, who were interested in obtaining the benefits and thus, the sample could be devoid of beneficiaries like; large sized farmers. In Bihar, only 7.5 per cent farmers hold land above 2 hectare and large farmers occupy 0.70 per cent of total area. The number of large holdings is just 0.02 per cent.

  For red-gram, control farmers incorporated.

- Draft report was prepared on the basis of title of the Chapter, as given by you i.e., "Household Characteristics, Cropping Pattern and Value of Output of Beneficiary Farmers," so it was prepared accordingly. However, as per your comments, Chapter – III redrafted with revised tables on 300 selected farmers (B: 200 Hhs + NB: 100 Hhs) by replacing the 'Beneficiary Farmers' to 'Selected Farmers.'
- Despite the scheme being meant for privileged category of farmers, the criteria followed here for distribution SMK was generally 'Any Interested Farmers,' so the sample constitutes very few SC and Women farmers.
- All figures recalculated, based on aggregate value.
- As regards the accuracy of tables 4.2 & 4.3 is concerned, these are prepared in accordance with the given table design.
- Table 4.11 crop wise area sown figures replaced by total area sown figures as suggested in the given table. As per the given table design, output produced from SMK has been shown in Quintals per household and Output used as seed in kilograms per household. So no actions are required.
- Wherever necessary justifications in the report were required, done accordingly.

(Rambalak Choudhary)
Research Officer-Cum-Project Leader

Annexure – III

Comments on the Revised Draft Report, received dated 1st December, 2020

Dear Professor Sinha

I am happy that you have now incorporated the non beneficiary analysis in the chapter 3 and also included control group farmers for the red gram crop as well. With these changes, now the report is suitable for including in the consolidated report.

Please make the following small changes in the revised draft report:

Table 3.5: Gross farm income from cultivated area are reported with respect to gross cropped area whereas they should be calculated with respect to net sown area not with respect to gross cropped area.

Therefore, farm business income * net sown area will give you the correct estimates of gross farm income per hh.

Table 4.1: Area under pulses needs to be reported in terms of per household and not the aggregate for the entire category of marginal, small, medium and large. please divide total area by the number of households to report the area under pulses for the respective category. Similarly, in Table 4.11, area sown acres is also given total for the respective category whereas it should be reported as per hh.

Kindly incorporate these changes and resubmit the final report at the earliest.

Best regards
Parmod

Annexure – IV

Agro-Economic Research Centre for Bihar & Jharkhand
T M Bhagalpur University, Bhagalpur – 812 007

Action Taken Report on Revised Draft Report

1. Title of the Draft Report : **Relevance and Distribution Efficiency of Seed Minikits of Pulses in Bihar**

2. Date of Dispatch of the Revised Draft Report : 14th Sept., 2020

3. Date of Receipt of the Comments on Revised Draft Report : 1st Dec., 2020

4. Date of Dispatch of the Final Report : 7th Dec., 2020

5. Actions Taken

   a. Table 3.5 revised as per net sown area.
   b. Table 4.1 revised as per household.
   c. Table 4.11 revised as per household.

(Rambalak Choudhary)
Research-Cum-Project Leader