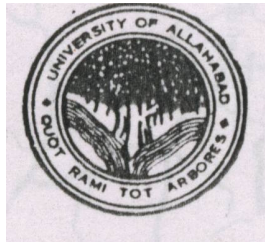


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*Estimation of Losses to Pulse Crops by Blue-Bulls in
Uttar Pradesh*

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Preface

India is basically an agrarian country because more than 60% of total population of the country is directly or indirectly dependent on agriculture and allied sectors. More than 70% population of the country also resides in villages and their livelihood are agriculture. Since agriculture is very risky pursuit at present therefore, the farmers are un-willing to engage themselves alone in agriculture sector. The size of land holding has been decreasing at very fast rate across the country and on account of this, the small size of holdings are economically unviable. Most of the farmers of the country are willing to give up the agriculture. Since the introduction of Green Revolution in India, the rice and wheat have been getting more importance at the cost of pulses and coarse grains. The cropping pattern has totally changed in favour of rice and wheat. With the expansion of irrigation network, the farmers have diverted the un-irrigated crops namely pulses, oilseeds and coarse grains in favour of rice, wheat, potato, sugarcane, vegetable etc. This type of cropping pattern has created acute shortage of pulses and oilseeds. The repeating of rice and wheat rotation is neither good for soil health nor agro-ecosystem. The continuous adoption of rice-wheat rotation is also cause of infestation of pests/diseases and deterioration of soil health. To maintain the dynamic equilibrium of agro-ecosystem and improve the quality of soil texture, the diversification of area of paddy and wheat to pulse crops are most important requirement at present scenario.

The share of area under pulses to total food-grains was 20.21% prior to Green Revolution which has decreased to 19.23% in 2009-10 in the country. The contribution of pulses in total production of food-grains was 13.90% in 1964-65 which has gone down to 6.35% in 2009-10 in the country. On account of this, the per capita availability of pulses was about 45gm per day in 2011 against minimum requirement of 80 gm per day. There is huge gap between production and requirement of pulses. The total production of pulses in the country was 1.70 crore M. tonnes against the demand of 2.58 crore M. tonnes in 1915-16. To meet the required demand of pulses, the Government of India has imported about 65 lakh M. tonnes of pulses. The population of the country has been increasing at the rate of 2 percent per annum against only 0.50 percent increase in the production of pulses. There is numbers of reasons for the low production of pulses in the

country. The main reasons for low production of pulses are diversion of areas of pulses to rice and wheat, frequent occurrence of natural calamities, attack of pest/diseases and blue-bulls etc. Among these reasons the attack of blue-bulls to pulse crops is most important cause of low production of pulse crops in the country. The blue-bulls are generally found in U.P., Uttarakhand, Haryana, M.P., Rajasthan and Gujarat. More than 25000 blue-bulls are present in different districts of U.P. The population of blue-bulls has been increasing at rate of 14.00% per annum. Prior to 1980 the blue-bulls were found only in forests, valley of rivers and ravines. Now they are found in plains to get their feed and waters. They are generally found in herds of 10 to 20. The deforestation is main cause of migration of blue-bulls from forests to plains. The huge quantity of production of pulses is destroyed by attack of blue-bulls in every year in Uttar Pradesh. The pulses are first choice for blue-bulls. It is roughly estimated that the more than 30.00% to 40.00% of total production of pulses is damaged by blue-bulls alone in the Uttar Pradesh. On account of this, farmers have been giving up the cultivation of pulses from their farms. A number of GOs have been issued by forest department of U.P. to curb the attack of blue-bulls to crops but these have not been implemented properly at ground level. The killing of blue-bulls is tedious activities in which the people do not take risk to kill blue-bulls. Since the population of blue-bulls has been increasing in every year, therefore, more and more areas are being destroyed by blue-bulls. The farmers are also not in a position to take suitable preventive measures to check infestation of blue-bulls in areas of pulses. The proper supports are also not available from forests, animal husbandry, revenue departments etc. Hence, reduction in the attack of blue-bulls to pulse crops is a big task at present scenario for policy markers, planners and bureaucrats etc. If the attack of blue-bulls is stopped by different preventive means, the millions tonnes of pulses of the state could be saved which would be fruitful in increasing the buffer stock of pulses in Uttar Pradesh. Secing the gravity of the situation, Ministry of Agriculture & Farmers Welfare, Government of India has asked to Agro-Economic Research Centre, Allahabad to undertake a study on “Estimation of Losses to Pulses by Blue-Bulls in Uttar Pradesh”. As per advice of Ministry of Agriculture, Government of India, the AER Centre, Allahabad has conducted this study in Uttar Pradesh. Four districts namely Badaun, Fatehpur, Allahabad and Jhansi districts of U.P. had been selected which belong to different regions. A total of 160 pulse growers were selected to estimate the losses by blue-bulls to pulses. The reference year of the study was 2014-15. The result of finding of the study is that about 43.00%

of total production of pulses on the sample farms had been destroyed by blue-bulls. Arhar and pea had been maximum damaged by blue-bulls.

The study was planned under overall supervision of Hon. Director, Sri D,K, Singh Ex R.O. of the Centre has drafted the report and its executive summary. The survey work had been done by Sri. S.N. Shukla, Dr. H.C. Malviya and Sri Hasib Ahmad of the Centre. The tabulation of Data on Excel had been done by Dr. H.C. Malviya, Sri Hasib Ahmad, Sri Ovesh Ahmad and Smt. N. Nigam. All the above mentioned staff of the Centre have done hard work in completion of the study, so they are fully acknowledged for the credit.

I also express my deep sense of gratitude to Deputy Directors of Agriculture of four selected districts and sample farmers for extending their full support and cooperation during survey work of the study.

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CHAPTER – 1

Brief Background of the Study

1. Introduction

India has attained substantial overall growth in agriculture sector on account of the advent of Green Revolution and adoption of new scientific techniques in the cultivation of crops. India is now fully sufficient in the production of wheat, rice but the per capita availability of pulses is still well below the minimum standard of requirement. This is a matter of serious concern for the scientists, planners and bureaucrats at present scenario. Since the introduction of Green Revolution in the country, maximum attention has been paid to rice and wheat by providing the adequate physical and financial support in order to raise the production and productivity of these two crops. Huge amount have been invested for innovation of new varieties of only rice and wheat crops while the pulse crops were neglected.

Prior to the commencement of Green Revolution in the country, the area under pulses, oilseeds and coarse grains was sufficient. But after 1970s, the area of these crops has been decreasing year by year due to expansion of area under rice and wheat.

The expansion of irrigation networks, availability of quality inputs, profitability of rice and wheat in comparison to pulse crops were major causes for decreasing the area under pulse crops across the country. The cropping pattern has changed in favour of rice and wheat. The area under rice and wheat has been increasing at the cost of decrease of area under coarse grains, pulses and oilseeds. The crop composition has totally shifted towards rice and wheat. On account of higher production, low risk, high margin of profit as compared to pulse crops, farmers are inclined to shift the area of pulse crops to rice and wheat crops. The cultivation of rice and wheat in cropping system is cause of incidence of pest and disease and deterioration of soil health. Therefore, it calls immediate diversification in crop rotation in favour of pulse crops for improving soil fertility.

The production of pulses has also been decreasing simultaneously with decrease of area under this crop. It is highly risky crop. It is much susceptible to pests, insects and diseases and on account of these, huge quantity of production of pulses are damaged in each year. The adverse climatic conditions, frequent occurrence strong of winds and hailstorm are also responsible for low production of pulse crops. Drought, excess rains, attack of blue-bulls are also major causes for low production of pulse crops. These are important cause of grave concern for pulse growers at present scenario.

Pulses are important diet for vegetarian population of the country. It is major source of protein for vegetarian people. It also provides minerals, vitamins and energy to vegetarian people. Pulses play important role in ameliorating wide spread malnutrition in the country.

Apart from these benefits, pulse crops are also source for restoring and maintaining the fertility of soil through nitrogen fixation and conversion of physical properties of soil by the help of their roots. Pulses are leguminous crops, so that it add more nitrogen to the soil than the nitrogen added by fertilizers. The soil texture and physical properties of soil are improved by sowing the pulse crops. Pulses provide nutritious green fodders and feed for live stock. The pulses contain 20 to 26 per cent protein which is also cheaper than animal protein. The availability of protein in different pulses is as follows.

Table-1.1
Protein content in different pulse crops

Sl. No.	Name of Pulse Crops	Availability of protein in %
1	Lentil (Masoor)	24 – 26
2	Moong	22 – 25
3	Urd	22 – 25
4	Gram	22 – 24
5	Pea	22 – 24
6	Arhar	20 – 25

It is evident from table-1-1 that lentil contains maximum protein content being 24 – 26 per cent followed by 22 – 25 % in moong and urd. The content of protein ranged between 20 and 26 per cent among the pulse crops.

The growth of production and productivity of almost all pulses is either stagnant or decreased after introduction of Green Revolution in the country, leading to a short fall in the per capita availability. On account of this, the consumption of pulses has become beyond the reach of common people while it is essential constituents of a balanced diet. The area under pulses is shrinking and production is also decreasing as compared with requirement of ever growing population of the country. The per capita availability of pulses was 69.70 gm per day in 1950-51 which has decreased to 42 grams per day in 1996-97. At the present, the per capita per day availability is about 26 grams in Uttar Pradesh against the recommended level of 80 gm by FAO/WHO. This is due to high growth in population and low growth in production of pulses. A number of programmes have been started by central and state governments to boost the production of pulses but result is not found positive. There is huge gap between the availability of pulses and its requirement. Therefore, the price of pulses has been increasing year by year. To maintain equilibrium between demand and supply, Central government is importing the pulses from foreign countries and has to pay the scarce foreign exchange which could have been invested to other productive purposes. In order to increase the production of pulses, Government of India had launched Pulse Development Scheme during 4th plan (1969-70) across different states of the country. Under this centrally sponsored scheme, new production techniques and improved varieties were provided to the farmers. Again during post Green Revolution i.e. 1986, a National Pulse Development Programme had been launched in 13 pulse growing states of the country. The basic aim of this programme was to encourage the farmers to increase the productivity of pulses by use of new techniques and improved varieties. Technology Mission on oilseeds and pulses had also been introduced in 1986 in the country. It had attributed maximum in achieving target and got grand success. The National Food Security Mission (NFSM) had also been introduced during 2008 by Government of India. NFSM comprises three components i.e. I. NFSM-rice, II. NFSM-wheat, III. NFSM-pulses. The main objectives of NFSM were to raise the production level of rice, wheat and pulses by increasing area and productivity in sustainable

manner. Next objective of this programme was to restore soil fertility and productivity of the individual farm. At the initial stage NFSM covered 16 districts for rice, 38 districts for wheat and 19 districts for pulses of Uttar Pradesh. At the present, all 75 districts of U.P. are covered under NFSM for pulses. The impact of NFSM on pulse crops was found positive and significant. Now the farmers are using proper and balanced inputs and applying latest scientific techniques in the cultivation of pulse crops.

It is unfortunate that there is no provision in NFSM to guide the pulse growers about the preventive measures to check the attack of blue-bulls to the standing pulse crops. There is also no provision in NFSM to provide the financial help to pulse growers to take up protective measures to reduce the attack of blue-bulls to pulse crops.

The pulse growers use the quality inputs and apply the latest scientific techniques in pulse crops to get better yield but they do not get better yield due to occurrence of drought, excess rains, hailstorm, attack of pest/insects, diseases and blue-bulls. More than 40% of total production of pulses of the state are generally damaged by these factors.

The total population of U.P. was 19,98,12,341 in 2011. The required quantity of pulses per year is about 58.34 lakh M. tonnes at present (on the basis of recommended quantity of 80 gms per capita per day) while the production of pulses was about 23.98 Lakh M. tonnes in 2011-12. It shows that production of pulses in Uttar Pradesh is much below than the required quantity.

Therefore production of pulses in Uttar Pradesh will have to be increased by more than two times from present level to fulfill the requirement of pulses for ever growing population of Uttar Pradesh. The production of pulse crops could be increased by increasing the area, raise the productivity, check infestation of blue-bulls and use of insecticide and pesticides etc. The proper and adequate compensation should be given to pulse growers on the occurrence of the natural calamities on pulse crops to boost the morale of pulse growers.

2. Estimation of Losses to Pulse Crops by Blue-Bulls in Uttar Pradesh

In the state of Uttar Pradesh about 70% of its population directly depends on agriculture which accounts for 31% of GDP in the state. This state ranks first in production of total food grains wheat, potato, vegetables and sugar-cane. Uttar Pradesh also ranks second in the production of pulses and rice. Although cultivation of pulses holds an important place in the farming system of the state, but the production of pulses lags much behind the increasing demand of pulses by the people. The area under pulses was only 9.40% to GCA in Uttar Pradesh during 2011-12. Among the pulses, gram and masoor accounted for 24.86% and 20.07% of the total area under pulses respectively in 2011-12. While area under pea, arhar, urd and moong was 20.90%, 13.28%, 23.53% and 3.36% respectively during corresponding period. The production of total pulses in Uttar Pradesh was 23.97 lakh M.T. in 2011-12 of which pea, masoor, arhar and gram had contributed 18.60%, 19.88%, 13.81% and 29.63% to total production of pulses of Uttar Pradesh during 2011-12. Thus pea, gram, masoor and arhar are important pulse crops of Uttar Pradesh. The Pea, arhar, masoor, urd and moong are generally damaged by blue-bulls across the state. It is roughly estimated at about 40 per cent of total production of pulses of the state are generally lost by blue-bulls every year.

The total population of blue-bulls was estimated at about 2, 54,449 in Uttar Pradesh in 2008-09. The total area under pulse crops was about 24.16 lakh ha. Of which more than 60 per cent was damaged by blue-bulls in 2008-09. It has also been observed that zaid pulse crops was much more damaged by blue-bulls (70.80%) during 2008-09 followed by rabi and kharif pulse crops. Total area of pulse crops in Uttar Pradesh being 23.50 lakh ha. was covered under NFSM during 2014-15.

A number of measures are being adopted to protect the attack of blue-bulls by state government and pulse growers but it is not found fruitful at present. The population of blue-bulls has been increasing at a very fast rate in every year in the state. They were only confined and localized in particular tract in past two decades. They were found in river valleys and dense forests but at present they are found in every village across the state. They are now fearless. On account of this, the farmers have been substituting area of pulse crops by wheat etc. due to fear of attack of

blue-bulls. The area and production of pulses have been decreasing year by year across the state of U.P. In order to increase the production of pulses in Uttar Pradesh, the attack of blue-bulls will have to be prevented at any cost. All development programmes related to increase in production of pulses of Uttar Pradesh can not produce fruitful result until the attack of blue-bulls is prevented. Hence, the study entitled **“Estimation of Losses to Pulse Crops by Blue-Bulls in Uttar Pradesh”** at present scenario is very useful in context to Uttar Pradesh to know the cause and means to prevent the attack of blue-bulls on pulse crops. The following objectives have been framed for this study.

3. Objectives

1. To assess the extent of damage to pulse crops by blue bulls
2. To determine adoption measures undertaken by government and farmers in reducing the losses by blue bulls.
3. To identify the constraints in the implementation of measures by state government to reduce the losses to pulse crops due to blue bulls.
4. To suggest suitable remedial measures to reduce and prevent the damage to pulses by blue bulls.

4. Proposed coverage of crops

The study has been conducted in Uttar Pradesh. Hence, all pulse crops namely gram, pea, lentil, arhar, urd and moong have been covered under this study to know the quantum losses of production of pulses due to attack of blue-bulls.

5. Data Collection

The study is based on primary as well as secondary data. The primary data have been collected from sample pulse growers of selected villages. The primary data collection has been done by personal interview method for reference year 2014-15. The secondary data have been collected from Directorate of Agriculture, Krishi Bhawan, Lucknow and other relevant sources.

6. Research Methodology

This study is confined to state of Uttar Pradesh as a whole. A multistage stratified mixed sampling technique were used to cover the stated objectives. Since, state is divided into four regions, namely Eastern, Central, Bundelkhand and Western and also covered by NFSM, therefore, one district from one region has been covered based on NFSM subject to maximum area of pulse during 2014-2015. From each selected district, two blocks have been selected on same criteria as cited above. From each block, thus selected a cluster of suitable number of villages have been undertaken. A list of pulse growers, thereafter from selected village have been collected and categorized into various size groups prevalent under study areas. The ultimate sample pulse growers have been undertaken according to probability proportion to total number in each category restricting the total number of sample growers to 40 in each district. The procedure of selection of district, blocks, villages and pulse growers are illustrated in Table-1.2 given below:

Table-1.2

Details of Sample selected

Name of regions	Nos. of district selected	Nos. of blocks selected	Nos. of villages selected	Nos. of sample farms selected
Eastern	1	2	4	40
Central	1	2	4	40
Bundelkhand	1	2	4	40
Western	1	2	4	40
U.P.	4	8	16	160

7. Reference year of study was 2014-15. Application of different statistical tools have been applied to get scientific result.

8. The schedules and questionnaires have been framed according to the objectives of the study.

9. Chapter Scheme

The following chapters have been framed for this study.

1. Brief Background of the Study
2. Area, production and yield of pulse crops in Uttar Pradesh
3. Background of selected districts of Uttar Pradesh.
4. Socio economic structure of sample farmers, land utilization pattern, cropping system, area and production of pulses.
5. Adoption of Preventive Measures to reduce the attack of blue-bulls to pulses and reasons for shifting the area under pulses to its competing crops.
6. Estimation of Losses by Blue-Bulls to pulse crops on the sample farms in 2014-15
7. Constraints and Suggestions in reducing the attack of Blue-Bulls to Pulse crops
8. Summary, Conclusion and Policy Implication
9. References

10. Constraints in the Study

The State Government did not take any appropriate measures to prevent the attack of blue-bulls to pulses, therefore it was not covered in the study. However, forest department has issued a number of GOs related to blue-bulls which has been described in Chapter-VII of the report.

CHAPTER – 2

Area, production and yield of pulse crops in Uttar Pradesh

Uttar Pradesh is most populous state of the country. More than 16 per cent of total population of the country resides in the state, while per centage share of geographical area of U.P. to total geographical area of the country was only 7.33 per cent in 2011. The density of population in U.P. was 828 per sq. km. The per centage of population below poverty line was 25.5 in 2004-05 against 21.8 in India as a whole. The per centage share of agriculture and allied sector in total GSDP in U.P. was 15.25 during 2009-10 against 28.76 during 2008-09. The per centage share of agriculture and allied sectors in total GSDP has been decreasing from year to year in U.P., showing a shortfall in overall growth in agriculture and allied sectors. More than 60% of the population of U.P. is depended on agriculture sector. More than 60% of the population of the state resides in villages and their livelihoods are depended on agriculture. Agriculture is still a gamble of monsoon, hence, hundred per cent risk is involved in this occupation.

1. Profile of Uttar Pradesh

The reporting area for land utilization of the state is 214.70 lakh hectares which is spread over 18 Mandals. Uttar Pradesh has 75 districts, 822 blocks and 1,07,452 revenue villages at present. The total population of the state was 19.96 crores in 2011 of which male population accounted for 52.40% followed by 47.60% for female population. The literacy per centage was 79.29 in male population against 59.26% among female population in U.P. in 2011. Details are given in Table-2.1.

Table-2.1
Uttar Pradesh at Glance

1.	Geographical Area (lakh Hect.)	214.70
2.	Mandal	18
3.	District	75
4.	Tehsil	327
5.	Block	822
6.	Revenue Village	107452
7.	Total Population (2011)	19.96 Crore
	(a) Male Population	10.46 Crore
	(b) Female Population	9.50 Crore
8.	Literacy Per centages (2011)	
	(a) Male	79.24
	(b) Female	59.26
	(c) Total	69.72

2. Land Utilization in Uttar Pradesh

The reporting area of the state was 214.70 lakh ha. in 2011-12 of which forest area accounted for only 6.71% which has been decreasing every year because of large scale of deforestation in the state. On account of this, wild animals have been continuously migrating from forests to villages to get their feeds. The blue-bulls are a big problem for farmers because they destroy the pulse crops. The forests department of U.P. does not understand the scale of blue-bulls problem in the state.

The net area sown in 2011-12 was 166.25 lakh ha. of which 54.77% was sown more than once. The cropping intensity was 154.77% during the same period (Table-2.2). The per capita availability of net area sown was estimated at 0.08 ha. in 2011-12.

Table-2.2
Net area sown, Area sown more than once and Gross cropped area in Uttar Pradesh
(2007-08 to 2011-12)

(Area in lakh hectare)

Sl. No.	Particulars	Years				
		2007-08	2008-09	2009-10	2010-11	2011-12
1.	Net Area sown	164.17	165.62	165.89	165.93	166.25
2.	Area sown more than once	89.03	89.09	88.51	90.22	91.05
3.	Gross cropped area	253.20	254.71	254.40	256.15	257.30
4.	Cropping Intensity	154.23	153.79	153.35	154.37	154.77

Source: Statistical abstract Uttar Pradesh 2013

3. Cropping pattern in Uttar Pradesh

Out of GCA in U.P., foodgrains accounted for 78.29% followed by 9.39% for pulses in 2012-13. Of the total area under food-grains, rice and wheat accounted for 29.30% and 48.61% respectively during 2012-13. It shows that rice and wheat are dominant cereal crops of the state. Both crops jointly occupied 77.91% of total area under food-grains. The net area sown was 166.33 lakh hectares in 2004-05 which has decreased to 166.25 lakh hectares in 2011-12, showing a marginal down fall of 0.06% over the period. The cropping pattern was always in favour of rice and wheat in U.P. Out of GCA, wheat accounted for 38.06% followed by 22.94%

of rice during 2012-13. There were marginal increase in area sown more than once and GCA in Uttar Pradesh during the study period (2007-08 to 2011-12). (Table-2.2)

4. Area under important crops in Uttar Pradesh

Area under important crops in Uttar Pradesh during 1970-71 and 2012-13 is worked-out in Table-2.3. Table-2.3 shows that out of GCA, the area under food-grains in U.P. occupied lions share being 83.84% in 1970-71 against 78.30% in 2012-13. The decrease in area under food grains was due to decrease in area of pulse crops. The share of pulse crops in total GCA was 16.05% in 1970-71 which went down to 9.39% in 2012-13, showing 35.16% decrease over the period. It reflects that there was a drastic downfall in area under pulses in Uttar Pradesh. However, the share of area under sugarcane and oilseeds to GCA were 8.23% and 4.13% respectively in 2012-13 against 5.80% and 3.00% in 1970-71. (Table-2.3)

Table-2.3
Area under different important crops during 1970-71 and 2012-13

(Area in lakh hect.)

Sl. No.	Name of Crops	Years			
		1970-71		2012-13	
		Area	% to GCA	Area	% to GCA
1.	Wheat	39.07	16.83	97.93	38.06
2.	Rice	44.76	29.87	59.03	- 22.95
3.	Pulses	37.25	16.05	24.16	9.39
4.	Food-grains	194.58	83.84	201.44	78.30
5.	Oilseeds	6.97	3.00	10.63	4.13
6.	Sugarcane	13.45	5.80	21.17	8.23
	GCA	232.07	100.00	257.28	100.00

5. Area and production Pulses in Uttar Pradesh

Share of area under pulses and production to food-grains in U.P. from 2004-05 to 2011-12 is worked-out in Table-2.4. It is evident from Table-2.4 that share of area under pulses to area under food-grains was 13.84% during 2004-05 which has decreased to 12.22% during 2011-12, showing 1.62% decrease over the period. Table-2.4 also shows that contribution of production of

pulse crops to total production of food-grains has also declined to 4.60% during 2011-12 to 6.07% during 2004-05. The production of pulses in U.P. was 23.97 Lakh M. Tonnes during 2011-12 against 24.30 lakh M. tonnes during 2004-05, there by showing 1.36% decrease over the period.

The maximum fall in area under pulses is witnessed during post Green Revolution period. At the advent of Green Revolution in the state, the availability of good quality of seed coupled with new techniques, expansion in irrigation sources, high production of rice and wheat were reasons for changing the cropping pattern in favour of rice and wheat in Uttar Pradesh. These two crops are also assured than pulses. The per hect profitability of rice and wheat is much higher than pulse crops hence, farmers are inclined to devote much area to rice and wheat rather than pulse crops. However the share of oilseeds and sugarcane to GCA in U.P. was 4.13% and 8.23% in 2012-13 against share of 3.00% and 5.80% in 1970-71 respectively.

Table-2.4
Per centage share of area and production of pulse crops to total area and production of food-grain in Uttar Pradesh from 2004-05 to 2011-12

(Area lakh hect. and Production lakh M.T.)

Years	% share of area to food-grains	% share of production of pulses to food-grains	Area under pulses	Area under food-grains	Production of pulses	Production of food-grains
2004-2005	13.84	6.07	28.17	203.55	24.30	399.96
2005-2006	13.20	5.37	26.40	300.07	22.05	410.86
2006-2007	12.41	4.33	24.68	198.88	18.14	418.65
2007-2008	11.54	4.03	22.70	196.72	16.27	403.32
2008-2009	11.57	4.40	23.20	200.53	20.84	473.82
2009-2010	12.77	4.27	25.50	199.75	19.06	446.45
2010-2011	12.15	4.36	24.48	201.55	20.16	461.92
2011-2012	12.22	4.60	24.16	201.44	23.97	520.57

6. Trends of area under pulses in U.P. from 2004-05 to 2011-12

The trends of area under pulses in U.P. from 2004-05 to 2011-12 are presented in table-2.5. It shows that the area under pulses in Uttar Pradesh has been decreasing from 2004-05 to 2011-12. The area under pulses was 28.17 lakh hectares in 2004-05 which has decreased to 24.16 lakh

hectares in 2011-12 showing 14.23% decrease over the period. The maximum decline in area under pulses is noticed being 19.42% during 2007-08 followed by 17.64% during 2008-09. The impact of NFSM in Uttar Pradesh on pulse growers was not much encouraging. The area under pulses is more or less stagnant during study period.

Table-2.5
Area under pulses in different years in Uttar Pradesh from 2004-05 to 2011-12

(lakh hectares)			
Years	Area under pulses	% change over previous year	% change over base year
2004-2005	28.17	--	100.00
2005-2006	26.40	- 6.28	93.72
2006-2007	24.68	- 6.52	87.61
2007-2008	22.70	- 8.02	80.58
2008-2009	23.20	+ 2.20	82.36
2009-2010	25.50	+ 9.91	90.52
2010-2011	24.48	- 4.00	86.90
2011-2012	24.16	- 1.31	85.76

7. Trends of production of pulses in Uttar Pradesh from 2004-05 to 2011-12

Trends of production of pulses in U.P. from 2004-05 to 2011-12 have been worked-out in Table-2.6. This table shows that production of pulses in U.P. has maintained the decreasing trends during study period. The growth in production of pulses was not significant. The production of pulses in U.P. was 24.30 lakh M. tonnes during 2004-05 which has decreased to 23.97 lakh M. tonnes during 2011-12 thereby showing 1.36% decrease over the period. The losses in production of pulses in U.P. during 2011-12 was due to severe occurrence of drought in the state. Except this year, the trend in growth of production of pulses in the state was also negative and not encouraging. The impact of NFSM on pulse crops is less positive in increasing the overall production of pulses in U.P. The existing quantity of production of pulses in the state is quite inadequate to meet the requirement of 19.96 crore population of Uttar Pradesh. Major share of production of pulses goes to waste due to incidence of pest/insects, diseases and attack of blue-bulls. Which can be reduced to some extent by use of effective preventive measures. At present the blue-bulls are major enemy in damaging the pulse crops across the state. Uttar

Pradesh was surplus state in the production of pulses upto 1970-71 but at present U.P. is deficit state in production of pulses.

Table-2.6
Production of pulse crops in different years in Uttar Pradesh (2004-05 to 2011-12)

(Production lakh M.T.)			
Years	Production of pulse crops	% change over previous years	% change over base year
2004-2005	24.30	--	100.00
2005-2006	22.05	+ 9.26	90.74
2006-2007	18.14	- 17.73	74.65
2007-2008	16.27	- 10.31	66.95
2008-2009	20.84	+ 28.09	85.76
2009-2010	19.06	- 8.54	78.43
2010-2011	20.16	+ 5.77	82.96
2011-2012	23.97	+ 18.90	98.64

8. Trends of productivity of pulses in U.P. from 2004-05 to 2011-12

The trends of productivity of pulses in U.P. in different years have been worked-out in Table-2.7. Table-2.7 shows that per ha. productivity of pulses was 8.75 qtls. during 2004-05 which has decreased to 8.24 qtls per ha. during 2011-12 showing 6.17% decrease over the period. The productivity of pulses in U.P. ranged between 7.17 qtls and 8.99 qtls per ha. across the study period. Table also shows that trend of productivity of pulses was more or less stagnant from 2004-05 to 2011-12. However, the rate of growth in productivity of pulses was very low since 2007-08 which was effected by severe drought, therefore, the productivity of pulses was negative during 2013-14 in comparison to year 2004-05 over an all the productivity of pulses in U.P. has been decreasing from year to year and its rate of growth was quite negative in comparison to rate of growth of productivity of rice and wheat. There is a need to enhance the productivity of pulses in U.P. to raise over all production of pulses to bridge the gap between demand and supply of “Dal”. Since the area under pulses is shrinking year by year, therefore, an efforts should be made to raise the yield per ha. of pulses to meet the consumption need of pulses for existing population of the state. NFSM has been playing a positive role in boosting the yield of pulses in U.P. to provide physical and financial helps to pulse growers. The impact of NFSM is found very encouraging on pulse growers.

Table-2.7
Productivity of different pulse crops in different years in Uttar Pradesh
(from 2004-05 to 2011-12)

Years	Productivity	% change over previous year	% change over base year
2004-2005	8.75	--	--
2005-2006	8.63	- 1.37	98.63
2006-2007	8.35	- 3.24	95.43
2007-2008	7.35	- 11.98	84.00
2008-2009	7.17	- 2.45	81.94
2009-2010	8.99	+ 25.38	102.74
2010-2011	7.47	- 16.91	85.37
2011-2012	8.24	+ 10.30	94.17

9. Area under different pulse crops in Uttar Pradesh (from 2004-05 to 2009-10)

Six pulse crops namely arhar, moong, urd, gram, pea, masoor (Lentil) are grown across the state. Among these six pulse crops, arhar, moong and urd belong to kharif season while gram, pea and masoor belong to rabi season. Arhar is annual pulse while moong and urd are also sown in zaid season. The area under six pulse crops in during different years are illustrated in table-2.8. Table-2.8 shows that out of total area under pulses being 24.16 lakh ha. in 2011-12 in U.P. the rabi pulses accounted for 59.83% and kharif pulses accounted for 40.17%. It shows that area under kharif pulses occupied less than 19.66% from the area under rabi pulses. Table-2.8 also reveals that this type of occupance of area under kharif and rabi pulses was more or less same across the state during study period (from 2004-05 to 2011-12). It is also evident from table-2.8 that the area under rabi pulses has been decreasing from year to year while the area under kharif pulses has been increasing during corresponding year.

The maximum shortfall in area under pea is witnessed from Table-2.8 while the area under masoor and gram were more or less stagnant during corresponding period. As far as kharif pulses are concerned, table reveals that area under arhar has been decreasing from year to year except few years while area of urd has shown increasing trend year by year. The area under moong was more or less stagnant from 2006-07 to 2009-10. It is also witnessed from table-2.8 that the gram and masoor were important pulses in U.P. in every year. Both crops jointly occupied 46.93% to total area of pulses in U.P. in 2011-12. Third important pulse crop was urd which occupied 23.53% to total area of pulses in 2011-12. It shows that the gram, masoor and urd are important

pulse crops of the state out of total area of pulses being 24.16 lakh ha. in 2011-12 these three pulses accounted for 70.46%. The arhar, moong and pea accounted for 13.28%, 3.36% and 12.90% in 2011-12 against 14.47%, 2.50% and 16.87% to total area under pulses in 2004-05 respectively. Two important pulses namely arhar and pea which are largely consumed by the people of U.P. have negative growth during study period in the state. On account of this, the price of arhar has gone up beyond control during 2014-15.

Table-2.8
Per centage share of area under different pulse crops to total area under all pulse crops in different years in Uttar Pradesh from 2004-05 to 2011-12

Years	Kharif Pulses				Rabi Pulse				All pulses
	Arhar	Moong	Urd	Total Kharif Pulses	Gram	Pea	Masoor	Total Rabi Pulse	
2004-05	14.47	2.50	18.53	35.50	24.60	16.87	23.03	64.50	100.00 (28.17)
2005-06	14.80	2.37	15.56	23.73	25.08	17.52	24.67	67.27	100.00 (26.40)
2006-07	15.67	2.70	16.11	34.48	26.52	15.06	23.95	65.52	100.00 (24.68)
2007-08	16.29	3.26	24.72	44.27	24.43	10.80	20.50	55.73	100.00 (22.70)
2008-09	14.03	2.64	19.23	35.90	27.10	14.57	22.43	64.10	100.00 (23.20)
2009-10	13.18	2.99	23.05	39.22	23.90	12.59	24.29	60.78	100.00 (25.50)
2010-11	13.66	3.34	22.10	39.10	24.03	12.40	24.46	60.90	100.00 (24.48)
2011-12	13.28	3.36	23.53	40.17	24.86	12.90	22.07	59.83	100.00 (24.16)

Note: Figures in brackets are area under pulses in lakh hectares.

10. Production of different pulse crops in Uttar Pradesh (from 2004-05 to 2011-12)

The per centage share of different pulse crops to total production of pulses in Uttar Pradesh from 2004-05 to 2011-12 have been estimated in table-2.9 which shows that out of total production of pulses being 19.06 lakh M. tonnes, the share of rabi season pulse crops was 78.82% followed by 25.18% of kharif season pulse crops during 2009-10. This type of contribution was more or less same during study period (from 2004-05 to 2011-12). Out of total production of total pulses being 23.75 lakh M. tonnes, during 2011-12, the contribution of gram was 29.63% followed by 19.88% and 18.60% of masoor and pea respectively. It is also noticed from Table-2.9 that share

of pea in total production was 26.10% during 2004-05 which has decreased to 18.60% during 2011-12. Against this, contribution of masoor in total production has been continuously increasing from 2004-05 to 2009-10. This was due to increase in area of masoor and enhancement in yield per hectare. The position of gram was more or less similar across the study period. It is also evident from table-2.9 that out of total production of pulses of U.P. during 2011-12, the share of urd was 15.94% followed by 13.81% and 2.14% of arhar and moong respectively. Arhar is most important pulse for U.P. but its production has been decreasing from year to year. The share of this crop was 16.13% during 2004-05 in total production of pulses which has decreased to 13.81% during 2011-12. The above discussion reflects that the production of arhar, pea and gram were not found encouraging during the study period. These three crops are generally damaged by blue-bulls. These are also much susceptible to pests/insects and diseases in comparison to other pulse crops. Therefore, these crops need a special attention in to reducing the losses by use of effective preventive measures in years to come. The total production of pulses in U.P. was only 23.97 lakh tonnes in U.P. in 2011-12 which was much less than requirement.

Table-2.9
Per centage share of Production of different pulse crops to total Production of all pulse crops in different years in Uttar Pradesh from 2004-05 to 2011-12

Years	Kharif Pulses				Rabi Pulse				All pulses
	Arhar	Moong	Urd	Total Kharif Pulses	Gram	Pea	Masoor	Total Rabi Pulse	
2004-05	16.13	1.32	8.33	25.78	26.12	26.10	22.00	74.22	100.00 (24.30)
2005-06	17.57	1.50	8.66	27.73	26.94	24.49	20.84	72.27	100.00 (22.05)
2006-07	15.68	1.76	12.48	29.92	26.85	20.08	23.15	70.08	100.00 (18.14)
2007-08	19.99	1.90	15.28	37.17	24.95	16.09	21.78	62.83	100.00 (16.27)
2008-09	14.29	1.63	11.95	27.87	30.59	19.51	22.03	72.13	100.00 (20.84)
2009-10	11.53	1.61	12.04	25.18	26.46	21.92	26.44	74.82	100.00 (19.06)
2010-11	14.94	2.75	17.04	34.73	26.90	17.43	20.94	65.27	100.00 (20.16)
2011-12	13.81	2.14	15.94	31.89	29.63	18.60	19.88	68.11	100.00 (23.97)

Note: Figures in brackets are production of all pulses in Lakh M. Tonnes.

11. Average yield of pulses in U.P. from 2004-05 to 2011-12

The per hectare average yield of arhar, moong, urd, gram, pea, masoor are illustrated in Table-2.10. Table-2.10 shows that yield per hectare was highest being 14.31 qtls in pea followed by 11.83 qtls, 10.70 qtls, 8.94 qtls, 6.72 qtls and 6.31 qtls of gram, arhar, masoor, urd and moong in 2011-12. The yield per hectare of all six pulse crops was higher during 2011-12 in comparison to per hectare yield during 2004-05. It is also evident from table that there were positive growth in per hectare yield of all six pulse crops of Uttar Pradesh but the growth is very marginal. It shows that pulse growers are investing and using the capital in the cultivation of pulse crops. They are also adopting the new techniques in the cultivation of pulse crops to get higher yield. The result is also positive.

Table-2.10

**Average yield per hectare of different pulse crops in different years in U.P.
(from 2004-05 to 2011-12)**

Years	Kharif Pulses			Rabi Pulses			(Qtls./hect.) All Pulses
	Arhar	Moong	Urd	Gram	Pea	Masoor	
2004-05	9.62	4.50	3.88	9.16	13.35	8.24	8.75
2005-06	9.92	5.29	4.05	8.97	11.67	7.06	8.63
2006-07	7.36	4.78	5.69	7.44	9.80	7.10	8.35
2007-08	8.79	4.17	4.43	7.32	10.86	7.62	7.35
2008-09	9.15	5.55	5.58	10.14	12.03	8.82	7.17
2009-10	6.54	4.00	3.90	8.28	13.02	8.13	8.99
2010-11	9.01	4.50	6.35	9.22	11.59	7.05	8.24
2011-12	10.70	6.31	6.72	11.83	14.31	8.94	9.92

Table-2.11

**Per centage share of pulse crops to Gross Cropped Area (GCA) in different years in U. P.
(from 2004-05 to 2011-12)**

(Area in lakh hectare)

Years	G.C.A.	Area under total pulses	% share of area under pulses to G.C.A.
2004-2005	255.24	28.17	11.04
2005-2006	253.07	26.40	10.43
2006-2007	254.15	24.68	9.71
2007-2008	253.20	22.70	8.97
2008-2009	254.71	23.20	9.11
2009-2010	254.40	25.50	10.02
2010-2011	256.15	24.48	9.56
2011-2012	257.30	24.16	9.39

Source: Statistical abstract Uttar Pradesh 2013

Table-2.12

**Season wise Area under pulses crops in different years in Uttar Pradesh
(from 2004-05 to 2011-12)**

(Area in lakh hectare)

Years	Kharif+Zaid Season	Rabi Season	Total area under pulses
2004-2005	10.00 (35.50)	18.17 (64.50)	28.17 (100.00)
2005-2006	8.64 (32.73)	17.76 (67.27)	26.40 (100.00)
2006-2007	8.50 (34.44)	16.18 (65.56)	24.68 (100.00)
2007-2008	10.05 (44.27)	12.65 (55.73)	22.70 (100.00)
2008-2009	8.33 (35.91)	14.87 (64.09)	23.20 (100.00)
2009-2010	10.00 (39.22)	15.50 (60.78)	25.50 (100.00)
2010-2011	NA	NA	24.48 (100.00)
2011-2012	NA	NA	24.16 (100.00)

Source: Statistical abstract Uttar Pradesh 2013

Note: Figures in brackets are per centage to total area under pulses

CHAPTER – 3

Background of selected districts of Uttar Pradesh

An attempt has been made in this chapter to know the back ground of four selected districts of Uttar Pradesh. The area, production and productivity of six important pulses namely arhar, moong, urd, gram, pea and masoor have also been analyzed in details in this chapter to know the individual performance of each pulse crop.

As it has already been mentioned in the first chapter of this report that four districts namely Badaun, Fatehpur, Allahabad and Jhansi were selected from Western, Central, Eastern and Bundelkhand regions respectively for this study.

3.1. Profile of Badaun district of Uttar Pradesh (Western Region)

The western region of U.P. comprises of 38 districts of which Badaun is one of them. Badaun is a progressive district. The breadth and lenth of this district is 5168 sq. Kms. The total population of this district was 36.83 lakh in 2011, of which male population accounted for 53.41% and female population accounted for 46.59%. The density of population was 712 per sq. km. The per centage of literacy of total population was only 51.30% against 67.70% state as a whole. This district has 15 blocks and 2081 villages at present. More than 70% population of this district resides in village and their main occupation are agriculture. (Table-3.1)

Out of total numbers of farmers of 529.61 thousand, the marginal, small, semi medium, medium and large farmers accounted for 76.16%, 15.54%, 6.58%, 1.65% and 0.07% respectively. The marginal and small farmers were maximum in numbers and accounted jointly for 91.70% of the total farmers. The average holding in this district was 0.82 hectare. The per capita availability of land was estimated at 0.09 hectare.

Table-3.1
Profile of Badaun district of western region of Uttar Pradesh (2011-12)

1.	Area Sq. Kms.	5168
2.	Total Population	3683896
	(a) Male	1967759 (53.41%)
	(b) Female	1716137 (46.59%)
3.	Density population per sq. km.	712
4.	% of Female population over 1000 male	872
5.	Total villages	2081
6.	Total Blocks	15
7.	Per centage of literacy in total population	51.30

3.1.1. Land utilization of Badaun district in 2011-12

The reporting area of this district was 4.27 lakh ha. of which 82% was under cultivation in 2011-12. The area under forests accounted for 1.15% of total reporting area. The gross cropped area was 6.05 lakh hectares in 2011-12. The cropping intensity was 172.67% in 2011-12. (Table-3.2)

Table-3.2
Land utilization in Badaun district in 2011-12

(Area in hect.)

1.	Reporting area	426768
2.	Area under forests	4902 (1.15)
3.	Net area sown	350106 (82.04)
4.	Area sown more than once	254439
5.	Gross cropped area	604545
6.	Cropping intensity	172.67
7.	Per capita area	0.09

Note: Figures in brackets are per centage to reporting area

3.1.2. Cropping pattern in Badaun district

The cropping pattern in Badaun district is presented in Table-3.3. Table-3.3 shows that wheat and bajra were dominant crops because wheat and bajra jointly accounted for 56.77% to GCA in 2011-12. Of GCA, the pulses and oilseeds accounted for 6.87% and 4.49% respectively during same period. The area under rice was only 1.32% of GCA because maximum area was covered by bajra during kharif season. The bajra is first choice in kharif season of the district.

Table-3.3
Cropping pattern in Badaun district (2011-12)

(Area in hect.)

Sl. No.	Name of important crops	Area
1.	Rice	7995 (1.32)
2.	Bajra	101130 (16.73)
3.	Wheat	242055 (40.04)
4.	Pulses	41532 (6.87)
5.	Oilseeds	27158 (4.49)
6.	Others	184705 (30.55)
	Total Gross Cropped Area	604545 (100.00)

Note: Figures in brackets are per centage to GCA

3.1.3. Area under different pulse crops in Badaun district

The area under different pulse crops of this district is presented in Table-3.4. This table shows that arhar, moong, urd, gram, pea and masoor were sown by the farmers during 2011-12. The urd was an important pulse in kharif season while masoor was important in rabi season pulse crop of the district during study period.

Out of total area under pulse crops being 41,532 hectares during 2011-12 the, share of urd was maximum being 86.01% followed by 9.97% of masoor. It shows that urd and masoor were important pulse crops of the district. The moong, gram, pea and arhar accounted for only 1.61%, 0.17%, 1.58% and 1.61% of total area under pulse crops during same period respectively. Urd is a cash crop of this district and not generally attacked by blue-bulls. Hence, urd is first choice of the farmers of this district. It is also evident from table-3.4 that the area under urd was 20093 hec in 2004-05 which has gone up to 35720 hec in 2011-12 showing 68.26% increase over the period. It has maintained rising trend from 2004-05 to 2011-12. However, the area under moong and arhar has maintained decreasing trends during corresponding period (table-3.4). Table-3.4 also shows that the area under gram, pea and masoor has decreased by 78.40%, 25.09% and 76.08% in 2011-12 from the area in 2004-05 respectively. The area under different pulse crops of rabi season of the district have been continuously decreasing from 2004-05 to 2011-12. It shows that there was much diversion of area under rabi pulse crops to wheat, potato, mentha etc. in Badaun district. It reflects that urd is only most dominant pulse crop of this district

at present(table-3.4). The area under total pulses of this district has been decreasing from 2004-05 to 2010-11. However, it has increased during 2011-12. An overall growth in area under pulse crops was insignificant during the study period.

Table-3.4
Area under different Pulse Crops in Badaun district (2004-05 to 2011-12)

(Area in Hect.)

Years	Arhar	Moong	Urd	Total Kharif	Gram	Pea	Masoor	Total Rabi	Total Pulse Crops
2004-05	1361 (3.35)	551 (1.36)	20093 (49.59)	22005 (54.30)	320 (0.79)	877 (2.16)	17320 (42.75)	18517 (45.70)	40522 (100.00)
2005-06	1088 (3.60)	329 (1.09)	16152 (53.49)	17569 (58.18)	222 (0.78)	854 (2.83)	11554 (38.25)	12630 (41.82)	30199 (100.00)
2006-07	958 (3.56)	529 (1.96)	16430 (61.03)	17917 (66.55)	146 (0.54)	626 (2.33)	8233 (30.58)	9005 (33.45)	26922 (100.00)
2007-08	627 (2.15)	286 (0.98)	21882 (75.06)	22795 (78.19)	94 (0.32)	579 (1.99)	5686 (19.50)	6359 (21.81)	29154 (100.00)
2008-09	593 (2.70)	247 (1.12)	15680 (71.30)	16520 (75.12)	96 (0.44)	587 (2.67)	4788 (21.77)	5471 (24.88)	21991 (100.00)
2009-10	862 (3.11)	246 (0.89)	20642 (74.54)	21750 (78.54)	119 (0.43)	885 (1.29)	4940 (17.84)	5944 (21.46)	27694 (100.00)
2010-11	865 (2.83)	229 (0.75)	23387 (76.46)	24481 (80.04)	116 (0.38)	810 (2.64)	5182 (16.94)	6108 (19.96)	30589 (100.00)
2011-12	670 (1.61)	274 (0.66)	35720 (86.01)	36664 (88.28)	69 (0.17)	657 (1.58)	4142 (9.97)	4868 (11.72)	41532 (100.00)

Note: Figures in brackets are per centage to total area under pulses

3.1.4. Production of different pulse crops in Badaun district

The production of different pulse crops of the district is presented in Table-3.5. Table shows that the total production of six pulse crops was 29,648 M. tonnes in 2004-05 of which share of masoor and urd were 47.67% and 40.93% respectively. The share of arhar and pea of the total production of pulses in 2004-05 were only 4.47% and 5.38% respectively. The moong and gram were not important crops of the district because the share of these crops were only 0.56% and 0.99% respectively during same period. The table-3.5 also reveals that production of masoor has been continuously decreasing in the district. The production of masoor was 14133 M. tonnes in 2004-05 which has decreased to 5995 M. tonnes in 2011-12, showing 57.58% decrease over the period. Against this, the production of urd has increased by 19.51% during the same period while other remaining pulses had maintained decreasing trend during study period. It reflects that urd is

an important pulse crop of the district as far as production is concerned. The urd is not generally destroyed by blue-bulls in the district. Therefore, farmers of this district are interested to grow urd on their farms to get better income than other pulses.

Table-3.5
Production of different Pulse Crops in Badaun district (2004-05 to 2011-12)

(M. Tonne)

Years	Arhar	Moong	Urd	Total Kharif	Gram	Pea	Masoor	Total Rabi	Total Pulse Crops
2004-05	1325 (4.47)	166 (0.56)	12135 (40.93)	13626 (45.96)	295 (0.99)	1594 (5.38)	14133 (47.67)	16022 (54.05)	29648 (100.00)
2005-06	1011 (4.45)	112 (0.49)	11822 (51.97)	12945 (56.91)	197 (0.87)	996 (4.38)	8608 (37.84)	9801 (43.09)	22746 (100.00)
2006-07	702 (3.41)	212 (1.03)	11890 (57.72)	12804 (62.16)	107 (0.52)	614 (2.98)	7072 (34.34)	7793 (37.84)	20597 (100.00)
2007-08	554 (2.17)	61 (0.24)	17175 (67.16)	17790 (69.57)	68 (0.27)	619 (2.42)	7096 (27.75)	7783 (30.43)	25573 (100.00)
2008-09	511 (2.55)	108 (0.54)	12480 (62.23)	13099 (65.32)	95 (0.47)	706 (3.52)	6153 (30.68)	6954 (34.68)	20053 (100.00)
2009-10	588 (2.75)	59 (0.28)	15295 (71.57)	15942 (74.60)	99 (0.46)	1152 (5.40)	4178 (19.54)	5429 (25.40)	21371 (100.00)
2010-11	702 (2.07)	133 (0.39)	25950 (76.54)	26785 (79.00)	103 (0.30)	1524 (4.50)	5493 (16.20)	7120 (21.00)	33905 (100.00)
2011-12	637 (1.46)	139 (0.32)	35821 (81.86)	36597 (83.64)	81 (0.81)	1086 (2.48)	5995 (13.70)	7162 (16.36)	43759 (100.00)

Note: Figures in brackets are per centage to total production of pulses

3.2. Profile of Fatehpur district of Uttar Pradesh (Central Region)

Fatehpur is an important district of central region of Uttar Pradesh. It is also well developed district of central region of Uttar Pradesh. The area of this district is 4152 sq. kms. The total population of this district was 26.33 lakh in 2011 of which 52.60% was males followed by 47.40% females. The per centage of female population over 1000 population of male was 901 in 2011. It shows that sex ratio was not adequate in this district. The literacy per centage was worked-out to be 67.40% of the total population of 26.33 lakh during same period. The per capita availability of land in the district was only 0.11 hectare. The district has 1522 villages and 13 blocks at present (Table-3.6). The marginal and small farmers accounted for 74.85% and

20.73% of the total number of farmers respectively. Most of area under cultivation is under irrigation network.

Table-3.6
Profile of Fatehpur district of central region of Uttar Pradesh (2011-12)

1.	Area Sq. Kms.	4152
2.	Total Population	2632733
	(a) Male	1384722 (52.60%)
	(b) Female	1248011 (47.40%)
3.	Density population per sq. km.	834
4.	% of Female population over 1000 male	901
5.	Total villages	1522
6.	Total Blocks	13
7.	Per centage of literacy in total population	67.40

3.2.1. Land utilization in Fatehpur district in 2011-12

Land utilization of Fatehpur district is reported in Table-3.7. The reporting area of this district was 4.22 lakh ha. of which 68.46% was under cultivation in 2011-12. It shows that major chunk being 31.54% was under not cultivation. However, the share of forests was only 1.89% to reporting area of this district in 2011-12. The cropping intensity of this district was only 142.56%. It shows that most of net area sown was not intensively cultivated in kharif season.

Table-3.7
Land utilization in Fatehpur district in 2011-12

(Area in hect.)

1.	Reporting area	422126
2.	Area under forests	7615 (1.80)
3.	Net area sown	288971 (68.46)
4.	Area sown more than once	122981
5.	Gross cropped area	411952
6.	Cropping intensity	142.56
7.	Per capita area	0.11

Note: Figures in brackets are per centage to reporting area

3.2.2. Cropping pattern in Fatehpur district in 2011-12

The cropping pattern in Fatehpur district is illustrated in Table-3.8. Table-3.8 shows that out of GCA of 4.12 lakh ha. the share of wheat was maximum being 41.16% followed by 19.37% of rice during 2011-12. The share of pulses and oilseeds were 18.94% and 6.02% respectively during 2011-12. It shows that pulse crops were also dominant in cropping sequence in the district. However, the wheat and rice jointly occupied 60.53% of GCA during 2011-12.

Table-3.8
Cropping pattern in Fatehpur district (2011-12)

(Area in hect.)

Sl. No.	Name of important crops	Area	
1.	Rice	79805	(19.37)
2.	Bajra	9787	(2.38)
3.	Wheat	169578	(41.16)
4.	Pulses	78011	(18.94)
5.	Oilseeds	24788	(6.02)
6.	Others	49983	(12.13)
	Total Gross Cropped Area	411952	(100.00)

Note: Figures in brackets are per centage to GCA

3.2.3. Area under different pulse crops in Fatehpur district

The area under different pulse crops in Fatehpur district is presented in Table-3.9. It is evident from table-3.9 that gram and arhar were important pulse crops of the district. Out of total area under pulse crops being 87,740 ha. during 2004-05, gram accounted for 53.87% followed by 29.29% of arhar. The share of urd, pea, masoor and moong were 11.02%, 1.49%, 1.86% and 2.12% of total area under pulse crops during 2004-05. It is also evident from table-3.9 that gram and arhar were important pulse crops, which had occupied 54.99% and 25.48% of total area under pulses respectively during 2011-12. It is observed that the area under gram has maintained a rising trend during the study period while area under arhar was fluctuating during study period. There was a negative growth in area under urd during corresponding period. It reflects that pulse crops were getting important place in cropping pattern in the district.

Table-3.9
Area under different Pulse Crops in Fatehpur district (2004-05 to 2011-12)

(Area in Hect.)

Years	Arhar	Moong	Urd	Total Kharif	Gram	Pea	Masoor	Total Rabi	Total Pulse Crops
2004-05	25701 (29.29)	1860 (2.12)	9670 (11.02)	37231 (42.43)	47265 (53.87)	1610 (1.84)	1634 (1.86)	50509 (57.57)	87740 (100.00)
2005-06	26372 (28.57)	1850 (2.00)	10387 (11.25)	38609 (41.83)	50119 (54.30)	1671 (1.81)	1894 (2.05)	53684 (58.17)	92293 (100.00)
2006-07	25701 (28.06)	2142 (2.34)	10210 (11.14)	38053 (41.55)	49959 (54.54)	1537 (1.68)	2045 (2.23)	53541 (58.45)	91594 (100.00)
2007-08	25196 (28.69)	2697 (3.07)	9680 (11.02)	37573 (42.78)	47457 (54.04)	1599 (1.82)	1196 (1.36)	50253 (57.22)	87825 (100.00)
2008-09	18346 (28.67)	2745 (3.54)	6903 (8.91)	27994 (36.12)	46709 (60.27)	1499 (1.93)	1354 (1.68)	49512 (63.88)	77506 (100.00)
2009-10	20836 (25.64)	4233 (5.21)	7810 (9.61)	32879 (40.46)	45601 (56.12)	1426 (1.75)	1354 (1.67)	48381 (59.54)	81260 (100.00)
2010-11	21301 (25.86)	5398 (6.55)	8152 (9.90)	34851 (42.31)	44727 (54.29)	1545 (1.88)	1260 (1.52)	47532 (57.69)	82383 (100.00)
2011-12	19879 (25.48)	5640 (6.85)	7407 (9.49)	32626 (41.82)	42900 (54.99)	1468 (1.88)	1017 (1.30)	45385 (58.18)	78011 (100.00)

Note: Figures in brackets are per centage to total area under pulses

3.2.4. Production of different pulses in Fatehpur district

The production of different pulses in Fatehpur district is shown in table-3.10. Table-3.10 shows that out of total production of pulses being 82,321 M. tonnes in the district during 2004-05 the share of gram was maximum being 56.33% followed by 35.95%, 3.43%, 1.77%, 1.43% and 1.09% of arhar, urd, pea, masoor and moong respectively. There was maximum downfall witnessed in the production of arhar in the district. The production of arhar was 29,593 M. Tonnes in 2004-05 which has decreased to 21,279 M. tonnes in 2011-12, showing 28.09% decrease over the period. Against this the production of moong and urd had maintained increasing trends across the study period. The production of gram was 46,372 M. tonnes in 2004-05 which has decreased to 44,461 M. tonnes in 2009-10, showing decreased by 4.12% over the period. However, the production of pea and masoor had marginally increased in corresponding period. This analysis reflects that the production of two major pulses namely arhar and gram had negative growth during study period. This was due to diversion of area of arhar and gram to rice and wheat respectively. The climatic stress expansion of irrigation, incidence of pests/insects and attack of blue-bulls were responsible for decreasing the production of pulses in the district. The

attack of blue-bulls to arhar and gram is a big problem for pulse growers of this district. The per capita per annum availability of pulses was worked out to be about 34.17 kg. This district was having surplus in the production of pulses. Arhar was generally exported from this district to deficit districts of Uttar Pradesh.

Table-3.10

Production of different Pulse Crops in Fatehpur district (2004-05 to 2011-12)

(M. Tonne)

Years	Arhar	Moong	Urd	Total Kharif	Gram	Pea	Masoor	Total Rabi	Total Pulse Crops
2004-05	29593 (35.95)	900 (1.09)	2823 (3.43)	33316 (40.47)	46372 (56.33)	1460 (1.77)	1173 (1.43)	49005 (59.53)	82321 (100.00)
2005-06	31647 (33.90)	1053 (1.13)	5477 (5.87)	38177 (40.90)	52435 (56.17)	1327 (1.42)	1413 (1.51)	55175 (59.10)	93352 (100.00)
2006-07	18738 (24.21)	1222 (1.58)	4955 (6.40)	24915 (32.19)	49827 (64.37)	1273 (1.64)	1391 (1.80)	52491 (67.81)	77406 (100.00)
2007-08	21163 (28.95)	978 (1.34)	5286 (7.23)	27427 (37.52)	43092 (58.95)	1572 (2.15)	1011 (1.38)	45675 (62.48)	73102 (100.00)
2008-09	15764 (19.89)	1980 (2.49)	3571 (4.51)	21315 (26.89)	55676 (70.27)	1223 (1.54)	1034 (1.30)	57933 (73.11)	79248 (100.00)
2009-10	9866 (15.89)	2436 (3.92)	2876 (4.64)	15178 (24.45)	44461 (71.63)	1380 (2.23)	1052 (1.69)	46893 (75.55)	62071 (100.00)
2010-11	20611 (24.44)	4583 (4.43)	5337 (6.33)	30531 (36.20)	51631 (61.22)	1393 (1.65)	787 (0.93)	54811 (63.80)	84342 (100.00)
2011-12	21279 (23.65)	4920 (5.67)	4878 (4.41)	31077 (34.54)	56308 (62.58)	1672 (1.86)	914 (1.02)	58894 (65.46)	89971 (100.00)

Note: Figures in brackets are per centage to total production of pulses

3.3. Profile of Allahabad district of Uttar Pradesh (Eastern Region)

The eastern region of U.P. is backward and less developed in comparison to western region of the state. The drought, floods and water logging are common phenomenon of this region. These are responsible reason for its backwardness. Major production of crops are damaged either by drought or floods in alternative year. On account of this the farmers of this region are poor and also hesitate to invest adequate capital on crops. This region has 28 districts at present of which Allahabad is one of them.

Among 28 districts of this region, Allahabad is much better in respect of agriculture than other districts. Allahabad is religiously culturally and educationally much better than other districts of the eastern region of U.P. Allahabad is divided into 3 parts namely Trans Ganga, Doaba and Trans Yamuna. The geographical character is different from each other. However, the maximum area under pulse crops are found in trans-yamuna. The total area of this district is 5482sq. kms. The population of this district was 59.54 lakh in 2011, of which male accounted for 52.60% followed by 47.40% of female. The density of population was very high being 1066 per sq. kms. The district has 20 blocks and 3053 villages. It is one of larger districts of eastern region of Uttar Pradesh.

Table-3.11
Profile of Allahabad district of Uttar Pradesh eastern region (2011-12)

1.	Area Sq. Kms.	5482
2.	Total Population	5954391
	(a) Male	3131807 (52.60)
	(b) Female	2822584 (47.40)
3.	Density population per sq. km.	1086
4.	% of Female population over 1000 male	902
5.	Total villages	3053
6.	Total Blocks	20
7.	Per centage of literacy in total population	68.80

3.3.1. Land utilization in Allahabad 2011-12

The land utilization in Allahabad is shown in table-3.12. Table-3.12 shows that the out of reporting area of 5.57 lakh ha. in 2011-12 of which the area under forests was 3.85%. More than 55% of reporting area was under cultivation in 2011-12. It reflects that about 45% of reporting area was not under plough in 2011-12. It is also evident from table-3.12 that 55.71% net area sown was repeated for sowing the crops in 2011-12. The cropping intensity was worked-out to be 155.71% during the same year. The per capita availability of land was only 0.05 hectare.

Table-3.12
Land utilization in Allahabad district in 2011-12

(Area in hect.)

1.	Reporting area	557074
2.	Area under forests	21455 (3.85)
3.	Net area sown	307953 (55.28)
4.	Area sown more than once	171551
5.	Gross cropped area	479504
6.	Cropping intensity	155.71
7.	Per capita area	0.05

Note: Figures in brackets are per centage to reporting area

3.3.2. Cropping pattern in Allahabad district 2011-12

The cropping pattern in Allahabad district during 2011-12 is analyzed in table-3.13. The table-3.13 shows that wheat and rice were dominant crops in Allahabad district during 2011-12. Out of GCA of 4.80 lakh hectares, wheat accounted for 44.85% followed by 30.58% rice during 2011-12. The area under pulse crops accounted for 10.47% to GCA during the same period. It shows that area under pulse crops was sufficient in relation to other crops. The farmers of this district have given importance to pulse crops in cropping pattern.

Table-3.13
Cropping pattern in Allahabad district (2011-12)

(Area in hect.)

Sl. No.	Name of important crops	Area
1.	Rice	146624 (30.58)
2.	Wheat	215055 (44.85)
3.	Bajra	28361 (5.91)
4.	Pulses	50199 (10.47)
5.	Oilseeds	2885 (0.60)
6.	Others	36380 (7.59)
	Total Gross Cropped Area	479504 (100.00)

Note: Figures in brackets are per centage to GCA

3.3.3. Area under pulse crops in different years in Allahabad district

The area under pulse crops in different years in Allahabad district is analyzed in table-3.14. Table-3.14 shows that arhar and gram were important pulse crops of the district, out of total area

under pulses being 50,812 hect. the arhar accounted for 33.15% followed by 31.57% for gram in 2004-05. The moong, urd, pea and masoor accounted for 7.59%, 7.18%, 9.37% and 11.15% to total area under pulses respectively during the same period. The total area of pulses was 50812 ha. during 2004-05 which has increased to 52,036 ha. during 2009-10, there by showing a marginal increase of 2.51% over the period. This increase was due to mainly increase in area under masoor. The area under kharif season pulses had maintained downfall trend in Allahabad district during the study period. As far as gram and pea are concerned, table-3.14 also reveals that the area under two rabi pulses i.e. gram and pea went down during the same period. The maximum shortfall in area under arhar and gram is witnessed from table-3.14. Since expansion of irrigation sources the unirrigated area under arhar and gram have been shifting in favour of rice and wheat. Even then, the area under pulses in the district is much higher than the other districts of eastern region of U.P. The total area under pulses was ranging between 50,199 ha. and 52,036 ha. during the study period.

Table-3.14
Area under different Pulse Crops in Allahabad district (2004-05 to 2011-12)

(Area in Hect.)

Years	Arhar	Moong	Urd	Total Kharif	Gram	Pea	Masoor	Total Rabi	Total Pulse Crops
2004-05	16844 (33.15)	3856 (7.59)	3650 (7.18)	24350 (47.91)	16039 (31.57)	4760 (9.37)	5663 (11.15)	26462 (52.09)	50812 (100.00)
2005-06	16449 (31.76)	3539 (6.83)	3616 (6.98)	23604 (45.57)	16707 (32.26)	4517 (8.72)	6966 (13.45)	28190 (54.43)	51794 (100.00)
2006-07	17701 (34.52)	3532 (6.89)	3577 (6.98)	24810 (48.39)	15255 (29.75)	4329 (8.44)	6880 (13.42)	26464 (51.61)	51274 (100.00)
2007-08	16646 (32.86)	3409 (6.73)	3587 (7.08)	23642 (46.67)	15308 (30.22)	4364 (8.61)	7348 (14.50)	27020 (53.33)	50662 (100.00)
2008-09	16212 (31.94)	3396 (6.69)	3536 (6.97)	23144 (45.60)	15474 (30.49)	4227 (8.33)	7906 (15.58)	27607 (54.40)	50751 (100.00)
2009-10	15362 (29.52)	3398 (6.53)	3387 (6.51)	22147 (42.56)	15420 (29.63)	4220 (8.11)	10249 (19.70)	29889 (57.44)	52036 (100.00)
2010-11	15542 (30.54)	3380 (6.64)	3376 (6.63)	22298 (43.81)	14508 (28.51)	4040 (7.94)	10048 (19.74)	28596 (56.19)	50894 (100.00)
2011-12	15597 (31.07)	3419 (6.81)	3377 (6.73)	22393 (44.61)	15750 (31.38)	4157 (8.28)	7899 (15.74)	27806 (55.39)	50199 (100.00)

Note: Figures in brackets are per centage to total area under pulses

3.3.4. Production of pulse crops in Allahabad district

The production of six pulse crops are presented in table-3.15. Table-3.15 shows that out of total production of pulses of 43,472 M. tonnes in Allahabad district during 2004-05 the contribution of arhar was maximum being 41.73% followed by 29.41% of gram. More than 70% of total production of the district was contributed by arhar and gram. However, the production of arhar in the district has been continuously decreasing from year to year. The production of arhar was 18,144 M. tonnes in 2004-05 which has decreased to 16813 M. tonnes in 2011-12 thereby showing 7.34% loss over the period. The production of urd and moong was more or less same during study period. There was high fluctuation in the production of both pulse crops. The production of gram was 12,783 M. tonnes in 2004-05 which has increased to 17,134 M. tonnes in 2011-12 showing 34.04% increase over the period. The production of pea and masoor were also positive in 2011-12 in comparison to the production in 2004-05. It shows that the six pulse crops of Allahabad district have positive growth during the study period. The production of all pulses in the district was maintaining by and large positive growth during the study period. The annual per capita availability of pulses was 7.30kg during 2004-05 against 8.70kg during 2011-12. It shows that annual per capita availability was lower than recommended requirement. The reason for decreasing the production of pulse crops in the district were the expansion of irrigation network change in cropping pattern shrinking in area under pulse crops etc. The attack of blue-bulls is also a big problem particularly for arhar and gram. Huge area under pulse crops are destroyed by blue-bulls every year. On account of this, farmers do not devote much area to pulse crops. The impact of NFSM was also positive in increasing the production of pulses of the district. It is a deficit district to meet the requirement of pulses for the total population.

Table-3.15
Production of different Pulse Crops in Allahabad district (2004-05 to 2011-12)

(M. Tonne)

Years	Arhar	Moong	Urd	Total Kharif	Gram	Pea	Masoor	Total Rabi	Total Pulse Crops
2004-05	18144 (41.73)	2127 (4.89)	1968 (4.53)	22239 (51.15)	12783 (29.41)	4384 (10.08)	4066 (9.35)	21233 (48.85)	43472 (100.00)
2005-06	22937 (43.00)	2288 (4.29)	2140 (4.01)	27365 (51.30)	17308 (32.44)	3478 (6.52)	5197 (9.74)	25983 (48.70)	53348 (100.00)
2006-07	14676 (35.24)	2599 (6.24)	2373 (5.70)	19648 (47.18)	13837 (32.22)	3584 (8.60)	4589 (11.02)	22010 (52.82)	41658 (100.00)
2007-08	18075 (38.98)	1537 (3.31)	1713 (3.69)	21325 (45.99)	14543 (31.36)	4290 (9.26)	6209 (13.39)	25042 (54.01)	46367 (100.00)
2008-09	20262 (40.71)	2748 (5.49)	2223 (4.44)	25233 (50.44)	15018 (30.02)	3499 (7.00)	6269 (12.53)	24786 (49.56)	50019 (100.00)
2009-10	6157 (19.71)	1961 (6.28)	1833 (5.87)	9951 (31.86)	9239 (29.58)	4085 (13.08)	7963 (25.49)	21287 (68.14)	31238 (100.00)
2010-11	13469 (32.34)	3349 (8.04)	2994 (7.19)	19812 (47.57)	15474 (37.16)	3624 (8.70)	2733 (6.56)	21831 (52.43)	41643 (100.00)
2011-12	16813 (32.52)	3525 (6.82)	3054 (5.91)	23392 (45.24)	17134 (33.14)	4427 (8.56)	6754 (13.06)	28315 (54.76)	51707 (100.00)

Note: Figures in brackets are per centage to total production of pulses

3.4. Profile of Jhansi district of Uttar Pradesh (Bundelkhand Region)

Jhansi belongs to Bundelkhand region of Uttar Pradesh. Bundelkhand region has 7 districts of which Jhansi is more progressive and developed district. The maximum area under pulse crops of U.P. are found in Bundelkhand region than the other regions of the state. Bundelkhand region is called bowl of pulses. About 50.85 % of total production of pulses in Uttar Pradesh is generally contributed by only this region. Since most of area under cultivation of this region are unirrigated, therefore, the impact of green revolution is not so effective in this region. The pulses and oilseeds are still prevalent in cropping pattern. The pulses are grown in almost all 7 districts of this region but Jhansi is largest among the 7 districts of the region.

This district is spread over 5024 sq. km. The total population of this district was 19.99 lakh in 2011 of which male accounted for 52.91% followed by 47.09% of female. The density of population of this district was only 398 per sq. kms. against 828 per sq. kms. of the state as a whole. The district has 8 blocks and 816 villages. The per centage of literacy of total population was 75. The sex ratio was 1 : 0.89 during the same period. Table-3.16.

Table-3.16

Profile of Jhansi district of Bundelkhand region of Uttar Pradesh (2011-12)

1.	Area Sq. Kms.	5024
2.	Total Population	1998603
	(a) Male	1057436 (52.91)
	(b) Female	941167 (47.09)
3.	Density population per sq. km.	398
4.	% of Female population over 1000 male	949
5.	Total villages	816
6.	Total Blocks	8
7.	Per centage of literacy in total population	75

3.4.1. Land utilization of Jhansi district 2011-12

Land utilization of Jhansi district in 2011-12 is analyzed in table-3.17. The table-3.17 shows that out of reporting of 5,01,327 ha. of Jhansi, the area under forest was only 6.87% in 2011-12 while 33.72% was not under cultivation. It shows that 66.28% of reporting area was under cultivation. The cropping intensity was only 154.16%. The per capita availability of land of net area sown was worked out as 0.16 ha. against 0.08 ha. of state as whole. The pressure of population on land was insignificant.

The irrigation intensity was only 105.82% against 144.12% of the state. It shows that most of land of the district is still un-irrigated. (Table-3.17)

Table-3.17
Land utilization in Jhansi district in 2011-12

(Area in hect.)

1.	Reporting area	501327
2.	Area under forests	34421 (6.86)
3.	Net area sown	332279 (66.28)
4.	Area sown more than once	179978
5.	Gross cropped area	512257
6.	Cropping intensity	154.16
7.	Per capita area	0.16

Note: Figures in brackets are per centage to reporting area

3.4.2. Cropping pattern in Jhansi district in 2011-12

The cropping pattern of this district in 2011-12 is presented in table-3.18. Table-3.18 shows that the pulses and wheat were dominant crops in this district in 2011-12. Out of GCA of 5.12 lakh ha. pulse crops accounted for 37.29% followed by 32.92% of wheat. Thus, these two crops jointly accounted for 70% of GCA in 2011-12. Next to these crops, the area under oilseeds was 23.03% to GCA during same period. Rice, maize and other crops occupied only 2.49%, 0.35% and 3.92% to GCA during corresponding period. It shows that pulses wheat and oilseeds were important crops of Jhansi district during 2011-12. This has happened due to less availability of irrigated land in this district.

Table-3.18
Cropping pattern in Jhansi district (2011-12)

(Area in hect.)

Sl. No.	Name of important crops	Area
1.	Rice	12769 (2.49)
2.	Wheat	168628 (32.92)
3.	Maize	1781 (0.35)
4.	Pulses	191016 (37.29)
5.	Oilseeds	117985 (23.03)
6.	Others	20078 (3.92)
	Total Gross Cropped Area	512257 (100.00)

Note: Figures in brackets are per centage to GCA

3.4.3. Area under different pulse crops in Jhansi district

The area under arhar, moong, urd, gram, pea and masoor of Jhansi district are presented Table-3.19. Table-3.19 reveals that urd was important pulse of kharif season, while pea, gram and masoor were main pulse crops of rabi season of the Jhansi district. Out of total area under pulses, rabi pulse crops accounted for 71.24% in 2004-05 against 28.76% of kharif season. Among the six pulses, pea and urd were important pulses of the district. Out of total area under pulses, the area under pea accounted for 43.63% followed by 25.70% of urd in 2004-05. It is also noticed from table-3.19 that area under gram was generally stagnant during the study period. While the area under pea has decreased by 60.76% in 2011-12 from the area of 1.14 lakh ha. in 2004-05. Against this, there was significant increase in area of masoor. The area under masoor was only 26,568 ha. in 2004-05 which has increased to 33,773 ha. in 2011-12 showing 27.12% increase over the period. The area under arhar and moong did not move upward during the study period. The area under these two pulse crops were more or less static during the same period. Overall the area under pulses in the district did not show much expansion from 2004-05 to 2011-12. It is evident from the table-3.19 that the shifting of area within the pulses rather than wheat and rice.

Table-3.19
Area under different Pulse Crops in Jhansi district (2004-05 to 2011-12)

(Area in Hect.)

Years	Arhar	Moong	Urd	Total Kharif	Gram	Pea	Masoor	Total Rabi	Total Pulse Crops
2004-05	2486 (0.95)	5504 (2.10)	67227 (25.70)	75217 (28.76)	45641 (17.45)	114110 (43.63)	26568 (10.16)	186319 (71.24)	261536 (100.00)
2005-06	2448 (1.05)	4965 (2.13)	53158 (22.78)	60571 (25.96)	40049 (17.16)	98684 (42.29)	34040 (15.59)	172773 (74.04)	233344 (100.00)
2006-07	3819 (2.46)	5715 (3.67)	33586 (21.60)	43120 (27.73)	41434 (26.64)	47392 (30.47)	23573 (15.16)	112399 (72.27)	155519 (100.00)
2007-08	830 (0.56)	6201 (4.18)	83126 (56.08)	90157 (60.82)	24090 (16.25)	23191 (15.65)	10791 (7.28)	58072 (39.18)	148229 (100.00)
2008-09	2692 (1.78)	3786 (2.50)	32802 (21.65)	39280 (25.93)	40001 (26.40)	49045 (32.37)	23175 (15.30)	112221 (74.07)	151501 (100.00)
2009-10	2411 (1.09)	6247 (2.82)	71768 (32.35)	80426 (36.25)	40027 (18.04)	49542 (22.33)	51869 (23.38)	141430 (63.75)	221864 (100.00)
2010-11	1907 (1.10)	5162 (2.98)	35906 (2070)	42975 (24.78)	39935 (23.03)	35658 (20.56)	54863 (31.63)	130456 (75.22)	173431 (100.00)
2011-12	1426 (0.75)	5863 (3.07)	54256 (28.40)	61545 (32.22)	50916 (26.66)	44782 (23.44)	33773 (17.68)	129471 (67.78)	191016 (100.00)

Note: Figures in brackets are per centage to total area under pulses

3.4.4. Production of different pulse crops in Jhansi district of Bundelkhand region of U.P.

The production of different pulse crops of Jhansi district is presented in table-3.20. It is witnessed from table that the production of all pulses was 2.41 lakh M. tonnes in 2004-05 which has decreased to 2.02 lakh M. tonnes in 2011-12 showing a drastic shortfall of 16.29% over the period. The production of kharif pulses namely arhar, moong and urd was only 13.01 thousand M. tonnes in 2004-05 against total production of rabi pulses of 22.83 thousand M. tonnes. It shows that the contribution of kharif pulses was only 5.42% to total of 2,41,408 M. tonnes in 2004-05. This type of tendency was also witnessed across the study period. The pea and gram and masoor are important pulses of the district. Out of total production of pulses in 2004-05, the pea accounted for large share being 68.54% followed by 16.19% and 9.09% of gram and masoor respectively. It is also evident from table-3.20 that the production of pea has maintained decreasing trend from 2004-05 to 2011-12, while the production trend of gram was more or less static during same period. Against this the production of masoor has been increasing from 2004-05 to 2011-12 except 2008-09. However, the production of total pulse crops was not so encouraging as it is required. The per capita availability of pulses was 101.12 kg. in 2011-12 against 12 kg. of state as a whole. It is a surplus district of the state as far as production of pulses is concerned.

Table-3.20
Production of different Pulse Crops in Jhansi district (2004-05 to 2011-12)

(M. Tonne)

Years	Arhar	Moong	Urd	Total Kharif	Gram	Pea	Masoor	Total Rabi	Total Pulse Crops
2004-05	1261 (0.52)	741 (0.31)	11093 (4.60)	13095 (5.42)	40908 (16.95)	165460 (68.54)	21945 (9.09)	228313 (94.58)	241408 (100.00)
2005-06	1054 (0.64)	1419 (0.86)	12705 (7.71)	15178 (9.21)	30401 (18.45)	101348 (61.51)	17837 (10.83)	149586 (90.79)	164764 (100.00)
2006-07	1492 (1.45)	1779 (1.33)	14341 (13.91)	17612 (17.09)	27873 (27.03)	45781 (44.40)	11857 (11.50)	85511 (82.92)	103123 (100.00)
2007-08	134 (0.23)	903 (1.47)	10475 (17.10)	11512 (18.80)	15285 (24.96)	29694 (48.49)	4748 (7.75)	49727 (81.20)	61239 (100.00)
2008-09	2362 (1.43)	1096 (0.66)	13745 (8.34)	17203 (10.43)	46371 (28.12)	75529 (45.80)	25794 (15.64)	147694 (89.57)	164897 (100.00)
2009-10	572 (0.35)	484 (0.29)	4956 (2.99)	6012 (3.63)	40863 (24.69)	70944 (42.86)	47719 (28.83)	159525 (96.37)	165537 (100.00)
2010-11	1880 (1.40)	2219 (1.65)	18780 (14.00)	22879 (17.05)	38227 (28.50)	37869 (28.22)	35167 (26.23)	111263 (82.95)	134142 (100.00)
2011-12	1438 (0.72)	2781 (1.37)	31306 (15.49)	35525 (17.58)	65124 (32.23)	71741 (35.50)	29686 (14.69)	166551 (82.42)	202076 (100.00)

Note: Figures in brackets are per centage to total production of pulses

CHAPTER – 4

Socio-economic structure of sample farmers, land utilization pattern, cropping system, area and production of pulses

An attempt has been made in this chapter to analyse the socio-economic structure of sample farmers, land utilization pattern, cropping system, area and production of pulses on the sample farms. Apart from these, the area damaged of pulses due to attack of blue-bulls have also been worked-out in this chapter.

4.1. Socio-economic status of sample farmers

The socio-economic status of sample farmers is presented in Table-4.1. As it has already been described in the first chapter of the report that 160 pulse growers were selected from 4 districts of four regions of Uttar Pradesh in 2014-15 for this study. Out of total 160 sample pulse growers, 51.25% was marginal followed by 26.25% and 22.50% of medium and large pulse growers respectively.

4.1.1. Demographic profile of the sample pulse growers

It is evident from table-4.1 that of the total population of 1314 of 160 sample farmers, 33.03% were males and 28.92% were female. The rest 38.05% were children. It shows that male population was higher by 42.16% over female population of 380. It is also evident from table-4.1 that the female population was less than male population across the size of farms.

4.1.2. Education profile of the Head of the House-holds

The education profile of the head of the house-holds is presented in Table-4.1. Table-4.1 shows that the only 15.00% of head of households were illiterate against this, 19.38% of head households were graduate. It is also evident the from table that among the literate head of households, 14.38% were upto primary level, followed by 17.50% of matric level while 33.74%

households had received upto secondary level education. It shows that 85% of total head of households were educated. Table-4.1 also reflects that the maximum number of illiterate head of households belonged to small sample size of farms. The higher literacy is found among the heads of large size of sample farms followed by heads of medium size of farms.

4.1.3. Caste Composition

The caste composition of sample households is presented in table-4.1. Table-4.1 shows that out of 160 sample households, 41.88% were OBC followed by 41.87% who were of general caste, while only 16.25% of total households were SC. The maximum number SC households being 26.83% belonged to small size of farms followed by 9.52% of OBC. None of SC sample household belonged to large size of farms. It reflects that the majority of sample growers either belonged to OBC or general caste.

4.1.4. Occupation of sample households

The occupation structure of sample households is shown in table-4.1. Table-4.1 shows that agriculture labour and service were main occupations of all sample households. Apart from this, dairy, labour and service were also subsidiary occupations of 81.88% of total households during the study period. It shows that almost all the sample households had adopted subsidiary occupations alongwith their main occupations. This was more witnessed among the small sample size of farms than that of large size of sample farms.

Table-4.1
General Characteristics of Sample House-holds

(2014-2015)

Sl. No.	Particulars	Size of Farms			
		Small	Medium	Large	Overall
1.	Education Status of head of Family (Nos.)				
	Illiterate	18 (21.95)	4 (9.52)	2 (5.56)	24 (15.00)
	Primary	12 (14.63)	6 (14.29)	5 (13.89)	23 (14.38)
	Matric	12 (14.63)	8 (19.05)	8 (22.22)	28 (17.50)

	Secondary	28 (34.15)	12 (28.57)	14 (38.89)	54 (33.74)
	Graduate	12 (14.63)	12 (28.58)	7 (19.44)	31 (19.38)
2.	Average Family Size (No.)				
	Male	191 (32.65)	115 (32.67)	128 (33.95)	434 (33.03)
	Female	166 (28.38)	98 (27.84)	116 (30.77)	380 (28.92)
	Children	228 (38.97)	139 (39.49)	133 (35.28)	500 (38.05)
	Total	585 (100.00)	352 (100.00)	377 (100.00)	1314 (100.00)
3.	Occupation				
	Agriculture + Dairy + Labour	82 (100.00)	42 (100.00)	36 (100.00)	160 (100.00)
	Subsidiary Occupation	73 (89.02)	36 (85.57)	22 (61.00)	131 (81.88)
4.	Gender of Head (Nos.)				
	Male	79 (96.34)	41 (97.62)	36 (100.00)	156 (97.50)
	Female	3 (3.66)	1 (2.38)	--	4 (2.50)
5.	Caste (Nos.)				
	SC/ST	22 (26.83)	4 (9.52)	--	26 (16.25)
	OBC	31 (37.80)	22 (52.38)	14 (38.89)	67 (41.88)
	General	35.37 (35.37)	16 (38.10)	22 (61.11)	67 (41.87)

Note: Figures in brackets are per centage

4.2. Land holding of sample households 2014-15

The average land holding of sample households has been worked-out in table-4.2. The per farm of owned land holding of all sample farms was 2.90 hec. while the per farm owned land holding of small sample households was 1.12 hec. against 2.93 hec. and 6.91 hec. of medium and large sample households respectively. The per farm operational land holding of 160 sample farmers was 2.92 hec. while the per farm operational holding was 1.14hec., 2.96 hec. and 6.95 hec of small, medium and large sample farmers respectively. It shows that the

per farm operational holding was a little bit higher than that of owned land. The almost all area owned land was fully cultivated across the size of sample farms. Table-4.2 also reveals that out of total operated of 467.21 hec. of the all sample farms only 41.78% area was under irrigation while 58.22% area was un-irrigated during the reference period.

It is also evident from table-4.2 that the share of irrigated land to total operated land was maximum being 55.26% on the small size of farms while 39.52% and 37.89% on medium and large size of sample farms respectively. It shows that major portion of operated land was un-irrigated across the sample size of farms. This was due to the reason that pulses were generally grown in un-irrigated land of selected districts.

Table-4.2
Average Land Holding of Sample House-holds (2014-2015)

(Hect.)

Sl. No.	Particulars	Size of Farms			
		Small	Medium	Large	Overall
1.	Owned Land				
	Irrigated	0.62	1.15	2.62	1.21
	Un-irrigated	0.50	1.78	4.29	1.69
	Total	1.12	2.93	6.91	2.90
2.	Un-cultivated Land				
	Irrigated	00	00	00	00
	Un-irrigated	00	0.03	00	0.01
	Total	00	0.03	00	0.01
3.	Leased-in-Land				
	Irrigated	0.01	0.02	0.01	0.01
	Un-irrigated	0.01	0.04	0.02	0.02
	Total	0.02	0.06	0.03	0.03
4.	Leased-out-Land				
	Irrigated	00	00	00	00
	Un-irrigated	00	00	00	00
	Total	00	00	00	00
5.	Total Operated Land				
	Irrigated	0.63	1.17	2.63	1.22
	Un-irrigated	0.51	1.79	4.31	1.70
	Total	1.14	2.96	6.95	2.92

4.3. Cropping pattern on the sample size of farms in 2014-15.

The cropping pattern on the sample size of farms during 2014-15 is presented in table-4.3 that out of 810.19 hect. of GCA of 160 sample farms, the kharif season crops accounted for 51.50% against 47.33% of rabi season crops. Among the kharif season crops, urd, paddy and arhar were important crops which had occupied 14.64%, 12.12% and 8.98% to GCA in reference year respectively. As far as rabi season crops are concerned wheat, gram, pea and masoor were important crops which occupied 20.24%, 14.17%, 4.10% and 7.96% to GCA respectively during 2014-15. Thus the pulses were dominant on the sample farms during the reference year.

It is also evident from table-4.3 that this type of cropping pattern was more or less the same across the different size of sample farms. Paddy, wheat and bajra had also important place in cropping pattern across sample size of farms during 2014-15. The per centage share of oilseeds and potato to GCA were 0.40 and 0.07 at the aggregate level. Table-4.3 also reveals that the few sample farmers of small and medium groups were also grown the summer moong on their farms during the reference year. Apart from pulse crops, the sample farmers of different groups of holdings had devoted the large areas to cereal crops namely wheat, rice, bajra during the reference. It shows that cropping pattern on the sample farms was quite adequate and perfect to fulfill the consumption needs of farmers and improve the fertility of soil.

Table-4.3
Cropping Pattern on sample Farms (2014-2015)

(Area in Hect.)

Sl. No.	Season / Crops	Size of Farms			
		Small	Medium	Large	All
1.	Kharif				
	Paddy	19.47 (11.55)	23.74 (10.82)	55.00 (13.03)	98.21 (12.12)
	Maize	00	00	00	00
	Bajra	9.15 (5.43)	9.95 (4.54)	11.55 (2.74)	30.65 (3.78)
	Jowar	8.25 (4.89)	4.68 (2.13)	13.25 (3.14)	26.18 (3.23)
	Sugercane	00	00	00	00
	Ground nut	00	00	00	00
	Soyabean	00	00	00	00
	Arhar	15.75 (9.34)	18.08 (8.24)	38.90 (9.21)	72.73 (8.98)

	Urd	29.67 (17.60)	33.95 (15.48)	55.00 (13.02)	118.62 (14.64)
	Moong	0.50 (0.30)	2.50 (1.14)	13.00 (3.08)	16.00 (1.98)
	Others	7.50 (4.45)	20.72 (9.45)	26.60 (6.30)	54.83 (6.77)
	Total Kharif Crops	90.29 (53.85)	113.62 (51.80)	213.30 (50.52)	417.21 (51.50)
2.	Rabi				
	Wheat	38.01 (22.55)	43.81 (19.97)	82.20 (19.47)	164.02 (20.24)
	Barley	1.00 (0.60)	00	2.00 (0.47)	3.00 (0.37)
	Gram	18.25 (10.83)	30.33 (13.83)	66.25 (15.69)	114.83 (14.17)
	Pea	3.75 (2.22)	9.00 (4.10)	20.50 (4.85)	33.25 (4.10)
	Masoor	12.83 (7.61)	18.75 (8.55)	32.95 (7.80)	64.53 (7.96)
	Oilseeds (Mustard etc.)	0.75 (0.44)	00	2.50 (0.59)	3.25 (0.40)
	Potato	00	0.60 (0.27)	00	0.60 (0.07)
	Vegetable	00	00	00	00
	Barseem	00	00	00	00
	Others	00	00	00	00
	Total Rabi Crops	74.59 (44.25)	102.49 (46.72)	206.40 (48.89)	383.48 (47.33)
3.	Summer				
	Maize	00	00	00	00
	Bajra	00	00	00	00
	Moong	0.50 (0.29)	2.00 (0.91)	00	2.50 (0.32)
	Others	1.70 (1.01)	1.25 (0.57)	2.55 (0.60)	5.50 (0.68)
	Zaid Crops	1.50 (0.89)	00	00	1.50 (0.19)
	Total zaid crops	3.70 (2.19)	3.25 (1.48)	2.55 (0.60)	9.50 (1.17)
	GCA	168.58 (100.00)	219.36 (100.00)	422.25 (100.00)	810.19 (100.00)

Note: Figures in bracket are per centage to GCA

4.4. Season-wise Area under pulses on the sample farms 2014-15

The per centage shares of area under pulses on the sample farms to GCA during reference year are presented in table-4.4. Table-4.4 reveals that the out of GCA at aggregated level, urd and gram accounted for 14.64% and 14.17% respectively. Next to these two crops arhar, masoor, pea and moong were also important pulses on the sample farms which occupied 8.98%, 7.96%, 4.10% and 2.28% to GCA during reference period respectively. Table-4.4 also reveals that rabi pulses accounted for 26.24% to GCA against 25.90% of kharif pulses, which was slight higher by 0.34% over kharif pulses during 2014-15. The zaid pulses accounted for only nominal share to GCA on the sample farms during the same period. This type of allocation of area under pulses were also witnessed across the sample size of farms.

Table-4.4
Season wise Area under Pulses on the sample farms (2014-15)

(Area in Hect.)

Name of pulse crops	Size of farms			
	Small	Medium	Large	All
Arhar	15.75 (9.34)	18.08 (8.24)	38.90 (9.21)	72.73 (8.98)
Urd	29.67 (17.60)	33.95 (15.48)	55.00 (13.02)	118.62 (14.64)
Moong	1.00 (0.59)	4.50 (2.05)	13.00 (3.08)	18.50 (2.28)
Kharif and Zaid season Pulses	46.42 (27.54)	56.53 (25.77)	106.90 (25.31)	209.85 (25.90)
Gram	18.25 (10.83)	30.33 (13.83)	66.25 (15.69)	114.83 (14.17)
Pea	3.75 (2.22)	9.00 (4.10)	20.50 (4.85)	33.25 (4.10)
Masoor	12.83 (7.61)	18.75 (8.55)	32.95 (7.80)	64.53 (7.96)
Rabi season Pulses	34.83 (20.65)	58.08 (26.48)	119.70 (28.35)	212.61 (26.24)
Total pulses	81.25 (48.19)	114.61 (52.25)	226.60 (53.65)	422.46 (52.17)
GCA	168.58 (100.00)	219.36 (100.00)	422.25 (100.00)	810.19 (100.00)

Note: Figures in brackets are per centage to GCA

5.5. Area under different pulse crops on the sample farms in reference year.

The area under different pulse crops on different categories of sample farms have been worked-out in table-4.5. Table-4.5 shows that urd gram, arhar and masoor were important pulse crops across the different categories of sample farms during reference year. Out of total area under pulses on the small size of farms, urd occupied maximum share of 36.52% followed by 22.46%, 19.38% and 15.79% of gram, arhar and masoor respectively, while pea and moong accounted for only 4.62% and 1.23% of total area under pulses on the small sample farms. In case of medium size of sample farms, urd and gram were dominant pulses which occupied 29.62% and 26.46% to total under pulse crops respectively. Next to these two pulses, arhar, masoor were also important pulses on medium size of sample farms. As far as large categories of sample farms is concerned, gram was dominant pulse followed by urd. The arhar and masoor also occupied 17.17% and 14.53% of total area under pulses during same period respectively. The above analysis shows that urd, gram, arhar and masoor were important pulse crops across the sample size of farms. The pea and moong were not so important as compared to urd and gram. It shows that urd and arhar of kharif season and gram and masoor of rabi season were much preferred by the sample farmers of 4 selected districts of 4 regions of U.P. during the reference year.

Table-4.5
Area under different pulse crops on the sample farms (2014-15)

(Area in Hect.)

Name of pulse crops	Size of farms			
	Small	Medium	Large	All
Arhar	15.75 (19.38)	18.08 (15.78)	38.90 (17.17)	72.73 (17.22)
Urd	29.67 (36.52)	33.95 (29.62)	55.00 (24.27)	118.62 (28.08)
Moong	1.00 (1.23)	4.50 (3.93)	13.00 (5.74)	18.50 (4.38)
Gram	18.25 (22.46)	30.33 (26.46)	66.25 (29.24)	114.83 (27.18)
Pea	3.75 (4.62)	9.00 (7.85)	20.50 (9.05)	33.25 (7.87)
Masoor	12.83 (15.79)	18.75 (16.36)	32.95 (14.53)	64.53 (15.27)
Total area pulse crops	81.25 (100.00)	114.61 (100.00)	226.60 (100.00)	422.46 (100.00)

Note: Figures in brackets are per centage to total area under pulses

5.6. Allocation of area under pulse crops according to the sample size of farms during the reference year 2014-15

The per centage allocations of area under different pulses namely arhar, urd, moong, gram, pea and masoor to total areas under pulses have been worked-out in table-4.5A. Out of total area under pulses of 422.46 hectes of 160 sample farms, urd, gram and arhar accounted for 28.08%, 27.18% and 17.22% respectively during the reference year. Thus, these three pulses viz urd, gram and arhar jointly accounted for 72.48% of total area under pulses on the sample farms. The masoor, pea and moong accounted for 15.27%, 7.87% and 4.38% of total area under pulses on the sample farms during the same period. As far as, allocation of area under pulse crops in different sample size of farms is concerned, Table-4.5A reveals that out of total area under arhar on the all the sample farms being 72.73 ha. the area under arhar was maximum being 53.48% on large farms followed by 24.86% and 21.66% on medium and small farms respectively. It shows that per centage share of area under arhar increases with increase in the size of farms. Of the total area under urd, the per centage share was maximum being 46.37% on large farms followed by 28.62% and 25.01% on medium and small size of farms respectively. More or less the same per centage share of other pulses are witnessed across the size of farms. Out of total area under pulses on the all the sample farms, share of area under pulses was maximum being 53.64% on large farms followed by 27.13% and 19.23% on medium and small sample farms respectively in the reference year.

Table-4.5A
Area under different pulse crops on the sample farms (2014-15)

(in Hect.)

Name of pulse crops	Size of farms			Total area under pulses
	Small	Medium	Large	
Arhar	15.75 (21.66)	18.08 (24.86)	38.90 (53.48)	72.73 (100.00)
Urd	29.67 (25.01)	33.95 (28.62)	55.00 (46.37)	118.62 (100.00)
Moong	1.00 (18.25)	4.50 (24.33)	13.00 (70.27)	18.50 (100.00)
Gram	18.25 (15.89)	30.33 (26.41)	66.25 (57.70)	114.83 (100.00)
Pea	3.75 (11.28)	9.00 (27.07)	20.50 (61.65)	33.25 (100.00)
Masoor	12.83 (19.88)	18.75 (29.06)	32.95 (51.06)	64.53 (100.00)
Total area pulse crops	81.25 (19.23)	114.61 (27.13)	226.60 (53.64)	422.46 (100.00)

Note: Figures in brackets are per centage to total area under pulses

4.7. Production of different pulse crops on the sample farms (2014-15)

The reference year (2014-15) was not favourable for pulse crops. The severe drought was also experienced in this year. On account of this, the production of pulses was highly affected across the state. Apart from this, the more than 50% of total sown areas of six pulses on the 160 sample farms of 4 districts of 4 regions were also damaged by blue-bulls in 2014-15. Hence, the production of pulses on the sample farms was much below than the normal production of the state during the reference year.

The per hectare production of six pulse crops has been estimated in table-4.6. The per hectare production of arhar at the aggregate level was only 2.06 qtls which ranged between 1.99 qtls and 2.17 qtls on large and medium size of sample farms respectively. The per hectare yield of arhar was 9.01 qtls in the state in 2011-12 against per hect yield of 2.06 qtls on the sample farms. It shows that per hect yield of arhar was 6.95 qtls less than the average yield of state. The short fall in the yield of arhar on sample farms was mainly due to attack of blue-bulls on arhar crop. More than 60% of area under arhar on the sample farms was damaged by blue-bulls. On account of this, the average yield has declined on the sample farms.

The urd is major pulse of kharif season. The per hectare yield of urd at the aggregate level was worked-out to be 3.27 qtls which ranged between 2.58 qtls and 4.97 qtls on large and small size of farms respectively. The average yield per hect decreases with the increase in size of farms. The per hectare yield of urd was 6.35 qtls in U.P. in 2011-12, while it was only 3.27 qtls on the sample farms. It shows that per hect. yield of urd on the sample farms was less than about 50% from the per hect yield of urd of Uttar Pradesh. This was due to 41.95% area of urd on the sample farms was damaged by blue-bulls during reference year.

Moong is a very un-predictive pulse crop. It is sown in summer as well as in kharif seasons. The farmers do not pay adequate attention in this cultivation. Table-4.6 reveals that per hect yield of moong was 2.37 qtls which ranged between 1.68qtls and 4.49 qtls on large and medium size of sample farms respectively. Out of total area under moong on the sample farms, only 28.38% was

damaged by the blue-bulls. The per hect yield of moong in U.P. was 4.29 qtls in 2011-12 while it was only 2.37 qtls on the sample farms. It was less than about 1.92 qtls from the per hect yield of state. The cause of better yield of moong on the sample farms was due to less frequent attack of blue-bulls on this crop.

Gram is an important pulse in Uttar Pradesh. More than 24 per cent of total area under pulses of Uttar Pradesh was occupied by gram alone. It is mostly sown in Bundelkhand region of Uttar Pradesh. The per hect. yield of gram on the sample farms is worked-out in table-4.6. It is evident from table that on an overall, the per hect. yield of gram in the sample farms was only 2.48 qtls against 11.12 qtls per hect yield of the state. The per hect yield of gram ranged between 2.30 qtls and 2.95 qtls across the sample size of farms. The per hect yield of gram was more or less equal on small and large size of sample farms. Out of total area under gram on the sample farms, 62.38% area was damaged by blue-bulls. On account of this, per hect yield of gram on the sample farms was much less from it's the normal production during reference year. There was severe attack of blue-bulls on gram on the sample farms during reference year. This was a main cause of low yield of gram on the sample farms.

Pea is also an important rabi pulse. It is generally sown across the state. It is very tender pulse and more susceptible to pests/insects and diseases. It requires much water than the gram and masoor. It is sown only in irrigated land. The per hect yield of pea on the sample farms is worked-out in table-4.6. It is evident from table-4.6 that the per hect yield of pea on sample farms was only 3.41 qtls against 14.31 qtls of the state as a whole in 2011-12. It shows that per hect. yield was much below on sample farms than that of state as a whole. The per hect. yield of pea was maximum being 5.07 qtls on small farms followed by 3.86 qtls and 2.91 qtls on medium and large size sample farms respectively. Thus per ha. yield decreases with increase in size of farms. The cause of low yield per hect of pea on the sample farms was due to severe attack of blue-bulls on pea crop during reference year. About 50% of total area under pea on sample farms was destroyed by blue-bulls in reference year. The drought also occurred during 2014-15. Therefore, there was sharp down fall in the production of pea on the sample farms in 2014-15.

Masoor is most important rabi pulse. It is generally grown in un-irrigated belts of Uttar Pradesh. Bundelkhand and Eastern regions of Uttar Pradesh are much suitable areas for its proper cultivation. It is used as DAL and Namkin across the state. It is also sent to other states of the country for the preparation of Namkin. The per hect yield of masoor is estimated in table-4.6. Table-4.6 shows that on an overall per hect yield of masoor was 3.23 qtls which ranged between 2.79 qtls and 4.62 qtls on large and small size of sample farms respectively. The per hect yield of masoor also decreases with increase in size of farms.

The per hect. yield of masoor was 8.94 qtls. in U.P. in 2014-15 while it was 3.23 qtls on the sample size of farm. It shows that there was huge gap between the per hect yield of masoor on the sample farms than that of state as a whole. About 45% of total area under masoor on the sample farms was damaged by blue-bulls in the reference year. On account of this, there was a sharp down fall in the production of masoor on the sample farms in reference year.

Table-4.6
Production of different Pulse Crops on the Sample farms (2014-2015)

(Qty. in Qtls.)

Sl. No.	Pulse Crops	Size of Farms			
		Small	Medium	Large	Overall
1.	Arhar	33.35 (2.12)	39.19 (2.17)	77.40 (1.99)	149.94 (2.06)
2.	Urd	147.45 (4.97)	98.20 (2.89)	141.85 (2.58)	387.50 (3.27)
3.	Moong	1.80 (1.80)	20.20 (4.49)	21.80 (1.68)	43.80 (2.37)
4.	Gram	42.00 (2.30)	89.52 (2.95)	153.58 (2.32)	285.10 (2.48)
5.	Pea	19.00 (5.07)	34.75 (3.86)	59.69 (2.91)	113.44 (3.41)
6.	Masoor	57.25 (4.62)	59.30 (3.16)	91.84 (2.79)	208.39 (3.23)
	Total	300.85 (3.70)	341.16 (2.98)	546.16 (2.41)	1188.17 (2.81)

Note: Figures in brackets are production per hectare/ctl.

The above analysis reflects that more than 50% production of pulse crops on the sample farms were damaged by blue-bulls during the reference year. The drought also occurred in most part of

the state in 2014-15 which was responsible for decreasing the production of pulses on the sample farms. The attack of blue-bulls on the pulse crops across the state is serious problems for pulse growers at present scenario.

4.8. Area of pulse crops damaged by Blue-Bulls on the sample farms during 2014-15.

The blue-bulls are the curse of pulses. On account of this, the farmers are desponding to allocate adequate area under pulses. If the attack of blue-bulls on pulse crops are continuing at present intensity, the farmers will give-up the pulses on their farms in years to come. The pulses are very risky crops because the frequent attack of pest/insect, diseases, occurrence of drought/floods and hailstorm etc. are major hurdles in way of proper cultivation of pulse crops in U.P. Apart from above constraints, the attack of blue-bulls are also responsible to degrade the moral of farmers. On account of these major problems, huge quantity of production of pulses goes down in very year. A number of schemes for the development of pulses have been started from time to time by central as well as state governments but the desired result could not be achieved till day. There is a huge gap between demand and production of pulses. The production of pulses is insufficient to meet the consumption demand of ever growing population of the country. The major reason of low production of pulses in U.P. is also attack of blue-bulls to pulses. The pulse-wise areas damaged by blue-bulls on sample farms have been worked-out in table-4.7.

Table-4.7 shows that the small sample farmers had devoted 81.25 hecta areas to all pulse crops during the reference year of which 55.63% was damaged by the blue-bulls. The maximum area being 73.02% of arhar followed by 61.02% of gram to sown area on small sample farms were destroyed by blue-bulls. Out of total area under urd, 47.92% was damaged by blue-bulls. The damaged areas of pea, masoor and moong by blue-bulls were 57.07%, 45.91% and 30.00% to its sown areas on the small sample farms respectively during the reference year. Thus almost all the pulse crops on the small sample farms were destroyed by blue-bulls during the reference year. Arhar and gram were much more targeted by blue-bulls in comparison to the other pulse crops.

Table-4.7 also reveals that out of total area under six pulse crops on the medium sample size of farms, 60.01% was damaged by blue-bulls. The maximum area being 92.58% and 68.81% of

gram and arhar were damaged by blue-bulls respectively. Out of sown area of masoor and pea on medium sample size farms, 58.08% and 46.56% were destroyed by blue-bulls respectively. Moong and urd were also damaged by blue-bulls during 2014-15. It shows that all pulse crops on the medium sample size of farms were damaged by blue-bulls. The arhar and gram were much preferred by blue-bulls as compared to moong and urd.

The large sample farmers had devoted 226.60 hectares area under pulse crops during reference year of which 45.53% was damaged by blue-bulls. Out of total damaged area of six pulse crops on the large size of sample farms, arhar accounted for maximum share being 54.04% followed by 48.91%, 48.80% and 47.41% of gram, pea and masoor respectively. While the area of urd and moong destroyed were 37.20% and 28.89% by blue-bulls during the same period. The analysis shows that attack of blue-bulls was generally done on arhar, gram, pea and masoor. The moong and urd were not much targeted by blue-bulls as compared to arhar. It is also witnessed from table that on an overall the gram and arhar were much damaged by blue-bulls during reference year. Next to these crops, pea and masoor were next choice of blue-bulls. The moong and urd were not much preferred by blue bulls. Out of total area under pulse crops on 160 sample farms 51.40% was destroyed by blue-bulls in reference year. This a very serious problems for the better growth of pulse crops in pulse growing belts of Uttar Pradesh. There is a need to protect the pulses from attack of blue-bulls by use of effective preventive measures.

Table-4.7
Area of pulse crops damaged by blue-bulls on sample Farms

(Area in Hect.)

Size of Holdings	Pulse crops											
	Arhar			Moong			Urd			Total Kharif		
	Area sown	Damaged area	% of damaged area to sown area	Area sown	Damaged area	% of damaged area to sown area	Area sown	Damaged area	% of damaged area to sown area	Area sown	Damaged area	% of damaged area to sown area
Small	15.75	11.50	73.02	1.00	0.30	30.00	29.67	14.22	47.93	46.42	26.02	56.05
Medium	18.08	12.44	68.81	4.50	1.30	28.89	33.95	15.08	44.42	56.53	28.82	50.98
Large	38.90	21.02	54.04	13.00	3.65	28.08	55.00	20.46	37.20	106.90	45.13	42.22
All	72.73	44.96	61.82	18.50	5.25	28.38	118.62	49.76	41.95	209.85	99.97	47.64

(Area in Hect.)

Size of Holdings	Pulse crops														
	Gram			Pea			Masoor			Total Rabi			All Pulse Crop		
	Area sown	Damaged area	% of damaged area to sown area	Area sown	Damaged area	% of damaged area to sown area	Area sown	Damaged area	% of damaged area to sown area	Area sown	Damaged area	% of damaged area to sown area	Area sown	Damaged area	% of damaged area to sown area
Small	18.25	11.15	61.02	3.75	2.14	57.07	12.83	5.89	45.91	34.83	19.18	55.06	81.25	45.20	55.63
Medium	30.33	28.08	92.58	9.00	4.19	46.56	18.75	7.69	41.01	58.08	39.96	68.80	114.61	68.78	60.01
Large	66.25	32.40	48.91	20.50	10.02	48.87	32.95	15.62	47.41	119.70	58.04	48.48	226.60	103.17	45.53
All	114.83	71.63	62.38	33.25	16.35	49.17	64.53	29.20	45.25	212.61	117.18	55.11	422.46	217.15	51.40

CHAPTER – 5

Adoption of Preventive Measures to reduce the attack of blue-bulls to pulses and reasons for shifting the area under pulses to its competing crops.

An attempt has been in this chapter to know the adoption of preventive measures to reduce the attack of blue-bulls to pulses on the sample farms of the study areas during the reference year. Besides this, the reasons of shifting of area under pulses to other competing crops have also been analyzed in this chapter.

5.1. Adoption of preventive measures to reduce the attack of blue-bulls to pulses on the sample farms during reference year 2014-15.

The analysis has been done according to crop-wise and size of farms to get real output of different preventive measures.

5.1.1. Preventive measures adopted by small sample farmers.

The pulses growers had done their best efforts to save their crops from attack of blue-bulls to adopt the different type of preventive measures which are shown in table-5.1.

It is evident from table-5.1 that the small sample farmers had adopted all the preventive measures in arhar crop. Most of area under arhar on the small sample farms was covered under preventive measure to save from the attack of blue-bulls. On account of this, about 40% of total production of arhar had been saved by small sample farmers, while 60% of total production of arhar on small sample farms had been destroyed by the blue-bulls.

Among the 8 preventive measures adopted by the small sample farmers on arhar crop, the use of crackers was more effective than other adopted measures. Next to this ringing bells and use of

dogs etc. were also effective measures to runaway the blue-bulls from the area of arhar crop. (Table-5.1)

As far as moong crop is concerned, table-5.1 shows that the effigy and crackers were also used by small sample farmers during the attack of blue-bulls. On account of this, about 26% of total production of moong was saved while 74% of total production of moong was destroyed by blue-bulls. It shows that two adopted measures were not so fruit-full to control the attack of blue-bulls.

In case of urd, table-5.1 shows that almost all area under urd on the small sample farms were protected from attack of blue-bulls. Among adopted preventive measures, the ringing bells, louding etc. were maximum used by small sample farmers during the attack of blue-bulls to urd crop. The crackers and effigy were also adopted by small sample farmers to control the attack of blue-bulls to urd crop. The preventive measures were found much effective because about 74% of total production of urd on the sample farmers was saved. It shows that only 24% of total production of urd on the small sample farms had been destroyed by blue-bulls during reference year.

Gram is a most important pulse crop on the sample farms during the reference year. The attack of blue-bulls to this crop was performed during mid night. Out of total area under gram on the sample farms, 83.83% was protected from the attack of blue-bulls to use different preventive measures table-5.1 reveals that the ringing of bells, louding, use of crackers and sticks etc. were adopted by small sample farmers during attack of blue-bulls to gram. On account of these preventive measures, about 84% of total production of gram on the sample farms was saved. The small sample farmers had also used other preventive measure to reduce the losses but they were not so effective to control the infestation of blue-bulls on gram crop.

Pea is also an important pulse crop on the small sample farms. Out of total area under pea being 3.75 hec, 3.25 hec (86.67%) was protected by use of different preventive measures. Among preventive measures, the ringing bells, use of crackers and effigy had been performed during the attack of blue-bulls to pea crop. On account of use of these preventive measures about 54.50% of

Table-5.1

Measures Adopted by Small sample Pulse Growers in Reducing the Losses by Blue-Bulls (2014-2015)

Measures Adopted	Pulse Crops											
	Arhar		Moong		Urd		Gram		Pea		Masoor	
	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced
Use of dung/ Neem solution	8.75	0.80	00	00	11.70	10.22	4.65	9.17	2.00	10.00	2.85	10.00
Use of chemical Methods	00	00	00	00	0.95	6.50	00	00	00	00	00	00
Use of effigy	10.25	7.08	0.50	13.50	15.50	15.00	7.45	11.73	2.50	9.00	8.10	00
Wiring iron / plastic	00	00	00	00	2.00	00	00	00	00	00	1.25	00
Use of cracker	15.25	13.63	0.50	12.50	20.60	19.10	14.50	18.13	3.00	14.33	7.70	21.65
Use of sticks / thrown stones	11.25	7.32	00	00	12.85	10.80	14.50	13.36	3.25	7.50	3.45	12.22
Use of gun	00	00	00	00	1.12	12.00	1.00	10.00	00	00	00	00
Ringing bell/ louding/ dogs / shining tapes	13.75	10.87	00	00	28.72	00	15.30	21.36	3.25	13.67	11.50	20.00
Total		39.70	1.00	26.00		73.62		83.75		54.50		63.87

total production of pea on small sample farms had been saved by the small sample farmers during reference year.

The area under masoor was 12.83 hec on the small sample farms during the reference year of which 89.63% area was covered under preventive measures. Among these preventive measures, the maximum area being 11.50 hec was protected by using the ringing bells followed by 8.10 hec to erect the effigy in masoor crop. The small sample farmers had saved the losses of 63.87% of total production of masoor on their farms during reference year.

5.1.2. Preventive measures adopted by medium sample farmers

The details of preventive measures adopted to check the attack of blue-bulls for reducing the losses in production of pulses on medium sample farms in reference year are worked-out in table-5.2. It is evident from the table-5.2 that 8 preventive measures had been applied to control the attack of blue-bulls on different pulses by the medium sample farmers during the reference year. Among all these preventive measures, the use of ringing bells, louding, shining the tapes were found more effective preventive measures to control the attack of blue-bulls to arhar crop on the medium sample farms. The selected medium sample farmers had also used the crackers at the time of attack of blue-bulls on arhar crop but it was not so effective to check the infestation of blue-bulls. Almost all the area under arhar was covered under preventive measures to check the infestation of blue-bulls. On account of these preventive measures, 76.90% of total production of arhar on the sample farms had been saved while 23.10% of total production of arhar had been destroyed by blue-bulls.

Table-5.2 also reveals that the medium sample farmers had saved 46.00% of total production of moong to use the preventive measures against the blue-bulls. The use of sticks, effigy and ringing bells were used by the medium sample farmers to run-away the blue-bulls from the field of moong.

In case of urd table-5.2 shows that 97.05% of total area under urd had been protected by different preventive measures. The maximum area under urd was controlled by use of ringing bells followed by use of crackers.

Table-5.2

Measures Adopted by Medium sample Pulse Growers in Reducing the Losses by Blue-Bulls (2014-2015)

Measures Adopted	Pulse Crops											
	Arhar		Moong		Urd		Gram		Pea		Masoor	
	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced
Use of dung/ Neem solution	11.00	5.91	1.00	10.00	13.25	7.92	13.15	7.00	0	00	2.00	10.00
Use of chemical Methods	1.00	10.00	00	00	00	00	1.00	10.00	00	00	00	00
Use of effigy	11.50	7.39	1.00	12.00	15.25	7.87	15.83	9.29	00	00	9.00	10.00
Wiring iron / plastic	1.00	20.00	00	00	8.00	12.50	2.50	24.00	4.00	16.25	5.50	19.90
Use of cracker	18.08	13.89	1.00	12.00	30.95	14.31	27.83	14.77	6.50	14.31	15.25	16.66
Use of sticks / thrown stones	12.00	7.08	1.00	12.00	24.25	6.23	17.15	8.34	1.50	13.33	3.75	10.67
Use of gun	00	00	00	00	00	00	00	00	00	00	00	00
Ringing bell/ louding / dogs / shining tapes	18.08	11.63	2.55	00	32.95	13.63	27.33	19.32	8.50	27.29	18.60	8.79
Total		76.90		46.00		62.46		92.72		71.18		76.02

It is witnessed from table-5.2 that 62.46% of total production of urd had been saved by sample farmers to use the preventive measures against the attack of blue-bulls.

The total area under gram on medium sample farms was 30.33 hec in reference year of which 91.76% was protected by different preventive measures. The sample farmers had used the crackers, sticks, ringing bells during the attack of blue bulls to gram crop. Apart from these, the sample farmers had also used dung, neem solution, chemical solution and effigy to save the crop from attack of blue-bulls. Some of the sample farmers had also barricaded the area of gram by use of wire etc. On account of this, 92.72% of total production gram on the sample farms had been saved. (Table-5.2)

The pea is first choice for blue-bulls. The blue-bulls like pea much more than other pulses. The medium sample farmers had devoted only 9.00 hec land to this crop of which 94.44% were saved by use of ringing bells. It is evident from table-5.2 that 71.18 of production of pea had been saved from attack of blue-bulls. Some of the sample farmers had also used the iron wire to protect the blue-bulls. The area under masoor on the medium sample farms was 18.75 hec of which 99.20% was protected by different protective measures. It is evident from table-5.2 that about 76.02% of total production of masoor on the sample farms had been saved by use of different preventive measures.

5.1.3. Preventive measures adopted by large sample farmers.

The preventive measures adopted by large sample farmers to reduce the losses of pulses by blue-bulls are presented in table-5.3. It is evident from table-5.3 that large sample farmers had used all the preventive measures to check infestation of blue-bulls. The total area under arhar had been protected from attack of blue-bulls. On account of this, about 27% of total production of arhar had been saved by large sample farmers. Among adopted preventive measures, iron wiring around the field of arhar was found more effective than other protective measures.

The area under moong on large sample farms was 13.00 hec of which 83.08% was protected. On account of this, 34.60% of total production of moong had been saved. As far as urd is

concerned, Table-5.3 shows that all the area under urd was protected by different preventive measures. The large sample farmers had used the ringing bells, crackers, broad casting dung/neem solution etc. to check the infestation of blue-bulls to urd crop. These preventive measures had saved 35.45% of total production of urd on the large sample farms.

The area under gram was 66.65 hecta on the large sample farms of which 95.85% was protected by different preventive measures. Almost all preventive measures had been used to control the attack of blue-bulls. The biological and chemical methods were also used. Apart from these, ringing bells, use of crackers and sticks had been used by large sample farmers at the time of attack of blue-bulls to the gram crop. In spite of these applied preventive measures, only 46.46% of total production of gram was saved. More than 53.54% of total production of gram had been destroyed by blue-bulls.

The large sample farmers had protected their pea crop from attack of blue-bulls. Table-5.3 reveals that only 23.85% of total production of pea had been saved from attack of blue-bulls. It shows that 76.15% of total production of pea on large farms had been destroyed by blue-bulls in reference year. Most of applied preventive measures were not found so effective to control the attack of blue-bulls to pea crop.

The table-5.3 also shows that the 88.77% of total area under masoor on large sample farms had been protected by use of different preventive measures to check the infestation of blue-bulls to masoor crop. Among the different measures, the large sample farmers had used the crackers and ringing bells etc. at the time of attack of blue-bulls to masoor crop.

It is also witnessed from table-5.3 that the out of total area under masoor, 3 hectares were protected by iron wire. The result was very fruitful because 54.16% of total production of masoor had been saved by large farmers to use the preventive measures.

The attack of blue-bulls is generally performed in the mid night. The blue-bulls are found in a group, a group of blue-bulls between 10 to 20 in numbers. They are physically very strong and also very fearless. To prevent the attack of blue-bulls is very dangerous activity. Even than

Table-5.3

Measures Adopted by Large sample Pulse Growers in Reducing the Losses by Blue-Bulls (2014-2015)

Measures Adopted	Pulse Crops											
	Arhar		Moong		Urd		Gram		Pea		Masoor	
	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced	Area covered (Hect.)	% of losses reduced
Use of dung/ Neem solution	20.40	3.33	8.00	6.50	23.00	4.57	17.00	4.42	2.00	3.50	8.00	5.00
Use of chemical Methods	00	00	00	00	00	00	00	00	00	00	00	00
Use of effigy	28.90	3.36	10.00	6.20	32.10	5.17	34.00	4.47	9.00	6.85	14.00	5.86
Wiring iron / plastic	00	00	00	00	00	00	2.00	12.50	00	00	3.00	11.67
Use of cracker	38.90	5.89	10.00	7.50	32.95	8.71	63.50	9.10	10.02	2.65	29.25	13.16
Use of sticks / thrown stones	23.75	5.48	10.00	7.20	32.95	6.68	38.50	5.12	9.55	5.69	17.50	6.00
Use of gun	00	00	00	00	00	00	00	00	00	00	00	00
Ringing bell/ louding / dogs / shining tapes	30.75	4.90	10.80	7.20	32.95	10.32	60.25	10.85	10.02	5.16	28.95	12.47
Total		26.96		34.60		35.45		46.46		23.85		54.16

farmers do their best efforts to save their crops from attack of blue-bulls. The farmers have been facing a number of problems in checking the infestation of blue-bulls. The farmers have no proper woolen cloths, good quality torch, modern weapons etc. to face the blue-bulls. Apart from these, the poor financial position of farmers do not permit them to purchase better quality of crackers etc. to control the infestation of blue-bulls. In spite of these constraints, the production losses have been saved in different crops by sample farmers by the use of various preventive measures.

It is evident from table-5.4 that maximum losses occurred in moong followed by arhar. The losses reduced in production of moong was only 35.53% followed by 47.52% in arhar. The preventive measures were found more effective in gram, masoor and urd crops. The sample farmers had saved 74.30%, 64.88% and 57.18% of total production of gram, masoor and urd respectively to the use of effective preventive measures.

Table-5.4

Reduction of Per cent Losses of Production of Different Pulses According to Size of Farms

Name of Crops	Reduction of Per cent Losses of Production of Different Pulses According to Size of Farms			
	Small	Medium	Large	Average
Arhar	39.70	75.90	26.96	47.52
Moong	26.00	46.00	34.60	35.53
Urd	73.62	62.46	35.45	57.18
Gram	83.75	92.72	46.46	74.30
Pea	54.50	71.18	23.85	49.84
Masoor	63.87	76.02	54.16	64.68

However, the production of pea had been saved by 49.84% by the use of preventive measures. It is also evident from table that small and medium sample farmers had better capacity to control the attack of blue-bulls than large sample farmers. The losses of pulses could be reduced to a great extent by controlling the attack of blue-bulls by the use of better scientific approach. Hence, the physical and financial helps should be provided to pulse growers to face the blue-bulls in a better way during the attack to pulse crops.

5.2. Source of knowledge about the reduction in the attack of blue-bulls to the pulse crops on the sample farms.

Most of farmers are innocent, less educated and are not acquainted with outside activities. They devote their total energy to perform agricultural activities to get better returns from their crops. At present, the presence of huge number of blue-bulls in rural areas are greater headache for farmers. About 50% of area under pulses on the sample farms during the reference had been damaged by blue-bulls alone. The farmers had tried their best to protect their pulse crops from the attack of blue-bulls but they failed to save the losses in production of pulses because of lack of proper guidance and knowledge. The source of knowledge about the reduction in the attack of blue-bulls on the sample farms are presented in table-5.5. It is evident from table-5.5 that neighbour and friends were main sources of knowledge about the reduction in the attack of blue-bulls to the pulse crops. The extension agencies, forest department, etc. did not disseminate any fruitful ideas to pulse growers for protecting the attack of blue-bulls on pulse crops. However, agriculture department and officers of NFSM had given ideas to sample farmer to reduce the attack by blue-bulls on the pulses crops. The sample farmers had applied some of preventive measures to reduce the losses of pulse crops on their farmers.

Table-5.5
Source of Knowledge about reducing the Attack by Blue-Bulls to Pulse Crops on the sample farms (2014-2015)

Size of Farms	Sources (Number)							
	Extension Agents	Neighbour	Friends	News Papers	Forest Department	Agriculture Department/ NFSM	Others	All
Small	2 (1.45)	52 (37.68)	42 (30.43)	4 (2.90)	2 (1.44)	28 (20.29)	8 (5.81)	138 (100.00)
Medium	5 (5.81)	28 (32.56)	26 (30.23)	5 (5.81)	4 (4.65)	16 (18.60)	2 (2.34)	86 (100.00)
Large	00	25 (40.98)	18 (29.51)	1 (1.64)	00	17 (27.87)	00	61 (100.00)
Total	7 (2.46)	105 (36.84)	86 (30.18)	10 (3.50)	6 (2.10)	61 (21.40)	10 (3.52)	285 (100.00)

Note: Figures in brackets are per centage to all

5.3. Various Reasons for Shifting Area under Pulse Crops to other Crops on the Sample Farms.

Since the introduction of the Green Revolution and expansion of irrigation net works in Uttar Pradesh, the areas under pulses have been decreasing year by year. The areas under kharif pulses have shifted to rice, maize, jowar and bajra crops while the area under rabi pulses have shifted to wheat, potato, vegetable etc. This is a continuous process. In spite of this, the prices of pulses are always higher than the price of cereal crops and profitability of pulses are also higher than the cereal crops. Even then, farmers are not very much willing and not taking much interest in the cultivation of pulse crops. The per hect. production of pulses is much below than that of the rice and wheat. The pulses are much risky than the rice and wheat. The pulses are not assured crops. Therefore, the farmers fear and hesitate to devote more area under pulses. Apart from these reasons, there are a number of reasons, such as heavy rains, drought, flood, hailstorm, attack of pest/insect, diseases and blue-bulls. Extension of irrigation facilities etc. are also responsible factors for shifting the area under pulses to their competing crops. The reasons for shifting of area under pulses on the sample farms to other crops have been highlighted in table-5.6, table-5.7 and table-5.8.

Table-5.6 reveals that the attack of blue-bulls and extension of irrigation facilities were main reasons for shifting area under kharif pulses to other crops on the small size of sample farms. Next to these two reasons, attack of disease and pests/insects followed by heavy rains were also main reasons to compel the small sample farmers to shift the area of kharif pulses to other alternative crops. As far as rabi pulses are concerned, table-5.6 shows that attack of diseases and blue-bulls were major reasons for shifting of area under rabi pulses to other alternative crops. Out of total small sample farmers, 40% and 39% of small sample farmers had reported that the attack of blue-bulls and insects/diseases were reasons for shifting the area of rabi pulses to wheat, potato and vegetables respectively. The low production and extension of irrigation facilities were also reasons for shifting the area under rabi pulses on small size sample farms to

other alternative crops. The frost and hailstorm were also reasons for shifting the area under rabi pulses to other crops.

As far as medium sample size of farms are concerned, arhar and urd were much damaged by heavy rains and frost. Apart from these attack of pests/insects disease and blue-bulls were also important reasons for shifting kharif pulses on medium size farms to rice, maize, bajra etc. Out of total sample of medium size of farms, 23.91%, 19.57%, 19.56% and 17.39% of sample farmers had reported that attack of diseases, blue-bulls, low production and heavy rains were reasons for shifting the kharif pulses to other alternative crops respectively. The major reasons for shifting area under rabi pulses to alternative crops were attack of diseases and blue-bulls as had been reported by medium size of sample farmers. (Table-5.7)

The large sample farmers had expressed their views that extension of irrigation facilities was major reason for shifting the area kharif pulses to rice crop. The other reasons were low production and attack of blue-bulls for shifting the under kharif pulses to other alternative crops as had been reported by large sample farms during the survey period.

As far as rabi pulses on large size of sample farmers are concerned, table-5.8 shows that attack of insects/pests, diseases, infestation of blue-bulls, extension of irrigation facilities and low production were important reasons for shifting area under rabi pulses on large size of sample farms to wheat crop. All the above reasons are responsible for changing the cropping pattern in favour of paddy, wheat, vegetable, maize etc. On account of these reasons, the area under kharif as well as rabi pulses have been decreasing trends since the commencement of Green Revolution in the country. One of the most important reasons for shifting areas of pulses is terror of blue-bulls at present time. The farmers are interested to take assured crops on their farms rather than growing pulses.

Table-5.6
Reasons for Shifting of Area under Pulse Crops to other Crops on Small Sample Farms (2014-15)
(No. sample Pulse growers)

Reasons	Pulse Crops							
	Arhar		Moong		Urd		Total Kharif	
	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers
Heavy Rains	2	11.76	--	--	4	7.69	6	8.33
Frost etc.	1	5.88	--	--	--	--	1	1.39
Attack of disease / pest / insect	4	23.53	--	--	10	19.23	14	19.44
Attack of Blue-bulls	5	29.41	1	33.33	16	30.77	22	30.56
Low production	2	11.77	--	--	6	11.54	8	11.11
Extension of irrigation facilities	2	11.77	2	66.67	12	23.08	16	22.23
More risky	1	5.88	--	--	4	7.69	5	6.94
Others	--	--	--	--	--	--	--	--
All	17	100.00	3	100.00	52	100.00	72	100.00

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Table-5.6
Reasons for Shifting of Area under Pulse Crops to other Crops on Small Sample Farms (2014-15)

(No. sample Pulse growers)

Reasons	Pulse Crops									
	Gram		Pea		Masoor		Total Rabi		All Pulse Crops	
	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers
Heavy Rains	00	00	00	00	00	00	00	00	6	4.20
Frost etc.	6	19.35	2	25.00	00	00	8	11.27	9	6.29
Attack of disease / pest / insect	10	32.26	3	37.50	12	37.50	25	35.21	39	27.27
Attack of Blue-bulls	8	25.81	2	25.00	8	25.00	18	25.35	40	27.97
Low production	4	12.90	00	00	5	15.63	9	12.67	17	11.89
Extension of irrigation facilities	3	9.68	1	12.50	5	15.62	9	12.68	25	17.48
More risky	00	00	00	00	2	6.25	2	2.82	7	4.90
Others	00	00	00	00	00	00	00	00	00	00
All	31	100.00	8	100.00	32	100.00	71	100.00	143	100.00

Table-5.7
Reasons for Shifting of Area under Pulse Crops to other Crops on Medium Sample Farms (2014-15)
(No. sample Pulse growers)

Reasons	Pulse Crops							
	Arhar		Moong		Urd		Total Kharif	
	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers
Heavy Rains	4	25.00	00	00	4	16.00	8	17.39
Frost etc.	3	18.75	00	00	00	00	3	6.52
Attack of disease / pest / insect	4	25.00	00	00	7	28.00	11	23.91
Attack of Blue-bulls	4	25.00	1	20.00	4	16.00	9	19.57
Low production	00	00	4	80.00	5	20.00	9	19.56
Extension of irrigation facilities	00	00	00	00	4	16.00	4	8.70
More risky	1	6.25	00	00	1	4.00	2	4.35
Others	00	00	00	00	00	00	0	00
All	16	100.00	5	100.00	25	100.00	46	100.00

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Table-5.7
Reasons for Shifting of Area under Pulse Crops to other Crops on Medium Sample Farms (2014-15)

(No. sample Pulse growers)

Reasons	Pulse Crops									
	Gram		Pea		Masoor		Total Rabi		All Pulse Crops	
	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers
Heavy Rains	00	00	00	00	00	00	00	00	8	8.25
Frost etc.	4	13.79	3	33.33	00	00	7	13.73	10	10.31
Attack of disease / pest / insect	8	27.59	4	44.45	3	23.08	15	29.41	26	26.80
Attack of Blue-bulls	8	27.59	2	22.22	2	15.38	12	23.53	21	21.65
Low production	4	13.79	00	00	2	15.39	6	11.76	15	15.46
Extension of irrigation facilities	3	10.34	00	00	4	30.77	7	13.73	11	11.34
More risky	2	6.90	00	00	2	15.38	4	7.84	6	6.19
Others	00	00	00	00	00	00	00	00	00	00
All	29	100.00	9	100.00	13	100.00	51	100.00	97	100.00

Table-5.8
Reasons for Shifting of Area under Pulse Crops to other Crops on Large Sample Farms (2014-15)
(No. sample Pulse growers)

Reasons	Pulse Crops							
	Arhar		Moong		Urd		Total Kharif	
	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers
Heavy Rains	3	25.00	00	00	2	8.33	5	11.63
Frost etc.	00	00	00	00	00	00	00	00
Attack of disease / pest / insect	3	25.00	00	00	4	16.67	7	16.28
Attack of Blue-bulls	2	16.67	2	28.57	3	12.50	7	16.28
Low production	1	8.33	2	28.57	4	16.67	7	16.27
Extension of irrigation facilities	1	8.33	3	42.86	8	33.33	12	27.91
More risky	2	16.67	00	00	3	12.50	5	11.63
Others	00	00	00	00	00	00	00	00
All	12	100.00	7	100.00	24	100.00	43	100.00

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Table-5.8
Reasons for Shifting of Area under Pulse Crops to other Crops on Large Sample Farms (2014-15)

(No. sample Pulse growers)

Reasons	Pulse Crops									
	Gram		Pea		Masoor		Total Rabi		All Pulse Crops	
	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers	No. of Sample Pulse Growers	% of sample Farmers to Total Selected Farmers
Heavy Rains	00	00	00	00	00	00	00	00	5	4.72
Frost etc.	4	12.50	3	23.08	00	00	7	11.11	7	6.60
Attack of disease / pest / insect	9	28.13	3	23.08	6	33.33	18	28.57	25	23.58
Attack of Blue-bulls	7	21.87	4	30.77	3	16.67	14	22.23	21	19.81
Low production	3	9.38	1	7.69	2	11.11	6	9.52	13	12.27
Extension of irrigation facilities	5	15.62	00	00	5	27.78	10	15.87	22	20.76
More risky	4	12.50	2	15.38	2	11.11	8	12.70	13	12.26
Others	00	00	00	00	00	00	00	00	00	00
All	32	100.00	13	100.00	18	100.00	63	100.00	106	100.00

5.4. Period of attack of blue-bulls on Pulse crops on the sample farms in reference year.

The attack of blue-bulls to pulse crops is generally performed in the mid-night. The evening is also suitable period for attack of blue-bulls. To know the period of attack of blue-bulls from sample farmers a provision had been made in the schedules to get exact reply from the respondents. The reply of the respondent has been analyzed in table-5.9, 5.10, 5.11 and 5.12. It shows that out of total damaged area of 99.97 hectares of kharif season pulses, 95.17% area was damaged by blue-bulls in the night and rest 4.83% area of pulses was damaged in the evening. As far as rabi pulses are concerned, table-5.12, shows that out of total damaged area of rabi pulses of 117.18 hectares, 96.65% area was damaged by blue-bulls during night and rest 4.35% area damaged by blue-bulls during the evening. It shows that almost all the area of pulses had been attacked by blue-bulls during the night. None of the sample farmers of four districts had reported about the attack of blue-bulls during the morning and noon. The frequency of attack of blue-bulls was more than ten times, however it differs from crop to crop in the study area. The blue-bulls are generally in a group which ranges between 10 and 20 numbers at the time of attack to crops.

The attacks of blue-bulls to the crops are mostly performed during midnight. At this time the most of farmers are confined to their houses particularly in the winter season. On account of these, farmers are unable to look after their crops in the night and helpless to take effective measures to protect attack of blue-bulls.

Table-5.9
Period of Attack of Blue-Bulls on different Pulse Crops on the Small size of Sample Farms 2014-2015

(Area in Hect.)

Period of Attack	Crops on Sample Farms 2014-2015											
	Arhar			Moong			Urd			Total Kharif		
	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls
Morning	00	00	00	00	00	00	00	00	00	00	00	00
Noon	00	00	00	00	00	00	00	00	00	00	00	00
Evening	00	00	00	00	00	00	0.10 (0.70)	1	10	0.10 (0.38)	1	10
Night	11.50 (100.00)	8	25	0.30 (100.00)	10	16	14.12 (99.30)	8	16	25.92 (99.62)	26	57
Over All	11.50 (100.00)	8	25	0.30 (100.00)	10	16	14.22 (100.00)	9	26	26.02 (100.00)	27	67

(Area in Hect.)

Period of Attack	Crops on Sample Farms 2014-2015														
	Gram			Pea			Masoor			Total rabi			All Pulse Crop		
	Area damage d	Freq uency of attac k	Appr oximate numbe r of blue bulls	Area damage d	Frequ ency of attack	Appr oximate numbe r of blue bulls	Area damage d	Frequ ency of attack	Appro ximate numbe r of blue bulls	Area damaged	Freq uency of attac k	Appro ximate numbe r of blue bulls	Area damage d	Frequ ency of attack	Appr oximate numbe r of blue bulls
Morning	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Noon	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Evening	00	00	00	00	00	00	00	00	00	00	00	00	0.10 (0.22)	1	10
Night	11.15 (100.00)	9	22	2.14 (100.00)	9	11	5.89 (100.00)	8	14	19.18 (100.00)	26	47	45.10 (99.78)	52	104
Over All	11.15 (100.00)	9	22	2.14 (100.00)	9	11	5.89 (100.00)	8	14	19.18 (100.00)	26	47	45.20 (100.00)	53	114

Note: figures in brackets are per centages

Table-5.10
Period of Attack of Blue-Bulls on different Pulse Crops on the Medium size of Sample Farms 2014-2015

(Area in Hect.)

Period of Attack	Crops on Sample Farms 2014-2015											
	Arhar			Moong			Urd			Total Kharif		
	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls
Morning	00	00	00	00	00	00	00	00	00	00	00	00
Noon	00	00	00	00	00	00	00	00	00	00	00	00
Evening	1.11 (8.92)	5	10	00	00	00	1.92 (12.73)	5	10	3.03 (10.51)	10	20
Night	11.33 (91.08)	8	19	1.30 (100.00)	8	15	13.16 (87.27)	8	19	25.79 (89.49)	24	53
Over All	12.44 (100.00)	13	29	1.30 (100.00)	8	15	15.08 (100.00)	13	29	28.82 (100.00)	34	73

(Area in Hect.)

Period of Attack	Crops on Sample Farms 2014-2015														
	Gram			Pea			Masoor			Total rabi			All Pulse Crop		
	Area damage d	Freq uenc y of atta ck	Appro ximate number of blue bulls	Area damage d	Frequ ency of attack	Approx imate number of blue bulls	Area damage d	Freq uency of attac k	Approx imate number of blue bulls	Area damage d	Freq uenc y of atta ck	Appro ximate number of blue bulls	Area damage d	Frequ ency of attack	Appro ximate number of blue bulls
Morning	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Noon	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Evening	3.19 (20.51)	6	12	00	00	00	00	00	00	3.19 (11.62)	6	12	6.22 (11.05)	16	32
Night	12.36 (79.49)	9	21	4.19 (100.00)	10	18	7.69 (100.00)	9	17	24.24 (88.38)	28	56	50.03 (88.95)	52	109
Over All	15.55 (100.00)	15	33	4.19 (100.00)	10	18	7.69 (100.00)	9	17	27.43 (100.00)	34	68	56.25 (100.00)	68	141

Note: Figures in brackets are per centages

Table-5.11
Period of Attack of Blue-Bulls on different Pulse Crops on the Large size of Sample Farms 2014-2015

(Area in Hect.)

Period of Attack	Crops on Sample Farms 2014-2015											
	Arhar			Moong			Urd			Total Kharif		
	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls	Area damaged	Frequen cy of attack	Approxi mate number of blue bulls
Morning	00	00	00	00	00	00	00	00	00	00	00	00
Noon	00	00	00	00	00	00	00	00	00	00	00	00
Evening	1.70 (8.09)	8	10	00	00	00	00	00	00	1.70 (3.77)	8	10
Night	19.32 (91.91)	39	22	3.65 (100.00)	4	9	20.46 (100.00)	8	20	43.43 (96.23)	51	51
Over All	21.02 (100.00)	47	32	3.65 (100.00)	4	9	20.46 (100.00)	8	20	45.13 (100.00)	59	61

(Area in Hect.)

Period of Attack	Crops on Sample Farms 2014-2015														
	Gram			Pea			Masoor			Total rabi			All Pulse Crop		
	Area damage d	Freq uency of attac k	Appr oxima te numbe r of blue bulls	Area damage d	Frequ ency of attack	Appr oxima te numbe r of blue bulls	Area damage d	Frequ ency of attack	Appro ximat e numbe r of blue bulls	Area damaged	Freq uency of attac k	Appro ximate numbe r of blue bulls	Area damage d	Frequ ency of attack	Appr oximate numbe r of blue bulls
Morning	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Noon	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Evening	1.23 (3.80)	5	12	00	00	00	0.20 (1.28)	4	8	1.43 (2.46)	9	20	3.13 (3.03)	17	30
Night	31.17 (96.20)	9	22	10.02 (100.00)	8	22	15.42 (98.72)	9	20	56.61 (97.54)	26	64	100.04 (96.97)	77	116
Over All	32.40 (100.00)	14	34	10.02 (100.00)	8	22	15.62 (100.00)	13	28	58.04 (100.00)	35	84	103.17 (100.00)	94	146

Table-5.12
Period of Attack of Blue-Bulls on different Pulse Crops on the all size of Sample Farms 2014-2015

(Area in Hect.)

Period of Attack	Crops on Sample Farms 2014-2015											
	Arhar			Moong			Urd			Total Kharif		
	Area damaged	Frequency of attack	Approximate number of blue bulls	Area damaged	Frequency of attack	Approximate number of blue bulls	Area damaged	Frequency of attack	Approximate number of blue bulls	Area damaged	Frequency of attack	Approximate number of blue bulls
Morning	00	00	00	00	00	00	00	00	00	00	00	00
Noon	00	00	00	00	00	00	00	00	00	00	00	00
Evening	2.81 (6.25)	13	20	00	00	00	2.02 (4.06)	6	20	4.83 (4.83)	19	40
Night	42.15 (93.75)	55	65	5.25 (100.00)	22	48	47.74 (95.94)	24	55	95.14 (95.17)	101	160
Over All	44.96 (100.00)	68	85	5.25 (100.00)	22	48	49.76 (100.00)	30	75	99.97 (100.00)	120	200

(Area in Hect.)

Period of Attack	Crops on Sample Farms 2014-2015														
	Gram			Pea			Masoor			Total rabi			All Pulse Crop		
	Area damaged	Frequency of attack	Approximate number of blue bulls	Area damaged	Frequency of attack	Approximate number of blue bulls	Area damaged	Frequency of attack	Approximate number of blue bulls	Area damaged	Frequency of attack	Approximate number of blue bulls	Area damaged	Frequency of attack	Approximate number of blue bulls
Morning	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Noon	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Evening	4.42 (6.17)	11	24	00	00	00	0.20 (0.68)	4	8	4.63 (3.95)	4	8	9.45 (4.35)	23	48
Night	67.21 (93.83)	27	65	16.35 (100.00)	27	51	29.00 (99.32)	26	51	112.55 (96.05)	25	51	207.69 (95.65)	126	211
Over All	71.63 (100.00)	38	89	16.35 (100.00)	27	51	29.20 (100.00)	30	59	117.18 (100.00)	29	59	217.15 (100.00)	149	259

Note: Figures in brackets are per centages

CHAPTER – 6

Estimation of Losses by Blue-Bulls to Pulse crops on the sample Farms in 2014-15

An effort has been made in this chapter to estimate the losses in production of pulses grown on the sample farmers in 2014-15 due to attack of blue-bulls. The analysis has been done according to pulse-wise and farm-wise in different analytical tables. The attack of blue-bulls starts from growing to harvesting stages of pulse crops. Hence, the stage-wise losses has also been worked-out in different analytical tables. The year 2014-15 was not a normal year as far as production of crops is concerned. There was a severe drought in 2014-15 across the state. Besides of this, hail storm and high velocity of winds had also occurred in 2014-15. On account of these, the production of all crops grown in the state was highly affected. In the mean time, the attack of pests/insect and diseases had also damaged production of pulses in 2014-15. The attack by blue-bulls to pulses was also very severe in this year and on account of this, huge quantity of production in pulses has gone waste.

It has already been mentioned in the first chapter of this report that 160 pulse growers from 4 districts of 4 regions of Uttar Pradesh were selected for this study. The details information related to production losses in pulses due to attack of blue-bulls had been collected from each respondent. On the basis of reply of the respondents, the data have been analyzed in different tables to know the losses in production of pulses grown on the sample farms by blue-bulls during reference year i.e. 2014-15. The detail of losses in production of arhar, moong, urd, gram, pea and masoor have been described in following sequences.

6.1. Losses in production of pulses on small size of sample farms

The losses in production of pulses by attack of blue-bulls on the small size of sample farms in reference year, i.e. 2014-15 have been worked-out in table-6.1.

6.1.1. Arhar

Arhar is a major crop and widely grown in eastern and central regions of Uttar Pradesh. It is generally sown in upland and does not require much water. Hence, it is generally sown in un-irrigated land. It is much susceptible to pests/insects and diseases. The occurrence of frost is also very harmful at time of its flowering stage. The blue-bulls like arhar very much. Out of total small sample farmers, 20.73 per cent had grown arhar on their farms. The per hect production of arhar was 2.06 qtls at the aggregate level which ranged between 1.99 qtls. and 2.17 qtls. The per hectare production of arhar was 2.12 qtls on small size of farms. It is evident from table-6.1 that 11.50 hectares area under arhar on the small sample farms had been damaged by blue-bulls. On account of this, 60.30% of total production of arhar on small farms had been destroyed by blue-bulls. The attack of blue-bulls was maximum in flowering, podding and ripping stages of arhar.

6.1.2. Moong

The small sample farmers had devoted only 1.00 hectare area under moong in the reference year of which 30.00% had been damaged by blue-bulls. On account of this, 74.00% loss was occurred in the production of moong. The attack of blue-bulls was maximum at the time of podding of moong.

6.1.3. Urd

The urd is a very important kharif pulses. It is widely grown across the state. The small sample farmers had devoted 29.67 hectares area to urd of which 47.92 per cent had been destroyed by blue-bulls. Table-6.1 shows that only 26.08 per cent of the production of urd had been lost due to

attack of blue-bulls. It shows that small sample farmers had applied effective preventative measures to reduce the losses in urd in reference year. The attack of blue-bulls was maximum at the time of podding and ripping stages of urd on the sample farms in reference year.

6.1.4. Gram

Gram is a very prestigious pulse and mostly grown in Bundelkhand region of Uttar Pradesh. The small sample farmers had devoted 18.25 hectares area under gram of which 11.15 hectares (61.02%) was destroyed by blue-bulls. Table-6.1 shows that 16.25% loss in production of gram occurred due to attack of blue-bulls. The blue-bulls had targeted it at the time of podding and ripping stages of gram.

6.1.5. Pea

The pea is first choice for blue-bulls. It is generally targeted at the time of its flowering and podding stages. The area under pea was 3.75 hectares of which 57.07 per cent had been damaged by blue-bulls. Table-6.1 shows that 45.50 per cent total production of pea had been destroyed by blue-bulls on the sample farms.

6.1.6. Masoor

The area under masoor was 12.83 hectares of which 5.89 hectares (45.91%) was damaged by blue-bulls. Table-6.1 shows that the 36.12% of total production of masoor was lost by attack of blue-bulls. The above analysis shows that the maximum losses in production of arhar, moong and pea occurred due to attack of blue-bulls which ranged on the sample farm between 45.50% and 74.00% in pea and moong respectively. The minimum loss in production of gram and urd is witnessed from table-6.1. The attack of blue-bulls was generally performed at podding and ripping stages of pulses on the sample farms in reference year.

Table-6.1

Losses in production of Pulses by attack of Blue-Bulls at different stages of production of pulses on the Small sample farms (2014-2015)

(Area in hect.)

Stages	Name of Pulse Crops											
	Arhar		Moong		Urd		Gram		Pea		Masoor	
	Area Damage d	% of losses in product ion	Area Damage d	% of losses in product ion	Area Damage d	% of losses in product ion	Area Damage d	% of losses in product ion	Area Damage d	% of losses in product ion	Area Damage d	% of losses in product ion
Growing	0.71 (6.17)	10.00	00	00	0.65 (4.57)	4.05	00	00	00	00	1.75 (29.71)	5.70
Flowering	1.49 (12.96)	15.00	00	00	1.76 (12.38)	8.08	00	00	00	00	2.60 (44.14)	20.45
Podding	4.78 (41.57)	14.50	0.25 (83.33)	70.00	6.05 (42.55)	9.77	6.00 (53.81)	8.13	0.50 (23.36)	24.60	1.54 (26.15)	9.97
Ripping	4.52 (39.13)	20.80	0.05 (16.67)	4.00	5.76 (40.50)	4.18	5.15 (46.19)	8.12	1.64 (76.64)	20.90	00	00
All	11.50 (100.00)	60.30	0.30 (100.00)	74.00	14.22 (100.00)	26.08	11.15 (100.00)	16.25	2.14 (100.00)	45.50	5.89 (100.00)	36.12

Note: Figures in brackets are per centage to all

6.2. Losses in production of pulses on medium size of sample farms.

The losses in production of pulses by attack of blue-bulls on the medium size of sample farms in reference year i.e. 2014-15 are worked-out in table-6.2.

6.2.1. Arhar

The area under arhar on medium sample farms was 18.08 hectares of which 12.44 hectares (68.81%) had been damaged by blue-bulls. The production of arhar was 2.17 qtls per hect. Table-6.2 shows that 23.10% of total production of arhar had been damaged by blue-bulls. It is also evident from table-6.2 that the attack of blue-bulls were mostly performed at podding, flowering and ripping stages of arhar.

6.2.2. Moong

Huge losses occurred in the production of moong. It is seen from table-6.2 that the 54.00% losses in production of moong was due to destruction of crops by blue-bulls on the medium sample size of farms. Out of total area under moong of 4.50 hectares, 1.30 hectares had been destroyed by blue-bulls. The attack of blue-bulls was maximum during podding and ripping stages of moong on the medium size of farms.

6.2.3. Urd

The area under urd was 33.95 hectares of which 44.42% area had been damaged by blue-bulls. On account of attack of blue-bulls, more than 37.00% of total production of urd had gone waste. The per hectare production was only 2.89 qtls. which was much below from the normal production of 5.86 qtls per hectare of U.P. in 2014-15. It shows that there was huge losses in production of urd on medium sample farms due to attack of blue-bulls. It is also observed from table-6.2 that the attack of blue-bulls had been done at every stage of production of urd. However, podding and ripping stages were targeted more by blue-bulls.

6.2.4. Gram

The details of losses in production of gram on medium sample farms are also presented in table-6.2. It is evident from table-6.2 that the 15.55 hectares under gram were damaged by blue-bulls, which was 51.27% to total sown area under gram. The attack of blue-bulls was done at every stage of production of gram, however, the maximum attack had been done at podding followed by ripping stage of production of gram. It is also noticed from table-6.2, that only 7.28% of total production of gram had been destroyed by blue-bulls. It shows that medium sample farmers had used effective preventive measures to control the attack of blue-bulls to gram crop in reference year.

6.2.5. Pea

The area under pea was 9.00 hectares of which 46.56 per cent had been damaged by blue-bulls. The attack of blue-bulls was done mostly at podding stage of pea. Apart from this, the ripping and flowering stages of pea were also targeted by blue-bulls. On account of this, 28.82% losses in production of pea occurred due to attack of blue-bulls. The per hectare production of pea on the medium sample farms was only 3.86 qtls which was much below the normal production of 7.55 qtls. per hectare of the state during 2014-15. The huge losses in production of pea occurred due to infestation of blue-bulls on pea areas in reference year.

6.2.6. Masoor

The losses in production of masoor by blue-bulls on the medium sample farms are also presented in table-6.2. Out of total area under masoor being 18.75 hectares, the destroyed area of masoor was 7.69 hectares which was 41.01 per cent of cropped area of masoor. The maximum attack of blue-bullswere done at podding and ripping stages of masoor. Besides this, the flowering and growing stages were also targeted by blue-bulls. It is evident from table-6.2 that 23.98% of total production of masoor was damaged by blue-bulls. The per hectare production of masoor on medium sample farms was 3.16 qtls. against 5.37 qtls of the state as a whole in 2014-15. The main reasons for downfall in production of masoor on medium sample farms was due to attack of blue-bulls.

Table-6.2

Losses in production of Pulses by attack of Blue-Bulls at different stages of production of pulses on the Medium sample farms (2014-2015)

(Area in hect.)

Stages	Name of Pulse Crops											
	Arhar		Moong		Urd		Gram		Pea		Masoor	
	Area Damage d	% of losses in production	Area Damage d	% of losses in production	Area Damage d	% of losses in production	Area Damage d	% of losses in production	Area Damage d	% of losses in production	Area Damage d	% of losses in production
Growing	2.50 (20.10)	4.50	00	00	0.63 (4.18)	5.09	0.87 (5.59)	0.20	0.03 (0.72)	0.75	0.22 (2.86)	1.15
Flowering	3.20 (25.72)	7.14	00	00	1.41 (9.35)	8.95	1.60 (10.29)	1.50	0.42 (10.02)	1.00	0.30 (3.90)	1.09
Podding	4.00 (32.15)	10.64	0.65 (50.00)	29.96	7.83 (51.92)	15.75	8.66 (55.69)	3.27	2.59 (61.81)	14.32	3.90 (50.72)	12.47
Ripping	2.74 (22.03)	0.82	0.65 (50.00)	24.00	5.21 (34.55)	7.75	4.42 (28.43)	2.31	1.15 (27.45)	12.75	3.27 (42.52)	9.27
All	12.44 (100.00)	23.10	1.30 (100.00)	54.00	15.08 (100.00)	37.54	15.55 (100.00)	7.28	4.19 (100.00)	28.82	7.69 (100.00)	23.98

Note: Figures in brackets are per centage to all

6.3. Losses in production of pulses on large sample farms.

The losses in production of pulses by blue-bulls on large sample farms are worked-out in Table-6.3 during reference year 2014-15. Arhar, moong, urd, gram, pea and masoor were grown by large size sample farmers on their farms in reference year. The crop-wise losses have been estimated in the following sequence.

6.3.1. Arhar

Arhar was also important crop on the large size of sample farms. Out of total area of arhar being 38.90 hectares, 21.02 hectares (54.04%) had been damaged by blue-bulls. The attack of blue-bulls were done during the flowering, podding and ripping stages of arhar. However, the maximum area of arhar had been damaged at podding followed by ripping stage. The per hectare production of arhar on large sample farms was only 1.99 qtls which was far below than the average production of 6.07 qtls of the state in 2014-15. Table-6.3 shows that 77.04% of production of arhar had been destroyed by blue-bulls on large size of sample farms in the reference year. This was major cause of low production of arhar on the large size of sample farms in the reference year.

6.3.2. Moong

The production losses in moong by blue-bulls on the large size sample farms are also presented in table-6.3. Table-6.3 shows that out of total area under moong being 13.00 hectares, 3.65 hectares (28.08%) had been damaged by blue-bulls in reference year. The attack of blue-bulls had started from growing to ripping stages of moong. However, the intensity of attack was higher in podding stage of moong. It is evident from table-6.3 that 65.40% of total production of moong had been destroyed by the blue-bulls. The per hectare production of moong on the large size of sample farms was 1.68 qtls which was much lower than the average production of 3.02 qtls of state as a whole in 2014-15. The major cause of low production of moong on sample farms was due to severe attack of blue-bulls to this crop.

6.3.3. Urd

Total area under urd was 55.00 hectares on large sample farms out of which 37.20 per cent had been damaged by blue-bulls in the reference year. The per hectare production of urd on the sample farms was 2.58 qtls which was 51.86 per cent less than the average production of 5.36 qtls per hectare of the state in 2014-15.

It is also evident from table-6.3 that 64.55% losses occurred in the production of urd by the attack of blue-bulls on the large size of sample farms. The flowering and podding stages of urd plants had been heavily attacked by blue-bulls. It shows that the large sample size farmers had not used effective preventive measures to check infestation of blue-bulls. This was main reason for huge losses in the production of urd on the large size sample farms in reference year.

6.3.4. Gram

The large sample farmers had devoted 66.25 hectares area under gram in 2014-15 of which 32.40 hectares (48.91%) had been destroyed by blue-bulls. On account of this, 53.54% of total production of gram had been wasted. The severe attack of blue-bulls had occurred during podding followed by ripping stage of gram. It is also evident from table-6.3 that the attack of blue-bulls had also taken place at growing as well as in flowering stage of gram. The per hectare yield of gram on the sample farms was 2.32 qtls in reference year which was lower by 26.81% from the per hectare yield of state in 2014-15. The main reason of low yield on gram on the sample farms was attack by blue-bulls.

6.3.5. Pea

The area under pea was 20.50 hectares on large sample size farms in reference year of which 48.86% had been damaged by blue-bulls. On account of this 76.15% of total production of pea had been wasted. The huge loss in production of pea was mainly due to attack of blue-bulls. The per hectare yield of pea on the sample farms was only 2.91 qtls which was far below than the per

hectare yield of 7.55 qtls of state as a whole in 2014-15. It is also evident from table-6.3 that the attack of blue-bulls had been done during the flowering and podding stages of pea.

6.3.6. Masoor

The losses in production of masoor by blue-bulls are presented in table-6.3. The area under masoor on the sample farms was 32.95 hectares of which 15.62 (47.41%) had been damaged by blue-bulls. On account of this, 45.84% of total production of masoor had been destroyed by blue-bulls. The per hectares yield of masoor on the sample farms was 2.79 qtls which was less than 48 per cent of state as a whole in 2014-15. The maximum frequency of attack by blue-bulls was done at time of podding followed by ripping of masoor.

The above analysis shows that the maximum losses in production of pulses was that of arhar being 77.04 per cent followed by 76.15 per cent, 64.55 per cent, 65.40 per cent, 53.54 per cent and 45.85 per cent in pea, urd, moong, gram and masoor respectively had occurred by the attack of blue-bulls on the large size sample farms during reference year 2014-15.

6.4. Losses in production of all pulses by blue-bulls on the sample farms in 2014-15

The losses in production of pulses by blue-bulls on all the sample farms in reference year have been worked-out in table-6.4. It is evident from table-6.4 that total losses in production of all pulses was 1.23 qtls per hectare against production of 2.81 qtls per hectare. It shows that the losses in production of all pulses was 43.80 per cent due to attack of blue-bulls on the sample farms in reference year. The losses in production of different pulses by blue-bulls varied from each other. The maximum losses being 59.98% was witnessed in moong followed by 59.48% in arhar by attack of blue-bulls (table-6.4). Next to these two pulses, the losses in production of pea, urd, masoor and gram were 55.02%, 43.86%, 36.95% and 33.53% respectively due to attack of blue-bulls. The maximum losses in production of pulses was found on the large sample farms followed by small size sample farms. The losses in production of pulses on medium sample farms was only 25.23% against 32.02% and 61.34% on small and large sample farms

respectively. It reflects that medium sample farmers had used better preventive measures to check infestation of blue-bulls.

Above analysis reflects that about 44% of total production of pulses goes waste in every year on the sample farms across the state due to infestation of blue-bulls. The real culprit of losses in production of pulses was the blue-bulls. There has been no progress in terms of equipment and technology to take preventive measures. No preventive work has been done by the government to prevent the attack of blue-bulls on the crops. The need is for policy makers to implement stringent laws that will preserve the crops from the attack of blue-bulls. There is a need for guidelines that will integrate the local villages seamlessly into conservation programme to control the attack of blue-bulls.

Table-6.3
Losses in production of Pulses by attack of Blue-Bulls at different stages of production of pulses on the Large sample farms
(2014-2015)

(Area in hect.)

Stages	Name of Pulse Crops											
	Arhar		Moong		Urd		Gram		Pea		Masoor	
	Area Damage d	% of losses in product ion	Area Damage d	% of losses in product ion	Area Damage d	% of losses in product ion	Area Damage d	% of losses in product ion	Area Damage d	% of losses in product ion	Area Damage d	% of losses in product ion
Growing	1.98 (9.42)	1.11	0.49 (13.42)	2.00	1.76 (8.60)	3.23	1.77 (5.46)	1.42	00	00	1.03 (6.59)	2.58
Flowering	3.08 (14.66)	14.05	0.61 (16.72)	3.17	2.68 (13.10)	4.80	3.54 (10.93)	6.24	4.75 (47.41)	35.40	1.58 (10.12)	2.72
Podding	10.76 (51.19)	40.72	1.85 (50.68)	41.67	10.94 (53.47)	37.14	16.18 (49.93)	29.93	5.27 (52.59)	40.75	7.31 (46.80)	21.83
Ripping	5.20 (24.73)	21.16	0.70 (19.18)	18.56	5.08 (24.83)	19.38	10.91 (33.68)	15.95	00	00	5.70 (36.49)	18.72
All	21.02 (100.00)	77.04	3.65 (100.00)	65.40	20.46 (100.00)	64.55	32.40 (100.00)	53.54	10.02 (100.00)	76.15	15.62 (100.00)	45.84

Note: Figures in brackets are per centage to all

Table-6.4
Losses in production of Pulses by Blue-Bulls on all Sample Farms (2014-2015)

Name of Crops	Size of Farms											
	Small			Medium			Large			All farms		
	Product ion Qtl.	Quantit y lost qtls.	% Loss to product ion	Product ion Qtl.	Quantit y lost qtls.	% Loss to product ion	Product ion Qtl.	Quantit y lost qtls.	% Loss to product ion	Product ion Qtl.	Quantit y lost qtls.	% Loss to product ion
Arhar	33.35 (2.12)	20.11 (1.28)	60.30	39.19 (2.17)	9.45 (0.52)	24.10	77.40 (1.99)	59.63	77.04	149.94 (2.06)	89.19 (1.23)	59.48
Moong	1.80 (1.80)	1.33 (1.33)	74.00	20.20 (4.49)	10.90 (2.42)	53.96	21.80 (1.63)	14.04	64.40	43.80 (2.37)	26.27 (1.42)	59.98
Urd	147.45 (4.97)	41.73 (1.41)	28.30	98.20 (2.89)	36.67 (1.08)	37.34	141.85 (2.58)	91.56	64.55	387.50 (3.27)	169.96 (1.43)	43.86
Gram	42.00 (2.30)	6.84 (0.37)	16.25	89.52 (2.95)	6.52 (0.22)	7.28	153.58 (2.32)	82.23	53.54	285.10 (2.48)	95.59 (0.83)	33.53
Pea	19.00 (5.07)	8.65 (2.31)	45.53	34.75 (3.86)	8.31 (0.92)	28.82	59.69 (2.91)	45.45	76.15	113.44 (3.41)	62.41 (1.88)	55.02
Masoor	57.25 (4.62)	20.68 (1.61)	36.12	59.30 (3.16)	14.22 (0.76)	23.98	91.84 (2.79)	42.11	45.85	208.39 (3.23)	77.01 (1.19)	36.95
All Pulses	300.85 (3.70)	99.34 (1.22)	33.02	341.16 (2.98)	86.07 (0.75)	25.23	546.16 (2.41)	335.02	61.34	1188.17 (2.81)	520.43 (1.23)	43.80

Note: Figures in brackets are per hectare

CHAPTER – 7

Constraints and Suggestions in Reducing the Attack of Blue-Bulls to Pulse Crops

7.1. Constraints

This chapter deals with the constraints and suggestions in reducing the attack by blue-bulls to pulse crops. It has been analyzed in previous chapter of this report that about 43% of total production of pulses on the sample farms had been destroyed by the blue-bulls in the reference year i.e. 2014-15. The losses in production of pulses ranged between 16.28% to 64.00% on the sample farms. A number of preventive measures were used by the sample farmers to check the infestation of blue-bulls. Even then, the major share of production of pulses are going waste in every year because of attack of blue-bulls. The sample farmers across the selected districts of U.P. had not used the scientific approach to tackle properly the situation. On account of this, the huge quantity of pulses had been destroyed by blue-bulls in every year. The lack of good infrastructural facilities, poor economic condition of farmers, lack of proper awareness among the farmers, strick rules about hunting blue-bulls, attachment with religious sentiments etc. were major hurdles in the way of reducing the infestation of blue-bulls. The forest departments of Uttar Pradesh looks after the wild animals in the state.

The role of forest department was more or less unsatisfactory in checking the ever growing population of blue-bulls in the state. The population of blue-bulls has been increasing by 14.00% per annum. At present the population of blue-bulls is 254449 in U.P. The average life of blue-bulls is about 21 years. About 40% population of state is affected by attack of blue-bulls. Out of 75 districts of the state, 43 districts are under grip of blue-bulls. The Uttar Pradesh Government had issued G.Os in 1994, 2001 and 2008 to address the DMs, SDMs, BDOs, Forest rangers and Teshildars for the implementation at ground level. All the above are authorized to permit the people to kill the blue-bulls as and when they attack to their standing crops. The GO No. 1487/14-4-2011 dated 30/08/2011 had again been issued to revive the previous GOs regarding the killing of blue-bulls. Under this provision, a committee at district level under chairman ship of DM had been constituted. The composition of committee was as follows:

1. DM	Chairman
2. Regional Forest Officer	Secretary
3. District Agriculture Officer	Member
4. District Animal Husbandry Officer	Member
5. District Horticulture Officer	Member

The above committee is authorized to take stock of block wise losses in production of crops by blue-bulls (*Boselaphus trago comelus*) and sus scrofo. Apart from this, the committee has to collect the block-wise information regarding number of killing of blue-bulls in three months. A number of rules have been framed against the blue-bulls. The rifle or 12 bore rifle will be used only for killing the blue-bulls. The forest department of U.P. has submitted a proposal to U.P. Government to treat blue-bulls as a vermin. On account of this blue-bulls could be killed without going through any formalities. However, animal rights activities are against the killing of blue-bulls.

Constraints in adoption of protective measures to reduce the attack of blue-bulls to pulse crops

The forest department Uttar Pradesh has been issuing a number of GOs since 1972. A number of amendments in GOs have also been made from time to time but it could not be implemented at grass-root level. Since, the blue-bulls have been recognized as a cow by majority of Hindu communities hence, the killing of blue-bulls is supposed to be a serious offence. In wake of this, the population of blue-bulls has been increasing at very fast rate in rural areas. Neither forest department of Uttar Pradesh nor Directorate of Animal Husbandry, Directorate of Agriculture Uttar Pradesh, Revenue Division of Uttar Pradesh have taken any preventive measures to control the attack of blue-bulls to standing crops yet. The farmers across the state adopt preventive measures to control the infestation of blue-bulls to save their crops. The farmers also have lot of constraints during adopting preventive measures against blue-bulls which have been described in details in following pages.

The sample farmers of different size of groups had reported that more than 50.00% of total area under pulses in reference year had been destroyed by blue-bulls. They were unable to check the

infestation of blue-bulls because of lack of proper protective means. The growers of pulse crops have been facing a number of problems which have been highlighted in different tables. The crop-wise problems have been analyzed to know the intensity of individual problem.

7.1.1. Arhar

Arhar is a very important pulse crop in Uttar Pradesh. It is sown in July and harvested in March in Uttar Pradesh. Hence, it is annual pulse crop. The DAL of arhar is widely consumed by north Indians. Since the last two years, the price of arhar DAL had gone beyond the expectation. Last year the price of arhar DAL was more than Rs. 150 per kg in the different markets of state. It was totally beyond the capacity of common people to purchase arhar DAL for their daily consumption. The main reason for such a hike in price of arhar DAL was due to low production. Since, it is annual crop therefore, natural calamities of both seasons namely rainy and winter seasons effect the production of arhar. Apart from these, attack of blue-bulls to arhar crops is very common. From flowering to podding of arhar, the intensity of attack of blue-bulls is very high. The blue-bulls hide / live in arhar fields also during day time. Hence, it is the first choice for blue-bulls.

Table-7.1
Problems Reported by Sample Arhar Growers Regarding Attack of Blue-Bulls
(Numbers)

Sl. No.	Problems	Size of Sample farms			
		Small	Medium	Large	All
1.	Non availability of resistance varieties	1 (5.88)	1 (6.25)	00	2 (4.44)
2.	Very expensive	1 (5.89)	2 (12.50)	00	3 (6.67)
3.	Deforestation	1 (5.88)	1 (6.25)	00	2 (4.44)
4.	Lack of effective preventive measures	3 (17.65)	2 (12.50)	1 (8.33)	6 (13.33)
5.	Attack of blue-bulls in the night	4 (23.53)	4 (25.00)	5 (41.67)	13 (28.89)
6.	Religious	5 (29.41)	3 (18.75)	2 (16.67)	10 (22.23)
7.	Ban on hunting	2 (11.76)	3 (18.75)	4 (33.33)	9 (20.00)
	All	17 (100.00)	16 (100.00)	12 (100.00)	45 (100.00)

Note: figures in brackets are per centage response of arhar growers

The problems reported by sample arhar growers regarding attack of blue-bulls are presented in table-7.1. Table-7.1 shows that attack of blue-bulls in the night followed by religious sentiments and ban on hunting were major constraints as had been reported by 28.89%, 22.23% and 20.00% of sample farmers respectively. Apart from these lack of preventive measures, costly materials and non-availability of resistance varieties were other important constraints as had been reported by 13.33%, 6.67% and 4.44% of sample farmers respectively.

7.1.2. Moong

Moong is an important pulse crop in the study areas. Out of total sample farmers only 20% farmers had sown moong on their farms in the reference year. Most of moong growers belonged to large size of farms. The problems reported by sample moong growers regarding attack of blue-bulls are presented in table-7.2. It is witnessed from table-7.2 that the ban on hunting blue-bulls, attack of blue-bulls in the night and lack of effective preventive measures were main problems for moong growers as had been reported by 28.12% 15.63% and 18.75% by the sample farmers respectively. The increasing population of blue-bulls was a big problem for sample farmers.

Table-7.2
Problems Reported by Sample Moong Growers Regarding Attack of Blue-Bulls
(Numbers)

Sl. No.	Problems	Size of Sample farms			
		Small	Medium	Large	All
1.	Non availability of resistance varieties	1 (33.33)	1 (20.00)	4 (16.67)	6 (18.75)
2.	Very expensive	00	00	00	00
3.	Deforestation	00	00	2 (8.33)	2 (6.25)
4.	Lack of effective preventive measures	2 (66.67)	00	4 (16.67)	6 (18.75)
5.	Attack of blue-bulls in the night	00	00	5 (20.83)	5 (15.63)
6.	Religious	00	00	4 (16.67)	4 (12.50)
7.	Ban on hunting	00	4 (80.00)	5 (20.83)	9 (28.12)
	All	3 (100.00)	5 (100.00)	24 (100.00)	32 (100.00)

Note: figures in brackets are per centage response of moong growers

Thus, lack of effective preventive measures was main problem for small sample growers while ban on hunting blue-bulls was major problems for medium size of sample farmers. On account of these problems the sample growers of moong could not protect their crop from attack of blue-bulls during reference year.

7.1.3. Urd

Urd is generally grown in un-irrigated land. The average production of urd is better than the moong. The attack of blue-bulls on urd is also less as compared to arhar. Even though, the sample growers of this crop had reported the problems related to attack of blue-bulls on urd crop during reference year. The problems are presented in table-7.3. It is evident from table-7.3 that the main problem was non-availability of preventive measures followed by non-availability of resistance varieties. The ban on hunting on blue-bulls was also major problems as had been reported by 15.84% of sample of urd growers. The high price of inputs of protective measures were also major problem as had been reported by 6.93% of sample of urd growers. The attack of blue-bulls was generally performed in the mid night, hence, they were unable to check the infestation of blue-bulls on their urd crop.

Table-7.3
Problems Reported by Sample Urd Growers Regarding Attack of Blue-Bulls
(Numbers)

Sl. No.	Problems	Size of Sample farms			
		Small	Medium	Large	All
1.	Non availability of resistance varieties	10 (19.23)	5 (20.00)	4 (16.67)	19 (18.82)
2.	Very expensive	5 (9.62)	2 (8.00)	00	7 (6.93)
3.	Deforestation	4 (7.69)	00	2 (8.33)	6 (5.94)
4.	Lack of effective preventive measures	13 (25.00)	10 (40.00)	8 (33.33)	31 (30.69)
5.	Attack of blue-bulls in the night	10 (19.23)	5 (20.00)	00	15 (14.85)
6.	Religious	4 (7.69)	00	3 (12.50)	7 (6.93)
7.	Ban on hunting	6 (11.54)	3 (12.00)	7 (29.17)	16 (15.84)
	All	52 (100.00)	25 (100.00)	24 (100.00)	101 (100.00)

Note: figures in brackets are per centage response of Urd growers

7.1.4. Gram

The multi response of 92 sample gram growers about the problems related to blue-bulls in the reference year are analyzed in table-7.4. Table-7.4 shows that about 22.58%, 20.69% and 21.88% of small, medium and large sample farmers respectively had revealed that ban on hunting blue-bulls was major problem to save the attack of blue-bulls to gram.

Apart from this, the attack of blue-bulls to gram crop in the mid night was also a big problems for sample farmers. The increase in population of blue-bulls is main headache as had been reported by sample farmers across the size of farms. The lack of effective preventive measures was also a serious problem as had been reported by 16.13%, 13.79% and 6.25% of small, medium and large size of sample farmers respectively.

Table-7.4
Problems Reported by Sample Gram Growers Regarding Attack of Blue-Bulls
(Numbers)

Sl. No.	Problems	Size of Sample farms			
		Small	Medium	Large	All
1.	Non availability of resistance varieties	5 (16.13)	4 (13.79)	7 (21.87)	16 (17.39)
2.	Very expensive	1 (3.23)	1 (3.45)	2 (6.25)	4 (4.35)
3.	Deforestation	3 (9.68)	2 (6.90)	1 (3.12)	6 (6.52)
4.	Lack of effective preventive measures	5 (16.13)	4 (13.79)	2 (6.25)	11 (11.96)
5.	Attack of blue-bulls in the night	6 (19.35)	10 (34.48)	10 (31.25)	26 (28.26)
6.	Religious	4 (12.90)	2 (6.90)	3 (9.38)	9 (9.78)
7.	Ban on hunting	7 (22.58)	6 (20.69)	7 (21.88)	20 (21.74)
	All	31 (100.00)	29 (100.00)	32 (100.00)	92 (100.00)

Note: figures in brackets are per centage response of Gram growers

7.1.5. Pea

Pea is a very tender crop in comparison to the gram and masoor. It is also very suitable for blue-bulls. Out of total sample farmers being 160 only 30 sample farmers had sown pea crop on their farms during the reference year. The details of problems of blue-bulls faced during pea production cycle on sample farms are presented in table-7.5. The attack of blue-bulls in the night, presence of large number of blue-bulls, ban on hunting blue-bulls and lack of preventive measures were major problems for sample growers across the size of farms. Among these problems attack of blue-bulls in the night followed by ban on hunting blue-bulls were most important problems as had been reported by 25.00%, 33.33% and 30.77% of the small, medium and large size of sample farmers respectively.

Table-7.5
Problems Reported by Sample Pea Growers Regarding Attack of Blue-Bulls
(Numbers)

Sl. No.	Problems	Size of Sample farms			
		Small	Medium	Large	All
1.	Non availability of resistance varieties	2 (25.00)	00	2 (15.38)	4 (13.33)
2.	Very expensive	00	00	00	00
3.	Deforestation	00	00	1 (7.69)	1 (3.33)
4.	Lack of effective preventive measures	2 (25.00)	2 (22.22)	1 (7.70)	5 (16.67)
5.	Attack of blue-bulls in the night	2 (25.00)	4 (44.45)	5 (38.46)	11 (36.67)
6.	Religious	00	00	00	00
7.	Ban on hunting	2 (25.00)	3 (33.33)	4 (30.77)	9 (30.00)
	All	8 (100.00)	9 (100.00)	13 (100.00)	30 (100.00)

Note: figures in brackets are per centage response of Pea growers

7.1.6. Masoor

The problems regarding the attack of blue-bulls faced during the production of masoor are worked-out by the per centage multiple responses of sample farmers in the table-7.6. Table-7.6 shows that attack of blue-bulls in the night, ban on hunting, lack of effective preventive measures and non-availability of resistance varieties were severe problems during the production of

masoor as had been reported by 33.34%, 26.98%, 17.46% and 15.87% of sample farmers respectively in reference year.

The above analysis shows that the attack of blue-bulls in the night ban on hunting, the presence of large number of blue-bulls and lack of preventive measures were main problems for which the sample farmers were not able to check the attack of blue-bulls to pulse crops. On account of this, the major portion of area under pulses of sample farms had been destroyed by blue-bulls in the reference year.

Table-7.6
Problems Reported by Sample Masoor Growers Regarding Attack of Blue-Bulls
(Numbers)

Sl. No.	Problems	Size of Sample farms			
		Small	Medium	Large	All
1.	Non availability of resistance varieties	4 (12.50)	2 (15.38)	4 (22.22)	10 (15.87)
2.	Very expensive	00	00	00	00
3.	Deforestation	1 (3.12)	00	00	1 (1.59)
4.	Lack of effective preventive measures	7 (21.88)	2 (15.39)	2 (11.11)	11 (17.46)
5.	Attack of blue-bulls in the night	10 (31.25)	5 (38.46)	6 (33.33)	21 (33.34)
6.	Religious	2 (6.25)	00	1 (5.56)	3 (4.76)
7.	Ban on hunting	8 (25.00)	4 (30.77)	5 (27.78)	17 (26.98)
	All	32 (100.00)	13 (100.00)	18 (100.00)	63 (100.00)

Note: figures in brackets are per centage response of Masoor growers

7.1.7. Rank of Constraints

The rank of constraints according to the importance given by the sample farmers have been highlighted in table-7.7. The rank decreases with increase in number. First rank denotes the most serious problems. Table-7.7 shows that the attack of blue-bulls in the night followed by ban on hunting blue-bulls were severe constraints to save the pulse from the attack of blue-bulls. These were reported by majority of sample growers. Apart from these, lack of effective preventive measures and deforestation were also major constraints to check the infestation of blue-bulls.

The most of the sample pulse growers have not rifle etc. to encounter the blue-bulls at the time of their attack to standing crops. They cannot use predator due to lack of knowledge etc. The result of predator is very fruitful in foreign countries. The fencing is a very useful preventive measures to control infestation of blue-bulls but the general farmers could not apply because it is a costlier preventive measure.

Table-7.7
Rank of constraints according to the importance as perceived by sample farmers

Sl. No.	Constraints	Name of Crops							Over all rank
		Arhar	Moong	Urd	Gram	Pea	Masoor	All Pulses	
1.	Non availability of resistance varieties	VI	III	II	III	IV	IV	22	IV
2.	Very expensive	V	VII	V	VII	VI	VII	37	VI
3.	Deforestation	VII	VI	VII	VI	V	VI	37	VII
4.	Lack of effective preventive measures	IV	II	I	IV	III	III	17	III
5.	Attack of blue-bulls in the night	I	IV	IV	I	I	I	12	I
6.	Religious	II	V	VI	V	VII	V	30	V
7.	Ban on hunting	III	I	III	II	II	II	13	II
		28	28	28	28	28	28	168	

Since blue-bulls are very powerful and have high speed (40 km. per hour) during running, therefore, they can not be captured easily. The use of the chemical, medicines are useful for fighting blue-bulls. The Itorphan, Hydrochlorides, Ketamine etc. are applied on blue-bulls to get them un-coconscious. Unfortunately these are not available to common farmers at present.

Non availability of resistance varieties of pulses were also major constraints as had been reported by sample farmers across the size of farms.

The religious sentiments are also attached with blue-bulls. The Hindu communities recognize the blue-bulls as a cow. Therefore, they do not hunt blue-bulls. On account of this blue-bulls are moving freely and fearlessly from one to other places. This type of views had been reported by majority of sample growers. The above analysis reflects that a number of constraints and

problems are being faced by pulse growers across the state and they are helpless to take proper preventive measures to save their crops from attack of blue-bulls. The women are also not getting time to look after themselves as they have to watch their fields against blue-bulls all the times.

In the light of above constraints, the sample pulse growers had also suggested a number of remedial measures to overcome the existing constraints/problems related to reducing the losses of production in pulses by blue-bulls.

7.2. Suggestions

The intensity of attack of blue-bulls to pulse crops has been increasing day by day across the state. The pulse growers are doing their best efforts to use of available preventive measures but all these measures are not found so effective in checking the attack of blue-bulls to pulses. More than 75.00% of total pulse growers were economically poor and unable to use the preventive measures to reduce the attack of blue-bulls to their pulse crops. However, they had suggested a number of remedies to check the attack of blue-bulls to pulse crops. The suggestions are totally based on their perceptions. The opinions of forest officials and NFSM have also been incorporated in the suggestions.

7.2.1. First of all it is required to check the population of blue-bulls. The population of blue-bulls has been increasing at the rate of geometrical progression in the state. Therefore, the forest and Animal husbandry departments should make joint efforts to check the growth of population of blue-bulls by the use of castration techniques.

7.2.2. The deforestation is also a major cause for infestation of wild animal to open areas to get their feed and water. On account of this, presence of blue-bulls in rural areas have been increasing at a very fast rate. Therefore, the deforestation should be stopped to shelter blue-bulls in the forests. This approach would be useful to some extent to reduce the attack of blue-bulls to pulse crops.

- 7.2.3.** The state government should make the policy to kill the blue-bulls and declare them vermin in U.P.
- 7.2.4.** There is a need for amendment in Wild Life Act to provide the right to farmers for killing the blue-bulls as and when the blue-bulls destroy the crops. The farmers should not be required to take permission either from local police or forest department. This would be useful to reduce the attack of blue-bulls to crops.
- 7.2.5.** Agriculture Scientists should evolve such a type of varieties of pulses which are resistant against blue-bulls. It is more required in case of arhar and pea crops. These are very tender pulses which are first choice for blue-bulls. In order to save the crops, the scientists are requested to evolve such a type of varieties of arhar and pea which are not eatable for blue-bulls.
- 7.2.6.** The staff of forest, animal husbandry, revenue and agriculture departments should be more active and vigilant in affected areas in checking the infestation of blue-bulls by using the scientific approach. In order to curb the blue-bulls infestation on pulses, state Government should ask to various departments to visit to affected pulse field regularly to take preventive measures.
- 7.2.7.** The hunting of blue-bulls should be allowed to villagers by the state government to check the increasing population of blue-bulls. The hide out location of blue-bulls should be identified to catch blue-bulls to make them unconciness.
- 7.2.8.** The extension workers of NFSM are now present in all the district of Uttar Pradesh. They provide the financial and technical assistances to pulse growers to boost the production of pulses. Apart from these activities, they should also be advised to guide the farmers to use biological and chemical methods on pulse crops to reduce the attack of blue-bulls. In this context, it is also advised to staff of NFSM to give financial help to needy pulse growers to purchase raw materials to use the biological

and chemical methods in pulse crops. The separate budget should be located under NFSM for this purposes.

- 7.2.9.** Free medical treatment should be given to injured farmers. This would inspire the farmers to chase the blue-bulls from the cropped areas.
- 7.2.10.** There is a need to give proper awareness to the farmers for the application of proper protective measures to check the attack of blue-bulls on pulses. They should be equipped with required knowledge and training to curb infestation of blue-bulls.
- 7.2.11.** The use of crackers during attack of blue-bulls to crops are one of the best preventive measures. Hence, the financial help is needed for poor pulse growers to purchase the crackers from the markets.
- 7.2.12.** The pulse growers should be advised by the staff of NFSM and agriculture department to barricade the area of pulse crops by fencing with wire of iron/plastic. This system would be helpful to check the attack of blue-bulls to pulse crops. In this context, it is suggested to NFSM and agriculture department to provide financial help to active pulse growers to use this type of protective measures.
- 7.2.13.** Farmers are also advised to barricade the area of pulses by use of bamboos which are easily available in the villages. This system will also be helpful in checking the attack of blue-bulls to pulse crops.
- 7.2.14.** The use of biological materials such as broadcasting of cow dung/solution of Neem products are also helpful in reducing the attack of blue-bulls to pulse crops. This type of preventive measures should be propagated among the farmers across the state
- 7.2.15.** More subsidy and incentive should be given to pulse growers for the expansion of area under pulse crops. All the pulse crops should be covered under Crops Insurance

Scheme. The compensation should be given to farmers if pulses are destroyed by blue-bulls as it is prevalent in case of natural calamities.

7.2.16. The forests department should declare that the blue-bulls are vermin so that the farmers will be in a position to kill the blue-bulls easily.

7.2.17. It should be propagated among the people that the blue-bulls do not come under cow breed. The physical appearance of blue-bulls is totally different from feature of cows. It is totally a wild animal. The sentiments of Hindus will not be hurt if the blue-bulls are killed by other communities.

7.2.18. Menace of blue-bulls is one of the biggest problems for pulse growers across the state. Therefore, Central as well as State governments should frame out a concrete strategy to control the growth in population of blue-bulls in rural areas.

A number of remedial measures are being adopted by the farmers to reduce the attack of blue-bulls to pulses but most of them are not much effective to prevent the attack of blue-bulls to pulses. The response of sample farmers related to effectiveness of different preventive measures have been highlighted in table-7.8.

Since the attack of blue-bulls to pulse crops are generally performed in mid night hence farmers are helpless to face the blue-bulls because of non-availability of good quality torch, weapons, woolen cloth etc. In order to chase the blue-bulls from field of crops, the state government should provide good quality of torch, woolen cloth and scientific weapons to face during attack of blue-bulls to crops.

It is evident from table-7.8 that the permission for the killing of blue-bulls followed by castration of blue-bulls were most important suggestions as had been reported by 35.37% and 17.07% of small size of sample farmers respectively. The extension of indigenous technique availability of resistance varieties and castration of blue-bulls were also important suggestions as had been reported by 31.71%, 18.29% and 26.83% of small size of farmers respectively.

Table-7.8
Suggestions from the sample Pulse growers to reduce the attack of blue-bulls to pulse crops

Suggestions	Size of Farms											
	Small			Medium			Large			All		
	1	2	3	1	2	3	1	2	3	1	2	3
Availability of resistance varieties	12 (14.63)	15 (18.29)	24 (29.27)	11 (26.19)	5 (11.90)	6 (14.29)	10 (27.78)	12 (33.33)	7 (19.44)	33 (20.62)	32 (20.00)	37 (23.12)
Enforcement of wildlife protection Act.	9 (10.98)	5 (6.09)	13 (15.85)	1 (2.38)	9 (21.43)	4 (9.52)	00	3 (8.33)	7 (19.44)	10 (6.25)	17 (10.63)	24 (15.00)
Expansion of indigenous techniques	5 (6.10)	26 (31.71)	18 (21.95)	4 (9.52)	12 (28.57)	14 (33.33)	2 (5.56)	5 (13.89)	8 (22.22)	11 (6.88)	43 (26.88)	40 (25.00)
Provision of subsidy to purchase of chemical solution and wires	13 (15.85)	8 (9.76)	16 (19.51)	2 (4.76)	6 (14.29)	6 (14.29)	1 (2.87)	5 (13.89)	8 (22.22)	16 (10.00)	10 (6.25)	30 (18.75)
Permitting the killing of Blue-bulls	29 (35.37)	6 (7.32)	6 (7.32)	18 (42.86)	00	3 (7.14)	19 (52.78)	3 (8.33)	4 (11.11)	66 (41.25)	9 (5.63)	13 (8.13)
Catch Blue-bulls for castration	14 (17.07)	22 (26.83)	5 (6.10)	6 (14.29)	10 (23.81)	9 (21.43)	4 (11.11)	11 (30.56)	2 (5.56)	24 (15.00)	43 (26.87)	16 (10.00)

Note: 1. Most Important, 2. Important, 3. Less Important

As far as medium size of farmers are concerned, table-7.8 reveals that the permission to kill blue-bulls followed by availability of resistance varieties of pulses and castration of blue-bulls were most attractive suggestions as had been reported by 42.86%, 26.19% and 14.29% of medium size of sample farmers respectively.

The large size of sample farmers had expressed their views that the permission for killing of blue-bulls was most important suggestions followed by availability of resistance varieties of pulses.

Over all, the permission for killing of blue-bulls, castration of blue-bulls, provision of subsidy on biological and chemical materials and availability of resistance varieties of pulses were most important suggestions as had been reported by majority sample farmers of 4 selected districts of Uttar Pradesh.

In the context of suggestions, a case study has also been conducted in Mirzapur district of Uttar Pradesh whose suggestions could be adopted as modal for all districts of Uttar Pradesh for checking the attack of blue-bulls to pulse crops. The name of farmer is Shri Adity Shah (engineer) who belonged to Majhawari village of Post Office of Kotwa Pandey of Mirzapur district. The village is way about 16 kms away from Mirzapur head quarter. This village is also situated near new campus of B.H.U. Sri Adity Shah was a senior engineer in Gujarat Resource Development Corporation, Ghandhi nagar, Gujarat. After retirement in 2012, he has come back to his native village to look after his parental cultivated land. He posses 4 hectares cultivated land. First of all, he has installed two solor tube-wells to irrigate the crops. Paddy, wheat and pulses are main crops of their farms. These crops were generally damaged by blue-bulls hence, he thought to do something to check the attack of blue-bulls. He had seen the use of Solar Fence Guard / System in Gujarat. The farmers of Gujarat have been using the Solar Fence Guard system across their field to protect the attack of blue-bulls. It is found very successful in Gujarat state. Therefore, he has also barricaded total land by solar fence guard system. The component of this system are cancelled wire, solar fence guard, two batteries of 12 volt, pillars (wooden / cemented) insulator etc. The total investment in the installation of this system is about Rs. 40000/= per hectare as he had reported to us. The life of this system is about 25 years if pillars

are cemented. The life batteries is only 3 or 4 years. If the farmers install the solar fence guard system around the field of crops, the blue-bulls and other wild animals would not be able to enter in field of pulse and other crops. In this system, there is no need of electricity and on account of this, the blue-bulls can not come in the contact because of the fear of 'ZHATKA'. The blue-bulls do not touch the solar fence guard due to fear of Zhatka. A number of benefits have also been reported by Sri Adity Shah which have been mentioned below.

- I. It can be installed anywhere because it does not require electricity.
- II. Monex solar fence guard system is hundred per cent perfect system in Gujarat state. This system produce minor current to blue-bulls. There is no causality of blue-bulls if they come in contact of wires. There is no need to use any type of other wires. The solar fence guard system also produces high level sound if anybody touches the wire.

Therefore, it is suggested to U.P. Government to guide the farmers to install the solar fence guard system on their field to protect them from the attack of blue bulls. The state Govt. should also provide financial assistance to interested cultivators in the installation of this system. This system could save the million tonnes of production of pulse crops in the state. This system should be propagated across the state to get rid from the attack of blue-bulls.

CHAPTER – 8

Summary, Conclusion and Policy Implication

8.1. Introduction

The country has attained self sufficiency in the production of wheat, rice, maize and jowar but it is well behind in the production of pulses and oilseeds. The country is in a position to export wheat while pulses are being imported from pulse growing countries to meet the consumption need of the people. The bumper production of wheat and rice has created problems for its proper storage. Since advent of Green Revolution in the country followed by extension of irrigation networks and availability of quality inputs, the area under wheat and rice has been increasing at the cost of pulses. The area under pulses was 37.25 lakh hectares in 1970-71 in U.P. which has decreased to 24.16 lakh hectares in 2012-13, showing 35.14 per cent decrease over the period. The production of pulses in U.P. was 24.30 lakh M. Tonnes during 2004-05 which has decreased to 23.97 lakh M. Tonnes during 2011-12, thereby showing 1.36 per cent decrease over the period. There was a fall in area under pulses in U.P. However, the productivity of pulses has been increasing year by year due to impact of different sponsored central schemes. The reasons for shortfall in the production of pulses in U.P. are shrinkage in area of pulses, frequent occurrence of drought, excess rains, hail-storm, attack of pests/insects, diseases etc. Besides these, attack of blue-bulls to pulse crops is major cause of low production of pulses in U.P. Out of 75 districts of U.P., 43 districts are in grip of blue-bulls. More than 40 per cent of total area of pulses are destroyed by blue-bulls alone.

The total population of blue-bulls was estimated at about 2,54,449 in U.P. in 2008-09. The population of blue-bulls has been increasing the at rate of 14 per cent per annum. There is no approach by forest department to check the growth of population of blue-bulls. They were only confined and localized in particular tracks in past two decades. They were found in river valleys and dense forests but at present, they are found in villages across the state. They are fearless and visible in day also. On account of these, the farmers have been giving-up the cultivation of pulses

on their farms. If this situation will prevail in years to come, the pulse crops will not be grown by the farmers. All developmental programmes related to increase in the production of pulses of U.P. cannot produce fruitful result until the attack of blue-bulls is prevented. Seeing the gravity of situation created by blue-bulls to pulses, the Ministry of Agriculture and Farmers Welfare has entrusted to Agro-Economic Research Centre, Allahabad to undertake a study entitled “Estimation of Losses to Pulses by Blue-Bulls in Uttar Pradesh”.

8.2. Objectives of the Study

The objectives of the study are mentioned below:

1. To assess the extent of damage to pulse crops by blue bulls
2. To determine adopted measures undertaken by government and farmers in reducing the losses by blue bulls.
3. To identify the constraints in the implementation of measures by state government to reduce the losses to pulse crops due to blue bulls.
4. To suggest suitable remedial measures to reduce and prevent the damage to pulses by blue bulls.

8.3. Proposed Coverage of Crops

The study has been conducted in Uttar Pradesh. Hence, all pulse crops namely gram, pea, lentil, arhar, urd and moong have been covered under this study to know the quantum losses of production of pulses due to attack of blue-bulls.

8.4. Collection of Data

The study is based on primary as well as secondary data. The primary data have been collected from sample pulse growers of selected villages. The collection of primary data have been done

by personal interview method for reference year 2014-15. The secondary data have been collected from Directorate of Agriculture, Krishi Bhawan, Lucknow and other relevant sources.

8.5. Research Methodology

This study is confined to state of Uttar Pradesh as a whole. A multistage stratified mixed sampling technique were used to cover the stated objectives. Since, state is divided into four regions, namely Eastern, Central, Bundelkhand and Western and also covered by NFSM, therefore, one district from one region has been covered based on NFSM subject to maximum area of pulses during 2014-2015. From each selected district, two blocks have been selected on same criteria as cited above. From each block thus selected a cluster of suitable number of villages have been undertaken. A list of pulse growers, thereafter from selected villages have been collected and categorized into various size groups prevalent under study areas. The ultimate sample pulse growers have been undertaken according to probability proportion to total number in each category restricting the total number of sample growers to 40 in each district.

8.6. Reference Year

Reference year of study is 2014-15. Application of different statistical tools have been applied to get scientific result.

8.7. Area, Production and Productivity of Pulses in Uttar Pradesh

8.7.1. Area

Uttar Pradesh is most populous state of country. More than 16 per cent of total population of the country resides in the state while per centage share of geographical area of U.P. to total geographical area of country is only 7.33 per cent in 2011. The density of population in U.P. was 818 per sq. km. Agriculture is main occupation of the state. Agriculture is still gamble of monsoon therefore, hundred per cent risk is involved in this occupation. The cropping intensity

was only 154.77 per cent during 2011-12. The per capita availability of net area sown was estimated at 0.08 hectare in 2011-12. Out of GCA, food-grains accounted for 78.29 per cent followed by 9.39 per cent pulses in 2011-12. The cropping pattern was always in favour of wheat and rice. Of the GCA, wheat accounted for 38.06 per cent followed by 22.94 per cent of rice during 2012-13. The share of pulse crops in total GCA was 16.05 per cent in 1970-71 which went down to 9.39 per cent in 2012-13, showing 41.49 per cent decrease over the period. The maximum fall in area under pulses is witnessed during post Green Revolution period.

Six pulse crops namely arhar, moong, urd, gram, pea and masoor are grown across the state. Out of total area under pulses being 24.16 lakh hectares in 2011-12 in U.P. rabi pulses (gram, pea and masoor) accounted for 59.83 per cent while kharif pulses (arhar, moong and urd) accounted for 40.17 per cent. It has been observed from data that area under rabi pulses has been decreasing from year to year while the area under kharif pulses has been increasing during corresponding period. The maximum shortfall in area under pea was witnessed while area under gram and masoor was more or less stagnant. Among the six pulses, gram, masoor, urd are important pulses. Arhar and pea which are largely consumed by people of U.P. have negative growth in areas during study period. On account of these, the price of arhar has gone up beyond the control during 2014-15.

8.7.2. Production of different pulse crops in Uttar Pradesh

The total production of all six pulses in state was only 23.97 lakh M. Tonnes during 2011-12 against 24.30 lakh M. Tonnes during 2004-05. The production of pulses in U.P. has been showing a decreasing trend from 2004-05 to 2011-12. There is a huge gap between availability of pulses and requirement. The growth rate of production of pulses in U.P. was negative and insignificant. Out of total production of pulses being 23.97 lakh M. tones during 2011-12, the contribution of gram was 29.63 per cent followed by 19.88 per cent and 18.60 per cent of masoor and pea respectively. The contribution of urd, arhar and moong was 15.94 per cent, 13.81 per cent and 2.14 per cent respectively during the same period. The production of arhar, pea and gram was not found encouraging during study period. Over all, the production of pulses in U.P.

is not sufficient to meet the consumption need to ever growing population. More than 40 per cent of total production of pulses are being damaged by blue-bulls alone.

8.7.3. Average Yield of Pulses in Uttar Pradesh

The per hectare yield of pea was 14.31 qtls followed by 11.83 qtls., 10.70 qtls, 8.94 qtls., 6.72 qtls. and 6.31 qtls. of gram, arhar, masoor, urd and moong respectively during 2011-12. There was a positive growth in average yield of all six pulse crops in U.P. during the study period. However, the growth in yield of pulses was marginal in U.P. during the study period.

8.8. Background of selected districts of Uttar Pradesh

The four districts namely Badaun, Fatehpur, Allahabad and Jhansi were selected from Western, Central, Eastern and Bundelkhand regions of U.P. respectively for the study. The profile of the selected districts has been analyzed in following sequence.

8.8.1. Badaun district

Badaun district belongs to western region of Uttar Pradesh. It is one of the agriculturally advanced districts of western region of state. The total population of the district was 36.83 lakh in 2011. The average holding of the district was 0.82 hectare. The per capita availability of land was estimated at 0.09 hectare. Wheat and bajra were dominant crops of the district in 2011-12. The pulses and oil seeds accounted for 6.87 per cent and 4.49 per cent to GCA during the same period. Urd and masoor were main pulse crops which accounted for 86.01 per cent and 9.97 per cent of total area under pulses in 2011-12. The moong, gram, pea and arhar accounted for 0.66 per cent, 0.17 per cent, 1.58 per cent and 1.61 per cent of total area under pulses in 2011-12 respectively. The growth in area under pulses was insignificant during study period i.e. 2004-05 to 2011-12.

The total production of six pulse crops was 2.96 lakh M. Tonnes in 2004-05 which has decreased to 43,759 M. tones in 2011-12, thereby showing 47.60 per cent decrease over the period. The

production of six pulses has drastically decreased in 2011-12 as compared to production of 2004-05. Urd was an important pulse of the district as far as production is concerned.

8.8.2. Fatehpur district

Fatehpur is an important district of central region of U.P. The total population of the district was 26.33 lakh in 2011. The per capita availability of land in the district was only 0.11 hectare. Most of cultivated areas is under irrigation network. The cropping intensity of this district was only 142.56 per cent in 2011-12. The wheat and rice were important cereals accounted for 41.16 per cent and 19.37 per cent to GCA in 2011-12. The shares of pulses and oilseeds were 18.54 per cent and 6.02 per cent to GCA respectively during the corresponding year. It shows that area under pulses was next to area of rice. Among the pulses, gram and arhar were important crops which occupied 54.99 per cent and 25.48 per cent of total area under pulses respectively during 2011-12. The position of arhar was found discouraging because its area has been continuously decreasing in alternative years.

The production of arhar was 29,593 qtls during 2004-05 which has decreased to 21,279 qtls during 2011-12, showing 28.09 per cent decrease over the period. Out of total production of all pulses during 2011-12, the share of gram was 62.58 per cent followed by 23.65 per cent of arhar. Thus, gram and arhar were dominant pulses in Fatehpur district.

8.8.3. Allahabad district

Allahabad is agriculturally very advanced district of Eastern region of U.P. The population of this district was 59.54 lakh in 2011. The density of population of the district was very high being 1066 per sq. km. More than 55 per cent of reporting area was under cultivation. The cropping intensity was worked-out to be 155.71 per cent in 2011-12. The wheat and rice were dominant crops in Allahabad district. Out of GCA of 4.80 lakh hectares, wheat accounted for 44.85 per cent followed by 30.58 per cent and 10.47 per cent of rice and pulses respectively during 2011-12.

Of the total area under pulses during 2011-12 in Allahabad district, the gram accounted for maximum share being 31.38 per cent followed by 31.07 per cent of arhar. Both jointly accounted for 62.45 per cent of total area under pulses during 2011-12. Next to these pulses, masoor accounted for 15.74 per cent followed by 8.28 per cent, 6.81 per cent and 6.72 per cent of pea, moong and urd respectively. The area under arhar and gram has been decreasing across the study period.

The total production of all pulses was 51,707 qtls. during 2011-12 of which gram had contributed 33.14 per cent followed by 32.52 per cent arhar. Thus, arhar and gram were important crops of the district. However, the drastic down fall in arhar witnessed from the records during the study period.

8.8.4. Jhansi district

Jhansi district belongs to Bundelkhand region of U.P. Most of the cultivated area of this district is un-irrigated. The total population of this district was 19.99 lakh in 2011. The density of population was only 398 sq. km. against 828 sq. km. of the state as a whole. The cropping intensity was only 154.16 per cent. The per capita availability of land was worked out to be 0.16 hectare against 0.08 hectare of the state as a whole. The pressure of population on land was in significant. The irrigation intensity was only 105.82 per cent against 144.12 per cent of the state. The pulses and wheat were dominant crops in the district in 2011-12. Out of GCA of 5.12 lakh hectares, pulses accounted for 37.29 per cent followed by 32.92 per cent wheat. The urd was important pulse of kharif season while pea, gram and masoor were main pulse crops of rabi season. Out of total area under all pulses during 2011-12 urd accounted for higher share being 28.40 per cent followed by 26.66 per cent, 23.44 per cent, 17.68 per cent and 3.07 per cent of gram, pea, masoor and moong respectively.

The total production of pulses was 20.20 lakh tones during 2011-12, of which pea accounted for 35.50 per cent share followed by 32.23 per cent, 15.49 per cent and 14.69 per cent of gram, urd and masoor respectively. It is a surplus district of the state as far as production of pulses is concerned.

8.9. Findings based on primary data

Out of 160 sample pulse growers, 51.25 per cent was marginal followed by 26.25 per cent and 22.50 per cent of medium and large pulse growers. Of the total head of households 15.00 per cent head of households were illiterate. The educational status of head of households were upto mark. Out of 160 sample households, 41.88 per cent were OBC followed by 41.87 per cent of general caste, while 16.25 per cent of total sample households belonged to SC category. The agriculture was main occupation of all the sample households. The per farm of owned land holding of all the sample farms was 2.92 hectares. The per farm operational holding was a little bit higher than that of owned land. Almost all owned land was fully irrigated across the size of sample farms.

Out of 810.19 hectares of GCA of 160 sample farms, kharif season crops accounted for 51.50 per cent against 47.33 per cent of rabi seasons crops. Among the kharif season crops, urd, paddy and arhar were important crops which occupied 14.64 per cent, 12.12 per cent and 8.98 per cent to GCA respectively. As far as rabi seasons crops are concerned, wheat, gram, pea and masoor were important crops which occupied 20.24 per cent, 14.17 per cent, 4.10 per cent and 7.96 per cent to GCA respectively.

Out of total area under all pulses of 422.46 hectares of the sample farms, urd, gram and arhar accounted for 28.08 per cent, 27.18 per cent and 17.22 per cent respectively. Thus these crops jointly accounted for 72.48 per cent of total area under pulses on the sample farms. The masoor, pea and moong accounted for 15.27 per cent, 7.87 per cent and 4.38 per cent of total area under pulses on the sample farms out of total area under all pulses being 422.46 hectares on the 160 sample farms, 51.42 per cent had been destroyed by blue-bulls during reference year. Of the total area under kharif pulses on all sample farms 47.64 per cent had been damaged by blue-bulls against 55.11 per cent of rabi pulse crops. Among the kharif pulses, the maximum area under arhar being 61.82 per cent followed by 41.95 per cent and 28.38 per cent of urd and moong respectively had been destroyed by blue-bulls respectively in reference year. Among the rabi pulses, the maximum area of gram being 62.38 per cent followed by 49.17 per cent and 45.40 per

cent of pea and masoor respectively had been damaged by blue-bulls in the reference year. Thus arhar, gram and pea had been damaged extensively by blue-bulls in comparison to masoor, moong and urd.

The production of all pulses on the sample farms in reference year was below the average production of state as a whole. The per hectare production of urd was 3.27 qtls. followed by 2.37 qtls. and 2.06 qtls of moong and arhar respectively. The per hectare yield was maximum of pea being 3.41 qtls followed by 3.23 qtls and 2.48 qtls of masoor and gram respectively. The cause of low yield of pulses on the sample farms was due to attack of blue-bulls to pulse crops in reference year.

The sample pulse growers had done best efforts to save their crops from attack of blue-bulls. The eight preventive measures namely use of dung/neem solution, use of chemical materials use of effigy, wiring, crackers, stricks/stones, gun, ringing bells, louding, shining taps etc. were adopted by sample farmers to check the attack of blue-bulls. Among these 8 preventive measures, the use of crackers strick/stones, louding and ringing bells etc. had been adopted maximum by the sample farmers. On account of use of preventive measures, the sample farmers had saved the production of gram of 66.47 per cent followed by 63.05 per cent, 56.14 per cent, 44.98 per cent, 40.02 per cent and 40.52 per cent of masoor, urd, pea, moong and arhar respectively.

8.10. Reasons for shifting of Area under Pulses to other crops on the sample farms

The drought, excess rains, occurrence of hailstorm, attack of pests/disease and blue-bulls are major reasons for shifting of area under pulses to wheat, rice, potato, sugarcane etc. The low profitability of pulses as compared to its alternative crops is also a reason of giving up the cultivation of pulse crops. At present, the attack of blue-bulls to pulses is also a major cause of shifting of area of pulses to its alternative crops. One of the most important reasons for shifting areas of pulses is terror of blue-bulls. The attack of blue-bulls are generally performed in midnight. The frequency of attack of blue-bulls was more than ten times, however. It differs from crop to crop. The blue-bulls are in groups which ranges 10 – 20 numbers at the time of attack.

8.11. Estimation of Losses by Blue-bulls to Pulses on the sample farms

The total losses in production of all pulses by attack of blue-bulls was 1.23 qtls. per hectare against production of 2.81 qtls per hectare. It shows that the losses in production of all pulses was 43.80 per cent due to attack by blue-bulls on the sample farms in 2014-15. The losses in production of different pulses varied from each other. The maximum losses being 59.98 per cent is witnessed in moong followed by 59.48 per cent in arhar by attack of blue-bulls. Next to these pulses, the losses in production of pea, urd, masoor and gram were 55.02 per cent, 43.86 per cent, 36.95 per cent and 33.53 per cent respectively due to attack of blue-bulls. The maximum losses in production of pulses is witnessed on large sample farms. The losses in production of pulses due to attack of blue-bulls on medium sample farms was only 25.23 per cent against 32.02 per cent and 61.34 per cent on small and large sample farms respectively. It shows that about 44.00 per cent of total production of pulses goes waste in every year on the sample farms across the state due to attack of blue-bulls to pulses. The real culprit of losses in production of pulses was blue-bulls across the study areas. There has been no progress in terms of equipment and technology to take preventive measures. No preventive work was done by Government to prevent the attack of blue-bulls to pulse crops in the study areas. The need is for policy makers to implement stringent laws that will preserve the pulses from attack of blue-bulls. There is need for guidelines that will integrate the local villages seamlessly into conservation programme to control the attack of blue-bulls across the state. The attack of blue-bulls is generally performed at podding, ripping and flowering stage of plants of pulses.

8.12. Constraints faced by sample farmers during adoption of Preventive measure to check the attack of blue-bulls to Pulses.

The major share of production of pulses are going waste in every year because of attack of blue-bulls. The losses in production ranged between 16.28 per cent to 64.00 per cent across the pulses on the sample farms. The sample farmers across the selected districts of U.P. had not used the scientific approach to tackle the situation. The lack of good infrastructure facilities, poor economic condition of farmers, lack of proper awareness among the farmers, strict rules about

hunting blue-bulls, attachment with religious sentiment etc. were major hurdle in way of reducing the infestation of blue-bulls. The role of forest, animal husbandry, agriculture and revenue departments in reducing the attack of blue-bulls to pulses were found unsatisfactory in the districts of sample study. The constraints faced by the sample farmers during adoption of preventive measure to control the attack of blue-bulls to pulses were non availability of resistance varieties, very high prices of raw material, deforestation, attack of blue-bulls in the night, religious attachment ban on hunting blue-bulls etc. Among these constraints, the attack of blue-bulls in night followed by ban on hunting blue-bulls were most important constraints as had been reported by majority sample farmers. Apart from these two constraints, lack of availability of preventive measures, lack of awareness and non availability of resistance varieties of pulses were also important constraints as had been reported by sample farmers.

The increase in the population of blue-bulls is main headache as had been reported by the sample farmers across the state. Since, the attack of blue-bulls to crops is generally performed in the night and farmers are not generally equipped with good quality of weapons to encounter the blue-bulls during attack to pulses. The farmers do not have proper woolen cloths, good quality torch to face blue-bulls in the night.

8.13. Suggestions

The attack of blue-bulls to pulses has been increasing day by day across the state. The most of sample farmers were economically poor and unable to use of preventive measures to reduce the attack of blue-bulls to pulses.

They had suggested a number of remedies to check the attack of blue-bulls to pulses. The suggestions are totally based on their perception. The opinions of forests officials and NFSM have also been incorporated in the suggestions.

8.13.1. Agriculture scientists should evolve such a type of varieties of pulses which are against consumption by blue-bulls. It is much required in case of arhar and pea crops. These crops are much targeted by blue-bulls.

- 8.13.2.** NFSM should provide financial help to needy pulse growers to purchase raw materials to use the biological and chemical methods in pulse crops. The separate budget should be allocated under NFSM for this purpose.
- 8.13.3.** There is a need to give proper awareness and training to the farmers for the application of proper protective measures to check attack of blue-bulls to pulse crops. They should be equipped with required knowledge and training to curb infestation of blue-bulls.
- 8.13.4.** The use of crackers during attack by blue-bulls were found very effective preventive measures. Therefore, the financial help is needed for poor pulse growers to purchase the crackers from markets.
- 8.13.5.** The attack of Blue-bulls is performed in the night. Therefore, they need woolen cloth raincoat, umbrella, torch, good quality weapons to check the attack of blue-bulls. This type of arrangement could be made at panchyat level.
- 8.13.6.** The permission for killing blue-bulls followed by castration of blue-bulls were most important suggestion as had been reported by 35.30 per cent, 17.07 per cent of small size of sample farmers respectively.
- 8.13.7.** The extension of indigenous techniques, availability of resistance varieties and castration of blue-bulls were also important suggestions as had been reported by 31.71 per cent, 18.22 per cent and 26.83 per cent of small size of sample farmers respectively.
- 8.13.8.** As far as medium size of sample farmers are concerned, they suggested that farmers be allowed to kill blue-bulls at the time of attack to crops. The castration of blue-bulls was most attractive suggestion to check the growth in population of blue-bulls.

Overall, the permission for killing of blue-bulls, provision of subsidy on biological and chemicals etc. were most important suggestions as had been reported by majority of sample farmers of four selected districts of Uttar Pradesh.

8.14. Policy Implication

8.14.1. First of all, it is required to check the population of blue-bulls. The population of blue-bulls has been increasing at the rate of geometrical propagation in the state. The forest and animal husbandry department should make joint efforts to check the growth of population of blue-bulls by use of castration techniques.

8.14.2. Forest department should take the responsibility to stop the deforestation. This would provide better shelter for blue-bulls in forest.

8.14.3. There is a need for amendment in Wildlife Act to provide the right to farmers for killing blue-bulls as and when the blue-bulls destroy the crops.

8.14.4. The Government should make a policy to kill blue-bulls to declare them vermin in Uttar Pradesh.

8.14.5. In a bid to curb the blue-bulls infestation on pulses, the State Government should ask its various concerned departments to visit the affected areas regularly to monitor the situation and act accordingly.

8.14.6. Free medical treatment should be given to injured farmers to safeguard their interest.

8.14.7. The pulse growers should be advised by the staff of NFSM and agriculture departments to barricade the pulses by fencing with wire of iron/plastic. This system was found very useful to control the attack of blue-bulls to pulses. In this context, it is suggested to NFSM and forest department to provide financial help to active pulse growers to use this type of preventive measures.

- 8.14.8.** The use of biological materials such as broadcasting of cow dung/solution of Neem products etc. are also helpful in reducing the attack of blue-bulls to pulse crops. This type of preventive measures should be propagated among the farmers across the state.
- 8.14.9.** It should be propagated among the people that blue-bulls do not come under cow breed. The physical appearance of blue-bulls is totally different from features of cow. It is totally a wild animal. Then the sentiments of Hindus will not be hurt if blue-bulls are killed by the people.
- 8.14.10.** Farmers are also advised to barricade the area of pulses by use bamboo which are easily available in the villages. This type of fencing will also be helpful to protect infestation of blue-bulls on crops.
- 8.14.11.** The use of Solar Fence Guard System has been found very effective preventive measure to control the attack of blue-bulls to crops in Gujarat state. The U.P. Government should guide the farmers to install Solar Fence Guard System on their fields to protect the attack of blue-bulls. In this context, it is suggested that state Government should provide the financial assistance to interested growers in the installation of the system. This system could save million tonnes of production of pulses in the state. This system should be propagated across the state to get rid from attack of blue-bulls to crops.

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Comments

“Estimation of Losses to Pulse Crops by Blue-Bulls in Uttar Pradesh”

AERC, University of Allahabad, Allahabad-211002

Comments received on 07/12/2016 from Shri. Rakesh Kumar, Assistant Director, Ministry of Agriculture and Farmers Welfare, Dept. of Agri., Coop. & farmers Welfare, Directorate of Economics & Statistics, (AER Division), Shastri Bhawan, New Delhi

Your team can go ahead with the draft for final report. The draft is overall fine except some grammatical errors, which we are hoping to be rectified after peer review.

Appendix – II

Action Taken on Comments

Date of comments received 07/12/2016

Date of dispatch of final report 20/12/2016

The grammatical errors in draft report have been rectified.

Executive Summary

Study No. 143

Publication No. 191

Estimation of Losses to Pulse Crops by Blue-Bulls in Uttar Pradesh

**Prof. Ramendu Roy
Dr. H.C. Malviya**



**Study Sponsored by Ministry of Agriculture and Farmers Welfare
Agro-Economic Research Centre
University of Allahabad
Allahabad-211002**

December 2016

Executive Summary

1. Introduction

The country has attained self sufficiency in the production of wheat, rice, maize and jowar but it is well behind in the production of pulses and oilseeds. The country is in a position to export wheat while pulses are being imported from pulse growing countries to meet the consumption need of the people. The bumper production of wheat and rice has created problems for its proper storage. Since advent of Green Revolution in the country followed by extension of irrigation networks and availability of quality inputs, the area under wheat and rice has been increasing at the cost of pulses. The area under pulses was 37.25 lakh hectares in 1970-71 in U.P. which has decreased to 24.16 lakh hectares in 2012-13, showing 35.14 per cent decrease over the period. The production of pulses in U.P. was 24.30 lakh M. Tonnes during 2004-05 which has decreased to 23.97 lakh M. Tonnes during 2011-12 thereby showing 1.36 per cent decrease over the period. There was a fall in area under pulses in U.P. However, the productivity of pulses has been increasing year by year due to impact of different sponsored central schemes. The reasons for shortfall in the production of pulses in U.P. are shrinkage in area of pulses, frequent occurrence of drought, excess rains, hail-storm, attack of pests/insects, diseases etc. Besides these, attack of blue-bulls to pulse crops is major cause of low production of pulses in U.P. Out of 75 districts of U.P., 43 districts are in grip of blue-bulls. More than 40 per cent of total areas of pulses are destroyed by blue-bulls alone.

The total population of blue-bulls was estimated at about 2,54,449 in U.P. in 2008-09. The population of blue-bulls has been increasing the at rate of 14 per cent per annum. There is no approach by forest department to check the growth of population of blue-bulls. They were only confined and localized in particular tracks in past two decades. They were found in river valleys and dense forests but at present, they are found in villages across the state. They are fearless and visible in day also. On account of these, the farmers have been giving-up the cultivation of pulses on their farms. If this situation will prevail in years to come, the pulse crops will not be grown by the farmers. All developmental programmes related to increase in the production of pulses of

U.P. cannot produce fruitful result until the attack of blue-bulls is prevented. Seeing the gravity of situation created by blue-bulls to pulses, the Ministry of Agriculture and Farmers Welfare, Govt. of India has entrusted to Agro-Economic Research Centre, Allahabad to undertake a study entitled “Estimation of Losses to Pulses by Blue-Bulls in Uttar Pradesh”.

2. Objectives of the Study

The objectives of the study are mentioned below:

- I. To assess the extent of damage to pulse crops by blue bulls
- II. To determine adopted measures undertaken by government and farmers in reducing the losses by blue bulls.
- III. To identify the constraints in the implementation of measures by state government to reduce the losses to pulse crops due to blue bulls.
- IV. To suggest suitable remedial measures to reduce and prevent the damage to pulses by blue bulls.

3. Proposed Coverage of Crops

The study has been conducted in Uttar Pradesh. Hence, all pulse crops namely gram, pea, lentil, arhar, urd and moong have been covered under this study to know the quantum losses of production of pulses due to attack of blue-bulls.

4. Collection of Data

The study is based on primary as well as secondary data. The primary data have been collected from sample pulse growers of selected villages. The collection of primary data have been done by personal interview method for reference year 2014-15. The secondary data have been collected from Directorate of Agriculture, Krishi Bhawan, Lucknow and other relevant sources.

5. Research Methodology

This study is confined to state of Uttar Pradesh as a whole. A multistage stratified mixed sampling technique were used to cover the stated objectives. Since, state is divided into four regions, namely Eastern, Central, Bundelkhand and Western and also covered by NFSM, therefore, one district from one region has been covered based on NFSM subject to maximum area of pulses during 2014-2015. From each selected district, two blocks have been selected on same criteria as cited above. From each block thus selected a cluster of suitable number of villages have been undertaken. A list of pulse growers, thereafter from selected villages have been collected and categorized into various size groups prevalent under study areas. The ultimate sample pulse growers have been undertaken according to probability proportion to total number in each category restricting the total number of sample growers to 40 in each district. The procedure of selection of district, blocks, villages and pulse growers are illustrated in Table-1.

Table-1
Details of Sample selected

Name of regions	Nos. of district selected	Nos. of blocks selected	Nos. of villages selected	Nos. of sample farms selected
Eastern	1	2	4	40
Central	1	2	4	40
Bundelkhand	1	2	4	40
Western	1	2	4	40
U.P.	4	8	16	160

6. Reference Year

Reference year of study is 2014-15. Application of different statistical tools have been applied to get scientific result.

7. Area, Production and Productivity of Pulses in Uttar Pradesh

7.1. Area

Uttar Pradesh is most populous state of country. More than 16 per cent of total population of the country resides in the state while per centage share of geographical area of U.P. to total geographical area of country was only 7.33 per cent in 2011. The density of population in U.P. was 818 per sq. km. Agriculture is main occupation of the state. Agriculture is still gamble of monsoon therefore, hundred per cent risk is involved in this occupation. The cropping intensity was only 154.77 per cent during 2011-12. The per capita availability of net area sown was estimated at 0.08 hectare in 2011-12. Out of GCA, food-grains accounted for 78.29 per cent followed by 9.39 per cent pulses in 2011-12. The cropping pattern was always in favour of wheat and rice. Of the GCA, wheat accounted for 38.06 per cent followed by 22.94 per cent of rice during 2012-13. The share of pulse crops in total GCA was 16.05 per cent in 1970-71 which went down to 9.39 per cent in 2012-13, showing 41.49 per cent decrease over the period. The maximum fall in area under pulses is witnessed during post Green Revolution period.

Six pulse crops namely arhar, moong, urd, gram, pea and masoor are grown across the state. Out of total area under pulses being 24.16 lakh hectares in 2011-12 in U.P. rabi pulses (gram, pea and masoor) accounted for 59.83 per cent while kharif pulses (arhar, moong and urd) accounted for 40.17 per cent. It has been observed from data that area under rabi pulses has been decreasing from year to year while the area under kharif pulses has been increasing during corresponding period. The maximum shortfall in area under pea was witnessed while area under gram and masoor was more or less stagnant. Among the six pulses, gram, masoor, urd are important pulses. Arhar and pea which are largely consumed by people of U.P. have negative growth in areas during study period. On account of these, the price of arhar has gone up beyond the control during 2014-15.

7.2. Production of different pulse crops in Uttar Pradesh

The total production of all six pulses in state was only 23.97 lakh M. Tonnes during 2011-12 against 24.30 lakh M. Tonnes during 2004-05. The production of pulses in U.P. has been showing a decreasing trend from 2004-05 to 2011-12. There is a huge gap between availability of pulses and requirement. The growth rate of production of pulses in U.P. was negative and insignificant. Out of total production of pulses being 23.97 lakh M. tones during 2011-12, the contribution of gram was 29.63 per cent followed by 19.88 per cent and 18.60 per cent of masoor and pea respectively. The contribution of urd, arhar and moong was 15.94 per cent, 13.81 per cent and 2.14 per cent respectively during the same period. The production of arhar, pea and gram was not found encouraging during study period. Over all, the production of pulses in U.P. is not sufficient to meet the consumption need to ever growing population. More than 40 per cent of total production of pulses are being damaged by blue-bulls alone.

7.3. Average Yield of Pulses in Uttar Pradesh

The per hectare yield of pea was 14.31 qtls followed by 11.83 qtls., 10.70 qtls, 8.94 qtls., 6.72 qtls. and 6.31 qtls. of gram, arhar, masoor, urd and moong respectively during 2011-12. There was a positive growth in average yield of all six pulse crops in U.P. during the study period. However, the growth in yield of pulses was marginal in U.P. during the study period. Table-2

Table-2

**Area, Production and Productivity of different pulse crops in different years in U.P.
(from 2004-05 to 2011-12)**

Years	Area	% change over base year	Production	% change over base year	Area in lakh hectares Production in lakh M.T. Productivity in qtls./hect.	
					Productivity	% change over base year
2004-2005	28.17	100.00	24.30	100.00	8.75	100.00
2005-2006	26.40	93.72	22.05	90.74	8.63	98.63
2006-2007	24.68	87.61	18.14	74.65	8.35	95.43
2007-2008	22.70	80.58	16.27	66.95	7.35	84.00
2008-2009	23.20	82.36	20.84	85.76	7.17	81.94
2009-2010	25.50	90.52	19.06	78.43	8.99	102.74
2010-2011	24.48	86.90	20.16	82.96	7.47	85.37

2011-2012	24.16	85.76	23.97	98.64	8.24	94.17
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8. Background of selected districts of Uttar Pradesh

The four districts namely Badaun, Fatehpur, Allahabad and Jhansi were selected from Western, Central, Eastern and Bundelkhand regions of U.P. respectively for the study. The profile of the selected districts has been analyzed in following sequence.

8.1. Badaun district

Badaun district belongs to western region of Uttar Pradesh. It is one of the agriculturally advanced districts of western region of state. The total population of the district was 36.83 lakh in 2011. The average holding of the district was 0.82 hectare. The per capita availability of land was estimated at 0.09 hectare. Wheat and bajra were dominant crops of the district in 2011-12. The pulses and oil seeds accounted for 6.87 per cent and 4.49 per cent to GCA during the same period. Urd and masoor were main pulse crops which accounted for 86.01 per cent and 9.97 per cent of total area under pulses in 2011-12. The moong, gram, pea and arhar accounted for 0.66 per cent, 0.17 per cent, 1.58 per cent and 1.61 per cent of total area under pulses in 2011-12 respectively. The growth in area under pulses was insignificant during study period i.e. 2004-05 to 2011-12.

The total production of six pulse crops was 2.96 lakh M. Tonnes in 2004-05 which has decreased to 43,759 M. tones in 2011-12, thereby showing 47.60 per cent decrease over the period. The production of six pulses has drastically decreased in 2011-12 as compared to production of 2004-05. Urd was an important pulse of the district as far as production is concerned.

8.2. Fatehpur district

Fatehpur is an important district of central region of U.P. The total population of the district was 26.33 lakh in 2011. The per capita availability of land in the district was only 0.11 hectare. Most of cultivated areas is under irrigation network. The cropping intensity of this district was only

142.56 per cent in 2011-12. The wheat and rice were important cereals accounted for 41.16 per cent and 19.37 per cent to GCA in 2011-12. The shares of pulses and oilseeds were 18.54 per cent and 6.02 per cent to GCA respectively during the corresponding year. It shows that area under pulses was next to area of rice. Among the pulses, gram and arhar were important crops which occupied 54.99 per cent and 25.48 per cent of total area under pulses respectively during 2011-12. The position of arhar was found discouraging because its area has been continuously decreasing in alternative years.

The production of arhar was 29,593 qtls during 2004-05 which has decreased to 21,279 qtls during 2011-12, showing 28.09 per cent decrease over the period. Out of total production of all pulses during 2011-12, the share of gram was 62.58 per cent followed by 23.65 per cent of arhar. Thus, gram and arhar were dominant pulses in Fatehpur district.

8.3. Allahabad district

Allahabad is agriculturally very advanced district of Eastern region of U.P. The population of this district was 59.54 lakh in 2011. The density of population of the district was very high being 1066 per sq. km. More than 55 per cent of reporting area was under cultivation. The cropping intensity was worked-out to be 155.71 per cent in 2011-12. The wheat and rice were dominant crops in Allahabad district. Out of GCA of 4.80 lakh hectares, wheat accounted for 44.85 per cent followed by 30.58 per cent and 10.47 per cent of rice and pulses respectively during 2011-12.

Of the total area under pulses during 2011-12 in Allahabad district, the gram accounted for maximum share being 31.38 per cent followed by 31.07 per cent of arhar. Both jointly accounted for 62.45 per cent of total area under pulses during 2011-12. Next to these pulses, masoor accounted for 15.74 per cent followed by 8.28 per cent, 6.81 per cent and 6.72 per cent of pea, moong and urd respectively. The area under arhar and gram has been decreasing across the study period.

The total production of all pulses was 51,707 qtls. during 2011-12 of which gram had contributed 33.14 per cent followed by 32.52 per cent arhar. Thus, arhar and gram were important crops of the district. However, the drastic down fall in arhar witnessed from the records during the study period.

8.4. Jhansi district

Jhansi district belongs to Bundelkhand region of U.P. Most of the cultivated area of this district is un-irrigated. The total population of this district was 19.99 lakh in 2011. The density of population was only 398 sq. km. against 828 sq. km. of the state as a whole. The cropping intensity was only 154.16 per cent. The per capita availability of land was worked out to be 0.16 hectare against 0.08 hectare of the state as a whole. The pressure of population on land was in significant. The irrigation intensity was only 105.82 per cent against 144.12 per cent of the state. The pulses and wheat were dominant crops in the district in 2011-12. Out of GCA of 5.12 lakh hectares, pulses accounted for 37.29 per cent followed by 32.92 per cent wheat. The urd was important pulse of kharif season while pea, gram and masoor were main pulse crops of rabi season. Out of total area under all pulses during 2011-12 urd accounted for higher share being 28.40 per cent followed by 26.66 per cent, 23.44 per cent, 17.68 per cent and 3.07 per cent of gram, pea, masoor and moong respectively.

The total production of pulses was 20.20 lakh tones during 2011-12, of which pea accounted for 35.50 per cent share followed by 32.23 per cent, 15.49 per cent and 14.69 per cent of gram, urd and masoor respectively. It is a surplus district of the state as far as production of pulses is concerned.

9. Findings based on primary data

Out of 160 sample pulse growers, 51.25 per cent was marginal followed by 26.25 per cent and 22.50 per cent of medium and large pulse growers. Of the total head of households 15.00 per cent head of households were illiterate. The educational status of head of households were upto mark. Out of 160 sample households, 41.88 per cent were OBC followed by 41.87 per cent of

general caste, while 16.25 per cent of total sample households belonged to SC category. The agriculture was main occupation of all the sample households. The per farm of owned land holding of all the sample farms was 2.92 hectares. The per farm operational holding was a little bit higher than that of owned land. Almost all owned land was fully irrigated across the size of sample farms.

Out of 810.19 hectares of GCA of 160 sample farms, kharif season crops accounted for 51.50 per cent against 47.33 per cent of rabi seasons crops. Among the kharif season crops, urd, paddy and arhar were important crops which occupied 14.64 per cent, 12.12 per cent and 8.98 per cent to GCA respectively. As far as rabi seasons crops are concerned, wheat, gram, pea and masoor were important crops which occupied 20.24 per cent, 14.17 per cent, 4.10 per cent and 7.96 per cent to GCA respectively.

Out of total area under all pulses of 422.46 hectares of the sample farms, urd, gram and arhar accounted for 28.08 per cent, 27.18 per cent and 17.22 per cent respectively. Thus these crops jointly accounted for 72.48 per cent of total area under pulses on the sample farms. The masoor, pea and moong accounted for 15.27 per cent, 7.87 per cent and 4.38 per cent of total area under pulses on the sample farms out of total area under all pulses being 422.46 hectares on the 160 sample farms, 51.42 per cent had been destroyed by blue-bulls during reference year. Of the total area under kharif pulses on all sample farms 47.64 per cent had been damaged by blue-bulls against 55.11 per cent of rabi pulse crops. Among the kharif pulses, the maximum area under arhar being 61.82 per cent followed by 41.95 per cent and 28.38 per cent of urd and moong respectively had been destroyed by blue-bulls respectively in reference year. Among the rabi pulses, the maximum area of gram being 62.38 per cent followed by 49.17 per cent and 45.40 per cent of pea and masoor respectively had been damaged by blue-bulls in the reference year. Thus arhar, gram and pea had been damaged extensively by blue-bulls in comparison to masoor, moong and urd. Table-3

Table-3
Area of pulse crops damaged by blue-bulls on the sample farms (2014-15)

Name of pulse crops	Area in pulses (Hect.)	Damage area (Hect.)	% of damaged area
Arhar	72.73 (17.22)	44.96	61.82
Moong	18.50 (4.38)	5.25	28.38
Urd	118.62 (28.08)	49.76	41.95
Total Kharif pulses	209.85 (49.67)	99.97	47.64
Gram	114.83 (27.18)	71.63	62.38
Pea	33.25 (7.87)	16.35	49.17
Masoor	64.53 (15.27)	29.30	45.40
Total rabi pulses	212.61 (50.33)	117.28	55.16
All pulses	422.46 (100.00)	217.25	51.42

Note: Figures in brackets are percentage to area under all pulses

The production of all pulses on the sample farms in reference year was below the average production of state as a whole. The per hectare production of urd was 3.27 qtls. followed by 2.37 qtls. and 2.06 qtls of moong and arhar respectively. The per hectare yield was maximum of pea being 3.41 qtls followed by 3.23 qtls and 2.48 qtls of masoor and gram respectively. The cause of low yield of pulses on the sample farms was due to attack of blue-bulls to pulse crops in reference year.

The sample pulse growers had done best efforts to save their crops from attack of blue-bulls. The eight preventive measures namely use of dung/neem solution, use of chemical materials use of effigy, wiring, crackers, stricks/stones, gun, ringing bells, louding, shining taps etc. were adopted by sample farmers to check the attack of blue-bulls. Among these 8 preventive measures, the use of crackers strick/stones, louding and ringing bells etc. had been adopted maximum by the sample farmers. On account of use of preventive measures, the sample farmers had saved the

production of gram of 66.47 per cent followed by 63.05 per cent, 56.14 per cent, 44.98 per cent, 40.02 per cent and 40.52 per cent of masoor, urd, pea, moong and arhar respectively.

10. Reasons for shifting of Area under Pulses to other crops on the sample farms

The drought, excess rains, occurrence of hailstorm, attack of pests/disease and blue-bulls are major reasons for shifting of area under pulses to wheat, rice, potato, sugarcane etc. The low profitability of pulses as compared to its alternative crops is also a reason of giving up the cultivation of pulse crops. At present, the attack of blue-bulls to pulses is also a major cause of shifting of area of pulses to its alternative crops. One of the most important reasons for shifting areas of pulses is terror of blue-bulls. The attack of blue-bulls are generally performed in midnight. The frequency of attack of blue-bulls was more than ten times, however. It differs from crop to crop. The blue-bulls are in groups which ranges 10 – 20 numbers at the time of attack.

11. Estimation of Losses by Blue-bulls to Pulses on the sample farms

The total losses in production of all pulses by attack of blue-bulls was 1.23 qtls. per hectare against production of 2.81 qtls per hectare. It shows that the losses in production of all pulses was 43.80 per cent due to attack by blue-bulls on the sample farms in 2014-15. The losses in production of different pulses varied from each other. The maximum losses being 59.98 per cent is witnessed in moong followed by 59.48 per cent in arhar by attack of blue-bulls. Next to these pulses, the losses in production of pea, urd, masoor and gram were 55.02 per cent, 43.86 per cent, 36.95 per cent and 33.53 per cent respectively due to attack of blue-bulls. The maximum losses in production of pulses is witnessed on large sample farms. The losses in production of pulses due to attack of blue-bulls on medium sample farms was only 25.23 per cent against 32.02 per cent and 61.34 per cent on small and large sample farms respectively. It shows that about 44.00 per cent of total production of pulses goes waste in every year on the sample farms across the state due to attack of blue-bulls to pulses. The real culprit of losses in production of pulses was blue-bulls across the study areas. There has been no progress in terms of equipment and technology to take preventive measures. No preventive work was done by Government to prevent the attack of blue-bulls to pulse crops in the study areas. The need is for policy makers to implement stringent laws that will preserve the pulses from attack of blue-bulls. There is need for guidelines that will integrate the local villages seamlessly into conservation programme to

control the attack of blue-bulls across the state. The attack of blue-bulls is generally performed at podding, rippling and flowering stage of plants of pulses. Table-4

Table-4

Losses in production of Pulses by Blue-Bulls on all Sample Farms (2014-2015)

Name of Crops	Size of Farms											
	Small			Medium			Large			All farms		
	Product ion Qtl.	Quantit y lost qtls.	% Loss to product ion	Product ion Qtl.	Quantit y lost qtls.	% Loss to product ion	Product ion Qtl.	Quantit y lost qtls.	% Loss to product ion	Product ion Qtl.	Quantit y lost qtls.	% Loss to product ion
Arhar	33.35 (2.12)	20.11 (1.28)	60.30	39.19 (2.17)	9.45 (0.52)	24.10	77.40 (1.99)	59.63	77.04	149.94 (2.06)	89.19 (1.23)	59.48
Moong	1.80 (1.80)	1.33 (1.33)	74.00	20.20 (4.49)	10.90 (2.42)	53.96	21.80 (1.63)	14.04	64.40	43.80 (2.37)	26.27 (1.42)	59.98
Urd	147.45 (4.97)	41.73 (1.41)	28.30	98.20 (2.89)	36.67 (1.08)	37.34	141.85 (2.58)	91.56	64.55	387.50 (3.27)	169.96 (1.43)	43.86
Gram	42.00 (2.30)	6.84 (0.37)	16.25	89.52 (2.95)	6.52 (0.22)	7.28	153.58 (2.32)	82.23	53.54	285.10 (2.48)	95.59 (0.83)	33.53
Pea	19.00 (5.07)	8.65 (2.31)	45.53	34.75 (3.86)	8.31 (0.92)	28.82	59.69 (2.91)	45.45	76.15	113.44 (3.41)	62.41 (1.88)	55.02
Masoor	57.25 (4.62)	20.68 (1.61)	36.12	59.30 (3.16)	14.22 (0.76)	23.98	91.84 (2.79)	42.11	45.85	208.39 (3.23)	77.01 (1.19)	36.95
All Pulses	300.85 (3.70)	99.34 (1.22)	33.02	341.16 (2.98)	86.07 (0.75)	25.23	546.16 (2.41)	335.02	61.34	1188.17 (2.81)	520.43 (1.23)	43.80

Note: Figures in brackets are per hectare

12. Constraints faced by sample farmers during adoption of Preventive measure to check the attack of blue-bulls to Pulses.

The major share of production of pulses are going waste in every year because of attack of blue-bulls. The losses in production ranged between 16.28 per cent to 64.00 per cent across the pulses on the sample farms. The sample farmers across the selected districts of U.P. had not used the scientific approach to tackle the situation. The lack of good infrastructure facilities, poor economic condition of farmers, lack of proper awareness among the farmers, strict rules about hunting blue-bulls, attachment with religious sentiment etc. were major hurdle in way of reducing the infestation of blue-bulls. The role of forest, animal husbandry, agriculture and revenue departments in reducing the attack of blue-bulls to pulses were found unsatisfactory in the districts of sample study. The constraints faced by the sample farmers during adoption of preventive measure to control the attack of blue-bulls to pulses were non availability of resistance varieties, very high prices of raw material, deforestation, attack of blue-bulls in the night, religious attachment ban on hunting blue-bulls etc. Among these constraints, the attack of blue-bulls in night followed by ban on hunting blue-bulls were most important constraints as had been reported by majority sample farmers. Apart from these two constraints, lack of availability of preventive measures, lack of awareness and non availability of resistance varieties of pulses were also important constraints as had been reported by sample farmers.

The increase in the population of blue-bulls is main headache as had been reported by the sample farmers across the state. Since, the attack of blue-bulls to crops is generally performed in the night and farmers are not generally equipped with good quality of weapons to encounter the blue-bulls during attack to pulses. The farmers do not have proper woolen cloths, good quality torch to face blue-bulls in the night.

13. Suggestions

The attack of blue-bulls to pulses has been increasing day by day across the state. The most of sample farmers were economically poor and unable to use of preventive measures to reduce the attack of blue-bulls to pulses.

They had suggested a number of remedies to check the attack of blue-bulls to pulses. The suggestions are totally based on their perception. The opinions of forests officials and NFSM have also been incorporated in the suggestions.

13.1. Agriculture scientists should evolve such a type of varieties of pulses which are against consumption by blue-bulls. It is much required in case of arhar and pea crops. These crops are much targeted by blue-bulls.

13.2. NFSM should provide financial help to needy pulse growers to purchase raw materials to use the biological and chemical methods in pulse crops. The separate budget should be allocated under NFSM for this purpose.

13.3. There is a need to give proper awareness and training to the farmers for the application of proper protective measures to check attack of blue-bulls to pulse crops. They should be equipped with required knowledge and training to curb infestation of blue-bulls.

13.4. The use of crackers during attack by blue-bulls was found very effective preventive measures. Therefore, the financial help is needed for poor pulse growers to purchase the crackers from markets.

13.5. The attack of Blue-bulls is performed in the night. Therefore, they need woolen cloth raincoat, umbrella, torch, good quality weapons to check the attack of blue-bulls. This type of arrangement could be made at panchyat level.

13.6. The permission for killing blue-bulls followed by castration of blue-bulls were most important suggestion as had been reported by 35.30 per cent, 17.07 per cent of small size of sample farmers respectively.

13.7. The extension of indigenous techniques, availability of resistance varieties and castration of blue-bulls were also important suggestions as had been reported by 31.71 per cent, 18.22 per cent and 26.83 per cent of small size of sample farmers respectively.

13.8. As far as medium size of sample farmers are concerned, they suggested that farmers be allowed to kill blue-bulls at the time of attack to crops. The castration of blue-bulls was most attractive suggestion to check the growth in population of blue-bulls.

Overall, the permission for killing of blue-bulls, provision of subsidy on biological and chemicals etc. were most important suggestions as had been reported by majority of sample farmers of four selected districts of Uttar Pradesh.

14. Policy Implication

14.1. First of all, it is required to check the population of blue-bulls. The population of blue-bulls has been increasing at the rate of geometrical propagation in the state. The forest and animal husbandry department should make joint efforts to check the growth of population of blue-bulls by use of castration techniques.

14.2. Forest department should take the responsibility to stop the deforestation. This would provide better shelter for blue-bulls in forest.

14.3. There is a need for amendment in Wildlife Act to provide the right to farmers for killing blue-bulls as and when the blue-bulls destroy the crops.

14.4. The Government should make a policy to kill blue-bulls to declare them vermin in Uttar Pradesh.

- 14.5.** In a bid to curb the blue-bulls infestation on pulses, the State Government should ask its various concerned departments to visit the affected areas regularly to monitor the situation and act accordingly.
- 14.6.** Free medical treatment should be given to injured farmers to safeguard their interest.
- 14.7.** The pulse growers should be advised by the staff of NFSM and agriculture departments to barricade the pulses by fencing with wire of iron/plastic. This system was found very useful to control the attack of blue-bulls to pulses. In this context, it is suggested to NFSM and forest department to provide financial help to active pulse growers to use this type of preventive measures.
- 14.8.** The use of biological materials such as broadcasting of cow dung/solution of Neem products etc. are also helpful in reducing the attack of blue-bulls to pulse crops. This type of preventive measures should be propagated among the farmers across the state.
- 14.9.** It should be propagated among the people that blue-bulls do not come under cow breed. The physical appearance of blue-bulls is totally different from features of cow. It is totally a wild animal. Then the sentiments of Hindus will not be hurt if blue-bulls are killed by the people.
- 14.10.** Farmers are also advised to barricade the area of pulses by use bamboo which are easily available in the villages. This type of fencing will also be helpful to protect infestation of blue-bulls on crops.
- 14.11.** The use of Solar Fence Guard System has been found very effective preventive measure to control the attack of blue-bulls to crops in Gujarat state. The U.P. Government should guide the farmers to install Solar Fence Guard System on their fields to protect the attack of blue-bulls. In this context, it is suggested that state Government should provide the financial assistance to interested growers in the installation of the system. This system could save million tonnes of production of pulses in the state. This system should be propagated across the state to get rid from attack of blue-bulls to crops.