CHAPTER – I

INTRODUCTION

Background

Agriculture is a pre-requisite to successful development of economy particularly in a country like India. Nearly 70 percent of the country's population depends directly and indirectly on agriculture for their livelihood. Today, food grains production of India has reached up to 215 million tones. On the other hand, the population of the country has been continuously increasing at high pace and it has crossed the mark of one billion. This is a challenge for policy makers and academicians today, whether the country will be able to provide required quantum of food to the country's population in coming years. It is the fact that food grains production has increased tremendously since independence and it rose from 51 million tones in 1950-51 to 213 million tones in 2002-03. During the same period the per capita availability of food grains has also increased from 395 grams to 492 gram per day. The increase in production has largely been due to increase in productivity of the crops. Increase in major food grains is being neutralized by high rate of population growth. While population had grown from 832 million in 1990-91 to 1.1 billion in 2005-06, an increase of nearly 33 per cent, total cereal production has grown by only 18 per cent from 138 million tones in 1990-91 to 162 million tones in 2005-06. Coarse cereals such as jowar, bajra, maize and others have grown by 11 per cent from 35 million tones to 39 million tones during the same period. Food grains' availability is also under strains due to marked increase in GDP and even per capita income, which have been inducing demand for food grains and other agricultural products as well. Over the last 40 years, enhancement in productivity has been a major concern in the agricultural research. It is well known that during the pre-independence era in the country, there has been the phase of recurred food shortages. Although much talked green revolution helped the country to achieve self-reliance in the food grains production, but the effect of green revolution appears to be paling.

In India, agriculture continues to be the case of concern for the economy. A consistent decline in the growth of the agricultural sector since 1990 onward could be observed as compared to the 1980s. It has also been observed that growth in real value of food grains' production has shown a declined (-3%) during the 1990s and (-5%) during 1999-2000 to 2002-03. This is a matter of serious concern on the front of food security of our country. As per the report of the Working Group on "Demand and Supply Projections for the Next Plan", the consumption requirement for food grains during 2007 will be 233 million tones, and the corresponding production requirement will be about 260 million tones inclusive of seed, feed and wastage. It has been estimated that India's demand for food grains by 2020 will be 351 million tones more than 50 per cent over the existing ones.

Inter-alia, food grain losses, pre and post harvest, have been the subject of considerable debate in recent years. As per one estimate made by Dr. Alam (1999) on post harvest losses, the total losses in food grains were estimated at (10 percent), (20-40%) in fruits & vegetables and (10-12%) in animal products & fisheries annually. The loss incurred in monetary terms, was to the tune of about Rs. 1,00,325 crores annually, which constituted losses of cereals, pulses and oilseeds to the extent of Rs 21,800 crores. In semi-perishables agricultural commodities, like: potato, onion & tapioca, it was to the tune of Rs 20,400 crores and in case of perishables, like: fruits, vegetables, milk, meat, fish & egg, the extent of loss was Rs. 58,125 crores. Besides, pre-harvesting losses in food grains were also significant. To estimate precisely the potential output of food grains that could come up from the area under cultivation, taking into consideration the wastage aspect it is important to know the proportion of seed, feed and wastage out of the total production of food grains. This study hence, aims at estimating the seed, feed and wastage ratios for major food grain crops and the subsequent availability of food grains for human consumption in the state of Bihar.

History of Methods of State Income Accounting Process

The Process

The national income accounts or simply national accounts can be defined as a set of systematic statistical statements, which reflect the value of the total final output produced in the various sectors of the economy, such as agriculture, industry, transport, trade, banking, etc., together with details of distribution of factor incomes among different groups and final expenditure of the economy. From production of goods and services to their final disposal, innumerable transactions take place. National accounts help us to understand in nutshell how these various transactions are inter-related and give us an idea of the working of an economy.

It will not be out of order to mention here that in the state income accounting process also, the value of total final output produced under various sectors of the economy of the state, viz., agriculture, industry, transport, trade, banking, etc., calculated together with details of distribution of factor incomes among different well-classified groups and final expenditure of the state economy. In fact, in India, prior to the development of national accounting system, which started in sixties, the main focus was on computing nation's income. Before independence, several attempts were made to compute nation's income by individual economists and research workers. But all these efforts were based essentially on macro-level data and involved a number of assumptions for want of requisite data and adequate resources. Notwithstanding the limitations, these studies provided the base for post-independence work on the subject. Since independence, due attention is being given to development of official estimates of national income and related aggregates to meet the requirements for planning and policy purposes. Recognising the need for providing estimates of national income on a regular basis, the Government of India set up an Expert Committee in 1949 known as National Income Committee under the chairmanship of Prof. P C Mahalanobis with Prof D R Gadgil and Prof. V K R V Rao as members, to make recommendations regarding the compilation of estimates of national income, the improvement of the statistical data on which the estimates were to be based and to suggest measures to promote research in the field of

national income. To assist the Committee, a National Income Unit (NIU) was set up. It was for the first time that this committee provided the estimates of national income for the entire Indian Union. The estimates and details of methodology adopted were published in the first and final reports of the National Income Committee brought out by Ministry of Finance in 1951 and 1954 respectively. The Committee recommended preparation of National Income estimates on a regular annual basis. Accepting this recommendation, the Government of India transferred the entire establishment of NIU, then working for the National Income Committee to the Ministry of Finance to take charge of the work on a regular basis. The work of estimation was ultimately transferred to the Central Statistical Organisation (CSO) and a full fledged National Income Divisions was created, which is now designated as National Accounts Division (NAD) in conformity with the expansion in its activity.

Conventional Series

As per the methodology and the pattern of presentation recommended by the National Income Committee, the first official estimates of national income were prepared by the CSO with base year 1948-49 for the estimates at constant prices. These estimates at constant 1948-49 prices along with the corresponding estimates at current prices and the accounts of the public authorities were published in 1956 in the publication Estimates of National Income in 1956. This series, commonly known as the conventional series, continued to be published till 1966 under the same title.

Revised Series (with Base Year 1960-61)

With the gradual improvement in the availability of basic data over the years, a review of Methodology for National Income Estimation and its extension to other fields of macro-economic aggregates was undertaken with a view to update the database and to shift the base year from 1948-49 to a more recent year. Special efforts in this regard were made for a comprehensive review of all available data both published and unpublished. The first results of these efforts were published in the National Income Statistics --- Proposals for a Revised Series for National Income Estimates, 1955-56 to 1959-60 (CSO, 1961). These proposals were discussed at a

seminar specially organized for the purpose. In the light of the view expressed in the seminar, several follow up studies were undertaken. The proposals' as improved/amended on the basis of the studies along with estimates as per the revised series of national income with year 1960-61 as new base for estimates at constant prices were published in the Brochure on the Revised Series on National Product, 1960-61 to 1964-65 (CSO, 1967) replacing the earlier series with base year 1948-49. With the introduction of this series with base year 1960-61 (hereafter referred to as 1960-61 series), the title of the annual publication was changed to Estimates of National Product. The coverage of the NAS was extended gradually from time to time to incorporate the estimates of private consumption expenditure, saving, capital formation, factor incomes, consolidated accounts of the nation and detailed accounts of the public sector. The title of the publication was, therefore, again changed to the present title National Accounts Statistics (NAS) with effect from January 1975 to depict the expanded scope of the publication.

Further, to meet the demand of the users, a special supplement, "National Accounts Statistics, 1960-61 to 1972-73 and disaggregated tables (CSO, 1975)" were brought out. Disaggregated tables on output, input, value added private consumption expenditure, saving and capital formation were included in this publication. While the publication presented the estimates at current prices for the years 1960-61 to 1972-73, those at constant (1960-61) prices were presented for the entire period of 1950-51 to 1972-73. All those tables presented in the special supplement became regular features from the subsequent issue of NAS (1976).

Revised Series with Base Year 1970-71

Subsequent change of the base year of the revised series from 1960-61 to 1970-71 (hereafter referred to as 1970-71 series) and the estimates according to 1970-71 series were published in NAS January 1978. Same scope, coverage and methodology were followed in preparation of these estimates as for earlier estimates included in NAS, October 1976. Latest available data from various sources formed the basis of these estimates. These included among others, population census, livestock census, various sample surveys and ad-hoc studies undertaken in the NAD Revised Series

was the outcome of both 1960-61 series and 1970-71 series. Special publication known as National Accounts Statistics: Sources and Methods, April 1980 (CSO, 1980) contained detailed methodology of estimation used in the revised series. The description of revisions/changes in the methodology/data have been mentioned in the Notes and Methodology in various issues of NAS as also in a special article in the Monthly Abstract of Statistics in its October 1985 issue. The estimates for the back years up to 1950-51 to 1970-71 prices were prepared and published in 1979 and 1980 issues of NAS in order to have comparable series of macro-economic aggregates resulting from the change of base year to 1970-71.

New Series with Base Year 1980-81

Taking into consideration the base year as 1980-81 (hereafter referred to as 1980-81 series), the CSO released a new series of national accounts aggregates in February 1988. After a comprehensive review of the database as well as the methodology employed in the estimation of various aggregates, this series has been introduced. A number of revisions arising out of the conceptual and methodological improvements as well as use of the latest available data were also involved in it. The revisions brought about for the 1980-81 series were the results of a large number of studies including those for the estimation of consumption of fixed capital based on the estimates of fixed capital stock using perpetual inventory method (PIM) carried out by the NAD since 1983, in collaboration with the Reserve Bank of India (RBI), the Directorate of Economics & Statistics (DES, Agr.) of the Ministry of Agriculture, Directorate of Economics & Statistics (DES) of the State Governments. Use of Perpetual Inventory Method (PIM) as carried out by the NAD since 1983, has been followed or is being followed by the Directorates of Economics & Statistics (DES) of the State Governments.

The coverage of the series had been enlarged to include the State of Sikkim, the improvements proposed for the 1980-81 series were also considered in depth at the Pune Seminar and Conference of the Indian Association for Research in National Income & Wealth (IARNIW) held in December 1984 and November 1985 respectively. The Advisory Committee discussed these proposals and consequential

changes in detail on National Accounts at two meetings specially convened for this purpose in April 1986 and June 1987. The CSO also benefited from the suggestions received from many other experts in the field of National Accounts.

Trends in Seed, Feed and Wastage Ratios in Bihar During three Decades (1975-76 to 2005-06)

Paddy and Lentil (Masoor) two major cereal and pulse crops respectively in the state were selected for the purpose of the study herein. Paddy constituted 57.12 per cent of the total area under cereals (64,00,000 ha). Lentil constituted 23.99 per cent of the total pulses areas (7,17,000 ha) in the state. As per latest information, total food grains' production in the state is about 115.13 lakh tonnes against its total estimated requirement of 135.44 lakh tones indicating a marked deficit of 20.31 lakh tones (15%).

Seed

It could be captured during the discussions with the state level officials that seed rates were recommended by the State Agriculture Department for various crops. According to this, the recommended seed rate for paddy ranged between 50 kg to 100 kg per ha and 25 kg to 40 kg per hectare for lentil crop across the state. But, it could be realized by the officials that majority of the farmers in the state did not follow these recommended seed rates. As a matter of fact, the farmers often use seed rates as per the availability and capability generally below recommended levels. Hence, it was very difficult to exactly estimate the quantum of seed ratio of the crops. Picture related to paddy production in the state led to the conclusion that seed used (in percentage terms) declined during the last three decades. One of the possible reasons (among others), might be, continuous increase in the production/productivity levels of the crop in the state. In case of lentil crop, it was observed that there had been a shift in the cropping pattern under rabi pulses. So, the increase or decrease in seed rates of pulses (in general) and lentil (in particular), over the past decades did not suggest definite trend. It is to be mentioned here that the State Government had been prescribing seed rate for lentil between 25 kg to 40 kg/ha across the state during the last three decades.

Feed

It is to be noted here that livestock census has not been conducted in the state regularly. Last livestock census was conducted in 1987. So, the current status of livestock in the state of Bihar has been estimated based on the earlier trend of change/increase during the five years period (i.e., 1982-87). As per census (1982), the total number of cows, bull and buffaloes were 22,168 thousand, which increased to 25,711 thousand (according to 1987 census), showing an increase of nearly 16 per cent. As per the Department of Animal Husbandry, the recommended feed quantities for livestock were 10 qtl per animal/annum. This leads to a requirement of more than 22,000 to 25,000 tonnes of feed for the cattle in the state during the referred period. It would have certainly gone up following an increasing trend in cattle population and its feed requirement.

Similarly, no census was conducted for poultry after 1987. Total number of poultry birds (as per 1982 census) was 1,37,66,000 that went up to 1,46,32,000 according to 1987 census. That is to say that there was an increase of 8,66,000 (6.29%) over the referred five years' period. Taking into account the minimum recommended requirement of poultry feed @ 5kg/annum/poultry bird, it was calculated at 4,330 tonnes. There was 1.07 times increase in number of poultry birds during the five years' period of 1982 to 1987. It must have increased 6-7 times during the 19 years' long period since 1987.

Wastage Ratios

As regards wastage ratios of food grains in the form of losses (at the time of or during the course of harvesting, transportation from field to threshing ground, threshing, storage, marketing, cooking, consuming, etc) are concerned, no record/data or information could be found at the state level despite repeated attempts. However, rough estimates in this regard reveal that on an average, there occurred 15 to 20 per cent losses in case of major cereals, i.e., paddy and wheat. Such losses were caused at different levels owing to insects and pests, milling and other reasons mentioned above. It is to be noted that an official version/estimate in this

regard could not be captured due to unavailability of accurate picture on this front at the official levels.

State Income and Wastage Ratios

It is to be noted here that several estimates of National Income were prepared during the British period. Notable among the estimators were: Dadabhai Naroji (1868), William Digby (1899), Findlay Shirraj (1911-19922 and 1931), Shah and Khambatta (1921), V K R V Rao (1925-1929 & 1931-32) and RC Desai (1931-40).

As a matter of fact, the value of output of agricultural sector was estimated by: (i) Dadabhai Naroji, (ii) Shah and Khambatta, (iii) Findlay Shirras and (iv) Wadia and Joshi and, then added a certain percentage of income of the non-agricultural sector. The assumptions of most of these estimators were guess-based and, hence devoid of any scientific basis. In the light of these lacunae, Dr. V K R V Rao used a combination of Census of Output 'and Census of Income Methods'. He divided the economy of India in two categories. In the first category: (i) Agriculture, (ii) pastures, (iii) mines, (iv) forests, (v) fishing and (vi) hunting were included. Output method was used to evaluate the product derived from these sectors. In the second category: (i) industry, (ii) transport, (iii) trade, (iv) public services and administration, (v) professions, (vi) liberal arts and (vii) domestic services were included. For these occupations census of income method was used. The income from house property and other items, which could not be covered under the above categories, were added to these two sub-totals. From the gross aggregate income so obtained were excluded the values of goods and services consumed in the process of production. By adding the net income earned from abroad, an estimation of national income was computed. That there are three methods for state Income Estimation/Accounting, viz (i) Production Method, (ii) Expenditure Method and (iii) Income Method for primary, secondary and tertiary sectors respectively. Production Method was usually followed in the state for estimating income of agricultural sector. As a matter of practice, the yield is estimated on the basis of crop cutting experiments conducted by State Agricultural Department. Under production method of the State Income Accounting Process, yield market price of final products

is taken into consideration. A good quantum of total crop produces (food grains) is wasted every year causing loss in the gross production. However, the quantities of seed and feed did not significantly affect the quantum of state income. It is to be mentioned here that enhancement in state income estimates is possible, provided wastage ratio could be reduced: reducing loss is gaining, of course.

Need for the Present Study

India has 16 percent of the total population of the world with only 2.5 percent of the total geographical area of the world. It is thus, evident and a challenging fact that the country has to feed 6.40 times bigger population in terms of available land resources. Meaning thereby to say that each and every square inch of its cultivable land has to be utilized in such a rational way by using latest technology of cultivation and ensuring minimum wastage of crops, so that farmers at the grass-root levels are able to earn genuine and profitable prices of their produces and the ultimate consumers may have greater access to produced agricultural commodities at reasonable prices. As a matter of fact, Indian agriculture contributes significantly to the aggregate economy through food crops, cash crops, oilseeds, pulses and other crops grown in the country. No doubt, India is self-sufficient for its need of agricultural commodities, except in times of natural disasters. For planning purposes with the objective of an accurate determination of Minimum Support Prices (MSPs) for various agricultural produces and to estimate how much of food grains are available for human consumption as well it is important to know the proportion of seed, feed and wastage of total production of food crops.

In the light of the above, this study is important, as it will provide estimates of seed, feed and wastage ratios for major food grain crops, and the availability of agricultural commodities (food grains) for human consumption. Yet another importance of such an 'instrumental study from policy-making point of view' is the revelation of the fact that such an effort has not been made in the past to estimate the proportions of wastages during/at various levels from production to consumption.

Objectives of the Study

The study has been conducted with the following objectives:

(1) To estimate the total quantity of food grains used for seed, feed and wastage, and

(2) To estimate the net availability of food grains for human consumption.

Organizations Responsible for the Study (Due Planning and Implementation)

In continuation of the minutes of the Officer In-charge meeting of the Agro-Economic Research Centres/Units held on February 26-27 2004 and the minutes circulated on 4th April, 2004, and in the light of the Work Plan for the year 2004-05, the Pilot study of **"Estimation of Seed, Feed and Wastage Ratio for Major Food grains"** was suggested by Indian Agricultural Statistics Research Institute, PUSA (New Delhi). Study design in respect of this study (suggested by IASRI) was made available by IASRI, Pusa itself.

Proposed Coverage

The Annual Meeting of Directors/Officers In-Charge of Agro-Economic Research Centres (AERCs)/Units held during February 26-27, 2004 at University of Delhi decided that 'the referred study' would be taken at each AERC covering one state by each AERC/Unit as desired by the Ministry of Agriculture, Government of India. Accordingly, following the instruction of the Ministry, the study mentioned above was undertaken by A E R C for Bihar & Jharkhand, T M Bhagalpur University with the state of Bihar as universe of study for the purpose.

In consequent to earlier studies related to similar issue, the present study has been specifically planned. A systematic and detail glance or discussion of the origin of such study is, however, inextricable part. In 1986, Government of India constituted a Committee of Experts comprising of members from different organizations, such as: DES, NSSO, CSO, IASRI, Ministry of Civil Supplies and Ministry of Agriculture with the objective to assess seed, feed and wastage ratios for food grains. This committee, based on the available data, reported that 12.5 percent of the total production of food grain crops was used as seed, feed and quantity of food grains wasted. After the submission of this report, the Committee stressed the need for a fresh study for

getting reliable estimates of the net quantity of food grains available for human consumption. Accordingly, Techno-Economic Research Institute undertook a pilot study on "Seed, Feed and Wastage Ratios in Food grains" on behalf of Planning Commission in some of the districts of Punjab, Haryana and Western Uttar Pradesh in 1986-87. As per the results of the study, 10.32 percent of the total production of food grains formed part of seed, feed and wastage in these areas. The individual corresponding figures for Western Utter Pradesh, Punjab and Haryana were: 12.01 percent, 8.22 percent and 10.84 percent respectively. It was recommended that the study should be extended over other selected regions in India too.

In consideration of such recommendation and under the circumstances described above, Pilot Study on **Estimation of Seed, Feed and Wastage Ratio for Major Food Grains** was assigned by the MOA, GOI following a meeting of Directors/Hon. Directors of AERCs/Units held in Delhi on 5th-6th August, 2005. (This is an important study, as the ratios to be evolved out of this study shall be used for next 10-12 years for taking various policy decisions). For the smooth methodical and scientific conduct of this study, the revised tentative chapter-scheme and table-formats were prepared/framed by Dr. H.V.L. Bathla of Indian Institute of Agricultural Statistics Research, New Delhi. Dr. R S Deshpande, Professor and Head (ADRT Unit), Institute for Social and Economic Change, Bangalore was made the Co-ordinator of this all-India study.

Under proposed coverage, it was clearly suggested that the study would be taken at each AERC covering one state by each AERC as directed by the Ministry of Agriculture. As such, all the 15 AERCs/Units situated in 15 different states/union territories covering all India territory, simultaneously conducted this important study involving high policy significance.

Tentative Method of Writing the Report

The study has been presented in a systematic feature in an intuitive manner under the following Chapter Plan (as suggested by the coordinator).

The study is divided in to five chapters.

Chapter Design

The first chapter (Introduction) contains the following sections

Introduction

History and methods of estimation followed in the State Income Accounting process.

1.1 Trends over last three decades in the seed, feed and wastage ratios based on State Income Accounting Methodology. (A few earlier studies undertaken in this direction have also been included).

1.2 Probable impact on the State Income Accounting due to this.

1.3 Need for the present study.

1.4 Objectives of the study.

1.5 Organizations responsible for the study (Due Planning and Implementation).

1.6 Review of Literature

Chapter – II

II. Description of the Survey

Chapter – II has its orbit around the following themes:

2.1 Sampling Design.

2.2 Profile of the regions selected for the study.

2.3 Cropping pattern of the State, Districts and villages selected thereof.

2.4 Methods of data collection (this included schedules used, items on which data collected, periodicity, by enquiry or physical observations, crops covered, field staff used, etc.).

III. Methodology

This chapter deals with methods of data collection, statistical tools used and the procedure for getting the ratios and other results.

IV. Results and Discussion

Chapter – IV includes interpretation of the following aspects divided in three major sections each having four sub sections, viz;

4.1 Utilization of grain for seed

4.1.1 Process of utilization

4.1.2 Methods and assumptions

4.1.3 Crop-wise estimates for seed

4.1.4 Farm size-wise estimates

4.2 Utilization of grain for feed

4.2.1 Process of utilization

4.2.2 Methods and assumptions

4.2.3 Crop-wise estimates for feed

4.2.4 Farm size-wise estimates

4.3 Wastages in food grains

4.3.1 Wastages at different production stages

4.3.2 Assumptions and Methods

4.3.3 Crop-wise estimates of Wastages

4.3.4 Farm size-wise estimates

V. Summary and Conclusion

Chapter – V contains extracted version of the expatiated analytical findings of Results and Discussions.

Review of Literature

A brief of the earlier studies conducted on the related aspect have been reviewed and presented here under:

i. **Gill & Johl (1966)** In their study, they found that due to lack of proper storage facilities and practices at village level about 2-5 percent of the produced are lost.

ii. **Chabra and Singh (1977)** Reported that harvesting and threshing by machines caused less losses as compared to manual/animal threshing. He also observed that dried and over dried condition of grains resulted in losses between 1-6 percent.

iii. **T. P. Ojha (1978)** In his study on paddy crop observed that the losses were maximum in post-harvest rather than pre-harvest. He had estimated that more than 40 percent by weight was losses in this crop at various stages of harvesting, transportation, threshing, storage, drying, milling, etc.

iv. **Birewar (1977)** In his study, finds that the wastages in food grains at post harvest level was high and he suggested for prevention of waste of food grains at post harvest level by ways of better management of threshing, transport, storage, processing and marketing.

v. **Majumdar (1979)** In his study estimated that during 1951-52 to 1976-77 on an average about 12.8 percent of losses in total food grains out put at national level occurred annually.

vi. **Raio & Sirohi (1980-81)** Study found that natural calamities and insects/pests attack in paddy crop were responsible for 25 percent of losses in the crop. They also found that during storage, losses varied between 5-10 percent.

vii. **P.S. Tyler (1991)** His study finds that 50 percent reduction in production was due to post-harvest losses. He observed that there was no ideal methodology for post-harvested loss assessment. It was also observed that the quantitative losses at various stages were not fully recognized, but systematic studies by different organizations indicated that their losses were enormous.

viii. **Deshpande & Singh (2001)** In their study they found that about 8 percent of total losses in paddy was due to storage.

ix. **Gill (2000)** Study finds that the post-harvest losses were 7-10 percent at the farm to market levels and another 4–5 percent from the market to distribution levels. As a whole, the losses equal to 12 million metric tonnes to 16 million metric tonnes of grains were estimated per year. Out of the total losses, wheat constituted about 3-4 million metric tonnes and rice 5-7 million metric tonnes.

x. **Singh & Khosla (1978)** In this study on post-harvest food grain losses in India, they estimated the magnitude of food grain losses at various stages. The study finds that out of total losses, the transit and storage losses in food grains ranged between 1.03 percent and 1.09 percent of the value of sales

during 1969-73. In case of rice at different post-harvest stages losses of about 10 percent to 37 percent were estimated.

xi **Singh (2000)** In his study, It was observed that the post-harvest losses relating to handling and storage did not receive the required attention. In India, a major par of the food grain is stored by our farming community for their own consumption or seed, labour payment in kind, etc. Both quantitative and qualitative loss was estimated at about 10 percent of the food grains due to conventional means of storage at the farmers' level.

xii. **Ramaswamy & Selvaraj (2002)** In their study found that out of the total domestic supply of pulses, as food, it accounted for nearly 82 per cent. Out of the total supply, seed accounted for (6%), feed (9%) and wastage (3%). They observed that nearly 4 to 5 lakh tones of pulses were wasted annually in the country.

CHAPTER-II

DESCRIPTION OF THE SURVEY

Sampling Design

A multi-stage random sampling method has been followed to select the ultimate respondents for detailed survey. Only two crops (paddy for cereal and lentil (masoor) under pulse crops) have been taken into consideration. The two crops have been identified based on the area predomination in the region of study i.e., in the state of Bihar.

At the first stage of sampling, two districts, namely Saran for cereal crop paddy and Patna for pulse crop lentil have been chosen having larger density of these crops. After the selection of the districts, at the second stage of sampling, a total number of 4 strata have been formed in each of the districts by suitably combining the contiguous blocks based on area under the crop. The blocks namely (i) Dighwara, (ii) Sonepur, (iii) Chapra and (iv) Dariyapur were selected in Saran district, whereas in Patna district (i) Sampatchack, (ii) Fatuha, (iii) Bihta and (iv) Bikram blocks were selected.

At the third stage of sampling, five villages from each strata/block have been selected randomly from amongst the list of villages of these blocks. In Saran district, (i) Bastijalal, (ii) Sitalpur, (iii) Trilokchak, (iv) Kuraiyan and (v) Kanakpur were the villages selected from Dighwara block. (i) Khariyadih, (ii) Sikarpur, (iii) Akilpur, (iv) Baijalpur and (v) Samara villages were chosen from Sonepur block. Villages selected from Chapra block consisted of (i) Purbi Telpa, (ii) Gheghta, (iii) Bishunpur, (iv) Dumari and (v) Khalpura Bala, whereas (i) Jagdishpur, (ii) Akbarpur, (iii) Bela, (iv)

Dariyapur and (v) Pratappur villages were selected for intensive detailed survey from Dariyapur block.

Out of the four selected blocks of Patna district, (i) Chipura, (ii) Chainpur, (iii) Bahuara (Bahuapur), (iv) Khushiyalchak and (v) Baruna villages were selected from Sampatchak block. Among the selected villages of Bihta block, were (i) Pannal, (ii) Kanchanpur, (iii) Pandepur, (iv) Jaitipur and (v) Gorhanna villages. (i) Pitambarpur, (ii) Bikhua, (iii) Nathupur, (iv) Gangapur and (v) Lasgarichak villages were selected from Fatuha block. Selected villages of Bikram block were (i) Rahi, (ii) Bara, (iii) Mohammadpur, (iv) Benibigha and (v) Baliyari.

Sampling at the fourth stage involved full enumeration of all farmers, who grew these crops in the villages.

At the fifth stage of sampling, all the enumerated farmers in each village were divided/classified in three broad categories, using size of holding as small (0.01 to 02 ha), medium (02 to 04 ha) and large (more than 04 ha). From each selected village five farmers belonging to the three above described categories, have been selected randomly at the sixth stage for detailed survey, thus making total sample size to *(5 villages X 15 selected respondents X 4 blocks X 2 districts = 600 farmers)*. In this way, this has totaled the sample to 600 (300 + 300) cultivators in the state of Bihar.

The reference year for the study had been 2004-05 and the sample households were visited twice with reasonable intervals in order to collect the kharif and rabi season data. Size class wise distribution of number of farmers in the two selected districts, viz., Saran and Patna has been presented (outlined) in tabular form below:

Table No. 2.1: Size Class wise Distribution of number of Sample Farmers in Selected Districts of Saran and Patna

Size of Holding	No. of Sample Farmers Selected		
	Saran	Patna	Overall
Small (0.01 to 02 ha)	185	203	388
Medium (2.01 to 04 ha)	72	73	145
Large (Above 4 ha)	43	24	67
All	300	300	600

Profile of the Selected Regions

The digital documentation contained in the table throws light on different important parameters of socio-economic status (as per 2003-04 data) of the sample districts and the state of Bihar. Geographical areas of Patna and Saran districts are 317236ha and 264100 ha respectively showing the fact that Patna district is nearly 1.21 times larger than Saran district. Area sown more than once in Patna district was estimated at 93843 ha. i.e., (29.59%) of the total geographical area of the district itself and only 3.69% of area sown more than once of Bihar . Data in the table further evolves gross cropped areas (G C As) of Patna, Saran and the state of Bihar to be at 389300 ha. 379784 ha and 11433900 ha respectively. As regards to percentage of gross irrigated area (G I A) to total geographical area, Saran district was ahead (111504 ha) of Patna (107033 ha).

Regarding operational holding, its total number in Patna district was 407713, Saran 425902, Bihar 14155000 and all-India -115580000. Data related to farm class wise distribution of farmers (in percentage term) created effectual ground for ascertaining that in regard to marginal farmers (owning below 1ha. of land), Patna district was in a better position with lower percentage of the same (84.73%) in comparison to that of Saran district (90.94%). Although there had been lower percentage of marginal farmers in Bihar (78.62%), which shows higher prosperity level in the state than the two districts, however, it was not as good as the Indian average (61.58%). With lowest percentage of small farmer (1 to 2 ha), Saran district (5.92%) could be termed as more prosperous on land holding parameter than that of Patna district (10.34%), Bihar as a whole (11.05%) and India (18.73%). In contrast to the above, in regard to percentages of semi medium (2-4 ha.) and medium farmers (4-10ha) Saran district was at levels (2.89% and 0.24%) respectively superseded by Patna district (4.18%) and (0.69%), the state of Bihar (7.30%) and (2.72%) and India (12.34%, and 6.14%) respectively. As far as large farmers are concerned, the surveyed districts of Patna (0.06%) and Saran (0.01%) were well behind 'Bihar' and 'India ' as a whole (0.31% and 1.21%) respectively [Table No 2.2].

Table No. 2.2: Profile of the Sampled District (2003-04)

SN		Items	Patna	Saran	Bihar	India
1.		Geographical area (ha.)	3,17,236	2,64,10	93,60,000	328.73 (M ha)
2.		Net Cultivated area (ha.)	216206		56,38,000	141.10 (M ha)
3.		Area Sown > Once	93,843		25, 43,230 ha	46.84 (M ha)
4.		Gross Cropped Area	3,89,300	3,79,784.00	1,14,33,900.00	190.84 (M ha)
5.		Gross Irrigated Area	1, 07,033	1, 11,504	---	78.4 (M ha)
6.		Operational Holdings	4,07,713.00	4,25,902.00	1,41,55000.00	11,55,80.000
	a.	Marginal (<1ha In %)	84.73	90.94	78.62	61.58
	b.	Small (1-2ha in %)	10.34	5.92	11.05	18.73
	c.	Semi Med. (2-4ha in %)	4.18	2.89	7.30	12.34
	d.	Medium (4-10ha in %)	0.69	0.24	2.72	6.14
	e.	Large (above 10ha. in %)	0.06	0.01	0.31	1.21
7		Cropping Intensity	---	---	---	---
8.		Total population	47,09,851	32,51,474	8,28,78,796	1,02,52,51,059
9.		Rural population	27,40,927	29,53,345	7,41,99,596	74,02,55,371
10.		Total Workers	14,28,697	8,61,631	2,80,80,004	40,25,12,190
11.		Non- workers	32,81,154	23,89,843	5,47,98,792	62,27,38,869
12.		Cultivator	3, 14,969 (22.05%)	3,06,06,7 (35.63%)	81, 92,108 (29.18%)	12, 76, 28,287 (31.71%)
13.		Agricultural laborers	4, 73,292 (33.13%)	3, 24,876 (37.71%)	1, 35, 27,884 (48.18%)	10, 74, 47,725 (26.70%)
14.		Workers in household Industries	53,839 (3.76%)	33,272 (3.86%)	10,86,638 (3.86)	1,63,95.870 (4.07)
15.		Other Workers	5,86,697 (41.06)	1,96,516 (22,80)	52,73,374 (18.78)	15,10,40,308 (37.52)
16.		Town	13	5	271	4691
17.		Block	16	15	533	---
18.		Villages	1428	1767	45103	627614
19.		Inhabited Villages	1284 (89.92%)	1560 (88.29)	---	---
20		Literacy rate	67.37	54.09	47.53	55.00

Source: Census 2001

It clearly implies that on the parameter of economic status in the rural areas (measured in terms of land holding size), the two sample districts were behind the level of such scenario of Bihar and India as a whole. As per 2001 census, Patna district had larger population (4709851) than Saran (3251474). As regards to rural population in percentage term, Saran district had greater concentration than that of Patna district. The rural population of Saran was estimated at 2953345, while the same in case of Patna district was 2740927. Rural population of Bihar was 74199596. It clearly reveals that Patna district having state headquarters in Patna city is far more urbanized than that of Saran district. As total population of Patna district was much more than that of Saran, obviously number of total workers also were higher in Patna district (14,28,697) i.e. nearly 1.66 times more than that of Saran district

(8,61,631). There is, thus, irresistible facts to suggest that Patna district would certainly be in a stronger economic position than that of Saran district. Total number of workers in Bihar and India were 2,80,80,004 and 40,25,12,190 respectively, Bihar having only 6.98 percent of India's total workers. Out of the total workers, cultivators (farmers) comprised a significant and the highest proportion in Saran district (35.63%) followed by all-India scenario (31.71%), Bihar as a whole (29.18) and Patna district (22.05%). Data in the table further provide strong conclusive to suggest that, except in the case of India (on overall level), in percentage terms, other workers' and 'agricultural labourers' dominated in number and percentage terms out of the total workers to the respective district/ the state in Patna district (41.06% and 33.13%), Saran district (agricultural laborers- 37.71 percent and Bihar (with 48.18%) of agricultural labourers.

On all India level, however, other workers (37.52%) and cultivators (31.71%) dominated. The higher percentages of 'other workers' and 'agricultural laborers ' in the surveyed districts and the state imply that either agriculture have not been proving to be much remunerative or ever increasing dependent population on cultivatable land resulting in conversion of farmers to the category of ' agricultural laborers. 'Percentage of workers engaged in household industries were very less ranging between 3.76 to 4.07 percent (in Patna and on all India level) respectively. Patna district had been more urbanized with 13 towns in comparison to Saran district (only 5 towns). Number of blocks in Patna and Saran districts was 16 and 15 respectively. In regard to number of revenue villages and inhabited villages, Saran district (with 1,767 and 1,560 respectively) were ahead of Patna district (1,428 and 1,284 respectively) – [Table No -2.2]. It would also be observed that out of the total number of villages, the percentage of inhabited villages in Patna district is only marginally higher (89.92%) than that of saran (88.29%).

In regard to literacy rate, Patna district (67.37%) was well ahead of Saran (54.09%) and Bihar 's average (47.53%). Obviously being the central place and capital of the state, having greater infrastructural and educational facilities, the literacy rate of Patna was higher.

Operational Holdings of Study Area

Attempts have been made to present the farm class wise number of farmers and area owned by them in the sample districts of Patna and Saran. The picture of Bihar has also been discussed in this section. In Patna district, number of marginal farmers (owning below 1ha. of land) was 3, 45,750. The percentage of marginal farmers to total farmers was highest (84.80%). Small farmers (1-2 ha) numbering 42,152 comprised of 10.34 per cent of the total. In Patna district, semi medium farmers (who possessed 2-4 ha of land), whose number was nearly 2.48 times less (17,027) than that of small farmers, had almost low percentage (4.18 %). Medium farmers (4 –10 ha) 2,746 in number possessed a total area of 14,208 ha. Participation of this category of farmers to total farmers was quite lower (0.67%). Number of large farmers was 38 only in the district study area. Their percentage to total farmers was negligible at 0.01 only. The overall dentition of farmers of all groups in Patna district was found at 4, 07,713. Thus, marginal and small farmers constituted larger proportions of total farm households (table No. 2.3).

As regards to Saran district, the data in the table is an éclat of presumed fact that larger the size of land holdings, smaller the number of farmers and vice-versa. Number of marginal small, semi medium, medium and large farmers in the district were 396419, 25786, 12603, 1035 and 59 respectively. The percentages of above noted categories to total farmers in the district were 90.95, 5.91, 2.90, 0.23 and 0.01 respectively. The overall number of farmers in the district was 435902 owning a total land area of 184988 ha [Table No –2.3].

Table No. 2.3: Operational Holdings of the Sample Districts and State (Reference Year 2003-04)

SN	Farm Class	Patna		Saran		Bihar	
		No.	Area	No.	Area	No.	Area
1.	Marginal (below1ha)	345750 (84.80)	113640 (51.46)	396419 (90.95)	111329 (60.19)	10193392 (78.62)	3590798 (33.43)
2.	Small 1-2 ha	42152 (10.34)	47838 (21.66)	25786 (5.91)	33935 (18.35)	1437614 (11.09)	1954378 (18.20)
3.	Semi-medium 2-4 ha.	17027 (4.18)	44612 (20.20)	12603 (2.90)	33240 (17.97)	945120 (7.29)	2576222 (23.98)
4.	Medium 4-10 ha.	2746 (0.67)	14208 (6.44)	1035 (0.23)	5346 (2..89)	351426 (2.71)	1981750 (18.45)
5.	Big (10 & above ha.)	38 (0.01)	572 (0.24)	59 (10.01)	1138 (0..60)	38898 (0.29)	639745 (5.94)
6.	Total no. & Area of Holdings	407713 (100.00)	220870 (100.00)	435902 (100.00)	184988 (100.00)	12966450 (100.00)	10742893 (100.00)

[Figures in parenthesis indicate percentage of respective total)

In regard to the land ownership for different classes in Bihar as a whole, it could be seen that quite a large proportion of farmers belonged to marginal category (78.62%) of the total followed by small (11.09%), semi medium (7.29%), medium (2.71%) and an almost negligible (0.29%) of the big farmers. Total area owned by them being 1, 07, 42,893 ha. It is Cleary observed that such a large number of marginal farmers (78.62%) in Bihar owned only 33.43 per cent of the total cultivable area, whereas small, semi-medium, medium and large categories of the farmers of the state owned 18.20, 23.98, 18.45 and 5.94 per cent respectively.

Source-wise Irrigation

Table containing data related to source wise irrigation in the sample districts connotes that out of the net irrigated area of 3429000 ha in Bihar, Patna district had the privilege of sharing larger area with a net irrigated area of 1,38,141 ha. in comparison to Saran district 1,09,111 ha. The only source in Patna district was tube well. In case of Saran district, tube well provided highest contribution/share in net-irrigated area (63.95%) followed by tank (17.42%), canal (16.05%) and well (2.55%) [Table 2.4]. However, Patna district is a bit at better position in regard to net area under irrigation.

Table No 2.4: Source-wise irrigation of Sample Districts and the State

(In ha.)

SN	Farm class	Patna	Saran	Bihar	India
1.	Canal	-	17513 (16.05)	9,40,000 (27.40)	15667000 (34.28)
2.	Tank	-	18999 (17.41)	1,41,000 (04.01)	2957000 (6.47)
3.	Tube well	1,38,141(100.00)	69772 (63.95)	21,26,000 (62.01)	14694000 (32.15)
4.	Other well	-	2,776 (2.59)	2,22,000 (06.58)	12385000 (27.10)
5.	Net irrigated area	1,38,141 (100.00)	1,09,111 (100.00)	34,29,000 (100.00)	45704000 (100.00)

[Figures in parenthesis indicate percentage of respective total]

Crop-wise Irrigated Areas of Sampled Districts

Data related to crop wise irrigated areas in selected districts and Bihar (as a whole), clearly unroll that while kharif paddy is the most prominent crop in Patna district (on the basis of having largest areas under irrigation out of total irrigated area of the district concerned), with 59.64 percent (1, 11,456ha.), it was wheat in Saran district

(76.18%) with 85,231 ha. of land under wheat in irrigated conditions. In Patna district, area under wheat had second largest area under irrigation (30.61%) followed by rabi potato (2.98%), vegetable (2.91%), summer and rabi maize (1.57%) kharif potato, fruits, sugarcane and gram had negligible areas under irrigation. In Saran district, larger areas under irrigation (after wheat and rabi were) found in case of summer rabi maize (8.92%) followed by rabi potato (5.35%), vegetable (4.45%) and Kharif potato (0.51%). Gram, fruits and rabi paddy got negligible areas under irrigated condition. Regarding Bihar (as a whole), out of its total irrigated area of 45,50,244 ha, like sample districts of Patna and Saran, larger areas under irrigation could be observed in case of food grains and cereal crops, viz;, kharif paddy (41.86%) followed by wheat (39.95%) and summer and rabi maize (6.82%)-[Table No 2.5].

Table No 2.5: Crop wise Irrigated Areas of Sample Districts and the State

(In Ha.)

SN	Crops	Patna	Saran	Bihar
1.	Kharif Paddy	1, 11,456 (59.64)	1,298(1.16)	19, 04,507 (41.86)
2.	Rabi Paddy	25 (0.01)	45 (0.04)	1,20354 (2.65)
3.	Kharif Maize	---	---	28,253 (0.62)
4.	Summer & Rabi maize	2,942(1.57)	9,976 (8.92)	3,10,163 (6.82)
5.	Gram	115(0.06)	46 (0.05)	2,674 (0.06)
6.	Wheat	57,258 (30.61)	85,231 (76.18)	18,17,765 (39.95)
7.	Sugarcane	362 (0.19)	---	38,148 (0.84)
8.	Kharif Potato	1,574 (0.84)	565 (0.51)	36,242 (0.80)
9.	Rabi Potato	5,569 (2.98)	5,977(5.35)	86,707(1.91)
10.	Fruit	307 (0.16)	223(0.20)	13,026(0.29)
11.	Vegetable	5,441(2.91)	5011(4.45)	81,666(1.80)
12.	Other	1945 (1.04)	3512 (3.14)	110719 (2.40)
13.	Total Irrigation	1,87,033 (100.00)	1,11,884 (100.00)	45,50,244 (100.00)

[Figures in parenthesis indicate percentage of respective total]

It can, thus, be concluded that in the sample districts and Bihar also, food grains and cereals are clearly grown in advantageous position (having larger areas under irrigation) in comparison to pulses, vegetables, cash crops (like potato, sugarcane, etc.).

Cropping Pattern of the State and Sample Districts

In this section, a short view of the data related to cropping pattern (based on average of triennium ending (2002-03 to 2004 - 2005) in the sample districts of Patna and Saran have been presented. Having extrapolated in percentage terms, it could be

observed that winter paddy (34.61%) and wheat (25.48%) were main food grains of Patna district. Out of a total area of 325129 ha under all kinds of cereal except paddy (winter) and wheat, maize (Bhadai 1.30 %) dominated. It was followed by garma and rabi maize. Paddy winter acquired the largest area of 1,12,521ha (34.61%). It was very poorly trailed by paddy autumn (0.21%) and paddy summer (0.01%). Barley, maruwa, Jowar and small millets were grown over negligible areas (0.28%, 0.19%, 0.01% and 0.01%,) respectively, i.e. below 1 percent of total area under cereal crops in the district- [Table No -2.6].

Table No- 2.6: Cropping Patterns of the Districts (Cereals/Food Grains) Triennium Ending (2003-03 to 2004-05)

SN	Crops	Patna		Saran	Bihar
		Area (In Ha.)	Production In Tons	Area (In Ha.)	Area (In Ha.)
1.	Maize (Bhadai)	4227 (1.30%)	10357	41,970 (10.74)	2, 78,898 (3.99)
2.	Maize (Garma)	2276 (0.70)	7410	4,688 (1.20)	1,50,612 (2.16)
3.	Maize (Rabi)	674 (0.21)	2011	5,294 (1.36)	189,444 (2.71)
4.	Maize Total	7177 (2.21)	19796	51,902 (13.28)	6,18,954 (8.85)
5.	Paddy Autumn	658 (0.21)	628	19,839 (5.08)	5,28,278 (7.55)
6.	Paddy Winter	1,12,521 (34.61)	286139	77,582 (19.85)	29,82,082 (34.62)
7.	Paddy Summer	25 (00.01)	56	45 (0.02)	1,28,831 (1.84)
8.	Paddy Total	1,13,204 (34.82)		97,466 (24.93)	36,39,191(11.93)
9.	Wheat	82,838 (25.48)		89,896 (23.00)	20,52,731 (25.41)
10.	Barley	897 (00.28)		463 (0.12)	27,968 (0.40)
11.	Marua (Rabi	620 (0.19)		618 (0.16)	27,649 (0.40)
12.	Jowar	7 (0.01)		---	1,601 (0.03)
13.	Small Millets	5 (0.01)		1,189 (0.26)	11,054 (0.11)
14.	Total Cereals	2,04,748 (100.00)		2, 41,532 (100.00%)	63,79,148 (100.00)
		3,25,129		3,90,952	69,98,102

[Figures in parenthesis indicate percentage of respective total]

Having a glance at the data of cereals under Saran district, it evolved that wheat (23%), paddy winter (19.85%) and maize (bhadai) (10.74%) were main food crops in the district. Out of a total area of 390952 ha under total cereals in the districts, less than 1 percent were devoted to small millets, marua (ragi) barley and paddy summer (0.26%, 0.16%, 0.12% and 0.20% respectively). Among other major food crops, Paddy autumn, maize (rabi) and maize (garma) were also grown in significant areas (5.08%, 1.36%, and 1.20%) respectively.

Figures contained in the table provide discretion to come to the total area under all types of maize in Bihar reflecting mediocre coverage (8.85%). It was much more than that of Patna district (2.21%), but almost equally smaller to that of Saran (13.28%). As

regards to total paddy, the percentage of area coverage to total area under all kind of cereals, Bihar's average (44.46%) was larger than Patna district (34.82%), and significantly larger than that of Saran (24.93%).

A clear-cut difference in regard to wheat could also be observed in case of Bihar, which was higher than that of the surveyed district of Saran (23.00%). Rest of the crops under cereals, viz; Barley, ragi, jowar and small millets did not show significant difference than the scenario of the sample districts.

Pulses

Data in the table below presents much larger areas under total pulses in Patna district (67,627ha.) in comparison to Saran (only 8,132ha.). The area under the same for Bihar (as a whole) was estimated at 7, 35,452ha. The larger of area under different types of pulses in the GCA could, at best be seen towards other rabi pulses meant for both the districts Patna and Saran, and the state of Bihar (82.96%, 67.90% and 74.15%) respectively. On the one hand, gram got second preference (14.50%) and arhar was grown in meager area (2.50%) in Patna district, these were: arhar (22.11%), other kharif pulses (06.64%) and gram (3.35%) in Saran, on the other. In Bihar, gram was found to have occupied the second largest area (12.01%) followed by other kharif pulses (8.09%) and arhar (5.75%). Conclusively, it can be said that rabi pulses dominated kharif pulses in the study area and in Bihar too [Table-2.6 (a)].

Table No. 2.6 (a) Cropping Pattern (Pulses)

SA	Crop	Patna	Saran	Bihar
1.	Gram	9,802 (14.50)	272 (3.35)	88,267 (12.01)
2.	Other Rabi Pulses	56,102 (82.96)	5,522 (67.90)	5,45,355 (74.15)
3.	Arhar	1,697 (2.50)	1,798 (22.11)	42,393 (05.75)
4.	Other Kharif Pulses	26 (00.04)	540 (06.64)	59,437 (08.09)
5.	Total Pulses	67,627 (100.00)	8,132 (100)	7,35,452 (100.00)

[Figures in parenthesis indicate percentage of respective total]

Oilseeds

Table containing information regarding area under oilseeds provides decent data to suggest that rapeseed and mustard occupied the largest areas (out of all oilseed crops) in the sampled districts of Patna, Saran and the state of Bihar (85.60%, 96.68% and 55.74%) respectively. Areas under total oilseed in these districts and the state were estimated at 2,069 ha, 3,252 ha and 175665 ha respectively. It is thus, evident

that oilseeds were grown in larger area in Saran district than in Patna; Linseed had been the second largely grown oilseed in the three cases (9.90%, 3.20% and 28.78%) respectively. In Patna district, castor and sunflower were also grown, though in very small areas of the total oilseeds (2.42% and 2.03%) respectively. Negligible area of 4ha (0.12%) only could be seen under sunflower in Saran district. However, in regard to the state of Bihar, sunflower (12.65%) covered third largest area after linseed followed by sesamum (2.34%) and castor seed (0.49%) [Table 2.6 (b)].

Table No. 2.6 (b) Cropping Pattern (Oil Seeds)

(In ha)

SA	CROPS	PATNA	SARAN	Bihar
1.	Rape & Mustard	1,771 (85.60)	3,144 (96.68%)	97924 (55.74%)
2.	Linseed	205 (9.90)	104 (3.20)	50569 (28.78)
3.	Castor seed	50 (2.42)	-	853 (00.49)
4.	Sesamum	1 (0.05)	-	4,107 (02.34)
5.	Sunflower	42 (2.03)	4 (00.12)	22,212 (12.65)
6.	Total oilseeds	2,069 (100.00)	3,252 (100.00)	1,75,665 (100.00)

[Figures in parenthesis indicate percentage of respective total]

Cash Crops

Data in table displaying areas under all types of cash crops acknowledge the existence of potato and onion to be the most prominently grown crops in Patna and Saran districts, whereas these were potato and sun hemp in the state of Bihar (75.90%, 14.07%, 87.13%, 8.89% and 35.43%, 26.22%) respectively. Areas under total cash crops in Patna and Saran districts and the Bihar state were estimated at 9,415 ha, 9,804 ha, and 3, 98,057 ha respectively. It can, thus be concluded that in regard to area under total cash crops, Saran district was ahead than Patna. Other cash crops that were grown of course, in smaller areas in Patna district were chilli (4.35%), sugarcane (4.04%) and coriander (1.46%). Also, sun hemp, sweet potato and garlic were grown but in negligible areas. In case of Saran district, sugarcane was the third main cash crop, though grown in quite small area of 285 ha (2.90%) only. Other cash crops didn't get any significant area in the district. In case of the state of Bihar, sugarcane (19.63%) and onion (12.14%) could be termed as other main cash crops. Cash crops, like: sweet potato (2.25%), coriander (1.62%), chilli (1.46%) and garlic (1.25%) got very smaller coverage [Table No- 2.6(c)].

Table No. 2.6 (c) Cropping Pattern (Cash Crops)

(In ha)

SN	CROPS	PATNA	SARAN	BIHAR
1.	Sugarcane	380 (4.04)	285 (2.90)	78,168 (19.63)
2.	Sunhemp	05 (0.06)	---	1,04,383 (26.22)
3.	Potato	7,147 (75.91)	8,544 (87.13)	1,41,049 (35.43)
4.	Sweet Potato	05 (00.06)	68 (00.70)	8,927 (2,25)
5.	Chilli	410 (04.35)	6 (00.07)	5,801 (1.46)
6.	Garlic	4 (00.05)	2 (00.02)	4,974 (1,25)
7.	Coriander	140 (01.46)	28 (00.29)	6,446 (1.62)
8.	Onion	1,324 (14.07)	871 (08.89)	48,309 (12.14)
9.	Total Cash Crop	9,415 (100.00)	9,804 (100.00)	3,98,057 (100.00)

[Figures in parenthesis indicate percentage of respective total]

Fruits

Data contained in the table showing area under different types of fruits in the sample districts, and the state make exposition that in both the sample districts of Patna and Saran, largest areas were covered by other fruits (92.60% and 93.23%) respectively. In both the districts, and the state of Bihar, mango was the second most prominently grown fruit (4.44%, 4.76% and 4.18% of the total areas under fruits of the concerned districts/state) respectively. Except for area under guava in Bihar, the areas under all other fruits, viz; banana, lemon, and coconut occupied meager areas in both the districts. Approximately similar trend of distribution of areas under different fruits could be observed in both the districts and the state of Bihar –[Table No -2.6 (d)].

Table No. 2.6 (d) Cropping Pattern (Fruits)

(In ha)

SA	CROPS	PATNA	SARAN	BIHAR
1.	Banana	531 (0.64)	646 (0.63)	27,713 (00.83)
2.	Mango	3,696 (4.44)	4,933 (4.76)	1,40,009 (04.18)
3.	Guava	1076 (1.29)	775 (0.76)	28,44,306 (84.87)
4.	Lemon	534 (0.64)	519 (0.51)	16,732 (0.05)
5.	Coconut	322 (0.39)	108 (0.11)	15,137 (0.46)
6.	Other Fruits	77,213 (92.60)	96,076 (93.23)	3,06,810 (09.61)
7.	Total Fruits	83,372 (100.00)	103057 (100.00)	33,50,707 (100.00)

[Figures in parenthesis indicate percentage of respective total]

Vegetables

Table containing data showing areas under vegetables grown in the sample districts and the state of Bihar is sufficient to get across the fact that almost similar trend of coverage (in percentage terms to total of respective districts and the state), had been existing. A marked difference in Saran district with regard to cabbage (1.91%) was,

however observed. Barring areas under other vegetables in Patna and Saran districts (34.85% and 30.51%), cauliflower (15.32%, 14.26%), lady's-finger (13.02%, 14.86%) respectively and in Patna district, cabbage, (9.30%) were the most prominent vegetable crops across the districts. Tomato and brinjal (8.30% and 8.11%) were also grown in larger areas in Patna district, whereas brinjal and tomato (12.70% and 10.21%) respectively got preference in Saran district. Across the districts, other vegetables, viz; pumpkin, nenuwa, jhingli, karaila, parwal and bodi were also grown covering more or less similar percentage areas in most of the cases, except nenuwa and kaddu in Saran district. Areas under these two vegetables were quite higher in Saran district (5.96% and 4.28%) than that of Patna district (2.94% and 3.01%) respectively. As regards to the vegetable scenario of Bihar as a whole, barring area under other vegetables (29.96%), most important vegetables (in terms of larger percentage areas to its (vegetables') total area of the state) - could be identified as: cauliflower (12.12%), lady's-finger (11.80%), brinjal (10.99%), tomato (9.20%), cabbage (7.41%), nenuwa (6.77%) and pumpkin (5.12%). Rest of the vegetables was grown in smaller areas in tune with the trend of area coverage across the two districts. Total areas under all vegetables in Patna and Saran districts and in the state of Bihar were estimated at 22,069 ha, 14,006 ha and 4,92,377 ha respectively. One of the possible reasons for devoting much larger area under vegetables in Patna district than that of Saran district might be that it had to fulfill the ever-increasing demand of capital headquarters of Patna itself for different vegetables, which has almost acquired the character/features, expansion and demographic dynamism of a metropolitan city. It is but obvious that to feed the large population of Patna and its large number of elite class population, greater emphasis on vegetables' cultivation would be given–[Table No -2.6 (e)].

Table No. 2.6 (e) Cropping Pattern (Vegetables)

SN	CROPS	PATNA	SARAN	BIHAR
1.	Cauliflower	3,382 (15.32)	1,996 (14.26)	59,726 (12.12)
2.	Cabbage	2,052 (9.30)	267 (1.91)	36,503 (7.41)
3.	Tomato	1,833 (8.30)	1,429 (10.21)	45,260 (9.20)
4.	Brinjal	1,788 (8.11)	1,779 (12.70)	54,096 (10.99)
5.	Bhindi	2,874 (13.02)	2,082 (14.86)	58,095 (11.80)
6	Kaddu (Pumpkin)	663 (3.01)	599 (4.28)	25,205 (5.12)
7.	Nenua	648 (2.94)	834 (5.96)	33,321 (6.77)
8.	Jhingni	256 (1.16)	189 (1.35)	7,749 (1.58)
9.	Karela	283 (1.29)	131 (00.94)	8,484 (1.73)
10.	Parwal	296 (1.35)	216 (1.52)	4,594 (0.94)
11.	Bodi	299 (1.35)	209 (1.50)	11,751 (2.38)
12.	Other vegetables	7,695 (34.85)	4,275 (30.51)	1,47,592 (29.96)
13.	Total vegetables	22,069 (100.00)	14006 (100.00)	4,92,377 (100.00)

[All figures in bracket indicate percentage to the total area under the group particular crop]

It also fetched higher prices for the growers in comparison to other food grains, pulses or oilseeds. Saran district didn't possess any such larger population of elite class to be fed at one place. The prices of vegetables in the district headquarter of Chapra town and other small towns were not remarkably higher, so the growers might not have been much encouraged in growing the same. Therefore, the area under vegetables in Saran district might possibly be smaller.

Methods of Data Collection

As per the suggested study design, two districts, one for cereal crop and the other for pulse crop, were selected from the state of Bihar, on the basis of area coverage. We have confined to two crops, one paddy under cereal, and lentil under pulse crops, based on the area predomination in the region. Two districts, namely Saran for the former crop and Patna for the later were chosen having larger density of these crops. As instructed by the Co-ordinator of the study, Institute for Social and Economic Change, ADRT, Bangalore – 560 072, intimation regarding the choice of the crops and the districts was sent to them.

After the selection of the district, a total number of 4 strata were formed by suitably combining the adjoining/contiguous blocks based on area under the crop. The four strata/blocks thus selected in Saran district, for cereal crop paddy were (I) Dighwara, (ii) Sonepur, (iii) Chapra and (iv) Dariyapur. The same in Patna district

selected for pulse crop lentil included (i) Sampatchack, (ii) Bihta, (iii) Fatuha and (iv) Bikram.

After that, from amongst the list of villages of these blocks, five villages were selected from each stratum randomly. The names of such selected five villages from each strata of Saran district were (i.) Bastijalal, (ii) Sitalpur, (iii) Trilokchak, (iv) Kuraiyan and (v) Kanakpur under Dighwara block, (i) Khariyadih, (ii) Sikarpur, (iii) Akilpur, (iv) Vaijalpur, and; (v) Samara under Sonepur block, (i) Purbi Telpa, (ii) Gheghta, (iii) Bishunpur, (iv) Dumari, and; (v) Khalpurabala under Chapra Sadar block, and; (i) Jagdishpur, (ii) Akbarpur, (iii) Bela, (iv) Daryapur and (v) Pratappur under Daryapur block. Following the same procedure, five villages selected from each strata of Patna district were (i) Chipura, (ii) Chainpur, (iii) Bahuara, (v) Khusiyalchak and (v) Baruna under Sampatchak block, (i) Pannal, (ii) Kanchanpur, (iii) Pandeypur, (iv) Jaitipur and (v) Gorhanna under Bihta block, (i) Pitambarpur, (ii) Bikhua, (iii) Nathupur, (iv) Gangapur and (v) Lasgarichak, under Fatuha block, and; (i) Rahi, (ii) Bara, (iii) Mohammadpur, (iv) Benibigha, and; (v) Balyari under Bikram block.

After that, a full enumeration was done of all the farmers growing these crops in the respective villages. For this, selected village wise total number of farmers were first of all known. The schedule – II, Complete Enumeration of the respondents of Selected Villages carried the exercises of obtaining village wise names of the cultivator, Father's/Husband's name, area owned, cultivated area and holding size code for the four selected blocks from each of the two selected districts, one for each crop. Proportionate numbers of cultivators from small (0.012 1 to 2 ha), medium (2.01 to 4 ha) and large (more than 4 ha) were selected randomly from the separately enumerated lists. From each of the selected village, 15 farmers were selected for detail study, thus making the total sample size to **15 F X 5 V X 4 B X 2 D = 600 (300 + 300)** cultivators in the state of Bihar. The reference year for the study being 2004-05, we visited sample households twice in order to collect kharif and rabi season data.
Information related to number of farmers in the villages, average size of holding, average size of holdings of sample farmers (category wise), NCA average per

household and GCA average per household, calculated/enunciated data in regard to size class wise distribution of agricultural land both irrigated and unirrigated meant for cereal crop (paddy) and pulse crop (lentil), size class wise cropping pattern (area share and the crop pattern to GCA of the sample farmers for cereal and pulse crops of Saran and Patna districts, production and productivity per hectare of all crops in the two districts, estimated and calculated quantum of seed requirement for cereal (paddy) and pulse crop (lentil) in the two respective districts, production and disposal of paddy and lentil, cereal (paddy) and pulse (lentil) consumed as feed by livestock in the selected districts, consumption of cereal and pulse as feed by poultry in the two districts, value of crop output (cereal and pulse crops) in the respectively selected districts, wastages of selected crops at different harvest and post harvest stages in the two selected districts, percentage of seed, feed and wastage in production of cereal and pulse in the selected districts separately and crop wise percentages of seed, feed and wastage in production of cereal and pulse crop were obtained at the primary and secondary levels as well. A specifically constituted Survey Research Team comprising Mrs. Rosline Kusum Marandi, Dr. Ranjan Kumar Sinha (Research Officer), Dr. Rajiv Kumar Sinha and Dr. S D Mishra under the supervision and occasional field level monitoring of the Hon. Director Prof. (Dr.) B K Jha, was assigned the task of empirical and secondary data/information collection/data entry works.

In this way, the methods of data collection for this study included several stages, parameters, enumeration and calculation of collected data.

CHAPTER – III

METHODOLOGY

A multistage stratified random sampling procedure was followed to select the study area and crops for estimation of seed, feed and wastage ratios for major food grains in Bihar.

At the first stage, two major food grains (one cereal and one pulse), based on the area predomination in the district were selected. The chosen crops in Bihar were paddy and Masoor (lentil). As per 2001 Agricultural Statistics of Bihar, these crops covered around 44 percent and 14.40 percent respectively of the gross cropped area of the state. Major paddy and lentil growing districts of Bihar were selected on the basis of their concentration in gross cropped area, which was comparatively higher across the district in the state. So, Saran district was selected for cereal crop because it had a higher density of paddy crop possessing about 90,435 hectare of land under the crop, which was about 38.59 percent of the gross cropped area of the district. Similarly, as for lentil, Ptana district was selected, because it had a higher density of this crop possessing about 33,988 hectare areas under the crop. It constituted about 14.06 percent of the gross cropped area of districts.

After selection of the crops and districts at the second stage, each district was divided into four strata by suitably combining the adjoining blocks. From each stratum, five villages were selected randomly for intensive survey. A complete enumeration of farmers in the selected villages was done and cultivators were classified into three categories, viz, small (below 2ha.), medium (2-4 ha.) and large (above 4.0ha). From each category, five cultivators had to be selected randomly. Thus from each village, 15 cultivators from the three size classes were selected from the enumerated list. The detail has been presented in table 3.1 and table 3.2.

Table 3.1: Stratum –wise list of selected villages and total number of Farmers for Paddy Crop in Saran District (Bihar)

Stratum No.	Name of Stratum of Talukas / Blocks	Name of the Selected Villages	Total Number of Farmers in the Village	Sample
I	Dighwara	1. Bastijalal	133	15
		2. Sitalpur	135	15
		3.Trilockchak	138	15
		4.Kuraiyan	130	15
		5. Kanakpur	128	15
				15
II	Sonepur	1. Khariyadih	138	15
		2. Sikarpur	132	15
		3.Akilpur	125	15
		4.Vajalpur	135	15
		5. Samara	126	15
				15
III	Chapra	1. Purbitelpa	137	15
		2. Gheghta	132	15
		3. Bishunpur	136	15
		4. Dumari	139	15
		5.Khalpurabala	132	15
				15
IV	Dariyapur	1. Jagdishpur	135	15
		2.Akbarpur	138	15
		3. Bela	137	15
		4. Dariyapur	138	15
		5. Pratappur	136	15
All		**20**	**2680**	**300**

The above table shows the details of four blocks and 20 villages. The table further indicates that in all 20 villages of Saran district, 2680 cultivators were found belonging to small, medium and large categories. Out of the total number of cultivators, 300 were chosen for the detail study, which constituted about 11.20 percent. The details of lentil growers in Patna district have been presented in table 3.2.

Table 3.2: Stratum –wise list of selected villages and total number of Farmers for Pulses Crop in Patna District (Bihar)

Stratum No.	Name of Stratum of Talukas / Blocks	Name of the Selected Villages	Total Number of Farmers in the Village	Sample
I	**Sampatchak**	1. Chipura	123	15
		2. Chinpur	120	15
		3. Bahuapur	122	15
		4. Khusialchak	124	15
		5. Baruna	122	15
				15
II	**Bihta**	1. Pannal	120	15
		2. Kanchanpur	122	15
		3. Pandepur	122	15
		4.Jaitipur	120	15
		5. Gorhanna	121	15
				15
III	**Fatuha**	1. Pitambarpur	124	15
		2. Bikhua	118	15
		3. Nathupur	123	15
		4. Gangapur	122	15
		5. Lasgarichak	122	15
				15
IV	**Bikram**	1. Rahi	122	15
		2. Bara	123	15
		3. Mohammadpur	123	15
		4. Benibigha	124	15
		5. Balyari	123	15
All		**20**	**2440**	**300**

The table placed above indicates that in four stratums, twenty villages of Patna district, there were 2440 cultivators. Out of the total cultivators, 300 cultivators were selected for in-depth study, which constituted around 12.30 per cent.

Thus, the sample size become 300 cultivators for each crop and from each district and the total become 600 for the two districts (300 paddy + 300 lentil = 600) growers formed the sample size of this study.

The size-wise list of total number of selected cultivators (village-wise) for paddy and lentil crops have been presented in table 3.3 and 3.4.

Table 3.3: Category-wise list of Sample Farmers in the Selected Villages of Saran District for Paddy Crop.

SN	Name of selected village	Number of farmers selected			All
		Small	Medium	Large	
1.	Bastijalal	12	02	1	15
2.	Sitalpur	04	08	3	15
3.	Trilockchak	11	03	1	15
4.	Kuraiyan	11	02	2	15
5.	Kanakpur	09	04	2	15
6.	Khariyadih	07	06	2	15
7.	Sikarpur	10	03	2	15
8.	Akilpur	08	05	2	15
9.	Vaijalpur	11	01	3	15
10.	Samara	14	01	0	15
11.	Purbitelpa	05	06	4	15
12.	Gheghta	14	01	0	15
13.	Bisunpur	15	00	0	15
14.	Dumari	10	03	2	15
15.	Khalpurbala	06	05	4	15
16.	Jagdishpur	06	05	4	15
17.	Akbarpur	09	05	1	15
18.	Bela	06	04	5	15
19.	Daryapur	07	05	3	15
20.	Pratappur	10	03	2	15
Total		**185**	**72**	**43**	**300**

It may be seen from table 3.3 that out of the total number of sampled respondents in Saran district, 185 (61.67%) belonged to small category, 72 (24.0%) medium and 43 (14.33%) large category. Due to non-availability of required number of sample farmers in each category, the deficit was adjusted by taking the sample farmers from other adjoining categories; thus, sample size was maintained at 15 in each village.

The size-wise list of total number of selected cultivators (village-wise) in Patna district (Bihar) for lentil crop is presented in table 3.4.

Table 3.4: Category-wise list of Sample Farmers in the Selected Villages of Patna District for Lentil Crop.

SN	Name of selected village	Number of farmers selected			All
		Small	Medium	Large	
1.	Chipura	10	4	1	15
2.	Chainpur	08	5	2	15
3.	Bahuapur	09	6	0	15
4.	Khusialchak	11	3	1	15
5.	Baruna	11	3	1	15
6.	Pannal	10	5	0	15
7.	Kanchanpur	12	3	0	15
8.	Pandepur	11	2	2	15
9.	Jaitipur	12	2	1	15
10.	Gorhanna	11	3	1	15
11.	Pitamberpur	09	4	2	15
12.	Bikhua	10	3	2	15
13.	Nathupur	12	2	1	15
14.	Gangapur	11	2	2	15
15.	Lasgarichak	09	4	2	15
16.	Rahi	09	4	2	15
17.	Bara	09	5	1	15
18.	Mohmadpur	09	5	1	15
19.	Benibigha	09	5	1	15
20.	Balyari	11	3	1	15
Total		**203**	**73**	**24**	**300**

The table no 3.4 stated above indicates that out of the total number of sample cultivators in Patna district 203 belonged to small category, 73 medium and only 24 to large category. The percentages of different categories of cultivators out of the total cultivators (300) were 67.66, 24.33 and 8.01 in small, medium and large categories of farms respectively.

At the last stage, for estimating the availability of total quantity of food grains for human consumption after the food grains had been used for seed, feed and also put as wastages during and after the harvesting stages, detail information is related to cropping pattern, production, disposal and wastages were collected from each selected cultivator through structured schedules provided by the Coordinator of the study (ADRT, ISEC, Bangalore). Besides this, data related to quantum of consumption of feed by animals, birds, etc were also collected.

The seed requirements for both the sample crops, viz; paddy and lentil have been obtained by asking the cultivators directly. Then, its proportion to the net production of their respective crops was calculated.

For estimating the feed ratio, data related to total quantity of feed consumed by the animals out of the total grain production was obtained thereby arriving at the net availability of food grains.

For assessing that how much of food grains were available for human consumption, the proportion of wastage at different production stages in the total production of food grains have been worked out.

Reference Period

Reference period of this study is 2004-05 (Kharif and Rabi seasons).

CHAPTER – IV

RESULTS AND DISCUSSION

In this chapter, an attempt has been made to provide estimates of seed, feed and wastage ratios for major food grains (paddy and lentil) based on primary data collected from the field survey in two districts, namely: Saran and Patna in Bihar State. The results of the survey have been described under the following headings:

Stratum and Village wise Distribution of Farmers

Saran (Paddy)

A glance at the table No 4 (a) presenting outward number profile of the selected villages and number of farmers in the respective village reveals that there were, 2,680 farmers in 20 villages of 04 stratums in saran district. In stratum -I, five villages namely: Bastijalal, Sitalpur, Trilokchak , Kuraiyan and Kanakpur were selected which had 133,135,138, 130 and 128 farmers respectively. In stratum two the villages namely: Khariuyadih, Sikarpur, Akilpur, Bajalpur (Vajalpur) and Samara were selected under Sonepur block. Out of a total farmers, village wise distribution of farmers were: 138,132,125,135 and 126 respectively. Stratum - III of the district the villages namely: Purbitelpa, Gheghta, Bishunpur, Dumari and Khalpurabala were selected. Farmers in these villages, stood at: 137, 132,136,139 and 132 respectively. Selected villages under stratum – IV were: Jagdishpur, Akbarpur, Bela, Dariyapur and Pratappur village. Total number of farmers in these village were: 135,138,137,138 and 138 respectively –[Table No – 4.1 (a)].

Table 4.1 a: Stratum –wise list of Selected Villages and Total Number of Farmers for Cereal Crop in Saran District

Stratum No.	Name of Stratum of Talukas / Blocks	Name of the Selected Villages	Total Number of Farmers in the Village
I	Dighwara	1. Bastijalal	133
		2. Sitalpur	135
		3.Trilockchak	138
		4.Kurayan	130
		5. Kanakpur	128
II	Sonpur	1. Khariyadih	138
		2. Sikarpur	132
		3.Akilpur	125
		4.Vajalpur	135
		5. Samara	126
III	Chapra	1. Purbitelpa	137
		2. Ghaghta	132
		3. Bishunpur	136
		4. Dumari	139
		5.Khalpura bala	132
IV	Dariyapur	1. Jagdishpur	135
		2.Akbarpur	138
		3. Bela	137
		4. Daryapur	138
		5. Pratappur	136
All	**4**	**20**	**2680**

Patna District (Lentil)

Stratum wise number of total farmers in the selected village of Patna district for pulse crop (lentil) is demonstrative of the fact that number of persons in sampled villages was smaller than that of Saran district.

Total number of farmers in the selected 20 villages of four stratums under the district was 2,440. The stratum wise distribution indicates that in stratum – I, the blocks namely: Sampatchak, Bihta, Fatuha and Bikram were selected. The village wise number of total farmers were enumerated as: 123, 120,122,124 and 122 respectively.

Villages namely: Pannal, Kanchanpur, Pandepur, Jaitipur and Gorhanna under stratum – II had total number of farmers at: 120, 122, 122, 120 and 121 persons respectively. Under stratum – III, the villages were: Pitambarpur, Bikhua , Nathupur , Gangapur and Lasgarichak having: 124, 118, 123, 122 and 122 persons respectively. Under the IVth stratum, names of selected villages were Bikram, Rahi, Bara,

Mohammedpur , Benibigha and Balyari villages were selected . The total number of persons in these villages were: 122, 123, 123, 124 and 123 respectively: -[Table-4.1 (b)].

Table 4.1 b: Stratum –wise list of Selected Name of Villages and Total Number of Farmers for Pulse Crop in Patna District.

Stratum No.	Name of Stratum of Talukas / Blocks	Name of the Selected Villages	Total Number of Farmers in the Village
I	Sampatchak	1. Chipura	123
		2. Chainpur	120
		3. Bahuapur	122
		4. Khusialchak	124
		5. Baruna	122
II	Bihta	1.Pannal	120
		2. Kanchanpur	122
		3. Pandepur	122
		4. Jaitipur	120
		5. Gorhanna	121
III	Fatuha	1. Pitambarpur	124
		2. Bikhua	118
		3. Nathupur	123
		4. Gangapur	122
		5. Lasgarichak	122
IV	Bikram	1. Rahi	122
		2. Bara	123
		3. Mohammadpur	123
		4. Benibigaha	124
		5. Balyari	123
All	**4**	**20**	**2440**

Saran District

Distribution and Average Size of Holding

The size wise distribution of number of farmers and average size of holdings for paddy and lentil growers have been presented in table 4.2 a and 4.2 b. Table containing data related to size class wise distribution of number of farmers and average size of holding outlines one of the interesting fact that accords sanction to the pre conceived fact that larger the size of holding greater the average size of cropped area. The size class wise average sizes of holding of selected sample farmers were 1.18 ha, 2.68 ha, and 6.77ha for small, medium and large groups of farmers respectively. The average cropped area per household was 2.34 ha. Average net-cropped areas per household were calculated at 1.08ha, 2.52ha and 6.57ha

respectively for the above three land holding classes. The average net-cropped area per household was 2.21 ha [Table 4.2 (a)].

Table 4.2 a: Size-class wise distribution of number of farmers and average size of holding for the selected cereal crop Saran Districts.

Size of Holding	** No. of farmers in the village (Nos.)	**Average size of holding (Ha.)	Leased in/ out area % of total area (%)	No. of sample farmers selected (Nos)	Average size of holding selected sample farmers (Ha.)	**Net cropped area average per house hold (Ha.)	**Gross cropped area average per House hold (Ha.)
Small	1656	1.32	--	185	1.18	1.08	1.70
Medium	644	2.48	--	72	2.68	2.52	4.03
Large	380	6.81	--	43	6.77	6.57	10.44
All	2680	2.46	--	300	2.34	2.21	3.51

** Small = 0 to 2 hectare, Medium= 2.01 to 4 ha, Large = More than 4ha.*

One of the possible reasons for this might be that small and marginal farmers possessed very small size of land, some of which is occupied by house to live in and cattle shed, so the remaining net cultivable area is reduced to marginal. On the other hand, the large farmers did own very larger areas, so their net cropped areas were not much affected/reduced. On over all level, the average gross cropped area per household was estimated at 3.51 hectares. Average of G.C.A. per household was to the extent of 1.70 ha for small surveyed farmers, 4.03 ha for medium farmers and 10.44 ha in case of large ones: [Table-no – 4 (a)]. This indicates almost similar trend of cropping intensities for large medium and small farmers (1.59, 1.60 and 1.58) respectively.

Out of the total number of farmers (2,680) in all the 20 selected villages of Saran district, 1,656 (61.80%) belonged to small, 644 medium (24.03%) and only 380 (14.17%) were large farmers. Average size of holding (at overall level) was 2.46 ha. The category wise data indicates that on average small farmers had 1.32 ha, medium farmers having 2.48 ha and large farmers possessed 6.81 ha. As regards to the size class wise number of sample farmers, out of the total of 300, number of small ones was 185 (61.67%), followed by medium 72 (24%) with 43 (14.33%) as large ones.

None of the respondent farmers was found to have leased-in and leased-out cultivated areas.

Patna District (Lentil)

Data related to size class wise distribution of farmers and average size of holding for the selected pulse crop (lentil) – grown by the sample farmers of Patna district as contained in table – 4.2 (b) reveal the average size of holding (at over all level) at 2.10 ha. The category wise data indicates that small farmers possessed 1.22 ha, medium 2.87 ha and large 6.96 ha. Out of the total number of 2,440 farmers in 20 selected villages in the district, 1644 (67.38%) were small, 592 (24.27%) medium and 204 (8.35%) large farmers. Farm size wise average sizes of holdings were calculated at 1.22 ha for small, 2.87 ha for medium and 6.96 ha for large farmers. The overall average was 2.10 ha. Farm class wise number of sample farmers selected for detail survey out of the total 300 respondents in the district, were 203 (67.67%) in small category, 73 (24.34%) in case of medium and 24 (7.99%) in large category.

The table further reveals that out of the total area, farm class wise average areas under cultivation were: 1.16 ha for small farmers, 2.77 ha for medium and 6.92 ha in case of large ones, and the average size at overall level being 2.01 ha. The farm class wise net-cropped areas (NCA) average per household were estimated at 1.013 ha for small farmers, 2.69 ha for medium and 6.78 ha for large ones. The overall average of NCA was 1.89 ha. As regards to gross cropped areas (GCA) average per household of the sample farmers, these were 1.84 ha for small farmers, 4.68 ha for medium and 11.93 ha in case of large ones. The overall GCA average per household was worked out at 3.39 ha [Table no 4.2 (b)].

Table 4.2 b: Size-class wise distribution of number of farmers and average size of holding for the selected pulse crop in Patna District.

Size of Holding*	**No. of farmers in the village (Nos.)	**Average size of holding (ha.)	Leased in/ out area % of total area (%)	No. of sample farmers selected (Nos)	Average size of holding selected sample farmers (ha.)	** Net-cropped area average per house hold (ha.)	**Gross cropped area average per House hold (ha.)
Small	1644	1.22	--	203	1.16	1.03	1.84
Medium	592	2.87	--	73	2.77	2.69	4.68
Large	204	6.96	--	24	6.92	6.78	11.93
All	2440	2.10	--	300	2.01	1.89	3.39

** Small = 0 to 2 hectare, Medium= 2.01 to 4 ha, Large = More than 4 ha.*

Irrigation Status: Distribution of Agricultural Land for Cereals (Paddy)

Regarding the coverage of irrigational facilities available for paddy crop in sampled district of Saran, out of total cropped area under paddy of (1,117.27) ha, 157.43 ha were irrigated, covering 14.09 per cent of the total paddy cropped area. It indicated that small paddy growers under unirrigated condition owned major area. The medium category farms had irrigated paddy area constituting 34.67 per cent and large had 65.26 per cent. The low area under irrigation for paddy may be due to larger area under this cultivation by medium category of farmers in comparison to small one. The table further reveals that out of the total area under paddy, 364.71 ha, 290.73 ha and 461.83 ha used by small, medium and large farmers respectively in surveyed villages of Saran district. Larger proportions of land under paddy cultivation were thus unirrigated in case of all categories of sampled farmers {Table No-4.3 (a)}.

Table 4.3 a: Size -class wise Distribution of Agricultural Land for Cereal (Paddy) Crop in Saran District

Size of Holding	Area (Hectare)		
	Irrigated	Un irrigated	Total
Small	57.51	307.20	364.71
Medium	34.67	256.07	290.73
Large	65.26	396.57	461.83
All	**157.43**	**959.84**	**1117.27**

Distribution of Area under Pulses (Lentil)

Collected data related to size class wise distribution of agricultural land for pulse crop (Lentil) in Patna district, leads to conclude that larger areas were under irrigated conditions at all levels. Out of the total 1,071.56 hectares of land under the selected pulse crop, 795.39 ha, had irrigation facility from one source, or the other. Farm class wise scenario, containing the configuration of data in table – 4.3b confirms that area under irrigated pulses were higher in case of large category (79.78%) followed by medium (73.69%) and small (70.28%). Out of the total area (295.51 ha) used by large landowners to grow pulse crop, 235.77 ha was covered under irrigation facility. Medium farmers possessed 261.13 ha of irrigated land for the crop out of a total of 354.34 ha and small farmers cultivated this crop in 298.50 ha of irrigated land (Table No-4.3 b). The higher irrigated area under pulse crops (Lentil) in Patna district may be due to larger Gross Cropped Area (GCA) under irrigated condition.

Table 4.3 b: Size -class wise Distribution of Agricultural Land for Pulse (Lentil) Crop in Patna District

Size of Holding	Area (Hectare)		
	Irrigated	Unirrigated	Total
Small	298.50	123.21	421.71
Medium	261.13	93.21	354.34
Large	235.77	59.75	295.51
All	**795.39**	**276.17**	**1071.56**

Cropping Pattern: Saran District

The table containing compiled data related to cropping pattern in sample villages of Saran district in Bihar ducks the fact that paddy had been the main crop there being grown in an area of 559.99 ha which accounts for 50.13% of the GCA (1,117.27 ha). It was followed by maize 171.72 ha (15.37%), wheat 164.99 ha (14.77%), mustard 112.28 ha (10.03%) and masuriya 108.29 ha (9.70%). Farm class wise cropping pattern distinctly reveals similar trend for medium and large categories of sample farmers. In the cropping preference of small farmers, Paddy dominated all other crops (48.51 %, i.e, grown in 176.90 ha. out of 364.71 ha. of GCA) followed by wheat 74.13 (19.58%), maize 47.49 (13.03%), masuriya 40.71 ha (11.17%) and mustard 28.18 ha

(7.70%) –[Table no – 4.4(a)]. Larger area under the fodder crop masuriya over the main oilseed crop of mustard suggests that the small farmers had to feed and maintain mostly milch cattle, which are one of the prime sources of their complementary livelihood. They use draught animals to cultivate their fields and also for transportation. This is more so, because they cannot afford high degree of mechanization in the process of cultivation.

Table 4.4 a: Cropping Pattern of the Sample Farmers for Cereal Crop of Saran District

Size of Holding	Area Share and the Crop (Portion to GCA)					GCA (in Ha)
Crop	Paddy	Maize	Massuriya	Wheat	Mustard	Total
Small	176.90	47.49	40.71	71.43	28.18	364.71
Medium	158.28	41.12	23.42	39.30	28.61	290.73
Large	224.80	83.11	44.16	54.27	55.49	461.83
All	**559.99**	**171.72**	**108.29**	**164.99**	**112.28**	**1117.27**

Cropping Pattern: Patna District

The pattern of area share and the crops in 20 selected villages under selected – Fatuha, Sampatchak , Bihta and Bikram blocks of Patna district surveyed for pulse crop lentil, countenances the data based fact that on overall level , paddy is the main crop of kharif season and occupied about (25.94%) of the GCA of 1071.56 ha followed by rabi season pulse crop Lentil 240.83 ha (22.48%), wheat 213.15 ha (19.90%), oilseeds 150.39 ha (14.03%), kharif crop Arhar 112.88 ha (10.53%) and least area being under cereal crop maize 76.33 ha (7.12%) table 4.4 (b).

Table 4.4 b: Cropping Pattern of the Sample Farmers for Pulse Crop of Patna District

Size of Holding	Area Share and the Crop (Portion to GCA)						GCA (in Ha)
Crop	Paddy	Maize	Arhar	Lentil	Wheat	Oil Seed	Total
Small	109.20	29.95	46.76	96.80	83.90	55.09	421.71
Medium	91.42	25.11	35.24	78.43	69.83	54.30	354.34
Large	77.35	21.27	30.88	65.60	59.42	41.00	295.51
All	277.97	76.33	112.88	240.83	213.15	150.39	1071.56

Farm class wise scenario of processed data elicits the same trend of cropping patterns and land area used by the small, medium and large categories of sampled respondents. Out of the GCA of 421.71ha for small farmers, paddy was grown in larger area (109.20ha.) followed by lentil (96.80ha.), wheat (83.90ha.), oilseeds (55.09ha.), arhar (46.76ha.), and the lowest area was put in growing maize (29.95 ha.). Similar cropping pattern and trend of area – devotion could be seen in case of sample medium and large farmers of the district. It is also evident from the table that in the study area, farmers (as a whole) prefer one pulse crop along with one major food crop each in both the seasons of kharif and rabi.

Production and Productivity of Crops: Saran District

The table No. 4.5a indicates the production of major food grains in the sample areas of Saran district. In case of paddy, at overall level, the production was recorded at 2209619 kg. The farm size wise analysis of data indicates that higher productions were observed in case of large farmers (861259 kg) followed by small (715840 kg) and medium farms (632520 kg). Data further indicate that at overall level, the production of maize, masuria, wheat and mustard were (834623 kg, 84357 kg, 528748.50 kg and 79679.70 kg) respectively. The production thus, varied with the variation of farm size. It is to be noted that paddy, maize and wheat are the three major cereal crops grown in sampled area of Saran district. Mustard is also grown in rabi season, where as massuriya, a fodder crop is prominently grown in kharif season. As regarding productivity of paddy, maize, wheat and mustard, the compiled data contained in the table, produce an encouraging picture on overall level. The productivity of paddy has been estimated at 3,935 kg/hectare. The productivity figures for all India (as per 2003-04 data) were 2,763 kg/ha whereas that in Bihar being as low as 2018 kg/ha. Similarly in regard to wheat and maize also, the overall productivity in the sampled areas were calculated at 3,204.73 kg/ha and 4,860.38 kg/ha respectively. Yield of rabi crops, i.e, mustard (oilseeds) was estimated at 709.66 kg/ha, which was clearly lower than the National average as well as the state average also - [Table No- 4.5 (a)]. The productivity of crop increases with the increase in farm size.

Table 5 a: Production and Productivity per hectare of all crops for paddy crop in Saran District (in kg & kg / ha.)

Size of Holding	Production										
	Paddy		Maize		Massuriya		Wheat		Mustard		Total gross value of production at farm harvest price
	Production	Productivity	Production	Productivity	Production	Productivity	Production	Productivity	Production	Prodctivity	Prices (In Rs.)
Small	715840	4008.29	227952	4800	32568	800	228576.00	3200	18035.20	640	6538443.20
Medium	632520	4002.54	199432	4850	17565	750	123795.00	3150	20027.00	700	5410892.00
Large	861259	3829.33	407239	4900	34224	775	176377.50	3250	41617.50	750	7461228.15
All	**2209613**	**3935.00**	**834623**	**4860.38**	**84357**	**779.00**	**528748.50**	**3204.73**	**79679.70**	**709.66**	**19410563.35**

* Small = 0 to 2 hectare, Medium= 2.01 to 4 ha, Large = More than 4ha.
Please follow these criteria to form the tables.

Table 5 b: Production and Productivity per hectare of all crops for Pulses crop in Patna District (in kg & kg / ha.)

Size of Holding	Production												
	Lentil		Wheat		Mustard		Arhar		Maize		Paddy		Total gross value of production at farm harvest price
	Production	Productivity	Production	Productivity	Production	Productivity	Pro Duction	Productivity	Production	Productivity	Production	Productivity	Prices (In Rs.)
Small	86287	889.38	268480.00	3200	35808.50	650	35070	750	134775.00	4500	425880	3900	6881610.40
Medium	69406	892.23	226947.50	3250	38010.00	700	26430	750	114878.25	4575	361109	3950	5925065.14
Large	60124	916.39	196086.00	3300	30750.00	750	24704	800	97842.00	4600	309400	4000	6242310.50
All	**215817**	**896.14**	**691513.50**	**3244.26**	**104568.50**	**695.32**	**86204**	**763.68**	**347495.25**	**4552.54**	**1096389**	**3944.27**	**19048986.04**

* Small = 0 to 2 hectare, Medium= 2.01 to 4 ha, Large = More than 4ha.
Please follow these criteria to form the table

Production and Productivity of Crops: Patna District

The table 4.5b indicates the production of major food grains in the sampled areas of Patna district. In case of lentil, at overall level, the production was recorded at 215817 kg. The farm size wise analysis of data indicates that higher productions was observed in case of small farms (86287 kg) followed by medium (69406 kg) and large (60124 kg). Data further indicate that at overall level, the quantum of production for wheat mustard, arhar, maize and paddy were 691513.50 kg, 104568.50 kg, 86204 kg, 347495.25 kg and 1096389 kg respectively. The production across farm size varied with the variation in farm size.

During the discussions en passant the interpretation of tabular data related to production and productivity of all pulse crops in Patna district revealed that the gross value of production of all crops grown in the study areas (viz; lentil, wheat, mustard, arhar maize and paddy): at farm harvest price was Rs. 1,90,48,986.04. The farm size wise data indicates that small farmers' price was Rs. 68610.40, medium farms Rs. 5925065.14 and for large farms Rs. 62422310.50. Like former district of Saran, the productivity of major food crops, viz; paddy (3,944.27 kg/ha), wheat (3,244.26kg/ha) and maize (4,552.54kg/ha), were higher than that of national average and also the state's average yield rates. As far as the productivity of selected rabi pulse crop (lentil), another rabi crop (mustard) and kharif pulse crop (Arhar) are concerned, except for mustard (695.32kg/ha), Patna district was at an higher advantageous stage for rest of the two crops than national average. Though the productivity of 'arhar' in the surveyed areas of Patna district (763.68 kg/ha) was lower than that of Bihar (1,184 kg/ha.) but higher than all India average (672kg/ha). Productivity of lentil also placed Patna district at higher position (896.14kg/ha) in comparison to Bihar's level (892 kg/ha) and all India average (741kg/ha) [Table No - 4.5 (b)].

Process of Utilization of Selected Grains

Seed

Quality seed is one of the vital inputs for production of any crop. Potentiality of production is directly and positively related to quality seeds. The selected crops of

paddy and lentil in the state of Bihar are important cereal and pulse crops respectively, but the quality of seed for paddy was found to have been deteriorating (as reported by some of the sampled growers of Saran district). It was so because the production of the hybrid seed was being used continuously for several times. One of the reasons for such a state of affairs might be larger area to be under paddy crop and the tendency of the marginal and small farmers (in particular) to use the seeds from the produced quantum repeatedly out of the once sown hybrid seeds. Yet another reason for using the seed from out of the self produced quantum of main food grains was reported to be the lack of trust of farmers in the hybrid seeds being provided by the institutional sources/agricultural department's agencies. In some cases, supply of adulterated seeds had also been reported in the sampled areas of Bihar. Such seeds or seeds repeatedly used year after year from the product of one time sown hybrid seed have the characteristics to deteriorate and adversely affect production. Therefore, it is necessary that seeds must be replaced every year by fresh lot of quality certified seeds recommended for the respective areas.

As regards lentil crop too improved variety was used in very limited areas. Significantly non-hybrid seeds of lentil covered larger areas. As a matter of fact, sampled farmers of Patna district were recorded as saying that they had been using such indigenous seeds since long. As a result, quality of seed was not so good as it should have been. It can, therefore, be suggested that the seed of pulse crop (lentil) should be replaced every four years. Those farmers, who preferred to change seeds, got higher returns, whereas those, who did not replace old seeds by new ones, obtained low yields. It is to be noted here that due to non-availability of quality seeds at local levels, general farmers were found to have used old seeds and for this reasons, they got lower yields, whereas one time used quality seeds led them to expect high returns.

During the course of field survey in both the sampled districts, it was observed that most of the farmers used previous year's seeds in case of both cereal and pulse crops (paddy & lentil) selected for the respective districts of Saran and Patna respectively. Very few cultivators reported that they purchased seeds of paddy and lentil from

shops and private traders. Some of the paddy and lentil growers reported that they used seeds in their fields having purchased from reputed farmers, who grew and stored these cereal and pulse crop for seed purpose only.

As far the quantum of HYV paddy and HYV lentil seeds in the state of Bihar is concerned, 1.94 lakh quintals of HYV paddy seed were used, which went up by 0.09 lakh quintals in 2006-07. The total quantum of HYV seed used in the later year was estimated at 2.03 lakh quintals. The area under HYV seeds (paddy) was nearly 20 lakh hectares. Quantum of HYV seeds for lentil used in the state was estimated at 288 quintals only.

Sowing Methods

Two methods of sowing paddy seeds were observed in the study area, i.e., transplanting and broadcasting method. In transplanting method, a nursery was grown and plants were transplanted from the nursery for growing paddy in the fields. In case of broadcasting method, seeds are sown directly in the paddy growing fields. The seed rates for both transplanting and broadcasting methods varied sharply between 50-60 per hectare to 80 – 100 kg per hectare respectively. The most common variety used by the farmers in the state of Bihar was PUSA 2-21, Ratna, Bala, Kiran, Jaya, Mahsari, BR-1, Sita, BR-34, Pankaj, etc.

Lentil Sowing

The method of sowing lentil followed in the state of Bihar was broadcasting method. One another method of sowing pulse crop lentil has been row sowing. For both methods, seed rates varied between 30-50 kg/ha. The common varieties used for lentil in state of Bihar had been T-44, PS-16, S.9 and Jaul ahar-45.

Seed Requirement: Saran District for Paddy

As regarding quantities of seeds of cereal paddy being kept for next sowing purpose and already used for the current year's uses in sample areas of Saran district, the compiled data in the (table 4.6a) render about 4.40 % of the total produced quantity of paddy crop kept for meeting the future requirement of seed at overall and 2.54

percent of total produce used as seed with production. The size class wise analysis indicates that on an average the quantities of seed in total quantum of production varied between 4.01 per cent and 4.93 per cent. Total quantity of paddy production in the sampled areas was 22,09,612.93 kg, for which 56,032 kg of seed were used and 97,164kg were kept for seed on the overall level. The analysis finds that across the farm size, quantity used and quantities kept for seed purpose did not vary significantly, which might be due to their traditional behaviour (table 4.6a).

Table No. 4.6 a: Seed requirement for Cereal Paddy in Saran District

District	Size of holding	Area (ha)	Production (Kg)	Quantity of Seed (Kg)		Percentage qty. of Seed with Production	
				Used	Kept	Used	Kept
Saran	Small	178.59	715839.93	17142	28714	2.39	4.01
	Medium	158.03	632520	15627	26008	2.47	4.11
	Large	224.91	861253	23263	42442	2.70	4.93
	All	**561.53**	**2209612.93**	**56032**	**97164**	**2.54**	**4.40**

Patna District: **Lentil**

It can be seen from table 4.6b that at overall level, the percentage quantities of seed used and kept were 9.42 and 13.16 respectively. The data of farm size wise use of seed indicates that small farms used comparatively higher percentage (9.59) followed by medium (9.57) and small (9.01). The quantities kept for seed across the farm size was again higher in case of small farms (14.84%) followed by medium farms (13.18%) and large farms (10.70%). In quantum term, the quantities at overall average level for seed used and seed kept were 20339 kg and 28393 kg respectively (table No. 4.6b).

Table 4.6 b: Seed requirement for Pulse (Lentil) Crop in Patna District

District	Size of holding	Area (ha)	Production (Kg)	Quantity of Seed (Kg)		Percentage qty. of Seed with Production	
				Used	Kept	Used	Kept
Patna	Small	97.02	86287	8278	12808	9.59	14.84
	Medium	77.79	69406	6641	9150	9.57	13.18
	Large	65.61	60124	5420	6435	9.01	10.70
	All	**240.42**	**215817**	**20339**	**28393**	**9.42**	**13.16**

Production and Disposal of Paddy: Saran District

Production and disposal patterns of paddy and lentil on different categories of farms have been described under section 4.7a Saran district paddy and 4.7b Patna district lentil.

Saran District: Paddy

Production and disposal patterns of paddy have been discussed in this section. It may be seen from the table 4.7a that out of the total production of paddy (2209613 kg, 210595 kg) was found to be marketed surplus. The remaining quantity of production was used for various purposes viz., previous year's seed used (56032 kg), kept for seed for next time (97164 kg), home consumption (394220 kg) later disposal (1322028 kg), kind wages to labour (141518 kg), animal feed (32853 kg) and 11385 kg. The percentages of disposal, out of total production, were 59.87 as marketed surplus, home consumption – 17.85, payment of wages to labour – 6.41, kept for next year's seed – 4.40, used as animal feed – 2.01 and others – 9.46. At overall level, about 69.36 per cent of the produce was disposed off as marketed surplus and remaining were used for various purposes.

Table 4.7 a: Production and Disposal for Cereal (paddy) in Saran District

(Qty in Kg)

District	Size of holding	Area (ha)	Production (Kg)	Previous year's Seed used	Kept for seed for next time	Marketed Surplus	Home consumption	Later disposal	Kind wages to Labour	Used as Animal feed	Used as Animal feed
Saran	Small	178.59	715840	17142	28714	58524	162839	424719	26170	10740	4284
	Medium	158.03	632520	15627	26008	47737	103241	399637	42472	9670	3755
	Large	224.91	861253	23263	42442	104334	128140	497672	72876	12443	3346
	All	**561.53**	**2209613**	**56032**	**97164**	**210595**	**394220**	**1322028**	**141518**	**32853**	**11385**

As regards farm size wise disposal pattern, the small sample farmers of surveyed areas preferred to retain maximum quantum of produce for later disposal and home consumption taken together (82.09%). These categories of farms used their production of cereal kept for next time seed (4.02%), wages to labourers (3.66%) and animal feed (2.10%). The disposal comportment in this regard as revealed by

medium farmers narrates the similar tale. The sample farmers of this land holding group also kept maximum quantity for later disposal and home consumption (63.19% and 16.33%) respectively followed by marketed surplus (7.55%), for wages to labourers (6.72%), kept for next time seed (4.12%), and animal feed (2.13%).

Production and Disposal Patterns of Paddy: Patna District

Production and disposal patterns of lentil in Patna district mentioned in table 4.7b reveals that out of the total production of lentil recorded at 215817 kg, 8320 kg was marketed surplus, kept for seed for next time 28393 kg, home consumption 72836 kg, later disposal 101256 kg, wage to labour 2012 kg, and animal feed 3000 kg. The table also indicates that seed used in previous year was 20339 kg, which was not taken into consideration in current year's production. In percentage term, about 50.77 per cent was marketed surplus and remaining quantity of the production was used in various purposes.

The table again indicates that the production of lentil in case of small farms was 86287 kg followed by medium category of farms – 69406 kg and large – 60124 kg. Out of the total production, in case of small, medium and large categories of farms, marketed surplus were found to be 28.90 per cent, 56.41 per cent and 75.67 per cent respectively. It means, larger the farm size groups, higher the marketed surplus proportion.

Table 4.7 b: Production and Disposal for Pulse (Lentil) Crop in Patna District

(Qty in Kg)

District	Size of holding	Area (ha)	Production (Kg)	Previous year's Seed used	Kept for seed for next time	Marketed Surplus	Home consumption	Later disposal	Kind wages to Labour	Used as Animal feed	Used as Animal feed
Patna	Small	97.02	86287	8278	12808	1560	47806	23373	0	740	0
	Medium	77.79	69406	6641	9150	4235	19210	34914	642	1255	0
	Large	65.61	60124	5420	6435	2525	5820	42969	1370	1005	0
	All	**240.42**	**215817**	**20339**	**28393**	**8320**	**72836**	**101256**	**2012**	**3000**	**0**

Process of Utilization of Grains for Feed

Livestock and poultry had been the important components in the farming system of Bihar. However, due to poor availability of feed, the productive capacities of both (livestock and poultry) were low. It adequate quantum of feed is made available for livestock and poultry, the yields of these may be certainly increased in the state. Important sources of fodder are: open grazing ground, fallow land during rainy season, fodder from weeding of major crops, etc. These sources of fodder are mostly available for cattle of the state. Dry fodder like: paddy straw, feeds and concentrates of crops and vegetables/fruits' wastes, etc., are mainly included in the class of fodder for cattle in Bihar.

For feeding the cattle, farmers of the state generally used chaff, cut grasses and dry fodder. Fodder is prepared by mixing concentrates (locally prepare animal feed) with waste rice, pulses, etc. It is also prepared by boiling/cooking these feeds. The practices of using mineral mixture by the farmers were generally observed very low. Poultry birds like: hens, ducks and pigeons are fed purchased poultry feed, rice and pulses.

In general, farmers were found to have also using residue and lentil as animal and poultry feed in the sampled district. The consumption of feed was found to have varied with the variation of types of animals and birds, their being in-milk or dry, Milch animals/draught animals, sizes and breed.

Consumption of Feed by Livestock: Saran District

The table 4.8a shows paddy consumed by livestock as feed fed in sample district of Saran. The total consumption of paddy fed to Milch and dry animals has been estimated at 32743 kg on overall level. Out of the total, quantum fed to in-milk livestock was found 22743 kg and in case of dry animals, it was 10000 kg to a total number of 559 animals. Per animal consumption at overall level has been worked out at 176.38 kg. The table further reveals that out of the total production of paddy (2209613 kg), 32743 kg were consumed as feed by animals, which was about 1.48 per cent of the total produce in the district.

Table 4.8 a: Cereal (Paddy) Consumed as feed by livestock in Saran District

Name of Animal	In Milk		Dry		Total Number of Animal	Total Consumption (Kg)	Consumption of Crop/ Animal
	No	Qty	No	Qty	No	Qty	(Kg)
Cow	195	22318	100	6745	295	29063	98.52
No clave	0	0	130	0	130	0	0.00
Buffaloes	23	425	44	1525	67	1950	29.10
B. Clave	0	0	23	455	23	455	19.78
Bullocks	0	0	44	1275	44	1275	28.98
He-buffaloes	0	0	0	0	0	0	0.00
Any Other	0	0	0	0	0	0	0.00
All	**218**	**22743**	**341**	**10000**	**559**	**32743**	**176.38**

Consumption of Feed by Livestock: Patna District

Data relating to consumption of pulse as feed by livestock is presented in table 4.8 b. Table indicates total quantity of feed to livestock, which was 3000 kg for 145 animals. Out of the total in milk and dry animals, milk and dry livestock were 47 and 98 respectively and the quantities consumed by them were estimated at 2060 kg and 940 kg respectively. Per animal consumption of pulses as feed was estimated at 88.26 kg. The total production of lentil in the sampled areas had been worked out at 215817 kg and out of it, only 3000 kg were used for feed for animals, which was around 1.39 per cent of the total production.

Table 4.8 b: Pulse (Lentil) Consumed as feed by livestock in Patna District

Name of Animal	In Milk		Dry		Total Number of Animal	Total Consumption (Kg)	Consumption of Crop/animal (KG)
	No	Qty	No	Qty	No	Qty	
Cow	36	1595	19	520	55	2115	38.45
No clave			37	0	37	0	0.00
Buffaloes	11	465	3	30	14	495	35.36
B.clave			9	130	9	130	14.44
Bullocks			0	0	0	0	0.00
He-buffaloes			0	0	0	0	0.00
Any Other			30	260	30	260	0.00
All	**47**	**2060**	**98**	**940**	**145**	**3000**	**88.26**

Consumption of Feed by Poultry in Sample District

Consumption of cereal and pulse as feed by poultry in the surveyed districts of Saran and Patna has been discussed in this section. During the course of the study, it was found that a small number of farmers fed grains to their poultry birds in Saran district, whereas in Patna district the respondents were not found to have owned poultry birds. In Saran district, respondents of different farm size groups owned a total of 1006 poultry birds. The total quantum of poultry feed consisted of broken rice and husk. They consumed 11385 kg of such feed per year. Total quantum of consumption of feed (cereals and pulses) by poultry birds was recorded to be highest in case of small farmers (4284 kg) followed by medium (3755 kg) and large (3346 kg). The farm size wise data reveals that there was a significant difference in the consumption of poultry feed. One of the reasons for this was higher number of birds in case of small farmers and lower incase of large farms. Therefore, naturally the consumption was found higher incase of small and lower of large farms (table No. 4.9).

Table 4.9: Consumption of Cereal and Pulse in as feed by Poultry in Saran and Patna District

Name of the Districts	Size of Holding	No. of Birds	Consumption of Crop (Kg)
Saran	Small	603	4284
	Medium	252	3755
	Large	151	3346
	All	**1006**	**11385**
Patna	Small	0	0
	Medium	0	0
	Large	0	0
	All	**0**	**0**

Value of Crop Output in Sample Area

In this section, total value of crop output has been calculated for both the crops, viz, Crop-1 (lentil) for Patna district separately. The gross value of crop output of cereal crop (paddy) and pulse crop (lentil taken together on overall level was estimated at Rs. 1,47,35,777.01, Out of it, the share of large farmers was highest Rs. 5439445.10 (36.91%) followed by small Rs. 4969214.91 (33.73%) and medium Rs. 4327117.00 (29.36%). It is to be mentioned here that farm level harvesting price for paddy was Rs.525/qtl (on an average), while the price of lentil being Rs 1450/= per quintal-

(Table No – 4.10). The farm class wise reveals that in both sampled district respondents of small size class had larger value of crop output in comparison to medium farms, which might be due to high number of respondents and large area under cultivation.

Table 4.10: Value of Crop output Cereal and Pulse Crop in Saran and Patna District.

Size of holding	Crop		Total Gross Value of Crop Output (Rs.)
	Crop 1 (Cereal)	Crop 2 (Pulse)	
Small	715839.93	86287.00	4969214.91
Medium	632520	69406.00	4327117.00
Large	861253	60124.00	5439445.10
All	**2209612.93**	**215817.00**	**14735777.01**

Farm-level harvesting price of Paddy (crop-1) on an average- Rs.525/qtls.
Farm-level harvesting price of Lentil (crop-2) on an average- Rs.1450 /qtls.

Wastage in Food Grains

Wastages in food grains occur at various stages from production to consumption. The process of wastages in food grains can be seen from before harvesting to bundling, carrying up to threshing floor, cleaning and storage levels of the crop. The extent of mechanization used in harvesting and post harvest operations also determined the quantum of wastages. The storage loss occurs mainly because of the storage structures used by farmers and damage caused by insects and pests. During the standing of the crop, birds and rats also destroyed it. At marketing level, the wastage occurs due to careless cleaning and handling of crops or if the market yards are not properly maintained. In the state of Bihar, post-harvest operations were generally performed manually on large scale by majority of the farmers. Small number of farmers used power threshers for threshing their crops. Strong wind and rain also destroyed the standing crops and lead to wastages of grains just during the ripening of the crop. Thus, 4 to 5 major stages of wastages in grains were generally found higher, i.e., harvesting, threshing, transportation, storage and marketing.

Wastage of Cereal at Harvest Stages: Saran District

In this section, the quantum of wastage of cereal (selected crop paddy) at different stages on Saran district has been dealt. The table containing related data delineated that out of the total production of 22,09,613.93 Kg of paddy grown by the sample

respondents of the district (on over all level), highest quantum of wastage was at the harvesting level itself 110714.90 kg (5.01%) followed by transportation 55205.67 kg (2.50%), straw 27836.26 kg (1.26%), storage 21647.67 kg (0.98%), threshing 16636.85 kg (0.76%), home consumption 10060.87 kg and (0.46%) and very meager quantity 648 kg (3.03%) was seen to have been wasted by way of residue in animal feed/poultry feed. Similar trend of wastage at different harvest stages is observed in case of small farmers, i.e., harvesting being the prominent level 35769.70 kg (5%) followed by transportation 17826.27 kg (2.49%) straw 9057.88 kg (1.27%), storage 8255.52 kg (1.16%), threshing 5951.60 kg (0.84%) home consumption 3377.89 kg (0.48%) and left in animal feed 215 kg (0.03%). One thing is very clear through this observation that maximum quantum of wastage of cereal (particularly paddy) - can be minimized to a great extent, if the harvesting operation is undertaken a bit earlier than full ripening when there is more humidity in the crop and also when there is more humidity in the environment, and the transportation of the crop is managed by tyre-vehicle in the early hours of the morning. Matrix in the table presents judicious interpretation that in case of medium respondents, maximum wastage was observed at harvesting level – 31827.80 kg (5.03%), followed by transportation 15776.56 kg (2.49%), straw 7924.04 kg (1.25%), storage 5883.24 kg (0.93%), threshing 4979.51 kg (0.79%), home consumption 2945.01 kg (0.47%) and a negligible quantum being in case of residue in animal feed 193 kg (0.03%). Table 4.11 a:

Table No. 4.11 (a): Wastage of Cereal (Paddy) crop at different harvest stages in Saran District

(Qty in Kg)

Size of holding	Area (ha)	Production (Kg)	Harvesting	Threshing and Shattered	Straw	Transport ation	Storage	Home consum ption	Left in Animal / Poultry Feed
Small	178.59	715839.93	35769.70	5951.60	9057.88	17826.27	8255.52	3377.89	215.00
Medium	158.03	632520.00	31827.80	4979.51	7924.04	15776.56	5883.24	2945.01	193.00
Large	224.91	861253.00	43117.40	5705.74	10854.34	21602.84	7508.91	3737.97	240.00
All	**561.53**	**2209612.93**	**110714.90**	**16636.85**	**27836.26**	**55205.67**	**21647.67**	**10060.87**	**648.00**

In case of large sampled respondents, the pictures of wastages were a bit different than that of medium farmers but surprisingly enough, it fully tallied with the trend of wastages observed in case of small farmers. Maximum wastages in case of large farmers were found at harvesting level 43117.40 kg (05.01%) followed by

transportation 21602.84 kg (2.51%) straw 10854.34 kg (1.26%), storage level 7508.91 kg (0.88%), threshing 5705.74 kg (0.67%), home consumption 3737.97 kg (0.44%) and left in animal feed 240 kg (0.03%).

It is, thus clears from the above data that wastage of paddy at harvesting level and during the course of transportation, was worked out to be highest in comparison to other losses.

Patna District (Wastage of Lentil)

The table no – 4.11(b) carefully led us to cogitate over the interesting points of wastages in regard to lentil crop in Patna district, which more similarly tally with the trend of wastages of cereal crop (paddy) on overall level in Patna district. Like wastages in paddy, coincidentally highest quantum of wastage in case of pulse crop (lentil) was observed at harvesting level 4007.80 kg (1.86%), followed by transportation 2216.65 kg (1.03%), straw 2112.00 kg (0.98, threshing 1255.89 kg (0.59%), storage 710.59 kg (0.33%), home consumption 458.26 kg (0.22%) and a negligible of 60 kg (0.33) of wastage being for left in animal feed. As regarding farm class wise wastages position, the data contained in the table clearly reveals highest wastage at harvesting level in all farm size groups followed by transportation (except in case of large farmers). After this, almost similar picture of wastages in terms of percentage (in descending order) could be visible in straw, threshing, storage, home consumption, and left in animal feed could be visible in all farm size classes [Table No-4.11 (b)].

Table 4.11 b: Wastage of Pulse (Lentil) Crop at different harvest stages in Patna District

(Qty in Kg)

Size of holding	Area (ha)	Production (Kg)	Harvesting	Threshing and Shattered	Straw	Transportation	Storage	Home consumption	Left in Animal / Poultry Feed
Small	97.02	86287.00	1626.90	438.96	823.45	940.65	243.88	196.65	13.00
Medium	77.79	69406.00	1324.40	396.93	664.55	669.00	210.95	139.17	26.00
Large	65.61	60124.00	1056.50	420.00	624.00	607.00	255.76	122.44	21.00
All	**240.42**	**215817.00**	**4007.80**	**1255.89**	**2112.00**	**2216.65**	**710.59**	458.26	**60.00**

The interpretation of data divulged through quantum of wastages, leads us to safely conclude that in case of selected pulse crop lentil – more care has to be taken while harvesting the crop and transportation has to be under taken maintaining all precautions against jerks in dilapidated roads. This will reduce the extent of wastages during the two stages to great extents. While total wastage at overall level out of total production of 215817 kg was 10821.19 kg this was revealed at 4283.19 kg (4.96%) for small farmers and 3431 kg (4.94%) incase of medium farms. Total production, in case of small and medium farmers was 86287 kg and 69406 kg respectively. In case of large farms, out of the total production of 60124 kg quantum of wastage at different stages were found to be 3106.7 kg (5.17%).

Percentages of Seed, Feed and Wastage of Paddy: Saran District.

In this section, efforts have been made to enact the percentages of seed, feed and wastage during production of cereal (paddy) in Saran district of Bihar. It was interesting to note that at overall level highest quantum was cornered by the surveyed respondents as seed kept 97164 kg (4.40%) followed by the quantum used in seed 56032 kg (2.54%) and used as feed 44238 kg (2%). Out of the total production of 2,20,9,613 kg of paddy grown by the sample farmers of Saran district, wastage was estimated at 2, 42,750.22 kg (10.99%). Farm class wise data reveal similar trend with regard to percentages of seed, feed and wastage in production of paddy grown by small, medium and large farmers. In all the three categories of farms, common tendency of keeping highest quantum as seed was observed followed by seed used and used as feed. In case of small farmers, seed kept got top priority 28714 kg (4.01%) followed by seed used 17142 kg (2.39%) and used as feed 15024 kg (2.10%). Medium farmers response regarding seed feed and wastages was similar in percentage terms which might be due to the fact that seed kept got highest preference 26008 kg (4.11%) followed by seed used 15627 kg (2.47%) and used as feed 13425 kg (2.12%). Among all the three groups of farmers, large farmers were interestingly found to have least preference for cereal crop being used as feed 15789 kg (1.83%). In this case also, similar pattern was observed and estimated at 42442 kg

(4.93%) as seed kept 23263 kg (2.70%) as seed used and used as feed 15789 kg (1.83%) [Table No-4.12 (a)].

Table 4.12 a: Percentage of seed, feed and wastage in Production of Cereal (Paddy) in Saran District

(Qty. in kg)

Size of holding	Area (ha)	Production	Seed Used		Seed Kept		Used as Feed		Wastage	
			Qty	%	Qty	%	Qty	%	Qty	%
Small	178.59	715839.9	17142	2.39	28714	4.01	15024.00	2.10	80453.86	11.24
Medium	158.03	632520	15627	2.47	26008	4.11	13425.00	2.12	69529.16	10.99
Large	224.91	861253	23263	2.70	42442	4.93	15789.00	1.83	92767.20	10.77
All	**561.53**	**2209613**	**56032**	**2.54**	**97164**	**4.40**	**44238.00**	**2.00**	**242750.22**	**10.99**

Percentage of Seed Feed and Wastage: Patna District

Data contained in table – 4. 12b concur the interpretation that surveyed farmers of the study area in Patna district, on overall level and farm size group wise, preferred highest /quantum of pulse crop lentil to be kept as seed 28393 kg followed by seed used 20339 kg and very meager quantum used as feed 3000 kg. On overall level, these were 2393 kg (13.16%), 20339 kg (9.42%) and 3000 kg (1.39) respectively. Total wastage in this case being 10821.19 kg (5.01%), was, interestingly, less than half than that of paddy in Saran district (10.99%). Like Patna district for cereal crop paddy, similar picture related to percentages of seed used, seed kept and used as feed was observed. Small farmers were more careful and ahead in regard to keeping seed than medium and large farmers 12808 kg, 9150 kg and 6435 kg (14.84%, 13.18% and 10.70%) respectively. The reason might be that small farmers, having less capacity of purchasing it from the market, had to depend upon the quantum grown in their own small pieces of land. As no extra irrigation is much needed to given for growing lentil, so larger part of land owned by the small sample growers were devoted for growing lentil during rabi season. It is therefore, the highest percentage of seed used was found in case of small farmers (9.59%), medium farms (9.57%) and large farmers (9.01%). With less quantum of production in the fields of small sample growers because of their smallholdings and preference for seed kept for the next crop, percentage of lentil used as feed was lowest in case of small farmers (0.86%).

Medium and large respondent farmers were found to have used higher percentage of lentil as feed (1.81% and 1.67%) respectively table 4.12b.

Table 4.12 b: Percentage of seed, feed and wastage in Production of Pulse (Lentil) in Patna District

(Qty in Kg)

Size of holding	Area (ha)	Production	Of Seed Used		Seed Kept		Used as Feed		Wastage	
			Qty	%	Qty	%	Qty	%	Qty	%
Small	97.02	86287	8278	9.59	12808	14.84	740.00	0.86	4283.49	4.96
Medium	77.79	69406	6641	9.57	9150	13.18	1255.00	1.81	3431.00	4.94
Large	65.61	60124	5420	9.01	6435	10.70	1005.00	1.67	3106.70	5.17
All	**240.42**	**215817**	**20339**	**9.42**	**28393**	**13.16**	**3000.00**	**1.39**	**10821.19**	**5.01**

Crop- Wise Percentage Estimates for Seed, Feed and Wastage

The analysis of percentage of seed, feed and wastages has been presented in table 4.13. The table reveals that the quantities of cereal (paddy) as seed used, feed and wastage came out at sample farms were 56032 kg (2.54%), 44238 kg (2 %), and 242750.22 kg (10.99%) respectively. The consumption of seed, feed and wastages at overall level were worked out at 343020.22 kg (15.52%) for cereal. The table further reveals that in case of pulse crop (lentil), out of the total production used as seed, feed and wastage were 20339 kg (9.42%), 3000 kg (1.39%) and 10821.19 kg (5.01%) respectively. At over all level, the consumption as seed, feed and wastage has been worked out to be 34160.19 kg (15.83%). The seed kept percentages for both the crops, out of the total production varied significantly and these were 97164 kg (4.40%) for paddy and 28393 kg (13.16%) for lentil. The overall analysis concludes that in case of cereals (paddy), out of the total production, percentage available for human consumption was 84.48 and for lentil, it was 84.17 per cent (table 4.13).

Table 4.13: Crop-wise Percentage of seed, feed and wastage in Production of Cereal and Pulse Crop

(Qty in Kg)

Crop	Area (ha)	Production	Seed Used		Seed Kept		Used as Feed		Wastage		Consumption as seed feed and Wastage	
			Qty	%	Qty	%	Qty	%	Qty	%	Qty	%
Cereal	561.53	2209613	56032	2.54	97164	4.40	44238.00	2.00	242750.22	10.99	343020.22	15.52
Pulse	240.42	215817	20339	9.42	28393	13.16	3000.00	1.39	10821.19	5.01	34160.19	15.83

CHAPTER – V

SUMMARY & CONCLUSION

India is a country with vast population having crossed over 110 crores mark and growing at alarming rate. It is yet another fact of concern that there has not been a proportionate increase in the production level of food grains in the country. It is, thus, the gap between the rise in population and availability of food grains has increased. If this trend persists for some time more, situation will go still worse. It is worth mentioning that out of the total quantum of food grains produced, net consumable quantity for the people becomes available only after deducting the required quantities for seed, feed and wastages/losses at different stages. If the quantum of wastages at different levels is reduced significantly, we can be able to fill the gap to a reasonable extent.

As per latest data on food grain production and its estimated requirement for the present population of Bihar, a deficit of nearly 20.31 lakh tones (15%) is indicated. The total food grain production in the state is about 115.13 lakh tones, whereas the estimated requirement is 135.44 lakh tones. To cope with present and future demands of food, it is necessary to know-how much quantum of food grains are available for human consumption after the quantity of food grains used for seed, feed and deducting wastages/losses at harvesting and post-harvesting stages. Realising the importance of this subject, Directorate of Economics & Statistics, Ministry of Agriculture, Government of India assigned Agro-Economic Research Centre for Bihar & Jharkhand to undertake a common study entitled Estimation of Seed, Feed and Wastage Ratios for Major Food grains (in our case, for Bihar).

Objectives

In the light of the direction of the Ministry, Agro-Economic Research Centre for Bihar & Jharkhand, T M Bhagalpur University took up the study in Bihar with the following objectives, taking 2004-05 as the reference year:

i. *To estimate the total quantity of food grains consumed for seed, feed and wastages, and;*
ii. *To estimate the net availability of food grains for human consumption.*

Methodology

As suggested by the Indian Institute of Agricultural Statistics Research (IIASR), New Delhi, two major food grains (one cereal and one pulse), based on the area predomination in the region were selected. The chosen crop in Bihar was paddy and lentil. As per 2001 Agricultural Statistics of Bihar, these crops covered around 44.00 per cent and 14.40 per cent respectively of the GCA of the state. The major paddy and lentil growing districts of Bihar were selected on the basis of their concentration in gross cropped area, which were comparatively higher across the district in the state. So, Saran district has been selected for cereal crop, as it had a higher density of paddy crop possessing about 90,435 hectares of land under the crop. It was about 38.59 per cent of the GCA in the district. Similarly, Patna district was selected for lentil as it had higher density of this crop. About 33,988 ha, of land was under this crop forming about 14.06 per cent of the GCA of the district.

After selection of the crops and districts, each district was divided into ***four strata*** by suitably combining the adjoining blocks, and from each stratum, five villages were selected randomly for intensive survey. A complete enumeration of the farmers in the selected villages was done and cultivators were classified into three broad categories, viz., small (0 to 2 ha), medium (2.01 to 4 ha) and large (above 4 ha). From each category, 5 cultivators had to be selected randomly (as per suggested methodology). But, due to non-availability of required number of sample farmers in each existing size class, adjusting the required number from other classes compensated the total number and the sample size (in each village) was maintained

at 15 thus, in each stratum, (containing 05 villages), the number of selected respondents was 75. This way, 300 respondents (4 strata x 75 respondents) formed the sample size in each of the selected districts. Taking together, total sample size covered under the study were 600 (300 for cereal paddy and 300 for pulses lentil). The reference period taken for this study was 2004-05 and the data were collected for kharif and rabi seasons.

At the final stage, for estimating the availability of total quantities of food grains for human consumption after having deducted the quantities of food grains used for seed, feed and wastages/losses at ***harvesting and post-harvesting stages,*** detailed information enquiries were made/obtained relating to cropping pattern, production and disposal of crops and their wastages at both stages from each selected sample farmer through structured schedule supplied by the Co-ordinator of the study, ADRT, Bangalore. Besides, this, data related to quantum of consumption of feed by animals were also collected for each animal from the surveyed respondents.

Profile of the Selected Regions

Bihar is one of the most populous states of India and is spread over an area of 93,60,000 ha. The population of the state predominantly depends on agricultural and allied activities, constituting more than 90.00 per cent of the total population. Bihar state is naturally divided into three sub-agro climatic zones. Agriculture, with fertile soil and favourable agro-climatic conditions, has been moving on the path of progress since independence, though at a slow pace. Despite a continuous decline in net shown area, there has been steady growth in production of principal crops in the state. Food grain production is still not enough to meet the minimum food requirements of the population of the state.

The geographical areas of Patna and Saran districts are 3,17,236 ha and 2,64,100 ha respectively. Out of the total geographical area, the net cultivated area of both the districts are 2,20,870 ha and 1,84,988 ha respectively. The GCAs of the districts were 3,89,300 ha and 3,79,784 ha respectively. The percentage of small, semi-medium, medium and large categories of farms in Patna and Saran districts were (95.14%,

4.18%, 0.67%, 0.01% and 90.95%, 5.92%, 2.90, 0.01%) respectively. The source of irrigation in both the sampled districts was tube wells, which constituted 100 per cent and 63.95 per cent of the net irrigated area.

Agriculture is the main occupation of both the sampled districts and also the main source of livelihood. Cereals were the main crop of the region followed by pulses, oilseeds and cash crops. Besides, fruits and vegetables were also grown in sizeable areas of the districts. Nearly 85 to 90 per cent area of both the sampled districts were under cereal crops and remaining areas were used for growing pulse crops, oilseeds and cash crops. This shows that cereals dominated in agricultural practices in the areas under study.

Cropping pattern of surveyed farmers of all stratum in Patna district reveals that paddy in kharif season (277.97 ha as portion of GCA of 1071.56 ha) and wheat in rabi season (213.15 ha) were the dominant cereal crops. Among pulse and oilseeds crops, lentil (240.83 ha) had been the main product. In Saran district, paddy and maize with (559.99 ha and 171.72 ha out of the GCA of 1117.27 ha) were the main cereal crops followed by wheat (164.99 ha) in the category. Mustard (112.28 ha) and Massuriya (108.29 ha) were the other important non-food crops.

The productivities of cereal crops, viz., paddy, wheat and maize in Saran district at 3935 kg/ha, 3204.73 kg/ha and 4860.38 kg/ha respectively were higher than the all India averages of 2077 kg/ha for rice, 2716 kg/ha and 1870 kg/ha for the referred crops. The yield rates for paddy, wheat and maize in Bihar had been estimated at 1516 kg/ha, 1783 kg/ha and 2374 kg/ha respectively. The performance of Patna district in regard to productivities of pulse crops, e.g., arhar and lentil at were better than all India averages of 672 kg/ha and 741 kg/ha respectively, however, these did not match the state average of Bihar (1184 kg/ha and 892 kg/ha) respectively. Only in case of mustard, the yield in Patna district (695.32 kg/ha) was well below the national average of India (1151 kg/ha) and the state's average of Bihar (830 kg/ha).

The profile of the four selected stratum under each of the sampled districts of Saran and Patna reveals that there were 2,680 and 2,440 farmers in 20 villages under 4 stratum separately in both the district. The size class wise average holding of Saran district paddy growers were 1.18 ha (small), 2.68 ha (medium) and 6.77 ha (large). Out of the total size of all holding, the average cropped area per household has been worked out at 1.08 ha (small), 2.68 ha (medium) and 6.77 ha (large). Out of the total size of all holdings the average cropped area per household has been worked out at 1.08 ha (small), 2.52 ha (medium) and 6.57 ha (large). The gross cropped area, on an average, has been worked out at 1.70 ha (small), 4.03 ha for medium and 10.44 ha (large). The overall picture showed that in all the 20 selected villages each from four stratum of the district, about 61.80 per cent belonged to small category, 24.03 per cent to medium and only 14.17 per cent belonged to large category. In all 20 villages, none of the respondents were found to have leased in and leased out cultivated land. The category wise distribution and average size of holding for the selected crop (lentil) in Patna district indicates that small category of farmers posses on an average (1.22 ha) of agricultural land, medium farmers (2.87 ha) and large (6.98 ha) for a total of 2,440 farmers in 20 selected villages of the district. Out of the total number of 2,440 farmers, 67.38 per cent were small, 24.27 per cent medium and only 8.35 per cent were reported as large. Out of the total land, the net cultivated area owned was 1.03 ha for small farmers, 2.69 ha for medium farmers and 6.78 ha for large farmers. The overall average of net-cropped area was 1.89 ha. The gross cropped areas, on an average, were 1.84 ha for small 4.68 ha for medium and 11.93 ha for large. The overall GCA per household was 3.39 ha.

Out of the total cropped area, the cereal crop under irrigation has been worked out at only 14.09 per cent in case of small farmers, 34.67 per cent for medium farmers and in case of large it was 65.26 per cent. The overall analysis indicates that a larger proportion of land under paddy cultivation was unirrigated. In case of lentil crop, out of the total 1071.56 ha of land under the crop, about 65.0 per cent has irrigation facility. The same trend, as in case of farm size wise analysis of paddy, was observed for lentil crop, i.e., about 79.78 per cent pulse area was irrigated in case of

large farmers, followed by medium (73.69%) and small (70.28%). The exceptionally high percentage of irrigation facilities in the district as a whole was observed as being rich from the irrigational facilities.

The cropping pattern in sample villages of both the sampled districts under different selected stratum indicates that in case of Saran, paddy had been the main crop, which constituted about 50.13 per cent of the total gross cropped area followed by maize 15.37 per cent, wheat 14.77 per cent, mustard 10.03 per cent, masuria 9.70 per cent and other crops possessed remaining of the percentages of GCA. The class wise analysis also shows more of less similar pattern.

The cropping pattern in sample villages of Patna district, on an average, indicates that kharif paddy and rabi wheat were the main crops and were grown in 25.94 per cent and 19.90 per cent areas of total gross cropped area across the farms and villages. Next important crops of the area was lentil 22.48 per cent, oilseeds 14.03 per cent, Arhar 15.53 per cent, maize 7.12 per cent and some minor cereals pulses and vegetables were found to have to been grown in smaller areas by the sampled farmers in the selected areas. The farm size wise analysis gives similar picture on overall level.

The production of major food grains in both the sampled districts varied significantly with variation of farm size. The overall production in case of paddy was 2209619 kg in Saran and lentil 215817 kg in Patna district.

The productivity of major cereals in Saran district, at overall level, for paddy, maize, wheat, and mustard has been worked out at 3935 kg/ha, 4860.38 kg/ha, 3204.73 kg/ha and 709.66 kg/ha. The farm size wise productivity was found higher 1008.29 kg/ha in case of paddy in small category. In cases of maize 4900 kg/ha, wheat 3250 kg/ha and mustard 750kg/ha productivity were found higher for large farmers.

The overall productivity of lentil was worked out at 896 kg /ha. In case of wheat, mustard, arhar, maize and paddy productivity were 3244.26 kg/ha, 695.32 kg/ha, 763.68 kg/ha, 4552.54 kg/ha and 3944.27 kg/ha. The highest productivities were

observed in case of large farmers for all the referred crops. As regards to quantities of seeds of cereal kept for next sowing purpose and already used for the current year, these were worked out to be about 4.40 per cent of the total produced and 2.54 per cent respectively. The size class wise analysis indicates that on an average, the quantities of seed kept in total quantum of production varied between 4.01 per cent in case of small farms to 4.93 per cent for large farmers.

In case of lentil, at overall level, out of the total production of 215817 kg, the percentage quantities of seed used and seed kept were 9.42 per cent and 13.16 per cent respectively. The farm size wise data indicates that small farmers used comparatively higher quantum of 8278 kg as seed 9.59 per cent followed by medium 9.57 per cent and large 9.01 per cent. The seed kept across farm size also varied with the variation of farm size for small 14.84 per cent, medium 13.18 per cent and large 10.70 per cent. The quantities of seed kept out of the total production levels of 86287 kg, 69406 kg and 60124 kg by the surveyed small, medium and large farmers were 12808 kg, 9150 kg and 6435 kg respectively.

The farm size wise disposal pattern of paddy indicates that small farmers retained lower proportion of produce for home consumption (162839 kg) and higher proportion for later disposal 424719 kg, (82.09%) followed by large 128140 kg (32.50%) and medium 103241 kg (26.19%). In quantum terms, large farms in the sampled area disposed higher quantities 497672 kg. At overall level, the production disposals, were worked out at 59.83 per cent (1322028 kg) for marketed surplus, 394220 kg, 17.85 per cent for home consumption, 141518 kg, 6.41 per cent for payment of wages to labourers, 97164 kg, 4.40 per cent in seed kept for next year's use 44238 kg, 2.01 per cent used as animal feed and 9.51 per cent of the produced quantum of paddy was found to have been used for other purposes.

The production and disposal patterns of lentil indicate that out of the total production of lentil 2,15,817 kg, about 8,320 kg was found as marketed surplus. The farm size wise data shows that out of the total production, the quantum of marketed surplus worked out in case of small, medium and large farms were 1560 kg, 4235 kg

and 2525 kg respectively. The analysis establishes a relationship between the marketed surplus and the farm size that means larger the farm size greater the marketed surplus and vice-versa.

The analysis of paddy consumed by livestock as feed indicates that per animal consumption, at overall level was about 176.36 kg per animal per annum. Out of the total estimated production of paddy 2209613 kg, nearly 42238 kg was found having used as feed to the animals, which was about 1.91 per cent.

The data related to consumption of pulses as feed to livestock in Patna district, has been worked out and found to be 88.26 kg per animal per year in the sampled areas. Out of the total production of pulses crop lentil at 2,15,817 kg, about 3000 kg have been used as feed, which stood at 1.39 per cent of the total production of pulses.

Consumption of feed by poultry, in case of paddy and lentil, indicates that in Saran district, the respondent farmers kept little number of poultry birds. So, the feeding of paddy were very meagre in both quantum and percentage terms. In case of lentil crop of Patna district, none of the respondents were found to maintain poultry birds. The farm size wise data reveals that in case of paddy, there was a significant difference in the consumption of paddy as poultry feed across the farm size. Small farms were found to have fed higher quantum of paddy feed (4284 kg) to poultry birds and lower in case of large farmers (3346 kg) that might be due to higher number of birds maintained by this category of farms in the areas.

The value of crop output in sampled area has been worked out and found that, at overall level, the gross value of output of cereals and pulse together was Rs. 1,47,35,777.01. The farm size wise data shows that the gross values of both the crops in case of large farms were higher Rs. 5439445.10 followed by small farmers Rs. 4969214.91 and medium Rs. 4327117.00. In the total value of out put the farm wise contributions were 36.91 per cent by large farms 33.73 per cent by small farms and 29.36 per cent by medium farms.

In case of wastage of cereals, the analysis indicates that wastages at harvesting level was (110714.90 kg), 5.01 per cent followed by transportation (55205.67 kg), 2.50 per cent, in straw (27836.26 kg), 1.26 per cent, storage (21647.67 kg), 0.98 per cent, in threshing (16636.85 kg), 0.76 per cent, wastages in home consumption (10060.87 kg), 0.46 per cent and in case of animal feed and poultry feed (648 kg), 3.03 per cent. The farm size wise analysis indicates maximum wastages in case of large farmers at harvesting stage (43117.40 kg), 5.01 per cent followed by transportation (21602.84 kg), 2.51 per cent, straw (10854.34 kg), 1.26 per cent, storage (7508.91 kg), 0.88 per cent, threshing (5705.74 kg) 0.67 per cent, in home consumption (3737.97 kg), 0.44 per cent and left in animal and poultry feed (240 kg), 0.03 per cent, which were comparatively lower in case of medium and small farms that largely due to the fact that large farmers generally maintained their livestock by servants, but in case of medium and small farms, they did maintain it by themselves.

In case of wastage of lentil at overall level, it was recorded at (4007.80 kg), 1.86 per cent in harvesting stage (2216.65 kg), 1.03 per cent in transportation (2216.65 kg), 0.98 per cent in straw (2112 kg), 0.59 per cent, in threshing (1255.89 kg) 0.33 per cent in storage (710.59 kg), 0.33 per cent in home consumption and negligible quantum (60 kg) in animal feed. The farm category wise percentages of wastage indicate that large category of farms suffered/experienced comparatively higher wastages than that of medium and small farmers.

The whole analysis of food grains' wastages across the sample size and districts concludes that harvesting and transportation were the major stages for wastages in food grains. Analysis of surveyed farmers in regard to percentages of seed, feed and wastage of paddy under the sampled district of Saran, at overall level, indicates that (97164 kg), about 4.40 per cent of the produce was kept for seed followed by (56032 kg), 2.54 per cent as seed used (44238 kg), 2.0 per cent used as feed and an altogether wastage of (242750.22 kg), was worked out to be at 10.99 per cent. The farm size wise data related to percentage of seed, feed and wastage in three categories of farms, were found highest 23263 kg (2.70%) in case of seed used for large farms and low in small farms 17142 kg, (2.39%). In case of production used as feed, the highest

percentage was observed in case of medium farms 13425 kg (2.12%), and lowest in large farms 15789 kg (1.83%). In case of wastages in total production, the highest proportion in percentage terms, could be seen in case of small farms 80453.86 kg (11.24%), and lowest in large farms 92767.20 kg (10.77%).

In case of pulse crop at overall level, the percentages of seed, feed and wastages were worked out to be 20339kg, 3000 kg and 10821.19 kg (9.42%, 1.39%, and 5.01%) respectively. Across the farm size, it was observed highest in case of seed used 8278 kg (9.59%) for small farms, used as feed in medium farms 1255 kg (1.81%) and wastages in large farms 3106.70 kg (5.17%). The crop wise percentages of seed, feed and wastages in production of paddy at over level have been worked out at 343020.22 kg (15.52%) in case of cereal and in case of pulse 34160.19 kg (15.83%). In both the sampled crops, the percentages and quantum of seed used in case of cereal and pulse were (56032 kg and 20339 kg) 2.54 and 9.42 respectively, used as feed 2.01% and 1.39% (44238kg and 3000 kg) respectively. The wastage in cereal was 242750.22 kg (10.99%), whereas in case of pulse it was 10821.19 kg (5.01%). The analysis concludes that the percentages of variation in seed, feed and wastages in regard to both the sample crops were observed significant. After deducting paddy used as seed, feed and wastages, 84.47 per cent of the net paddy production was available for consumption. Like wise in case of lentil, 84.18 per cent of net production of this crop was available for human consumption in the sampled areas.

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Annexure - I

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The report is well-planned work. A few suggestions are given below:

Comments on Chapters

No Comments

Chapter – I

No Comments

Chapter – II

No Comments

Chapter – IV

Process of utilization of selected grains for seed and feed is not discussed in this chapter. A similar kind of the problem was observed in case of analysis of wastage section. It is suggested to include these sections in the chapter since it will help in understanding existing practices of utilizing grains for seed and feed in the state and will also help in providing underlying reasons for realized estimates of seed, feed and wastage ratios.

Chapter – V

Authors may use tables or figures or both to show precisely results of the study in the state.

Only after incorporation of the above mentioned comments, the report could be accepted.

With regards,

Yours sincerely

Sd/-

(R S Deshpande)
ADRT Centre,

Date of Despatch of Comments : June 04, 2007
Date of Receipt of Comments : 8th June 2007

Annexure -II

Action Taken Report

Chapter – I

No action needed

Chapter – II

No action needed

Chapter – IV

Process of utilization of selected grains for seed, feed and wastages have been analyzed and added at appropriate places as suggested.

Chapter – V

Figures have been incorporated (used) in this chapter to show precisely results of the study in the state wherever needed (as suggested by the Co-ordinator).

With regards,

(B K Jha)
Hon. Director

Dated: 25th August 2007