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DYNAMICS OF FERTILIZER USE IN DRYLAND AREAS

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DYNAMICS OF FERTILIZER USE IN DRYLAND AREAS

A Thesis

By

NIRMAL KUMAR

submitted to the Faculty of the Post-Graduate School,
Indian Agricultural Research Institute, New Delhi,
in partial fulfilment of the requirements
for the award of the degree of

DOCTOR OF PHILOSOPHY
IN
AGRICULTURAL EXTENSION

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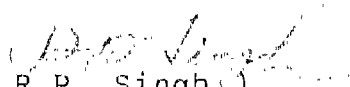


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CERTIFICATE

I hereby certify that this thesis entitled, "Dynamics of Fertilizer Use in Dryland Areas" submitted in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy to the Post-Graduate School, Indian Agricultural Research Institute, New Delhi, is a record of bona fide research work carried out by Shri Nirmal Kumar under my guidance and supervision. No part of the thesis has been submitted for any other degree or diploma. Such help or source of information, as has been availed of, during the course of investigation, has been duly acknowledged by him.


(R.P. Singh)
Chairman
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ACKNOWLEDGEMENT

Inevitability has compelled me to resort to this mode of acknowledging the help rendered to me in the completion of my research work. Words seem hopelessly inadequate and limitation of my diction stands quite prominent in the context of magnitude of feelings. Notwithstanding, my best efforts to put them in black and white, I, in all probability, would be failing to give the right expression to my heartfelt feelings.

I take this privilege to express my esteem and profound sense of gratitude to my Chairman Dr. R.P. Singh, Principal Scientist, Division of Agricultural Extension, Indian Agricultural Research Institute, New Delhi for his abiding interest, learned guidance, thoughtful suggestions, constant encouragement with love and affection and lending an air of self-assurance throughout the study that arouse my real enthusiasm for the successful completion of this piece of work to its final form.

One of those spells of intense gloom and inertia, which has always been my lot, has set in again. I hear Professor of Agricultural Extension, I.A.R.I., New Delhi, one of members of my Advisory Committee, Dr. Y.P. Singh's gentle voice imploring me, for him on, I grit my teeth, I can never bear to think myself as unworthy of¹ his kindness and unabiding persuasion.

I avail this opportunity to express my warm regards and sincere thanks to Dr. B.P. Sinha, Head, Division of Agricultural Extension, Dr. K.N. Singh, Head, Division of Agronomy, I.A.R.I., New Delhi and Dr. V.S. Rustogi, Principal Scientist, Indian Agricultural Statistics Research Institute, New Delhi, the members of my Advisory Committee, for their timely guidance and constructive criticism during my course and research work, which proved to be of immense help.

My sincere thanks are also due to sample farmers of the study area and the technical staff of district Gurgaon, who provided necessary information and data needed in completion of the present study.

I will be failing in my duty if I forget to extend my sincere appreciation and thanks to Dr. J.S. Katariya, Scientist, Division of Agricultural Extension, I.A.R.I., New Delhi and Mr. Pratap Singh, SMS, Department of Agriculture, Gurgaon, who extended their whole-hearted cooperation during the data collection.

Thanks are due to Post-Graduate School, I.A.R.I., New Delhi for providing me financial assistance in the form of a Senior Fellowship to meet educational expenses during the period of my study.

I am very much grateful to Mr. A.K. Singh, Mr. O.P. Singh, Mr. S.K. Singh, Mr. K.K. Singh, Dr. T.V.K. Singh, Dr. A.N. Singh, Dr. (Mrs.) S.K. Verma, Dr. M.K. Mandape,

Dr. D.B.S. Sisodia, Mr. Sanjeev Jha, Mr. R.N. Padariya, Mr. M.R. Ansari and Mr. B.N. Sadangi, for their willing and ungrudging help in successful completion of the study.

It is my pleasure to thank and acknowledge the co-operation given by all my well wishers and friends who helped me during this work and could not find a separate mention.

I will be failing in my duty if I do not express my deep sense of gratitude and indebtedness to my parents, brothers, bhabhi and my better-half whose patience, constant inspiration and encouragement helped me to attain this goal.

It is the fulfilment of the long cherished desire of my brother Mr. Nagendra Singh for my higher education and I do not have words to express my heartiest gratitude to him.

Nirmal Kumar
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New Delhi

Dated: 9.3.1990

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CHAPTER I

INTRODUCTION

The term 'dryland' generally implies that water is a limiting factor during crop season, precipitation is low and conventional irrigation is absent. Areas receiving more than 800 mm annual rainfall are termed as rainfed areas, whereas the areas receiving annual rainfall less than 800 mm are known as dryland areas. Under this parameter/classification, all the drylands are rainfed, but all the rainfed are not drylands. Dryland agriculture is defined as agriculture in areas where potential evaporation and transpiration is greater than the amount of water supplied by precipitation. To be more specific, dryland areas are those where the balance of moisture is always on the deficit side which is bound to affect production, ultimately resulting into total or partial failure of crops.

The importance of fertilizer in the development of agriculture needs no elaboration. It is one of the most vital inputs for productive farming, not only in irrigated but dryland/rainfed areas too. The national average consumption of fertilizer per unit of area has witnessed manifold increase since the introduction of High-Yielding genotypes of wheat

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and rice in mid-sixties. However, the fact remains that we lag far behind agriculturally advanced countries like Netherlands, USA, West Germany and Japan. Moreover, there exists serious imbalances in fertilizer application between irrigated and dryland/rainfed areas.

Emphasising the importance of fertilizers, Norman Borlaug (1971) observed: "If the high-yielding dwarf wheat and rice varieties are the catalysts that have ignited the 'Green Revolution', then the chemical fertilizer is the fuel that has powered its forward thrust".

The drylands are not only thirsty but hungry too. Therefore, any effort to increase crop production must be directed towards meeting the requirements of both moisture and nutrients. Since the organic fertilizers are not available in adequate quantities, there is no way out but to use chemical fertilizer to meet the nutrient requirements of crops. However, the farmers in dryland areas are generally apathetic to use of chemical fertilizer. It is true that scanty and erratic rainfall leads to low availability and uptake of nutrients and keep the yield response at a low level. There is, however, a wrong notion on the part of farmers that fertilizer application under moisture-stress conditions does more harm than good. If the use of fertilizer is linked with moisture status of the soil, their hesitation will go and the use of fertilizer can be increased. Most of the farmers have a feeling that fertilizer is not for

dryland/rainfed farming. This underlines the need to understand and disseminate the idea that fertilizer is not only for irrigated farming but also for dryland agriculture. Rather we must propagate that fertilizer is even much more essential for dryland crops and its use is a must for yield maximisation in dryland crops.

Although nearly three-fourth of our net sown area is rainfed, it accounts for only 15 per cent of total fertilizer consumption in the country. The major focus in dryland agriculture is on those 47 million hectares (or 36 per cent of the net cropped area) where the mean annual rainfall is below 750 mm. Almost the entire production of coarse grains and the bulk of oilseeds, pulses and cotton are harvested in these areas. Even with low production and productivity, the drylands account for nearly 42 per cent of our total foodgrain production. Besides being low, the production in dryland areas is highly unstable. It is, therefore, important that our dryland agriculture is transformed into a modern, viable and dynamic enterprise for ensuring national food security and for promoting growth and social justice. Unless the potential of drylands is exploited judiciously, it may not be possible to meet effectively the growing challenges of incremental food requirements in the times to come. Our population is expected to reach one billion mark by the turn of this century. our food grain requirements then would be around 240 million tonnes.

It has been estimated that even when the entire water resources are fully exploited, over 50 per cent of the total cropped area in our country will remain rainfed for all times to come. It is in view of this fact that much emphasis is being laid these days on raising the crop productivity level in dryland/rainfed areas. It is in the fitness of things that dryland agriculture is engaging serious attention of the central and state governments. Needless to say that fertilizer is a key factor in maximising production even in dryland/rainfed areas. Concerted efforts, therefore, need to be made to promote optimum and efficient use of balanced fertilizers in these areas which have suffered utter neglect in the past. Even with the present level of advancement in dryland agriculture including fertilizer use, the productivity of crops grown in dryland areas can be increased significantly. The urgent and immediate need is speedy and effective transfer of location-specific modern technologies to the farmers.

Besides being low, crop production and productivity in dryland areas fluctuate widely from year to year depending upon the behaviour of the monsoon. Concentration of efforts in irrigated areas for securing higher production has further created serious regional imbalances between dryland and irrigated areas. Because of risky nature of cultivation and low income, dryland farmers are not in a position to invest in and take advantage of modern agricultural technology. Also, due to high risk involved, availability of institutional credit

to the dryland farmers is extremely poor. Thus, the dryland areas are caught in a vicious circle of high risk, low investment, poor technology and low production. Since they hold great promise for much higher crop production and productivity, dry farming technology assumes great importance and relevance.

In the words of Swaminathan (1972), "One can not afford to lose soil fertility, soil is our most precious commodity and the maintenance of its fertility and continued productivity is of paramount importance to the future of our country. The use of fertilizer in a judicious way is basic to keep soil fertility at a reasonable level in a productive agricultural system".

Sivaraman (1972) rightly said that the Indian socio-economic scene is very much dependent on agriculture and the Indian agriculture is very much dependent on fertilizers.

The poor fertility status coupled with inadequate moisture status sets a limit to crop production in dryland. This, in turn, leaves the farmer poor and not in a position to invest much in cash inputs and take risks. In effect, low production gives birth to low marketable surplus, low bargaining power, low income, low savings, low investment capacity and ultimately ends in low agricultural production. Each factor tends to react upon the other, keeping the vicious circle of poverty intact (Jain, 1983).

At the same time, continued production depletes the

nutrient status of the soil which thus accelerates the process of low productivity of soil (Vijayalaxmi, 1979). So both the soil and the farmer get poorer and poorer.

The possibility of fertilizer use in dryland farming is limited by nature itself, because the availability and uptake of nutrients is affected directly by the effect of water on metabolic activity of the plants, soil aeration and the salt concentration of the soil solution. In the immediate vicinity of the roots only, a small portion of the total nutrient requirements of the plant is available (Kemmler, 1975; Tisdale and Nelson, 1975).

The final economic yield of a crop is the result of the combined effect of several factors of plant growth and development plus good management. It is the function of the management to decide upon a proper combination and apply production inputs to the best advantage of all factors of plant growth and development. Nutrient supply is, thus, only one factor of production and its beneficial effect could be reduced or totally vitiated by any other factor becoming limiting. Thus, fertilizer pays only when other factors are well managed (Venkateswarlu and Spratt, 1977).

It is very clear that the use of fertilizer is no substitute for good farming. For realising its benefit, other production inputs have to be carefully managed. Thus, a good dryland crop husbandry system includes the following important components (Chaudhary, 1979).

- a) Preparation of land ahead of crop season and sowing early to let the crop grow and mature within the brief moisture availability period.
- b) Use of efficient crop and varieties based on adaptability, duration and input-responsiveness.
- c) Securing adequate crop stand to get 'population effect'.
- d) Placement of low to medium level of fertilizers.
- e) Weed control and plant protection to save moisture and nutrient.
- f) Soil and water conservation including run-off harvest for life-saving irrigation.
- g) Intercropping for stabilising production.

Under unirrigated and drought conditions, the moisture status of the soil limits absorption of nutrients from surface layer. Therefore, deeper placement of nutrients is recommended in dryland. But the essentiality of placement itself makes the technology complex and puts the farmers in a difficult position to adopt it.

Long duration varieties are not input-responsive under dryland conditions and they suffer from acute moisture stress towards maturity which mars all beneficial effects of any yield-boosting input, including fertilizer.

Crop production in dryland is truly a gamble in rains which are extremely erratic as to their onset, amount, frequency, duration and cessation. The efficiency of fertilizer use depends to a large extent on the time and amount of rainfall. But the undependable rainfall introduces an element of risk, uncertainty and instability in crop production. The farmers with low risk-bearing capacity seem reluctant to invest on the costlier inputs like improved seeds, fertilizers, etc.

Fertilizer use economics is a function of the price relation of the agricultural produce and that of the fertilizers. Even a high response to applied fertilizers will not be of much use if the price relation is unfavourable. Since the prevailing prices of agricultural products fall far short of the economic level, measure should be taken to increase the level of response and/or restructure the price relation in order to increase fertilizer use.

In case of dryland agriculture, use of fertilizer was earlier considered untenable and wasteful, but the researchers under the co-ordinated dryland research scheme have demonstrated that judicious use of fertilizer is an insurance against drought. The scientific researches have shown that with the use of integrated nutrient system involving fertilizer, organic manures and intercropping with leguminous crops, crop yield can be stabilised and better responses to applied nutrient obtained along with increase in the soil fertility status.

Fertilizer alone as yield parameter can contribute to 50 per cent increase over traditional systems and if clubbed with seed and management, considerable increase in yield can be obtained. Fertilizer as input parameter can help in achieving more production target than irrigation.

Earlier efforts to increase the productivity of dryland crops through application of manures and fertilizers did not meet with much success. This was mainly due to the cultivation of traditional crops and their varieties with low genetic potential. The situation has, of late, changed with the availability of high-yielding short-duration and fertilizer-responsive crop varieties. It has now been established by experimentation on a fairly large scale that with the adoption of improved technology, fertilizer application in drylands can be profitable. In fact, in certain cases, response to fertilizer application is higher under dryland conditions at lower levels of fertilizer application than in irrigated areas. This is generally due to poor native soil fertility in the typical dryland regions.

A survey conducted by Jha and Sarin (1984) in 114 non-irrigated districts of semi-arid tropics of India revealed that the average fertilizer use was only 18.5 kg/ha ($N_2 + P_2O_5 + K_2O$), in these districts as against the all India average of 46.4 kg/ha during 1984-85. Interestingly, most of the fertilizer use in dryland areas is confined to cash crops like cotton, groundnut, chillies, etc. Coarse grains, pulses and

oilseeds which constitute the predominant cropping systems in dryland situations receive either nil or almost negligible amounts of fertilizer. This has been the major concern in boosting the productivity of crops grown in dryland areas.

Realising the importance and national priority of rainfed agriculture, the fertilizer industry has involved itself to supplement the efforts of the Government for the transfer of rainfed technology in farmers' fields in their respective areas of operation.

Almost all the constituents of the fertilizer industry have taken up various promotional programmes since the mid-seventies to promote fertilizer use for rainfed crops. Although the programmes vary from organisation to organisation, the general approach consists of small plot (0.2-0.4 ha) bunch type of demonstrations in contiguous areas in demonstrating the effectiveness of recommended package of practices along with balanced fertilizer use as the main thrust. In order to reinforce the impact of such field demonstrations, group discussion, farmers' training, field day, crop seminar, exhibition, slide show, etc. are concurrently organised for bringing home the message across a large farming community. Some fertilizer companies have established farmers' Service Centres to cater to the needs of effective input supply and information exchange. The distribution of minikits containing improved seeds, fertilizers, plant protection chemicals and also seed-cum-fertilizer drills have been arranged amongst the small and marginal farmers.

Some of the organisations have taken up soil and water conservation practices in a limited scale in the form of land shaping, contour bunding, check dam, etc.

Since fertilizer has got a proven role to play in achieving the much needed growth in the agricultural productivity from the dryland areas, it is necessary that due attention is focussed on the strategies to be evolved or pushing up fertilizer consumption in dryland areas, which at present, is deplorably low. Experience over the years has demonstrated that an essential pre-requisite for bringing about any appreciable growth in fertilizer consumption is easy, timely and adequate availability of the right type of fertilizer in the required quantity at the door step of the farmer. This calls for a massive effort to build up a well-knit, integrated and scientific distribution infrastructure that would not only ensure the availability of this vital input to the under-privileged dryland farmer just when he needs it, but also provide him with the much needed technology necessary to ensure the efficient utilization of applied fertilizers. It is only after the farmer is thoroughly convince that application of fertilizer is a profitable proposition that he would be motivated to use the recommended dosage of fertilizer necessary for optimising the yield in dryland areas. Such an infrastructure would have to be developed from the grass-roots levels well spread out in the interior far-flung areas where all the essential agricultural inputs : like fertilizers, pesticides, seeds, credit, agricultural implements and extension

services can be provided under one roof through a single window to the cultivator as it is not possible to imagine the desired growth in the agricultural productivity from dryland areas coming about with mere application of fertilizer without the concomitant package of other inputs.

In the context of providing the essential services needed to motivate the dryland farmers for increased use of fertilizers, perhaps the co-operatives would be in a position to better serve the farming community through well-planned and pragmatic efforts directed at efficient distribution of fertilizer as well as the technical back-up to ensure the judicious utilisation of the same by proper placement, at right time in the right doses.

It is of utmost importance that the co-operative network in the country be geared -up to take on the challenging task of bringing about some equilibrium in the agricultural productivity between the irrigated and the dryland areas. To expect the private trade to participate in this endeavour in a big way by operating more retail outlets in rainfed areas would be quite a difficult proposition in view of the low levels of profitability of their operations at existing levels of remuneration that are available to them. Nevertheless, their contribution towards promoting fertilizer use in rainfed areas could be significantly enhanced by giving them funds for carrying out extension work in selected areas which offer good potential and yet somehow they have not received the necessary attention,

perhaps because it is not rewarding to venture into these areas at present.

Fertilizer consumption in India does not confirm to a definite pattern within the country although it has been steadily increasing every year. Fertilizer consumption per hectare of gross cropped area in the states varies from 1.8 kg in Nagaland to 370.5 kg in Pondicherry. The National Commission on Agriculture (1976) reported that out of over 405 districts, 110 districts consume nearly 75 per cent of the total fertilizer used in the country. Among 110 districts, 60 districts accounted for nearly 53 per cent of the total fertilizer consumption. In order to narrow the gap in districtwise fertilizer consumption and to promote its efficient and balanced use, Intensive Fertilizer Promotion Campaign (IFPC) was launched in May 1976 in 58 districts having low fertilizer consumption.

As most of the evaluation studies such as Directorate of Evaluation and Programme Evaluation Organisation have consistently reported, the major percentage of farmers were not using balanced dose of fertilizer specially in dryland crops. The behaviour is, evidently, uncondusive for agricutural development.

Low fertilizer consumption in rainfed/dryland area is because of poor economic condition of the farmers and high cost of fertilizer. Non-availability of crop loan in time;

lack of knowledge about which fertilizer to use in a particular crop in what quantity, when and how; inadequate subsidy on fertilizers and low price of the farm produce are other contributing factors. To improve fertilizer marketing and fertilizer use in dryland, a strategy is required to be developed so as to ensure availability of fertilizers within easy reach, adequate subsidy on fertilizers, availability of fertilizer at cheaper price, simple procedure in granting crop loan and training on all aspects of fertilizer use. Various agencies like Fertilizer Industry, Agricultural Universities, I.C.A.R. Institutes and Department of Agriculture of Central and State Governments should join hands so that the strategy is given effect to.

Very many Indian and foreign studies are available on adoption of fertilizers. Most of these studies, however, have been conducted in irrigated areas. There is hardly any study on factors influencing the adoption of fertilizers in dryland which is so crucial for fertilizer promotion programme. National Commission on Agriculture, in its report on recommendation on fertilizer distribution, remarked that the strategy for fertilizer consumption must be followed by study of the factors inhibiting the growth of fertilizer in any area. Steps will have to be taken thereafter to remove the bottlenecks and lay down an aggressive fertilizer promotion policy,

In order to promote fertilizer use in dryland areas, it is important to critically analyse the factors responsible for

low fertilizer application in these areas so that proper strategy may accordingly be worked out. It was with this idea in view that the present study was designed. The specific objectives of the study were as follows:

1. To assess the nature and extent of fertilizer use in different crops.
2. To ascertain the level of knowledge and opinion of farmers about the recommendations regarding fertilizer use.
3. To analyse the efforts being made to promote fertilizer use.
4. To identify inhibitors and promoters of fertilizer use.

SCOPE AND IMPORTANCE

It is hoped that this study will help a great deal in developing suitable strategy for promoting fertilizer use in dryland areas leading to increased crop productivity which is presently very low. It will also help to identify the genuine problems faced by dryland farmers in fertilizer use and the possible ways to overcome the same. It may provide necessary guidelines to planners, policy makers, administrators, subject-matter specialists and extension

personnel in this regard.

This study is also expected to serve as a guideline for future researches in this area of vital importance.

Limitations

An effort was made to make this study as objective and systematic as possible. However, the limitations that are more or less common to every student's research project in the field of social sciences and more so dealing with agriculture were very much there. These were the limitations of time, money and conveyance.

The data were collected from only 160 farmers from Gurgaon in Haryana and hence, the conclusions arrived at may not be valid for the state of Haryana as a whole. But although the findings of the study would be directly applicable only to the area under study, the same may be generalised for areas where similar conditions exist.

The findings of this study are based on verbal expressions of the respondents. Therefore, the findings are conditioned by the extent of reliable and valid information provided by the respondents selected for the purpose of investigations.

The study would have been more comprehensive had some more independent variables been included for better assessment of their contributions towards fertilizer use in dryland. This

could not be possible because of obvious limitations with the researcher.

Organisation of the Thesis

This thesis consists of five chapters. The first chapter deals with introduction, objectives, scope and limitations of the study. The second chapter throws light on the relevant literature pertaining to the study. The third chapter on methods and techniques provides relevant background information about the locale, sampling, measurement of variables and analysis of data. The fourth chapter covers the results and discussion. The summary and conclusion as well as implications appear in the last chapter, followed by bibliography. The thesis ends with appendices.

CHAPTER II

REVIEW OF LITERATURE

A comprehensive review of available relevant literature is a pre-requisite for any scientific investigation. It helps a great deal in defining the problem, formulating the specific objectives, deciding the methodology and discussing the findings of the project in hand.

The researcher could come across only a few studies directly relevant to use of fertilizers in dryland and related problems. However, some of the past researchers having direct or indirect bearing on the study under report have been reviewed in the chapter under the following heads:

- I. Technological gaps and extent of adoption of fertilizers.
- II. Factors associated with fertilizer use.
- III. Knowledge about fertilizer use.
- IV. Constraints/problems of farmers in relation to fertilizer use.
- V. Promotors/strategies of fertilizer use.

I. Technological gaps and extent of adoption of fertilizers

A cursory look into the past fertilizer consumption patterns revealed not only low fertilizer consumption per hectare of aerable land in India as compared to other countries but also insignificant change in the ratio of NPK consumption. Despite the introduction of various developmental programmes like IADP, IAAP, HYVP, SFDA, DPAP, etc., the situation with regard to balanced use of NPK in our country is far from satisfactory. Although there is a big gap between what is recommended and what is adopted in respect of fertilizers, especially in case of dryland, very little effort has been made to critically examine the factors responsible for this gap.

Hussain (1964) observed that the effectiveness of demonstration was 72 per cent for fertilizer use as compared to 56, 52, and 47 per cent in case of seed, implement and plant protection respectively.

Shetty (1965) found that there existed a wide variation in the extent of doses of fertilizers used. He also observed very high seasonal variations in the use of fertilizers. Most of the farmers did not use even half the recommended doses of fertilizers.

Desai and Sharma (1966) reported the average rate of application of nitrogenous fertilizers in irrigated wheat was only 16 lb of nitrogen per acre against the recommended dose of 40 lb.

Desai and Narayan (1967) reported that the use of fertilizers in hybrid maize was less than 50 per cent of the recommended dose in case of nitrogenous fertilizers and less than 25 per cent in case of phosphatic fertilizers.

Most of the evaluation studies including those of Directorate of Evaluation, U.P. (1967), Agro-Economic Research Centre, University of Madras (1967) and Agro-Economic Research Centre, Vishwa Bharati (1967) in their respective studies of crops like wheat and rice reported that there was considerable deviation in the doses of fertilizers applied from the doses recommended.

Sisodia (1968) in his study of HYVP, for wheat in Indore district reported that 80 per cent of the farmers growing HYV used the recommended doses of nitrogen. Only 20 per cent applied the recommended doses of phosphatic fertilizers. The difference between the recommended and applied doses was much more in case of phosphatic and potassic fertilizers.

Agro-Economic Research Centre, Andhra Pradesh University (1969) observed in their studies on HYVP for paddy in West and East Godavari districts that per acre doses of NPK applied were 100.65 lb, 15.66 lb and 4.17 lb respectively as against the recommended doses of 60-70 lb of nitrogen, 40 lb of phosphorus and 30 lb of potash.

PEO (1969) in its report of HYVP for Kharif paddy revealed use of nitrogenous fertilizer at an average rate of 54 kg

per acre in the form of ammonium sulphate as against the recommended dose of 200 kg. Application of phosphatic and potassic fertilizers was also below the recommended doses. Out of . . . 80 per cent of the participants who applied fertilizers, only 12 per cent applied nitrogen, phosphorus and potash in combination, 15 per cent nitrogen with phosphorus and 27 per cent nitrogen with potash.

Nair (1969) in his study conducted in Kerala state, pointed out that 90 per cent of the participants in HYVP applied nitrogenous fertilizers but majority applied only less than half the recommended doses. Out of the 71 per cent of the farmers applying phosphatic fertilizers, only one farmer applied full dose, others applied even below 50 per cent of the recommended doses. Potassic fertilizers were used by 60 per cent of the farmers but by none in full doses.

Ranganathan (1969) indicated that in terms of absolute quantity, there was more consumption of fertilizer in irrigated area than in non-irrigated areas.

Prasad and Chaudhary (1972) while giving a comparative statement of fertilizers' use in a progressive and non-progressive village concluded that there was more use of chemical fertilizers in the progressive village as compared to the non-progressive one, but the quantity applied was below the recommendation.

Jati and Tripathi (1972) made a study on the extent of fertilizer consumption in terms of percentage of farmers using them in the IADP districts and found that fertilizers were being used on a wide variety of crops like paddy, wheat, maize, groundnut, jute, pulses and sugarcane by a large section of the farming population ranging from 2 per cent in case of jute to 86 per cent in wheat. There was decline in the application of fertilizers at different stages of adoption. It was also revealed that the respondents had maximum response (73.3%) for calcium ammonium nitrate, whereas it was minimum (32.2%) in case of urea.

Desai et al. (1973) stated that over 80 per cent of the farmers applied fertilizers to only one crop in the year of adoption, and none applied fertilizers in more than three crops.

Chauhan and Sinha (1973) reported that only 43 per cent of the sample farmers used chemical fertilizers and that too mostly confined to jowar, wheat and sugarcane.

Ziaulkarin and Mahboob (1974) while analysing the adoption of fertilizers in Bangladesh reported that 50 per cent of the growers applied urea, about 1/6th of the growers applied phosphate and only 5 per cent of them adopted potash. It was found that almost half (46%) of the growers did not adopt any fertilizer. The findings indicate that the fertilizer use was far below the desired level.

Moulik (1975) observed that on an average, 66 per cent of wheat growers applied fertilizers in 75.38 per cent of the area under wheat.

Chattopadhyay (1976) in his study found that in case of nitrogenous fertilizers, the gap varied from nil to 65 per cent with an average of about 30 per cent. In case of phosphatic fertilizers, the range was from nil to 100 per cent with an average of about 57 per cent. The technological gap in case of total fertilizers used varied from nil to 66 per cent with an average of about 41 per cent.

Bhilegaonkar (1976) in his study on fertilizer utilization behaviour of farmers observed that the total nutrients (NPK) used in kg/acre were 19.03, 22.89 and 23.92 respectively for big, medium and small farmers in the year 1972-73 (before constraints), whereas the corresponding figures in the year 1974-75 (after constraints) were 16.56, 18.0 and 20.16 kg/acre respectively for big, medium and small farmers. The doses of nitrogen used by big, medium and small farmers respectively were 10.72, 13.12 and 14.15 kg/acre during 1972-73 and 9.56, 10.95 and 12.12 kg/acre in 1974-75. This shows that the use of nitrogen was very low.

Somasundaram (1976) concluded that out of the three fertilizers (NPK), nitrogenous fertilizers were applied by the majority of adopters followed by phosphatic fertilizers, the least applied was phosphatic fertilizers.

Singh (1977) found very high technological gaps in case of phosphatic and potassic fertilizers.

Sethy (1978) did not find any non-adopter with respect to adoption of any of the components of fertilizer technology. However, only 11.25, 8.75 and 7.5 per cent fully adopted the recommended doses of nitrogenous, phosphatic and potassic fertilizers.

Kulkarni et al. (1978) found that the use of NPK fertilizers was less than recommended in hybrid jowar and nitrogen and phosphorus were used more in kharif than in rabi hybrid jowar.

Venkateswarlu (1979) while analysing dryland agriculture with special reference to fertilizer use found wide variations in responses to applied fertilizer from location to location, crop to crop and season to season. There was also response variation between research plots under good management and in farmer's field under average management. As a result, farmers often became skeptic of using fertilizer in dry soils.

Siddiqui (1980) in his study found that the yield response obtained under farmer's field trial experiments was merely illustrative in nature and indicated the potential yield levels which could be realised through a balanced application of fertilizers. He further reported that in practice, response of different crops obtaining in the farmer's fields was still very uneven. This implies that intensity of fertilizer

use and the equilibrium yield level can be increased considerably through the spread of cultural practices and know-how associated with the yield response obtained in farmer's field trial experiment.

Singh 1980) observed that the average response of rice at low level of nitrogen use (40 kg/hectare) was found to be around 15 kg per kg of nutrient in Northern and North-Eastern regions, while the highest response of nearly 18 kg was observed in North-Western regions. The average response declined from 13.3 kg to 11.5 kg as the fertilizer dose increased from 40 to 120 kg/ha. The overall increase in yields through the application of nitrogen at 120 kg/ha varied between 38 and 74 per cent in different regions.

II. Factors associated with fertilizer use

There are many factors associated with adoption and non-adoption of fertilizers. The studies reviewed here reveal some of them.

Reports from India as well as abroad have shown that size of holding is positively associated with adoption of fertilizers (Lionberger and Coughenour, 1957; Dube, 1961; Sawhney, 1961; Reddy, 1962; Jaiswal, 1965; Singh and Sohal, 1967 and Rao, 1968)

The NCAER (1964) in a nationwide survey reported that fertilizer users, on an average, had a much larger farm than the non-users and larger the size of holding, greater was the adoption of chemical fertilizer by farmers. This finding was

supported by Ratiram (1964).

Moulik (1965) observed that farmers had favourable attitude towards nitrogenous fertilizers. He further reported that young and middle-aged farmers had more favourable attitude than old farmers. He found that farmer's knowledge about nitrogenous fertilizers was significantly and positively associated with adoption of these fertilizers.

Rao and Moulik (1966) identified several socio-economic and psychological factors like knowledge and attitude towards fertilizers, level of aspiration, irrigation potentiality and cropping intensity as related to fertilizer adoption.

Agro-Economic Research Centre, Vishwa Bharati (1967) in its studies on HYVP pointed out that size of the farm had no effect on consumption of fertilizers and no distinct trend was found to be operative. Similar statement was also reported by Sharma (1969) in his evaluation study of HYVP for IR-8 paddy in Karnal district.

Cropping intensity has direct bearing on use of fertilizers. Research studies including those of Vyas et al. (1969) reported that there was positive and significant relationship between adoption of high-yielding varieties and fertilizer use with cropping intensity.

Contrary to the above finding, however, FAI and NCAER (1974) reported that the cropping intensity had a negative effect on fertilizer use in wheat and jowar crops only,

whereas its association with fertilizer use per hectare in other selected crops was not statistically significant. Only in case of wheat and maize, the cropping pattern index had a negative effect on per hectare fertilizer use, indicating that other factors influencing it remaining the same as increase in the percentage of total area under wheat or maize to the total area under all crops cultivated would reduce the quantity of fertilizers used per hectare in wheat or maize.

Choudhary and Prasad (1972) reported that socio-economic status was associated with adoption of fertilizers.

NCAER (1974) in a study reported that the status of ownership of land had positive effect on fertilizer use.

Lal (1975) stressed that fertilizer use economics is a function of the price of the agricultural produce and that of the fertilizers. Even a high response to applied fertilizer will not be of much use if the price relation is unfavourable. Fertilizer use is essentially a business proposition and will be resorted to only if it is attractive to the farmer. Thus, the FAO fertilizer programme sets a new benefit-cost ratio of 2.0 as the standard to convince the farmers in developing countries of the possibility of mineral fertilizer use.

He further observed that since the prevailing price of agricultural products fall far short of the economic level, measure should be taken to increase the level of response

and/or to restructure the price relation in order to encourage further use of fertilizers.

Bhilegaonkar (1976) found education and knowledge positively and significantly correlated with adoption of fertilizer. He also reported that big farmers had high risk orientation in fertilizer use.

Rao (1979) observed that higher caste farmers with large holdings, better education and more irrigated areas were more prone to the use of fertilizers by taking advantage of institutional facilities. Since the dryland farmers are much worse off in their socio-economic position, the rate of fertilizer adoption is likely to be slow.

Siddiqui (1980) opined that farmers with smaller holdings do take time in adopting fertilizer technology, but once they adopt the technology, fertilizer is used as a land augmenting input to maximise production from their limited land resources.

In another study Siddiqui (1980) observed that the relationship between price of fertilizer and price farmers get for their produce plays a critical role in determining the level of fertilizer consumption. A favourable price relationship between input and output can be instrumental in stimulating the growth in fertilizer consumption and agricultural production. A review of the fertilizer/crop price relationship during the last 10 years indicated that whenever this relationship became unfavourable, fertilizer consumption was adversely

affected. It is obvious that growth in fertilizer consumption can not be sustained unless the fertilizer/crop price relationship is improved.

Siddiqui (1980) in his study on economics of fertilizer use concluded that the use of fertilizer for increasing crop production depends almost entirely on the economics of its use. A variety of factors, he remarked, determine the extent and intensity of fertilizer use once the adoption process has set in. The farmer allocates his resources, i.e., land, labour and capital to different crops with the objective ^{of} maximising production/profit. In the initial stage of adoption process, a farmer seldom applies fertilizer to all crops grown in a season.

The extent of fertilizer use is, thus, defined as the proportion of crop area fertilized to total area sown under all crops in an agricultural year. Intensity of fertilizer use is defined as the rate of fertilizer use per unit of fertilized area. Farmer's decision regarding resource allocation and, thus, the extent and intensity of fertilizer use is determined by a large number of factors which can be broadly classified into three categories:

- i) Physical or locational (crop response to various inputs including fertilizer which depends on type of soil, seed variety and irrigation facilities, etc.).
- ii) Economic (prices of input and output)
- iii) Institutional (technical know-how and managerial ability of the farmers, source and availability of credit facility, size of farm and tenurial systems, etc.).

He also observed that a rise in the relative prices would lead to a fall in the equilibrium level of fertilizer use per unit area fertilized. Besides physical factors, crop response to fertilizer application also depend on the package of practices.

Singh and S^hahu (1981) emphasised that in a groundnut based cropping system, groundnut leaves behind considerable mineralizable nitrogen in soil and as such the succeeding crop of cereal or a non-legume be fertilized with nitrogen, reducing the dose by at least 20-25 kg/ha. They further concluded that in a sequential cropping system, inclusion of a legume component helps in reducing the fertilizer nitrogen requirement of the succeeding crop.

Singh et al. (1984) underlined the need for highlighting facts associated with fertilizer use in dryland regions. One, fertilizer use exhibits its full potential under adequate moisture regime and only when basic soil fertility constraints are removed. Second, high response to unit application of nutrient is obtained under improved crop management system. This implies that high-yielding cultivar/hybrid has to be used, the crop has to be sown in time, adequate plant stand has to be maintained per unit area and above all, timely weed control and effective disease and pest management has to be done if the best is desired to the fertilizer use.

Time of application and method of application, besides balanced fertilizer use, are directly related to fertilizer use

efficiency, irrespective of agroclimatic regions, the soils or the crop grown. They further reported that fertilizer placement in case of post-rainy season crops leads to higher response and better returns. Timeliness and precision are the key factors in efficient fertilizer use in dryland.

Singh and Ray (1985) in their study reported significant influence of index of borrowing of credit for fertilizer, status of land ownership and knowledge about soil fertility and fertilizer management on level of fertilizer use in case of marginal farmers. Similarly, attitude, personal guidance, economic motivation, knowledge and use of cosmopolite sources of information were found significantly correlated with fertilizer use in case of small farmers.

The use of fertilizers in case of medium farmers was found significantly correlated with personal guidance, farm mechanisation, attitude and irrigation index.

The study further revealed that on the whole, personal guidance, economic motivation, knowledge about soil fertility and management, index of borrowing of credit for fertilizer, attitude towards fertilizer use and farm mechanisation significantly influenced the use of fertilizer in respective order.

Parmar (1985) emphasized that in order to increase fertilizer use efficiency in dryland areas, the basic requirement is to adopt proper soil and moisture conservation practices. Watershed programmes are likely to result in better moisture

conservation in the soil, efficient water-harvesting techniques and increased area under the command of each well. All these factors will lead to increased crop production and subsequent need for greater use of fertilizers in dry-farming conditions. As recommended at present, ^P~~A~~pplication of nitrogen in two or more splits allows the farmers to supply nitrogen as the crop grows. Application of full dose of nitrogen at sowing may stimulate profused growth and thereby exhaust the soil moisture supply before the period of maximum water requirement of crop. Almost universal recommendations of split application has certainly led to an improvement in fertilizer use efficiency. The split application practice enables the farmer to withhold or supplement the recommended dose as need be. If the soil moisture conditions are not favourable and if there is a prolonged drought, the second split may be omitted and this will result in saving of fertilizers.

Singh and Tiwari (1985) opined that fertilizer being a costly input, ways and means will have to be found to increase its use efficiency. Legumes play an important role in this regard. It has been shown that a saving of 20-30 kg N/hectare could be affected for a post-rainy season oilseed or cereal crops by practising a rainy season pulse-oilseed cropping sequence.

Surendrajan (1987) emphasised that the economically weaker class of farmers need full credit backing for enhanced productivity in 47 per cent of cultivated area. Medium farmers also require full or partial credit support and as such endeavour

would enhance productivity in another 30 per cent of cultivated area. The affluent class of farmers need not be dependent on outside finance but agricultural operations in this class with a commercial outlook will contribute to a larger production and higher productivity if credit is made available as an added incentives. Therefore, credit has a role to play among all classes of farming in promoting fertilizer consumption. He also observed that in the absence of adequate finance to meet input cost, farmers may tend to skip or curtail application of fertilizers below the recommended level.

As Chandra (1987) pointed out, packaging and handling play important role in marketing and distribution of fertilizers and ultimately fertilizer consumption. The fertilizer consumption pattern also differs from season to season and crop to crop. Much advance planning is, therefore, required particularly in dryland areas. The advance planning covers the following operations: bench mark survey; team visits to explain the advantages of using fertilizers in different crops, i.e., extension programmes, soil testing, lining up of field demonstrations and arrangement for buffering of various fertilizers well in advance.

Pandey (1987) found that neither dealers nor farmers had any stock of fertilizers. A dealer was purchasing only a day's or a couple of days' requirement in the hope that price may further go down. Similarly, farmers move from shop to shop in mandi to enquire about the rebate being given on different

brands and occasionally go back with the hope that either the price will further go down or they may get better rebate in bigger mandi or district town. As a result of this, the godown capacity available with the dealers and the farmers remained unutilised ultimately affecting fertilizer consumption.

As Randhawa and Sinha (1987) expressed, use of fertilizer depends upon a number of factors such as soil type, weather condition, irrigation, use of high-yielding varieties, adequate credit, promotion and transfer of technology. They further remarked that limited moisture availability restricts fertilizer use in drylands.

III. Knowledge about fertilizers

Williams (1958) and Sizer and Porter (1966) in their studies on farmer's decision in the use of fertilizers drew salient conclusions in terms of increased yield per acre resulting from the farmers' knowledge regarding fertilizer use.

Rogers (1961) found a positive association between the farmers' knowledge of innovation and the extent of adoption of the same. In another study, however, Rogers and Havens (1961) observed that farmer's knowledge about fertilizers acted as an intervening variable between the farmer's attitude.

Some of the Indian studies (Jaiswal, 1965; Shankaraih, 1965; Mazumdar and Mazumdar, 1967; Rao, 1968; Nair, 1969)

reported a positive and significant correlation between knowledge of the farmers about agricultural innovations and their adoption. These studies took into consideration the use of chemical fertilizers as one of the practices and included it in computation of adoption quotient.

Desai et al. (1973) observed that among the various characteristics of the cultivators, only literacy was associated with the spread of awareness about the use of fertilizers.

In a joint statement given by FAI and NCAER (1974), it was reported that use of HYV, irrigation, income of the household, ownership of land, credit availability and use of organic manures were some of the factors significantly and positively associated with the use of fertilizers in different crops.

In a study conducted by Bidhan Chandra Krishi Vishwa-vidyalaya (1976), the level of fertilizers use was found to be an important variable in determining the productivity of crops. It is, therefore, essential to train and motivate the farmers to use the recommended dose of fertilizers.

Venkateswarlu (1978) said that to get the maximum benefit in dryland, balanced fertilizer application is a must. Many of the current fertilizer recommendations include P & K which are to overcome the possible deficiency in the long run. In dryland agriculture where crop yields are low and risk minimisation is important, it is necessary to have alternative

approach.

It further said that broadcasting fertilizer is inefficient. It is necessary to place fertilizer in or near the plant row to increase its efficiency.

Phosphates and potassium required are generally applied as a basal dose. However, split application of nitrogen is recommended in dryland situations so that full dose can be applied if the season is normal, otherwise fertilizer to be applied later can be saved.

Any practice that tends to increase moisture storage in the profile enhances fertilizer use efficiency.

In dryland where two situations are common, viz., risk and prevalence of poor farmers, it is very necessary to consider several possibilities of incorporating the much needed plant nutrients. It should also be the endeavour of the dryland farmer to turn over some organic residues, either be it cattle manures, compost or crop residues, to improve soil productivity and enhance fertilizer use efficiency. In drought-prone areas, a minimal dose of fertilizer (20-20-0) is suggested for all crops except pulses where nitrogen can be further reduced.

Singh (1979) observed in his study that under unirrigated drought conditions, the moisture status of the soil limits absorption of nutrients from surface layers and more particularly their expression in terms of grain yield.

Therefore, deeper placement of nutrient is recommended.

But the essentiality of placement itself makes the technology complex and puts the farmers in a difficult position to adopt it.

Moreover, time is a great input in dryland cropping as farmers often have to cover a large area within a short period as soon as monsoon arrives. Since there is a lack of draft animal and farm labour at their disposal and also an efficient seed-cum-fertilizer drill is absent, the farmers often go without using fertilizers.

Arakeri (1979) in his study reported that there was a belief, not only in the minds of the farmers but also in the minds of agricultural scientists and technologist, that the use of fertilizer for dryland crops especially in low rain-fall areas was harmful. It is gratifying that there was growing realisation of the necessity to increase productivity in dryland areas and that the farmers were getting convinced of its advantages and were ready to convince others. Even then the use of fertilizers in crops grown under rainfed conditions was much below the recommended level.

Venkateshwarlu (1979), in another study, advocated the profitability of fertilizer use in drylands but also indicated that the responses of crops to fertilizers varied with crops. He found that cereals responded to N and P; pulses, particularly quick-growing short-duration crops, to phosphorus; and deep-rooted crops to nitrogen. He underlined the need to avoid blanket fertilizer schedules for different crops, more so with

phosphatic fertilizers. This is all the more important in dryland agriculture, where phosphate deficiency would be more common, particularly in semi-arid, sub-humid soils and black-soil region.

As Singh and Sahu (1984) found in their study, the initial soil characterisation is particularly important for ascertaining the benefits from fertilizer use under dryland conditions. Available soil moisture storage is important while considering the benefits from fertilizer use in dryland farming. To use fertilizer with profit, the farmers need to know the available moisture in the soil that can sustain the crop till maturity, the crop response that can be expected from varying rates of fertilizer application, the cost of fertilizer along with added cost of application and the expected price of the produce.

Kanwar (1985) reported that fertilizer is a key factor for crop production in dryland farming. As he suggested in this connection, we need to understand and disseminate the following ideas: (i) We must dispel the idea that fertilizers are only for irrigated farming. Rather we must propagate that fertilizers are even much more essential for dryland crops, (ii) Fertilizer use is to be tailored according to moisture availability. Split application of fertilizer is far more useful and is appropriate too to cover the element of risk. (iii) Time of fertilizer and credit availability is also important.

Urmani (1985) found that in order to increase the

efficiency of fertilizer application, part application of nitrogen through foliage was considered to be helpful. It was, however, observed that application of nitrogenous fertilizer at the time of sowing through soil was the best. Foliar application had limitation in drylands. Application at late stage probably results in non-utilisation of applied fertilizer due to moisture restriction. As he further stressed fertilizer is a costly input and should be used judiciously as proper utilization results in increased efficiency. Hence, it becomes essential to follow better management practices. These include good variety, adequate plant population and better weed control. It is observed that the efficiency of nitrogen application is increased substantially with improved management.

He further highlighted the importance of method and time of fertilizer application. Basal placement at 10 cm depth near seed row has been found to be the best method. Broadcast may sometimes result in wastage, if dry spell follows. Applying fertilizer at sowing looking to moisture storage is the safest way to use this costly input.

Parihar and Gajri (1985) reported that for achieving high water use efficiency, it is necessary to apply fertilizer for meeting the requirement of achievable yield since the achievable yield is dictated by water in relation to water supplies. Apart from water supplies, initial fertility of the soil is another important factor that determines the amount of fertilizer required to achieve the expected yield.

Singh (1985) opined that next to water, nutrient supply is the major limiting factor for crop production in dryland. Contrary to the popular belief, fertilizer application is highly remunerative and is considered one of the essential and critical inputs of dryland technology. It is now well known that initial fertilizer application increases crop vigour.

He further emphasized that for maximising fertilizer use efficiency, it is essential to apply fertilizer at a proper time and place it at a proper depth in the soil. In rabi crops, fertilizer must be drilled at or before sowing so as to place it in the moist zone. To the rainy season crops, half of nitrogen and whole of phosphorus and potash should be drilled at sowing and the remaining half top-dressed one month after/with the rains.

Aggarwal (1985) reported that in arid environment having light-textured soils, use of farm-yard manures had been found to be complimentary to inorganic fertilizers for crops like pearl millet. He further said that application of organic manures has a far-reaching influence in terms of residual effect on dryland crops.

Randhawa and Sinha (1987) emphasised that the crops under dryland respond much more to fertilizer under proper moisture condition. Nevertheless, in moisture-stress conditioning during the growth period, fertilizer makes the plant to withstand stress

much better than non-fertilized crops. However, fertilizer being the costliest input, its use efficiency has to be increased by placing it in moist zone and complementing it with green-manures and organic-manures.

IV. Constraints/problems of farmers in relation to fertilizer use

Since long, efforts have been made to identify the constraints in adoption of fertilizers but very little attention has been paid to analyse the problems faced by the farmers in relation to fertilizer use. A limited number of studies dealing with these have been reviewed and the findings are presented in this study under the following paragraphs.

Radhyshyam (1965) and Prasad (1967) found that as expressed by the majority of non-adopters, high cost of fertilizers and lack of money were the main reasons for non-adoption of fertilizers.

Gupta (1967) stressed that water scarcity, financial difficulty and the belief that high doses of fertilizers were not beneficial were the main reasons for the partial adoption of fertilizers in hybrid maize in Aligarh district of Uttar Pradesh.

The Agro-Economic Research Centre, Jabalpur (1968) in its exploratory study conducted on the problems in fertilizer use pointed out that the main problems faced by the non-adopters were lack of financial resources, lack of irrigation facilities,

unsuitability of soil and non-availability of fertilizers.

As the Agro-economic Centre, Vishwa Bharati (1968) reported, the apprehension that the high dose of fertilizers might spoil the soil fertility was the main reason of partial adoption of fertilizers.

In a study of the Programme Evaluation Organization (1968), 19.72 per cent of the farmers mentioned untimely supply of fertilizers as one of the important reasons for its non-adoption. Other reasons cited by them were lack of adequate irrigation facilities (13.5%) and inadequate supply of fertilizers (8.3%). In another report again, the Programme Evaluation Organisation listed the problems mentioned by farmers. Included among these were credit problem (20.18%), shortage of irrigation water (20.18%), unavailability of fertilizers (17.9%) and inadequate supply of fertilizers (17.91%).

Chaudhary and Ojha (1969) reported that the main problems expressed by the farmers in the use of fertilizers were non-availability of desired fertilizers, black-marketing in the sale of fertilizers and insufficient credit facilities.

Rao (1969) observed that due to stagnation of flood water, the cultivators did not apply full doses of fertilizers in IR-8 paddy in the Amritsar district of Panjab. In another study, he pointed out that water shortage for irrigation was the main reason for partial adoption of fertilizers in IR-8 paddy in Saharanpur district of Uttar Pradesh.

Nair (1969) reported that high cost of fertilizers and untimely and inadequate supply of fertilizers were the main problems faced by the farmers in fertilizer use.

In contradiction to what Nair (1969) observed, the Agro-economic Research Centre, Sardar Patel University (1969) found that almost all the farmers using fertilizers received fertilizers in time and in adequate quantity. However, hardly a few were aware of the doses of fertilizers to be used.

Singh (1969) revealed that inadequate irrigation facilities, lack of adequate and timely supply of fertilizers and lack of financial resources were the important problems the farmers were faced with in fertilizer use. As he further reported, the farmers' apprehension that high doses of fertilizers were harmful for soil and spoil the tastes of products were the main reasons for partial or non-adoption of fertilizers.

Choudhary and Prasad (1972) in a research study conducted in a progressive and non-progressive village of the union territory of Delhi reported that the problems in adoption of fertilizers in the progressive village, in order to rank, were high cost of fertilizer, lack of money, unavailability of fertilizers in time, low prices of produce, unavailability of fertilizers in the village, lack of credit facilities, lack of adequate knowledge about fertilizers, lack of irrigation facilities, adverse effects of fertilizers on soil and susceptibility of crops to diseases and pests. In case of the non-progressive village, however, the problems of fertilizer

adopters, in order of rank, were, lack of irrigation facilities, high cost of fertilizers, unavailability of fertilizers in the village, lack of credit facilities, lack of money, unavailability of fertilizers in time, lack of adequate knowledge about fertilizers, low price of produce, unsuitability of well irrigation water, adverse effect of fertilizers on soil and deterioration in taste of produce.

Choudhary (1973) while analysing the problems in the use of fertilizers with respect to categories of farmers reported that small farmers perceived lack of money as the most important problem. Other problems of small farmers, in order of importance, were high cost of fertilizers, unavailability of fertilizers in the village, lack of adequate knowledge about fertilizer, adverse effect of fertilizers on soil, adulteration in fertilizers, lack of transport facilities and supply of short weights of fertilizer bags.

Untimely supply of fertilizers was the most important problems for big farmers. Their other problems, in order of importance, were black marketing of fertilizers, lack of money, high cost of fertilizers, non-availability of fertilizers in the village, block officers taking too much time in giving loan for fertilizers, lack of desired fertilizers in the market, depot manager taking too much time in giving delivery of fertilizers, lack of adequate knowledge about fertilizer use, supply of short weights, adulteration, lack of easily

available credit, lack of transport facilities, bad effect of fertilizers on soil, soil test report not coming to the farmers, unavailability of machines for fertilizer spray and lack of irrigation facilities.

Jati and Tripathi (1973) reported that 66.7 percent of the farmers adopted fertilizers, whereas 18.75 per cent did not. The proportion of those who reverted after sometimes was 15.18 per cent. The causes of non-adoption were stated to be high cost and inadequate and untimely supply. The causes for reversion were increased crop susceptibility to pests, development of acidity and consequent determination of physical condition of soils. Sharma and Nair (1974) also reported the same constraints for partial adoption of fertilizers.

Fertilizer Association of India (1975) reported that aberrant weather condition, sharp hike in fertilizer prices, inadequate credit and other factors like lack of timely availability, etc., were some of the factors responsible for slowing down the offtake of fertilizers.

Hansel (1975) revealed that transport demand, larger per acre cost and unreliability of recommendation might contribute to the low level application and to the under representation of this input in developing countries. The economic and reliable recommendations play a major role in promoting fertilizer use. He further reported that adequate producer credit such as input-tied credits promote fertilizer adoption because they

provide funds needed by the small scale producers, relieve the risk of innovation and at the same time allow for fertilizer application under condition of economically more competitive alternatives.

Sirohi and Sharma (1976) also reported effect of fertilizer constraint on farm returns in two situations, viz., without and with multiple cropping patterns. The constraint was more in small farms than in large ones due to fertilizer constraint only. They further stated that the decrease in returns on small farms due to reduction in fertilizer supply was Rs. 578.62 (11.67%) without multiple cropping and Rs. 784.24 (9.82%) with multiple cropping. However, the decrease in return on large farms due to shortage of fertilizer supply was greater in absolute terms but was less in per cent term as compared to that on small farms. It decreased by 12.97 per cent without multiple cropping and 7.56 per cent with multiple cropping.

Rastogi (1978) isolated the following constraints in fertilizer use as perceived by the farmer: high cost of fertilizer, shortage of capital, fear and heavy losses or unsuitability to drylands, non-availability, returns non-remunerative and lack of knowledge about their use in dryland.

Sahrawat et al. (1979) found that soils of semi-arid tropics, despite their low fertility status, were quite productive particularly with fertilizer use. Lack of assured supply of available soil moisture throughout the growing season was

the primary limitation. The major cause of this was erratic distribution of rainfall during the rainy season in conjunction with high evapo-transpiration rate.

Havangi (1979) indicated that inadequate and untimely finances were the major handicaps in fertilizer use at the farmers' level.

Mahapatra (1985) expressed his views about the dryland condition where rain is almost uncertain. It is difficult to convince a farmer to invest on fertilizers and other inputs. The risk factor in such areas is very high due to which a farmer is always hesitant to take up cost-intensive modern technologies. Very often it is felt that probably the non-availability of fertilizers is one of the main reasons for restricting the consumption growth in such areas. There is no doubt that availability of fertilizers improves offtake provided other conditions are favourable. In otherwords, it is unlikely that fertilizer consumption will be increased merely by opening retail points where the condition for crop growth is unfavourable.

Parmar (1985) explained three main reasons for low consumption of fertilizer in dryland areas. Firstly, improved technology for dryland farming has been recently evolved. Secondly, high element of risk is involved because of erratic rainfall pattern, thirdly, there are some crops which do not give adequate response to fertilizers under rainfed conditions.

Singh (1985) expressed that the optimum fertilizer use was critically evaluated through operational research. Though the farmers appear fully convinced about the usefulness of fertilizers, yet drought discourages them to take up fertilizer use. Non-availability of fertilizers within easy reach and availability of bigger packings against their small requirements continue to be the constraints to fertilizers use by the small farmers in dryland areas.

Murthy (1985) opined that because of the unpredictable nature of the time and amount of rainfall, dryland farmers are generally unwilling to apply fertilizers. Most of the dryland farmers are economically poor and depend largely upon credit facilities/subsidies for the purchase of necessary inputs. In the absence of availability of the required credit/subsidy, they are unable to use the necessary inputs in the proper dosage.

As he further observed, because of the poor and untimely demand for the agricultural inputs in rainfed areas, proper storage facilities have not been developed in such places. It is also generally noticed that in rainfed areas, the number of retail sale points are limited in number. It is partly true that by increasing the number of retail sale points, consumption of fertilizer can be increased.

Urmani (1985) narrated some of the problems encountered at field level. The major problem is lack of adequate and

timely finance. Non-adoption of fertilizer in drylands are largely due to non-availability of funds. Ease in credit advancement and relatively lower rate of interest should be considered for finance to increase use of fertilizer in drylands.

Kumar and Mishra (1985) pointed out several reasons for low fertilizer consumption in dryland. These were: unawareness of farmers as regards the beneficial effect of fertilization on crop yields, lack of awareness about the modern dryland agricultural technology and its potential to increase agricultural production, ineffective fertilizer distribution system, non-availability of inputs and services during critical periods, weak and inadequate extension programme in the rainfed areas, and lack of intensive and coordinated efforts on the part of government, research institutes and fertilizer industries.

Shah and Kute (1987) observed a number of infrastructural constraints adversely affecting the increase in fertilizer consumption. These were related to transportation, warehousing, packaging, fertilizer cost, distribution channel and credit.

In addition to the infrastructural constraints, they found climatic, technological and socio-economic problems adversely affecting fertilizer use.

V. Promotors/strategies of fertilizer use

Ray and Chaudhary (1975) emphasised the role of meeting credit need of the farmers in fertilizer promotion.

Arulraj and Knight (1977) remarked that ultimate acceptance of a technology is mainly governed by the attribute of the technology and the socio-economic setting in which the farmers operate. For illustration, small and medium farmers put significant importance to cost of the innovation, whereas big farmers are concerned with the profitability aspect only. Thus, cost and profitability are the main factors regulating fertilizer use.

Venkateswarlu and Spratt (1977) suggested that the final economic yield of a crop is the result of the combined effect of several factors of plant growth and development plus good management. It is the function of management to decide upon a proper combination and apply production inputs to the best advantage of all factors of plant growth and development. Nutrient supply is, thus, only one factor of production and its beneficial effects could be reduced or totally vitiated by another factor becoming limiting. Thus, fertilizer plays only when other factors are well managed.

Singh et al. (1978) found excessive use of labour and fertilizer on certain size group of farms in some zones even in the existing situation. They further found credit leading to more use of fertilizers.

Chaudhary (1979) also pointed out that use of fertilizer is no substitute for good farming. For realising full benefits from fertilizer use, therefore, other production inputs have to be carefully managed.

On the basis of his observation, Arakeri (1979) underlined the need for increased and intensified efforts in a number of areas for promoting fertilizer use in dryland including studying residual effect of fertilizer, soil-moisture regime vis-a-vis fertilizer application, possibility of changing cropping pattern, bridging the extension gap, assuring supply and services to the farmers in time and availability of low cost equipments.

Vijailaxhmi (1979) considered it essential for high production that the basic resources like soil and water are optimised with optimal use of fertilizer. This is of very great relevance as fertilizer costs are high, the investment capacity of farmer is low and the risk involved is great.

He further reported that in Kharif, it is advantageous to split the nitrogen dose and apply all phosphorus as basal. In order to make the best use of fertilizer applied, it is advisable to place the fertilizer. This would have a wider implication in farmers' field, where weed control is not always satisfactory. Precious fertilizer that would otherwise be used by weeds could be effectively utilised by placing fertilizer in bands as nearer the row as possible. Band placement

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eventually also helps in avoiding pests and diseases. In rabi also, fertilizer must be placed below the seed in the same furrow to obtain the maximum returns.

Fertilizer should be used only after the low monetary inputs have been mastered for maximum efficiency. Practices that increase availability of moisture, early sowing, optimum plant population and stand, right choice of varieties and crops and timely weed control all indirectly increase fertilizer use efficiency.

As Pandey (1985) remarked, fertilizer industry can be associated to supplement the efforts of the government for promoting fertilizer use to increase crop productivity in dryland areas. Government may consider allowing certain subsidy to the fertilizer industry to undertake extension activities more vigorously in dry areas.

In his study on integrated soil fertility management, Aggarwal (1985) found that the economic use of fertilizer could be practiced better on the basis of soil test for individual fields rather than that on the basis of regional recommendations. He further said that fertilizer is costly and for making efficient use of this input, the integrated nutrient supply system should form an integral part of the farming system to improve productivity per unit of fertilizer applied.

Kumar and Mishra¹ (1985) suggested that infrastructure for fertilizer distribution should be strengthened through an

increase in the number of retail points, godowns and establishment of Farmer's Service Centres, Promotional activities like field demonstrations, crop seminar, farmer's meetings, mini-kit distribution and soil testing should be carried out in an intensive manner.

He further emphasised that for drylands, specific agricultural implements like fespo plough, ridger, seeder, bullock-drawn seed-cum-fertilizer drills and blade horrow should be provided either free of cost or on subsidised basis for the use of the farmers. In order to motivate and help the dryland farmers, therefore, the distribution of mini-kits containing improved seeds and fertilizer, free of cost, should be made.

Saxena et al. (1985) outlined that the rainfed areas suffer from certain problems for which transfer of technology is slow and crop productivity is also poor. The inherent constraints of such areas are to be identified and location specific technologies adopted for getting desired results. In fact, fertilizer application helps in effective utilization of limited water in the soil profile and fighting drought situation. In view of the above facts, significant yield advancements have been found in dryland crops with the application of moderate doses of fertilizer.

They found that in order to reinforce the impact of field demonstrations, group discussion, farmer's training, field day, crop seminar, exhibition, slide show, etc. were organised

in bringing home the message across a large farming community. The distribution of minikits containing improved seeds, fertilizers and also seed-cum-fertilizer drills were being arranged amongst the small and marginal farmers.

In addition to the general programme, village adoption programme is undertaken as the major step by almost all the fertilizer companies with a view to increasing awareness of farmers for increased fertilizer use and higher productivity in dryland areas. In order to enhance the benefits of fertilizer use, they suggested that the whole package of dryland practices including early ploughing, use of HYV, early sowing, fertilizer placement, optimum plant protection, intercropping, etc., should be adopted. The establishment of Agro-service centres by industry is another direction in stimulating fertilizer consumption, especially in rainfed areas.

Mahapatra (1985) strongly felt the need for opening sale points more intensively in rainfed areas. This should be widely dispersed to make the fertilizer available within easy reach of the farmers. In this context, it may be relevant to review the existing situation.

Kute (1985) felt that in order to achieve the stupendous task of increasing fertilizer consumption substantially in rainfed areas, it is important that a strategy is carefully worked out by opening additional retail sale points in interior areas for readjustment and optimisation of infrastructure, close coordination at various levels of agencies involved, effective

monitoring of supplies and distribution of fertilizers, promotional efforts on the part of lead manufacturers and other related agencies.

He suggested that in order to stabilise fertilizer consumption at a higher level for achieving maximum possible crop production, provision should be made for other agricultural inputs like seeds, pesticides, irrigation water, credit, improved implements or equipments like seed-cum-fertilizer drills supported by dynamic management and coordination at all levels.

He further remarked that since the farmers in rainfed areas have been following age-old cultivation practices, they need to be educated and trained in respect of efficient use of various agricultural inputs and scientific farming by organising fertilizer demonstrations and trials right on their fields and organising farmers' training programmes, seminars, conferences, meetings, etc. at their doorsteps. Their participation in field days, fairs, festivals, exhibitions should form a very important part of the programme.

Based on his experiences over the years, Pradhan (1985) found that an essential pre-requisite for bringing about any appreciable growth in fertilizer consumption is easy, timely and adequate availability of right type of fertilizer in the required quantity at the door step of the farmers. This calls for a massive effort to build up a well-knit integrated and scientific distribution infrastructure that would not only

ensure the availability of this vital input to the under-privileged dryland farmer just when he needs it, but also provide him with the much needed technology necessary to ensure the efficient utilisation of applied fertilizers. It is only after the farmer is thoroughly convinced that application of fertilizer is a profitable proposition, that he would be motivated to use the recommended dosage of fertilizer necessary for optimising the yield of dryland areas. Such an infrastructure would have been developed from the grass-root level, well spread out in the interior farflung areas where all the essential agricultural inputs like fertilizer, pesticides, seeds, credits, agricultural implements and extension services can be provided under one roof through a single window to the cultivators as it is not possible to imagine the desired growth in the agricultural productivity from dryland areas coming about with the mere application of fertilizer without the concomitant package of other inputs mentioned above.

He further said that in the context of providing the essential services needed to motivate the dryland farmer for increased use of fertilizer, perhaps the cooperatives would be in a better position to serve the farming community through well planned, and pragmatic efforts directed at efficient distribution of fertilizers as well as the technical back-up to ensure the judicious utilisation of the same by proper placement, at right time in right doses.

Singh (1987) considered it important that the persons engaged in fertilizer sale promotion and use are exposed to the technology of fertilizer use, the transfer of fertilizer use technology, the temptation to farmers for fertilizer use and the techniques used for fertilizer sale promotion.

Pandey (1987) pointed out that the increase in food grain production in India has a close relation with fertilizer consumption. Therefore, adequate availability of fertilizer within easy reach of farmers is of immense importance to the national effort of increasing food grain production.

Chandra (1987) remarked that for increasing the consumption of fertilizer in remote non-irrigated areas, introduction of smaller packings, say of 25 kg instead of 50 kg, had been found to be very effective.

Shah and Kute (1987) suggested that fertilizer movement plan should be prepared well in advance and implemented as per the rail, road and other transportation facilities well in advance of the time of consumption so that the right type of fertilizer is available in sufficient quantity nearest to the place of consumption. They also said that in view of the lower requirement of fertilizers, it may be appropriate to have 25 kg packings of low concentrated fertilizers. Besides, it should be advantageous to make fertilizer available in time through cooperative societies, cooperative banks, NABARD and nationalised banks, etc. well in advance which would increase the purchasing

power of the farmers thereby increasing fertilizer consumption. They further proposed that all the concerned government, semi-government and private agencies, particularly the fertilizer industry, should undertake special fertilizer promotional and extension programmes.

Kumar (1987) remarked that the wide gap of average yield and fertilizer consumption which exists amongst different areas can be narrowed down by integrated extension and promotional strategy. The extension services and fertilizer promotion have to be situation specific. It is important to select the media-mix approach for making a dent in increasing fertilizer use. The activities having direct bearing on increased fertilizer use like field demonstration, village adoption programme, long-term fertilizer development programmes and single-window concept of supplying all inputs under one roof have to be taken up on priority.

CHAPTER III

METHODS AND TECHNIQUES

Systematic methodology is the key to success of any research project as it has direct bearing on the relevance of research findings specially in case of social research. Methodology includes techniques, devices and procedures to be applied for conducting research.

This chapter presents the research methods and techniques used in the study. For the sake of clarity and convenience, this chapter is divided into five sections:

1. Locale of study
2. Sampling procedure
3. Selection and measurements of variables
4. Tools and techniques of data collection
5. Statistical tools used for the analysis of data.

1. Locale of study

The very nature of the investigation demanded that it be conducted in a dry-farming tract. Having this basic consideration in view, dry-farming tracts of Haryana state were

selected for the study. The state has been divided into three zones on the basis of cropping patterns, rainfall, soil type and irrigated areas, etc. Zone I consists of hot and arid regions (Mohindragarh and Bhiwani districts), Zone II includes hot and semi-arid regions (Sirsa, Hisar, Jind, Nuh, Gurgaon and Rohtak districts) and Zone III represents irrigated and hot humid parts (Sonapat district).

The study was conducted in two purposively selected sub-divisions, namely, Gurgaon and Nuh of Gurgaon district in zone II keeping in view the requirements of the study, accessibility and already established rapport with the district officials of the State Department of Agriculture.

One block from each sub-division was randomly selected considering the requirements of the study. The blocks selected were Farrukhnagar and Nuh. From each of these selected blocks, two villages, namely, Mohammedpur and Sadhrana from Farrukhnagar and Adwar and Nangali from Nuh were randomly selected.

The location of the selected blocks and villages in Gurgaon district has been shown in Figure 1.

Background information about the locale of study

Haryana state: Necessary and relevant information about the locale of study was collected from different sources including interviews with concerned officials and formal and informal village leaders and available records.

It was considered desirable to give a brief description of the locale so that the findings of the study may be applied in similar situations elsewhere because introduction and acceptance of any new technology in rural areas largely depends upon physical, economic and social conditions of the locality. In addition, the climatic endowment and soil conditions vary considerably between states and regions and have tremendous impact on crop production.

Haryana state is situated between latitudes $27^{\circ}03'$ to $31^{\circ}09'$ north and longitudes $74^{\circ}44'$ to $77^{\circ}06'$ and forms a part of Indo-Gangetic plain. Out of six physiographic regions in the state, the upland plain as the Ghaggar Yamuna doab of Gurgaon district constitutes the study area. The total geographical area is 44.21 lakh hectares sloping from the north-east to the north-west and the west.

Haryana has sub-tropical, semi-dry continental monsoon's climate. The climate is marked by wide range of temperature and humidity. Summers are scorchingly hot but winters are fairly cool. Bio-climatically, the state has three zones and the study area falls under hot and semi-arid zone.

Temperature varies from 3.2° C minimum in January to 47.4° C maximum in June. There is no lack of sunshine in any part of the year. The dry period in a year amounts to 268 days and about 63 per cent days in the rainy season are also dry.

Normal annual rainfall varies from less than 300 mm in

south-western to 1200 mm in the hilly tracts of north-eastern parts of the state. Over 70 per cent of the rainfall is received in July.

Evaporation is more than the rainfall in each month. The ground frost and hailstorms are infrequent. Fog occurs for 5 to 7 days and dust storms for about 5 to 10 days in a year.

The relative humidity is generally low and the lowest being in summer months from March to June, when the temperature rises and wind speed remains maximum. It varies between 55 in March to 84 in August.

Soils of the area is typical alluvial deposits of Indo-gangetic basin and ranges from clay-loam to sandy-loam. Soils are light to medium textured. 11,755 km² or 29 per cent of the area is under loamy sand, while sandy loam covers an area of 22,602 sq. km or 55 per cent. Soils of the Haryana state are poor in nitrogen content.

Haryana is predominantly an agricultural and one of the most progressive states. The net cultivated area is 405 lakh hectares and uncultivated area including permanent pastures and grassland is 0.47 lakh hectares. Fallow land amounts to 1.85 lakh hectares. The total cropped area is 43.94 lakh hectares. The area under forest is 1.3 lakh hectares.

The major sources of irrigation are canals and tube-wells.

The percentage of gross irrigated area to the total gross sown area as in 1980-81 is 60.6. More than 80 per cent of the study area is under dryland where there is no facilities of supplemental irrigation.

The major cereal crops grown during kharif season are bajra, jowar and paddy, whereas wheat, oilseed, barley and Bengal gram are the major crops grown in rabi season.

Gurgaon district

The district Gurgaon comprises nine blocks, namely, Tauru, Nuh, Nagina, Punhana, Firozpur Jhirka, Sohna, Gurgaon, Pataudi and Farrukhnagar. The total area of the district is 2716 sq km and it constitutes 6.14 per cent of the total area of Haryana state. There are 721 villages inhabited by 849598 people, which comes to 6.57 per cent of the total population of the state.

Gurgaon district is one of the 12 districts of Haryana. The district is situated at 28°28' latitude and 77°72' longitude. The district town Gurgaon is situated 32 km from the national capital, New Delhi. Gurgaon district is the southern-most district of the state of Haryana bounded by Delhi and Rohtak districts in the north, Faridabad district in the east, Alwar and Bharatpur district of Rajasthan in the south and Mohinder-garh and Rohtak districts in the west. Gurgaon district comprises three sub-divisions, namely, Gurgaon, Nuh and Ferozpur

ghirka. The landscape of the district is rather peculiar. It has varied topography comprising valleys, undulated lands and alluvial plains with Aravali ranges existing in south-eastern and south-western parts of the district. The soil of the area varies from sandy loam to loam. In certain low-lying areas, the soils are clayey and saline. The Mewat (Nuh) area of the district has drainage problem due to varied topography of hills and plains. Based on the present knowledge, the underground water potential is limited. In vast areas of the district, the underground water is brackish and unfit for use in cultivation.

Climate and Rainfall

The climate of Gurgaon district is more temperate compared to other districts of Haryana. May and June are the hottest months recording temperatures upto 45°C , while December and January are the coldest months recording temperature as low as 1°C . Duststorms during the summer months is a common feature. The monsoon sets generally in the 1st week of July and continues up to the end of August. The average rainfall in the district is about 62 cm.

It is evident from Table 3.1 that the total area of the district is 273000 hectares of which 219000 hectares (80.22%) is cultivated area. The net sown area out of the cultivable area in the district is 185000 hectares (84.47%). About 12000 hectares area is under forest. The area under double cropping

TABLE 3.1: Land utilization pattern of the district

Sl. No.	Particulars	Area in thousand hectares
1.	Total area according to village paper	273
2.	Cultivable area	219
3.	Net area sown	185
4.	Total cropped area	288
5.	Area sown more than once	103
6.	Land put to non-agricultural uses	37
7.	Forest	12
8.	Barren and uncultivated	7
9.	Current fallow	32
10.	Permanent pasture	12

Source: NRDMS DISTRICT DATABASE, GURGAON

is 103000 hectares, that is only 47 per cent of the cultivable area. So there is much scope of increasing the area under double crops.

As shown in Table 3.2, the main sources of irrigation in the district are tubewells and government canals. The net irrigated area is 94000 hectares (50.8% of the net sown area). Only 6000 hectares and 1000 hectares are irrigated by government canal and tanks respectively, while the rest of 87000 hectares are irrigated by tubewells and pumpsets. Lack of

TABLE 3.2: Area under irrigation (sourcewise) of the district

Sl. No.	Source	Area in hectare
1.	Government canal	6000
2.	Tanks	1000
3.	Wells	0
4.	Tube wells	87000
5.	Other sources	0
	Total	94000

Percentage to net area sown: 50.8

Source: NRDMS DISTRICT DATABASE, GURGAON.

underground water, inadequate availability of canal water, brackish ground water and power shortage are the major problems faced by the cultivators.

It is evident from Table 3.3 that bajra and jowar among kharif crops and wheat and oilseeds among rabi crops are the major crops grown in the district.

Fertilizer consumption pattern

The average fertilizer consumption in the district is 19.5 kg/hectare. The fertilizer consumption pattern of the

TABLE 3.3: Area under major crops in the district

Sl. No.	Crop	Area in hectare
<u>Kharif</u>		
1.	Bajra	60000
2.	Jowar	20000
3.	Paddy	812
4.	Kharif pulses	712
5.	Kharif (oilseeds)	423
<u>Rabi</u>		
1.	Wheat	102000
2.	Oilseeds	45000
3.	Barley	10000
4.	Gram	9000

Source: District Agriculture Office records

district for the last two consecutive years in form of nutrients is presented in Table 3.4.

Table 3.4 reveals that fertilizer consumption is more in rabi as compared to kharif. It further shows that the consumption of nitrogen is more as compared to phosphorus and potash. The total nutrient consumption in kharif 1987-88 was

TABLE 3.4: Fertilizer consumption in form of nutrients of the district (in tonnes)

Years	Kharif				Rabi			
	N	P	K	Total	N	P	K	Total
1987-88	667.10	40.57	1.76	709.43	5780.60	1826.40	30.70	7637.70
1988-89	1263.80	154.50	30.00	1448.30	6282.60	2572.50	26.40	8881.50

Source: District Agriculture Office records.

709.43 tonnes, while it was as high as 7637.70 tonnes in rabi season. The table further reveals that during the year 1988-89, fertilizer consumption increased in both the seasons over the year. The difference in the amount of nutrient consumption in kharif and rabi seasons clearly shows that farmers use more fertilizer in rabi than in kharif crops.

Farrukhnagar and Nuh blocks

Block

The agricultural situation and the infrastructural facilities in both the selected blocks are as follows: (Table 3.5).

It is evident from Table 3.5 that more than 75 per cent of the total area is under cultivation in both the blocks and 32.62 per cent and 23.51 per cent area is under double cropping in Farrukhnagar and Nuh respectively. The table further reveals that there is not much scope of increasing cultivable land. The

TABLE 3.5: Land utilization pattern of the blocks

Sl. No.	Particulars	Areas in hectares	
		Farrukhnagar	Nuh
1.	Total geographical area	21583	46046
2.	Total cropped area	23492	43976
3.	Cultivable area	18673	36268
4.	Net area sown	16451	33148
5.	Area sown more than once	7041	10828
6.	Forest	169	215
7.	Barren and uncultivable	2392	9078
8.	Current fallows	2222	3120
9.	Others	349	485

Source: Compiled from Block Office record.

difference in area under double crops in the two blocks may be because of difference in irrigation facilities.

TABLE 3.6.- Area under irrigation (sourcewise) of the blocks

Sl. No.	Source	Area in hectares	
		Farrukhnagar	Nuh
1.	Government canal	Nil	9147
2.	Tanks	Nil	7
3.	Well/Rehat	21	16
4.	Tubewells	7748	3888
Total		7769	13058
Percentage to net sown area		47.22	39.39

Source: Compiled from Block records.

It is evident from Table 3.6 that there are only two major sources of irrigation in the block, namely, canal and tubewells. In Farrukhnagar 47.22 per cent of the net sown land is irrigated, whereas in Nuh the percentage irrigated area to net sown area is only 39.39. In Farrukhnagar maximum area is irrigated by tubewells and only 21 hectare is irrigated by well/rehat, while in Nuh the maximum area (9147 hectares) is irrigated by canal followed by tubewells (3888 hectares). Lack of underground water, brackish underground water and power shortage may be some of the reasons for the difference in the irrigated areas of the two blocks.

TABLE 3.7: Area under major crops of the blocks

Sl. No.	Crop	Area in hectare	
		Farrukhnagar	Nuh
<u>Kharif</u>			
1.	Bajara	7110	7571
2.	Jowar	1275	7308
3.	Guar	91	165
4.	Paddy	12	24
5.	Maize	15	65
6.	Sugarcane	4	39
Total		8507	15172
<u>Rabi</u>			
1.	Wheat	8865	16248
2.	Oilseed	4245	8996
3.	Barley	760	2206
4.	Gram	625	935
5.	Others	490	419
Total		14985	28804

Source: Block office record.

The data in Table 3.7 reveals that bajra and jowar are the main kharif crops in both the blocks. It further shows that in Farrukhnagar block 83.57 per cent and 14.98 per cent of kharif area is covered by bajra and jowar respectively, while in Nuh block 49.90 per cent and 46.16 per cent of the kharif area is covered by bajra and jowar respectively.

There are a number of rabi crops grown in both the blocks but wheat and oilseed crops cover about 80 per cent of the total rabi sown area in these blocks.

Thus, it can be said that bajra and jowar in kharif, and wheat and oilseeds in rabi are the major crops grown in both the blocks. The area sown in rabi is almost double of that sown in kharif in both the blocks.

TABLE 3.8:- Service institutions/facilities in the blocks

Sl. No.	Particulars	Farrukh-nagar	Nuh
1.	Starting date of the block	June, 1986	April, 1956
2.	No. of revenue villages	37	118
3.	V.E.W. circles	8	20
4.	Seed stores	8	4
5.	Cooperative stores	1	1
6.	Primary schools	37	88
7.	Middle schools	12	14
8.	High schools	5	11
9.	Intermediate college	Nil	1
10.	Veterinary hospital	1	1
11.	Primary health centres	5	3

contd.....

TABLE 3.8 (CONTD.)

Sl. No.	Particulars	Farrukh nagar	Nuh
12.	Primary health sub-centres	7	20
13.	Co-operative fertilizer sale centres	8	12
14.	Plant protection centres	Nil	1
15.	Market committee	1	1
16.	Regional rural banks (branches)	5	7

Source: C.A.O. office records.

The above table reveals that service institutions are quite in good number to cater to the socio-economic needs of the people.

Villages under study

The location and background information about the villages under study helps the investigator to foresee and analyse some situational factors which may have bearing on the research problem. Table 3.9 presents some relevant information about the four selected villages with respect to their location and background.

2. Sampling procedure

A list of farmers was prepared for each of the four selected villages with the help of concerned VEWs and sarpanches. The farmers of each village were classified into

Fig.1: MAP OF GURGAON DISTRICT
SHOWING LOCALE OF THE STUDY.

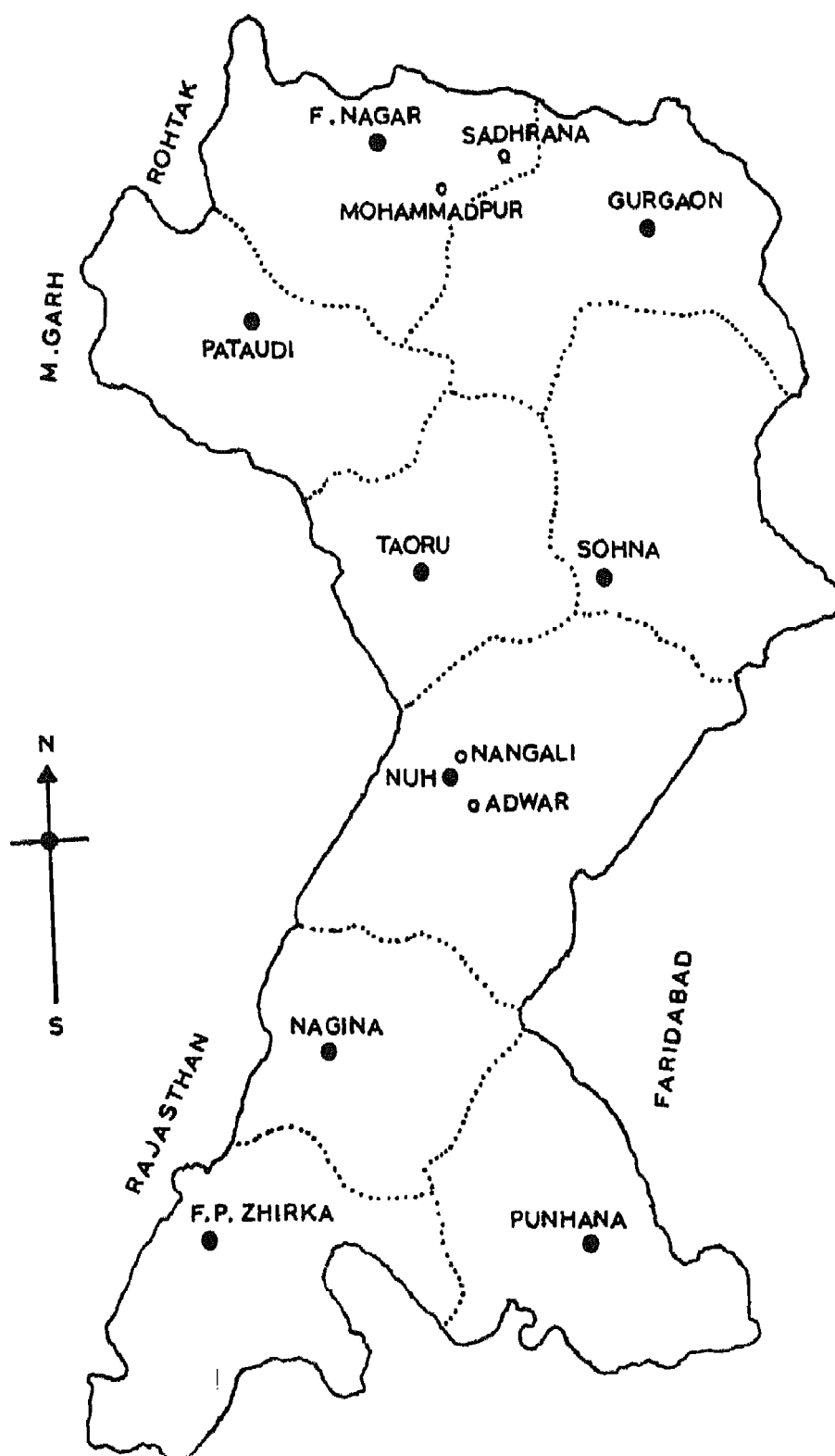


TABLE 3.9:- Location and background information about the villages

Sl. No.	Particulars	Selected villages			
		Mohamm-edpur	Sadh-rana	Adwar	Nan-gali
A) Distance in km from:					
1.	Railway station	3	3	37	42
2.	Metalled road	0.5	0	0	1
3.	Block headquarter	2	10	5	2
4.	Nearest mandi/township	2	10	4	2
5.	Fertilizer depot	2	5	4	2
6.	School				
	i) Primary	0	0	0	0
	ii) Middle	2	3	0	2
	iii) Secondary/Hr. secondary	2	3	4	2
	iv) College	22	17	4	2
7.	Co-operative society	1.5	3	0	2
8.	Bank	2	3	4	2
9.	Primary health centres	2	3	4	2
10.	Veterinary hospital	2	3	4	2
11.	Artificial insamination centre	2	10	4	2
B) Total population of village:		2535	2487	2087	1474
	i) Male	1358	1270	1145	853
	ii) Female	1177	1217	942	621
C) Geographical area of the village (in hectares)		286	949	622	210
Area under cultivation (in hectares)		245	690	558	185
	i) Irrigated	125	270	18	89
	ii) Unirrigated	120	420	540	96

Source: Block office records.

four groups, i.e., marginal, small, medium and big on the basis of land holding size having up to 2.5 acres, 2.5 to 5.0 acres, 5 to 10 acres and above 10 acres respectively.

A proportionate random sample of 40 farmers was drawn from different land holding categories from each village. In this way, a total of 160 farmers formed the sample of the study. The category-wise distribution of respondents is given in Table 3.10.

TABLE 3.10: Distribution of respondents by land-holding categories

Sl. No.	Categories of respondents	Total No. of families	Number samples
1.	Marginal (0 - 2.5 acres)	176	44
2.	Small (2.5 - 5.0 acres)	244	61
3.	Medium (5.0 - 10.0 acres)	80	20
4.	Big (above 10.0 acres)	140	35

	Total	640	160

3. Selection and measurement of variables

The main focus in this study was on determining the level of fertilizer use and the constraints involved in its adoption. However, some socio-economic and psychological factors were also included with the assumption that they have

an important bearing on adoption of fertilizers. Given here under are operational definitions of the variables used in this study, also indicating as to how they were measured.

Age

It is one of the basic characteristics of an individual linked with his maturity, physical well being, productivity and work efficiency. In this study, it refers to the chronological age of the respondent in years at the time of investigation.

Caste

It denotes hierarchical status conferred upon a member of a society from time immemorial according to law of 'Manu'. Necessary information about the respondents in this regard could be had by direct questioning. Based on this variable, the respondents were grouped into three categories, i.e., scheduled, backward and other castes.

Education

It refers to the academic qualification of the respondents acquired through schooling. The years of schooling were classified into five groups - illiterate, able to read and write, primary, middle and secondary/higher secondary.

Occupation

It refers to the main source of livelihood. The

respondents of this study were only those whose main or secondary occupation was agriculture.

Land-owning status

In terms of land holding size, marginal, small, medium and big farmers owning up to 2.5, 2.5 to 5.0, 5.0 to 10.0 and more than 10.0 acres respectively were selected for the study.

Operational land holding size

It refers to the actual area of land in acres under cultivation with the respondent at the time of investigation. The average size of irrigated and unirrigated holdings was calculated for different categories of farmers.

Possession of farm machinery and equipments

The possession of farm machinery and implements was measured in terms of the quantity of each item the respondents possessed. Accordingly, the frequency of respondents for different class intervals of farm machinery and implements was worked out.

Source of draught power and other farm animals

It refers to the actual draught power possessed by the respondents and used for various farm operations at their farms. It was measured by the frequency of farmers possessing 0, 1 to

2, 3 to 4 and 5 and above draft animals. Similar observation was made even with respect to other farm animals.

Man power in crop enterprise

It refers to the use of manual labour including both hired and family labour (including boys and girls above 15 years) utilized full time or part time for carrying out various farm operations.

The man power was categorised in terms of number (0 to 1, 2 to 3, 4 to 5 and more than 5) and the frequency of respondents for each category was computed.

Cropping pattern

It refers to the total cropped area under different crops. The cropping pattern for each crop was computed by adding the areas for each crop for different categories of respondents and were expressed in terms of percentage.

Sources and level of income

It refers to the actual total annual income (in rupees) of the respondent from various sources. It was categorised as low (upto Rs. 7.5 thousand), medium (Rs. 7.5 to 15 thousand) and high (more than Rs. 15 thousand).

Fertilizer consumption/level of fertilizer use

It refers to the total quantity of fertilizer consumed

by a farmer in a year. It was worked out by adding the quantities of different types of fertilizer used for different crops in a year and then converting the same in terms of nutrients. The level of measurement was kg/acre.

Knowledge about fertilizer use

Broadly speaking, knowledge refers to a body of understood information posed^{55e} by an individual. It has been defined as "those behaviours and test situations which emphasize remembering either by recognition or recall of ideas, material or phenomena" (Bloom et al., 1956).

Unlike other package of practices, fertilizer use is believed to be most sophisticated as well as complex in nature. Keeping this in view, important components of fertilizer use, viz., period of fertilizer use, doses of fertilizer, time and method of fertilizer application, advantage of fertilizer use in dryland and some general questions pertaining to fertilizers were taken into account. The recommendations pertaining to dose, time and method of fertilizer application were decided based on suggestions given by the concerned subject-matter specialists.

Items for knowledge test regarding fertilizers were arranged so as to cover the entire aspects of fertilizer technology. The items were selected keeping in view the following criteria:

1. The items should be relevant, recommended for the area and communicated to the farmers.
2. The items should involve understanding and thinking.
3. The items should involve varying degrees of difficulty and up-to-date scientific facts to enable the researcher to classify the respondents in different groups in terms of level of knowledge.

Knowledge scoring: Scoring was done on the basis of arbitrary scores assigned to each item. There were altogether 24 items each carrying equal weightage. To each positive statement, 2 score was assigned for agree, one for undecided and zero for disagree, likewise, for each negative statement, zero score was assigned for agree, one for undecided and 2 for disagree. The maximum score that a respondent could secure was thus, forty eight.

Based on knowledge scores, the respondents were classified into four categories depending on whether they had poor (upto 25%), average (26 to 50%), good (51 to 75%) or very good (more than 75%) about fertilizers. The scores obtained by different categories of farmers were further analysed to test the difference in their knowledge.

Opinion about fertilizer

Altogether nine statements were prepared based on review of literature, consultation with subject matter specialists and

scientists and informal interview with a group of farmers. The same were administered to the sample farmers requesting them to select any of the three response categories against each statement - agree, undecided and disagree - which were assigned 3, 2 and 1 score respectively. For each statement, the frequencies of agree, undecided and disagree, responses were counted and expressed in terms of favourable, unfavourable and neutral opinion about fertilizer.

The score obtained by different categories of farmers for all statements were further analysed. The mean scores obtained by different categories of respondents were compared with the theoretical mid-point score to determine whether they had favourable or unfavourable opinion about fertilizer. The scores obtained were further subjected to statistical analysis to test the significance of difference in opinion of different categories of farmers.

Extent of adoption

The extent of adoption is the degree to which a person actually adopts a practice. In the present study, the extent of fertilizer adoption was conceived as the degree to which a particular recommended practice was practiced by the respondent.

Constraints to fertilizer use

Constraints imply forcible restrictions and confinement of action. In this study, constraints meant the 'impediments'

in the way of adoption of fertilizer in dryland areas. The constraints related to supply, price, credit, etc.

With a view to determining the nature and extent of problems of the farmers faced in fertilizer use, a list of 22 specific problems was prepared based on informal interview with a group of about 50 farmers other than the respondents of the study. These problems were got rated by the respondents on a three-point continuum. The three response categories provided against each problem were 'very much a constraint', 'somewhat a constraint' and 'not a constraint' with scores of 2, 1 and 0 respectively. The total weighted score for each problem was computed by summing the frequencies of respondents in different response categories, times the respective scores. The average weighted score was calculated by dividing the total weighted score with the number of respondents. The constraints were ranked on the basis of average weighted scores.

Extension contact and participation in extension activities

Extension contact was studied in terms of the frequency of contacts with extension personnel; including private fertilizer dealers, co-operative personnel dealing in fertilizers, representatives of fertilizer firms, specialists/scientists of agricultural universities and ICAR Institutes, Agricultural Development Officers (ADOs), Village Extension Workers (VEWs) and SMSs of State Department of Agriculture. Similarly,

participation of farmers in extension activities was measured in relation to their involvement in demonstration, kisan mela/ exhibition, fertilizer festivals, field days, film show, village meeting for fertilizer promotion, group discussion meeting and educational tour to Agricultural Universities/ICAR Institutes/ KVK centres.

The extent of contacts with personal sources of information was determined by getting the different contact sources rated on a three point continuum - frequently (more than 5 times), seldom (less than 5 time) and never - with respective weightage of three, two and one. The total weighted score for each source was computed by summing the scores of the individual respondents categorywise. The average weighted score was calculated by dividing the total weighted score with the number of respondents. The personal sources of information were ranked on the basis of average weighted score. They were further subjected to statistical analysis to know the relative importance of different sources of information and to test the significance of difference in extent of contact by different categories of farmers with a particular source of information.

Extent of use of services

It refers to the extent of use of services provided by the government, Agricultural University and voluntary organisation. It was measured by getting the different services rated on a four-point continuum - never, once, twice and thrice

and more. The frequency in each category for each service was counted and expressed in percentages.

Exposure to mass media

It is conceptualised as the extent of use of different mass media - radio, TV and printed materials. With a view to determining the extent of use, each medium was got rated on a four point continuum - regularly, sometimes, rarely and never - with respective weightage of 3, 2, 1 and 0. The total weighted score for each mass medium was computed by summing the scores of individual respondent belonging to different categories. The average weighted score was calculated by dividing the total weighted score with the number of respondents.

4. Tools and techniques of data collection

Keeping in view the specific objectives of the study and various dimensions involved there in, two schedules were developed - one for collecting background information about the villages and the other for eliciting information from the farmers. The village schedule was designed for having general information about each village under study. The farmers were personally interviewed with the help of the structured schedule. They were asked a series of questions on different aspects concerning fertilizer use, so as to have necessary and relevant information which could help to analyse and interpret fertilizer use behaviour in respect of moisture conservation practices, cropping patterns, knowledge, opinion, adoption,

exposure to sources of information, problems faced, suggestions to overcome the problems and so on.

In addition to the two schedules, one questionnaire was also prepared for scientists and extension personnel with a view to having their views regarding the factors responsible for low fertilizer use in drylands and remedial measures for the same.

The schedules and questionnaire were pretested in two villages of Gurgaon district. These villages were other than those where the actual study was conducted. On the basis of pre-testing, necessary modifications were made in the final schedule. The schedule to be used for personal interview with the farmers was initially prepared in English. It was later translated into Hindi for data collection. The text of the schedules and questionnaire are given in Appendix.

Before actual data collection, a close rapport was established with the field extension personnel of the State Department of Agriculture and farmers of the selected villages. The background information about the villages was obtained by personal observations, consultation with the extension personnel and their officials and by having access to records and reports available. The data collection was done from October to December, 1988. To ensure accuracy of information obtained, enough time was given with each respondent. Only three to four respondents were interviewed in a day. The researcher had more than one sitting with some respondents.

5. Statistical tools used for the analysis of data

The following statistical methods were used in this study for precise and meaningful analysis and interpretation of data collected:

- Frequency
- Percentage
- Average
- 't' test
- 'F' test

Data were analysed for the most part by using tabular form. This technique of analysis is intensively used for its inherent quality of portraying the true picture of fertilizer use in dryland in simplest form.

There were four categories of respondents, namely, marginal, small, medium and big farmers. It was considered worthwhile to find out the significance of inter-pair differences in knowledge and opinion of different categories of farmers about fertilizer use, for which 't' test was applied.

'F' test was applied to find out the variation among different categories of farmers with respect to each source of contact used. When 'F' value was found significant, the inter-pair differences between the mean scores of different categories of farmers were tested by using C.D. (critical difference) values.

CHAPTER IV

FINDINGS AND DISCUSSION

In this chapter of the dissertation has been presented the findings of the study along with discussion under different sub-heads as given under:

I

Section I: Socio-economic profile of selected farmers

Section II: Land use pattern

Section III: Resource utilization

Section IV: Nature and extent of fertilizer use

Section V: Knowledge and opinion about fertilizer use

Section VI: Efforts in promotion of fertilizer use

Section VII: Inhibitors and promoters of fertilizer use

SECTION I

4.1 Socio-Economic profile of selected farmers

4.1.1 Age

The working capacity at farm is influenced by the age

of the farmer. Experience gained in farm business is also commonly reflected through age. The distribution of users and non-users of fertilizers by age and land holding category is shown in Table 4.1.

As the data presented in Table 4.1 apparently indicate, more than two-fifth of the respondents belonged to the age group of 21-40 years. About one-third of them were of middle age group (41-60 years) and one-fourth about 60 years of age.

The classification of respondents belonging to different age groups into users and non-users of fertilizer further reveals that majority of the users were from the age group of 21-40 years followed by the age group of 41-60 years and above 60 years.

As the above table further brings to light, the number of users of fertilizers among different land-holding categories was found to be highest (95%) in case of medium farmers, followed by big farmers (94.28%). The highest percentage of non-users (68.18%) was expectedly found among marginal farmers. The farmers belonging to the age groups of 21-40 years and 41-60 years and land-holding categories of big and medium were cent per cent users of fertilizers.

The table as a whole depicts that most of the users of fertilizer were farmers having more land and relatively younger in age. Out of 28.75 per cent non-users, the proportion of those in the age group of 60 years was as high as 15.62 per cent

TABLE 4.1: Distribution of users and non-users of fertilizer by age and land holding

Age interval	Number of farmers	Category of farmers								Total	
		Marginal		Small		Medium		Big			
		User	Non-user	User	Non-user	User	Non-user	User	Non-user	User	Non-user
21-40 yrs	64 (40.00)	7 (15.91)	7 (15.91)	23 (37.70)	3 (4.92)	8 (40.00)	-	16 (45.71)	-	54 (33.75)	10 (6.25)
41-60 yrs	51 (31.87)	5 (11.36)	8 (18.18)	17 (27.87)	3 (4.92)	7 (35.00)	-	11 (31.43)	-	40 (25.00)	11 (6.88)
More than 60 years	45 (28.13)	2 (4.55)	15 (34.09)	8 (13.12)	7 (11.47)	4 (20.00)	1 (5.00)	6 (17.14)	2 (5.72)	20 (12.50)	25 (15.62)
Total	160 (100.00)	14 (31.82)	30 (68.18)	48 (78.69)	13 (21.31)	19 (95.00)	1 (5.00)	33 (94.28)	2 (5.72)	114 (71.25)	46 (28.75)

Figures in parentheses indicate percentage for each category of the farmers.

indicating that older-age farmers were less prone to fertilizer application. On the whole, the distribution of 114 users and 46 non-users by age and land-holding size indicates that fertilizer use was not uniform among the farmers from different age and land-holding categories.

Fertilizer use in dryland is a practice which is not widely accepted and the why of this may be explained in terms of risk involvement, poor resource base, lack of knowledge, indifferent or unfavourable attitude and lack of extension efforts. As regards age, the older farmers in general are sceptical about use of any modern technology. It holds true even with fertilizer use.

4.1.2 Caste

In rural India, caste still plays a very vital role. It is one of the important factors which affects adoption of improved agricultural practices and hence was included as an independent variable in this study. The distribution of users and non-users of fertilizers by caste and land-holding size is given in Table 4.2.

A perusal of Table 4.2 points out that majority of the respondents (56%) belonged to upper caste group followed by backward and scheduled castes. The proportions of users of fertilizers in upper, backward and scheduled caste groups were 91.62 and 34 per cent respectively, clearly indicating more number of users in upper caste group.

TABLE 4.2: Distribution of users and non-users of fertilizer by caste and land holding

Caste group	Number of farmers	Category of farmers										Total		
		Marginal			Small			Medium			Big			
		User	Non-user		User	Non-user		User	Non-user		User		Non-user	
Scheduled caste	29 (18.12)	2 (4.55)	13 (29.55)	8 (13.12)	6 (9.83)	-	-	-	-	-	10 (6.25)	19 (11.87)		
Backward	50 (31.25)	4 (9.09)	12 (27.27)	15 (24.59)	4 (6.56)	4 (20.00)	1 (5.00)	8 (22.86)	2 (5.72)	31 (19.38)	19 (11.87)			
Others	81 (50.63)	8 (18.18)	5 (11.36)	25 (40.98)	3 (4.92)	15 (75.00)	-	25 (71.42)	-	73 (45.62)	8 (5.00)			
Total	160 (100.00)	14 (31.82)	30 (68.18)	48 (78.69)	13 (21.31)	19 (95.00)	1 (5.00)	33 (94.28)	2 (5.72)	114 (71.25)	46 (28.75)			

Figures in parentheses indicate percentage for each category of farmers.

Caste in general being an important factor that ascribes status both social and economic to an individual has a great role to play in socio-economic development. As it could be seen in Table 4.2, cent per cent of the big and medium farmers, over 40 per cent of the small farmers and majority of even the marginal farmers belonging to upper caste group were found to be users of fertilizer. It was obviously because of large land holdings and hence better resource base that all the big and medium farmers belonging to upper caste group were found using fertilizer. As against scheduled and backward caste, the majority of even the upper caste small and marginal farmers were better adopters of fertilizer. This again may be explained in terms of relatively better resource base, greater extension contact and higher achievement motivation.

4.1.3 Education

Education is one of the important factors which accelerates the growth of farm business. A better educated farmer is expected to respond more favourably to improved technology and thereby have better returns from farming. As regards the respondents of this study, the effect of education on fertilizer use is evident from the data presented in Table 4.3.

Table 4.3 clearly brings out that fertilizer users were better educated as compared to non-users. The category-wise analysis indicates that illiteracy or low level of education prevailed mostly among the marginal and small farmers.

TABLE 4.3: Distribution of users and non-users of fertilizer by educational level and land holding

Literacy level	Number of farmers	Category of farmers								Total	
		Marginal		Small		Medium		Big			
		User	Non-user	User	Non-user	User	Non-user	User	Non-user	User	Non-user
Illiterate	39 (24.37)	1 (2.27)	21 (47.73)	5 (8.20)	6 (9.83)	1 (5.00)	1 (5.00)	2 (5.72)	2 (5.72)	9 (5.63)	30 (18.74)
Able to read and write	22 (13.75)	3 (6.82)	4 (9.09)	8 (13.11)	3 (4.92)	2 (10.00)	-	2 (5.72)	-	15 (9.37)	7- (4.38)
Primary	25 (15.63)	4 (9.09)	3 (6.82)	9 (14.76)	2 (3.28)	3 (15.00)	-	4 (11.42)	-	20 (12.50)	5 (3.13)
Middle	56 (35.00)	6 (13.64)	2 (4.54)	23 (37.70)	2 (3.28)	7 (35.00)	-	16 (45.71)	-	52 (32.50)	4 (25.00)
Secondary-Hr. secondary	18 (11.25)	-	-	3 (4.92)	-	6 (30.00)	-	9 (25.71)	-	18 (11.25)	-
Total	160 (100.00)	14 (31.82)	30 (68.18)	48 (78.69)	13 (21.31)	19 (95.00)	1 (5.00)	33 (94.28)	2 (5.72)	114 (71.25)	46 (28.75)

Figures in parentheses indicate percentage for each category of farmers.

It is crystal clear from what Table 4.3 speak that the percentage of fertilizer users increased with increasing level of education. It varied from 5.63 per cent among illiterates to 11.25 per cent among secondary/higher secondary group.

4.1.4 Possession of draft animals

Bullocks were the main source of farm power in the area of study. The number of draft animals possessed^{ssg} by farmers is generally governed by their land-holding size. The distribution of different categories of farmers by number of draft animals possessed is given in Table 4.4.

TABLE 4.4: Distribution of different categories of farmers by number of draft animals possessed.

Category of farmers	Farmers holding milch animals				Total
	None	1-2	3-4	5 and more	
Marginal	31 (70.45)	13 (29.55)	-	-	44 (27.50)
Small	32 (52.45)	29 (47.54)	-	-	61 (38.13)
Medium	2 (10.00)	11 (55.00)	7 (35.00)	-	20 (12.50)
Big	5 (14.28)	19 (54.28)	11 (31.42)	-	35 (21.87)
Total	70 (43.75)	72 (45.00)	18 (11.25)	-	160 (100.00)

Figures in parentheses indicate percentage.

It is clear from Table 4.4 that majority of the marginal farmers (70.45%) had no draft animals at all and only 29.55 per cent were having 1-2 draft animals. As regards small farmers, more than 50 per cent had no draft animal at all and about 50 per cent were having 1-2 draft animal. The reason is quite obvious. Because of very small land-holding size, they could not afford to maintain a pair of bullock. They found it more economical to hire bullocks as and when required. Particularly in dryland areas where cropping intensity is very low, the requirement of bullocks by marginal and small farmers is minimal.

Nearly 55.00 and 35.00 per cent of the medium and big farmers had 1-2 and 3-4 draft animals respectively. Not even a single marginal and small farmers had 3-4 draft animals.

The above table further reveals that about 60 per cent of the total farmers had draft animals. Out of them 49.37 per cent were having 1-2 and only 10.00 per cent 3-4 draft animals.

Tractors are generally owned by big land holders. But even those who own tractor usually keep bullocks for some operations which are not done ordinarily by tractor. One marginal, one small farmer and two medium farmers also had tractors. An enquiry in this matter indicates that they hire out tractors to supplement their earnings.

4.1.5 Possession of milch animals

Milch animals form an integral part of farming particularly in the state where this study was conducted. Even dry

farming tracts abound in bovine population. In addition to providing milk for own consumption, fuel, manure and motive power, milch animals also supplement income from farming. The data regarding possession of milch animals by the respondents are reported in Table 4.5

TABLE 4.5: Distribution of different categories of farmers by number of milch animals possessed.

Category of farmers	Farmers holding draft animals				Total
	None	1-2	3-4	5 and above	
Marginal	26 (59.09)	18 (40.90)	-	-	44 (27.50)
Small	30 (49.18)	31 (50.82)	-	-	61 (38.13)
Medium	3 (15.00)	6 (30.00)	8 (40.00)	3 (15.00)	20 (12.50)
Big	5 (14.28)	10 (28.57)	15 (42.82)	5 (14.28)	35 (21.87)
Total	47 (29.38)	90 (56.25)	15 (9.37)	8 (5.00)	160 (100.00)

Figures in parentheses indicate percentage.

Table 4.5 clearly reveals that the respondents having larger holding size possessed more number of milch animals. About 40 per cent of the medium and big farmers possessed 3-4 and as many as nearly 15 per cent of medium and big

farmers possessed 5 and more than 5 milch animals. While about 40 per cent marginal and 50 per cent small farmers possessed 1-2, none had 3-4 milch animals. Unavailability of fodder is a major constraint in rearing of milch animals. Those having larger land holding could afford to put some area under fodder and hence they were able to maintain 3-4 or more than 4 milch animals.

In case of marginal and small farmers, as their size of land holding was not big enough to afford sufficient land for fodder cultivation, their first priority was to grow crops for their own consumption. But since milk fetches good price ensuring remunerative return, they managed to maintain one or two milch animals to sustain their family.

4.1.6 Man power for farming

Farming in dryland areas is managed mostly by family labour, also because the farmers in general can not afford to hire labour because of poor economic condition.

It is obvious from Table 4.6 that 75 families out of 160 had 2-3 adult men engaged full time in farming. While 46 families had only one, 19 families had as many as 4-5 adult men engaged full time in farming. Similarly, 72 families had 2-3 adult women, 40 only one adult woman and only 12 families 4-5 adult women engaged full time in farming. The similarities between men and women engaged in farming may be due to two reasons. Firstly, the women of Haryana are very

TABLE 4.6: Distribution of manpower utilization on farm on part and for full time basis

Man power	Part-time					Full-time				
	Boys (15-21 yrs)	Girls (15-21 yrs)	Adult men	Adult women	Perma- nent labou- rers	Boys (15-21 yrs)	Girls (15-21 yrs)	Adult men	Adult women	Perma- nent labou- rers
0-1	12	10	-	-	25	11	42	46	40	-
2-3	16	5	-	-	24	9	71	75	72	-
4-5	1	-	-	-	2	-	42	19	12	-
Above 5	-	-	--	-	-	-	4	-	-	-

laborious and hard working. Secondly, there is no social barrier for the women to work in the field along with men regardless of their socio-economic status. Unlike this, it is a taboo for women of higher socio-economic status in many other states to work outside the home.

The trend of full-time utilization of girls above 15 years and below 21 years was almost the same as in case of adult men and adult women. It means the girls of the area under study had little access to education because they were fully engaged in agriculture. Contrary to this, very few boys above 15 years and below 21 years of age were engaged full time in agriculture.

4.1.7 Possession of implements and tools

Farm implements and tools are useful assets that aid not only in saving labour but also in increasing working efficiency at farm. An inventory of implements and tools possessed by the farmers is presented in Table 4.7.

It is evident from Table 4.7 that chaff cutter (local) and deshi plough were the main implements possessed by almost all the farmers. Leveller and seed drill (local) were possessed by more than 60 per cent of the farmers. These constituted the main set of implements that a farmer was expected to have. It was a usual practice for those having smaller holdings to borrow implements and tools and draft animals from other farmers. Almost 50 per cent of the farmers

TABLE 4.7: Frequency and percentage of farmers owning different agricultural implements/tools

SL. No.	Implements/tools	Frequency	Percentage
1.	Chaff cutter (local)	146	91.25
2.	Deshi plough	145	90.62
3.	Leveller	104	65.00
4.	Seed-drill (local)	102	63.75
5.	Bullock cart	78	48.75
6.	Improved plough	14	8.75
7.	Cultivator	11	6.88
8.	Tractor	11	6.88
9.	Seed-cum-fertilizer drill	3	1.88
10.	Duster	1	0.62
11.	Sprayer	1	0.62

possessed bullock cart and they used it as a source of income by hiring it out for transportation purposes besides meeting their own requirements.

Nearly 9 per cent of the farmers had improved plough and nearly 7 per cent cultivator. Both these implements are very useful for dryland agriculture but due to poor economic condition, most of the farmers did not have these implements. Out of 160 farmers, only 11 had tractor with cultivator.

seed-cum-fertilizer drill was available with only three farmers and duster with only one.

To conclude, majority of the farmers had country-made tools and implements like chaff cutter, desi plough, leveller, seed drill and bullock cart which are less costly and used extensively. Implements and tools like improved ploughs, dusters and sprayers, although not very costly, were possessed by very few farmers.

4.1.8 Occupation

It refers to the main source of livelihood.

TABLE 4.8: Distribution of farmers by farming and non-farming occupations

Occupation	Frequ- ency	Percen- tage
A. Farming		
1. Main	127	79.37
2. Secondary	33	20.62
B. Non-farming		
1. Main:		
i) Labour	17	10.62
ii) Caste occupation	-	-
iii) Business	2	1.25
iv) Independent profession	2	1.25
v) Service	12	7.50
2. Secondary:		
i) Labour	31	19.39
ii) Caste occupation	2	1.25
iii) Business	2	1.25
iv) Independent profession	5	3.12
v) Service	7	4.37

The data regarding occupation of the respondents as reported in Table 4.8 reveal that farming was the main occupation of about 80 per cent of the respondents. For the remaining about 20 per cent, farming was a secondary occupation.

The above table further reveals that 10.62 per cent of the respondents were engaged in labour work followed by 7.5 per cent in service. The proportion of those engaged in business and independent profession was less than 2 per cent.

Among the secondary non-farming occupations, labour topped the list. This was a source of additional income for a little above 19 per cent of the respondents. Next to labour was service which was followed by independent profession. Between 3 to 4 per cent of the respondents were engaged in these occupations. Not even 2 per cent of the respondents were engaged in business or caste occupation.

4.1.9 Total annual income

The data regarding total annual income as reported in Table 4.9 clearly indicate that there was vast disparity in income among the respondents of different groups. More than 50 per cent of the big farmers and 25 per cent of the medium farmers had annual income of more than Rs. 15 thousand. The percentage of those having this income was very small in case of marginal and small farmers. In the medium annual income ^{category} bracket (more than 7.5 to 15 thousand) were about 50 per cent medium, 37 per cent small and only 11 per cent marginal farmers.

TABLE 4.9: Distribution of different categories of farmers showing level of income

Category of farmers	Annual income in Rs.			Total
	Low (upto 7.5 thousands)	Medium (7.5 - 15 thousands)	High (Above 15 thousands)	
Marginal	38 (86.36)	5 (11.36)	1 (2.27)	44
Small	33 (54.09)	23 (37.70)	5 (8.19)	61
Medium	4 (20.00)	11 (55.00)	5 (25.00)	20
Big	-	16 (45.71)	19 (54.28)	35
Total	75 (46.87)	55 (34.37)	30 (18.76)	160

Figures in parentheses indicate percentage.

Majority of the marginal and small farmers belonged to low annual income group (upto 7.5 thousand). None of the big farmers was in this group. The variation in income of different categories of farmers may be attributed to differences in their land holding size, educational status, proneness to new agricultural technology and occupation, etc.

SECTION II

4.2 Land use pattern4.2.1 Land holding

By and large, size of land holding is the most important component of socio-economic status of farmers. The main focus in this study was on fertilizer use behaviour of farmers belonging to different land-holding categories for the simple reason that fertilizer is the costliest input in agriculture.

TABLE 5.1: Average land-holding of different categories of farmers (in acres)

Category of farmers	Cultivated area			Percentage irrigated to the total cultivated area
	Irrigated	Unirrigated	Total	
Marginal	18.5 (0.42)	73.00 (1.65)	91.5 (2.07)	20.21
Small	81.00 (1.39)	195.00 (3.19)	276.00 (4.52)	29.34
Medium	47.00 (2.35)	116.00 (5.80)	163.00 (8.15)	28.83
Big	196.50 (5.61)	509.00 (14.54)	705.50 (20.15)	27.85
Total	343	893	1236	

Figures in parentheses indicate average land-holding size.

As shown in Table 5.1, the marginal, small, medium and big farmers were found to have, on an average, 2.07, 4.52, 8.15 and 20.15 acres of land respectively. Expectedly, average irrigated area was found to be maximum (5.61 acres) in case of big farmers, followed by medium (2.35 acres), small (1.39 acres) and marginal (0.2 acres) farmers. Almost similar pattern was also found for average unirrigated area, the big farmers owning the maximum (15.54 acres) and the marginal ones the minimum (1.65 acres) area.

The table further reveals that the total net unirrigated area to the total cultivated area owned by the four categories of farmers accounted for more than 70 per cent, the rest being irrigated. Even category-wise, similar was the pattern. Thus, regardless of land holding size, nearly 70 per cent of the cultivated area was obviously unirrigated.

4.2.2. Cropped area under major crops

The nature and type of crops to be grown on a farm depends on farmers' decision regarding apportionment of areas. From amongst the various crops that can be successfully grown on a particular farm, farmers select a few keeping in view his resources, requirements, expected returns, crop production technology available and market value of farm output. A distribution of average cropped area under some of the major crops by land holding size is shown in Table 5.2.

TABLE 5.2: Area under major crops grown by different categories of farmers (in acres)

Category of farmers	Area of different crops under local varieties					Area of different crops under high yielding varieties				
	Bajra	Jowar	Guar	Wheat	Mustard	Bajra	Jowar	Guar	Wheat	Mustard
Marginal	19.50 (0.44)	13.00 (0.30)	8.00 (0.18)	1.00 (0.02)	4.00 (0.09)	24.50 (0.56)	-	-	24.50 (0.56)	16.50 (0.33)
Small	4.00 (0.07)	50.00 (0.82)	41.50 (0.68)	2.00 (0.03)	2.00 (0.03)	85.00 (1.39)	-	-	88.50 (1.40)	76.50 (1.25)
Medium	-	18.00 (0.90)	27.00 (1.35)	-	-	52.00 (2.60)	-	-	49.00 (2.45)	36.00 (1.80)
Big	-	87.00 (2.49)	62.50 (1.79)	-	-	139.5 (3.99)	-	-	184.50 (5.27)	219.00 (6.26)
Total	23.50 (0.15)	168.00 (1.05)	139.00 (0.86)	3.00 (0.02)	6.00 (0.04)	301.00 (1.88)	-	-	346.5 (2.16)	348.00 (2.18)

Figures in parentheses indicate average rate.

It is clear from Table 5.2 that major crops in the study areas were bajra, jowar, guar, wheat and mustard. Bajra jowar and guar were found to be major kharif crops and wheat and mustard rabi crops. Obviously, the averages of cropped area for different crops were found consistently increasing from marginal to big farmers. It is indicative of clear association between cropped area and holding size. The averages of cropped area under high-yielding varieties of bajra were found to be 0.56, 1.39, 2.60 and 3.99 acres for marginal, small, medium and big farmers respectively. The corresponding averages of cropped area under local variety of bajra were comparatively higher. Similar trend was noticed even in wheat and mustard crops. However, the averages of cropped area under high-yielding varieties of wheat and mustard (2.16 and 2.18 acres respectively) were higher than those under bajra (1.88 acres). In case of jowar and guar, the total averages of cropped area (1.05 and 0.86 acres) respectively under local varieties were less than the total averages under the other three crops separately.

4.2.3 Distribution of rainfed area under different crops

As a thumb rule, farmers cultivate approximately half of their rainfed holding in kharif and the remaining half in rabi season.

TABLE 5.3: Distribution of rainfed area under different crops (in acres)

Crops	Area under the crop	Percentage of total net cultivated areas	Percentage of total rainfed cropped area in the season
<u>Kharif</u>			
Bajra	324.50	36.34	51.38
Jowar	168.00	18.81	26.61
Guar	139.00	15.56	22.01
Total	631.50	70.71	100.00
<u>Rabi</u>			
Wheat	349.50	39.14	49.68
Mustard	354.00	39.64	50.32
Total	703.50	78.78	100.00

The total cultivated area of the sample farmers was 1236 acres and the total rainfed area was 893 acres.

In 1988-89, the farmers under study put 70.71 per cent of their cultivated area under kharif crops and 78.78 per cent under rabi crops (Table 5.3). The bulk of the area was sown only once. This happens preforce in dryland agriculture. Secondly, no particular season, kharif or rabi, was considered more favourable than the other.

Further, bajra occupied 36.34 per cent of the net cultivated rainfed area of the villages where the study was conducted.

It had 51.38 per cent of the area under rainfed crops grown in kharif season. This shows that individually, bajra occupied half of the total cropped area in kharif season.

Jowar occupied 18.81 per cent of the rainfed cultivated area and 26.61 per cent of the area under rainfed crops in the kharif season. Similarly, guar was sown in 15.56 per cent of the rainfed cultivated area and 22.01 per cent of the rainfed crops in the season. Jowar and guar, thus, emerged to be the major crops sown in kharif season under rainfed conditions.

In rabi season, wheat and mustard were the only crops grown in the area under study. Mustard and wheat respectively occupied 39.14 and 39.64 per cent of the net cultivated rainfed area and as much as 50.32 and 49.68 per cent under rainfed crops in rabi season. Thus, mustard and wheat occupied almost equal area of the total cropped area in the rabi season. Relatively, however, mustard being a cash crop and fetching better return was preferred by the farmers to wheat. It is evident from the fact that the former occupied a little larger area than the latter in that area.

The marginally increased cropped area over the net cultivated area of the villages under study, as shown in Table 5.3, is indicative of the fact that at least in some areas, the farmers took two crops in one year. As it emerged in course of informal discussion, areas in which a single crop was taken, either in kharif or in rabi, a particular crop was not grown in the same field year after year.

4.2.4 Kharif crops under different rainfall situations

Besides the rainfall being high or low, the variations in time and frequency of monsoon rains have also been found to determine the sowing of kharif crops. The farmers reported the following three such conditions as important:

1. Delayed onset of monsoon
2. Incessant rain during July and early August
3. Pre-monsoon rain or early onset of monsoon in the second half of April or May or in the first half of June.

The Table 5.4 represents the preferred decisions of farmers in respect of crops to be grown in the three different situations.

Delayed onset of monsoon

About 22 per cent of the farmers reported that all the fields sown in the preceeding rabi were kept fallow in kharif because of delayed onset of monsoon. The decision of the farmers, however, varied widely in respect of lands lying fallow in the preceding rabi. While 27.5 per cent of them preferred leaving land fallow in kharif as well, 30 per cent decided to grow bajra and 20 per cent jowar and guar.

TABLE 5.4: Cropping scheme under different rainfall situations

Sl. No.	Situations	Cropping scheme	Frequency	Percentage
1.	Delayed onset of monsoon	a) Rabi-sown fields kept fallow	35	21.88
		b) Rabi-fallow fields kept fallow	44	27.50
		c) Rabi-fallow fields sown bajra	48	30.00
		d) Rabi-fallow fields sown jowar or guar	33	20.62
2.	Incessant rain during July & early August	a) Leave the field fallow	73	45.62
		b) Sow jowar or guar in August	48	30.00
		c) Sow bajra even during rains	39	24.38
3.	Pre-monsoon rain or early onset of monsoon	a) Sow bajra in April or May	85	53.12
		b) Sow bajra, jowar or guar at usual time of sowing	75	46.88

Incessant rains during July and early August

In this situation, it becomes difficult to sow bajra which is normally sown dry. In such a situation, 45.62, 30.00 and 24.36 per cent of the respondents respectively preferred leaving the field fallow during kharif, sowing of jowar and guar in late August and sowing of bajra even during rains. Under this situation

as well, the area sown was definitely expected to be lower than the normal. The reason why none of the farmers went in for bajra, jowar or guar sowing in August was the expectation that leaving the land fallow in kharif and sowing the same in rabi would give them better return than bajra, jowar or guar.

As per recommendations, bajra can be transplanted till the first week of August. Therefore, this practice needs to be emphasized particularly in the event of incessant early monsoon rain. May be a few successful result demonstrations on bajra transplanted in August will drive home the intended message to the farmers. The relative economics of leaving the land fallow in kharif and taking rabi crop also needs to be studied and highlighted.

Pre-monsoon rain or early onset of monsoon

Desi bajra (local variety) was sown as early as end of April and early May, if there was adequate rain. It was reported by 53.12 per cent of the farmers. Another 46.88 per cent preferred to sow bajra, jowar or guar at usual time of sowing in July. In case there was continued dry spell and the crop was likely to wither out, it was used as green fodder. This is an insurance against total failure. The farmers did not see any loss in sowing bajra in April or May if it rained. The economics and profitability of this practice again needs to be studied.

4.2.5 Preparatory tillage

TABLE 5.5: Distribution of farmers by pre-sowing operations in different crops

Crop	Number of presowing ploughing practiced	Farmers response		Recommended number of ploughing
		Frequen- cy	Percen- tage	
Bajra	One	126	78.75	2 to 3
	Two	24	15.00	
	More than two	10	6.25	
Jowar	One	93	58.13	2 to 3
	Two	42	26.25	
	More than two	25	15.62	
Guar	One	139	86.88	2 to 3
	Two	21	13.12	
	More than two	-	-	
Wheat	Three	23	14.38	5 to 6
	Four	33	20.62	
	Five	59	36.88	
	More than five	45	28.12	
Mustard	Three	31	19.37	3 to 4
	Four	63	39.38	
	Five	66	41.25	
	More than five	-	-	

In bajra, the number of pre-sowing ploughing varied from one to three, the majority (more than 75%) of the respondents going in for only one ploughing and very few for two or three ploughings. Almost similar trend was followed in case of jowar and guar also. There was wide variation among the farmers in respect of number of pre-sowing ploughings given for rabi crops, viz., wheat and mustard (Table 5.5). This variation was less in kharif crops, viz., bajra, jowar and guar.

The number of pre-sowing ploughings given for rabi crops by the majority of the respondents was very much in line with what is recommended. In case of kharif crops, however, it was less than the recommended number. The proportion of farmers who gave 5-6 ploughings, the recommended number in wheat, was as high as 65 per cent. Nearly 59 per cent of the farmers reported giving the recommended number of ploughings in mustard. In all the kharif crops, including bajra, jowar and guar, the majority of farmers were found giving less than the recommended number of ploughings.

The number of ploughings given to fallow lands in kharif depends on the resources and time available at the disposal of the farmers at the needed point of time. This condition varied from farmer to farmer. There was also variation in the quantum and frequency of rainfall different villages received and this also accounted for the variation. The number of pre-sowing ploughings in rabi crops seemed to be circumstantial rather

than because of difference in knowledge and beliefs of the farmers concerning the desirability of a given number of ploughings.

4.2.6 Varieties

Table 5.6 gives an account of the varieties of bajra, wheat and mustard that were being sown by the farmers.

Indian agriculture has witnessed a breakthrough mostly through high-yielding varieties. Naturally, the farmers in general have taken to the use of high-yield potential seeds. Very much in line with the national trend, the high-yielding varieties of bajra and wheat were used by a large number of farmers. As high as 100 per cent medium farmers, 97.64 per cent big farmers, 93.42 per cent small farmers and 63.64 per cent marginal farmers reported sowing the recommended hybrid bajra. But surprisingly, most of the farmers failed to name the hybrid bajra they were growing. Not even a single farmer was found using any recommended varieties of jowar and guar.

All the medium and big farmers reported using improved wheats. The percentage of users among small farmers was also as high as 80. The corresponding percentage in case of marginal farmers was, however less than 50 per cent. About 90 per cent of the big and 80 per cent of the medium farmers did use improved variety of mustard, while this percentage was less than 50 in case of marginal and small farmers.

TABLE 5.6: Adoption of improved and local crop varieties
by different categories of farmers

Crop	Recommended varieties	Frequency of farmers				
		Varieties	Marginal	Small	Medium	Big
Bajra	BK 560	BK 560	2	8	8	4
	WCC 75		(4.54)	(13.11)	(40.00)	(11.42)
	MBH 110					
	MH 179	MBH 110	3	2	2	4
	MBH 60	-	(6.82)	(3.27)	(10.00)	(11.42)
	ICMS 7703					
		Other	23	47	10	26
			(52.30)	(77.04)	(50.00)	(74.80)
Jowar		Local	16	4	-	1
			(36.36)	(6.58)		(2.86)
	JS 20	Local	44	61	20	35
	JS 263		(100.00)	(100.00)	(100.00)	(100.00)
Guar	JS 29/1					
	G.N. 2	Local	44	61	20	35
	G.N. 277		(100.00)	(100.00)	(100.00)	(100.00)
	HFG 119					

Contd.....

TABLE 5.6 (CONTD.)

Crop	Recommended varieties	Frequency of farmers				
		Varieties	Marginal	Small	Medium	Big
Wheat	C-306	C-306	13 (29.54)	21 (34.42)	8 (40.00)	15 (42.86)
	WH 147					
	WH 291					
	HD 2204	WH 147	1 (0.02)	16 (26.22)	6 (30.00)	7 (20.00)
	HD 2329					
	HD 1553					
	HD 2204	HD 1553	7 (15.90)	11 (18.03)	6 (30.00)	11 (31.42)
	Kalyan Sona					
		HD 2329	-	1 (2.27)	-	2 (5.71)
		Local	23 (52.27)	12 (19.67)	-	-
Mustard	T 59	T-59	2 (4.54)	15 (24.59)	6 (30.00)	19 (54.28)
	Pusa Bold					
	RH 30	Pua Bold	-	7 (11.47)	8 (40.00)	9 (25.71)
		Other ¹	9 (20.45)	5 (8.19)	2 (10.00)	3 (8.57)
		Local	33 (75.00)	34 (55.73)	4 (20.00)	4 (11.42)

Figures in parentheses indicate percentages.

TABLE 5.7: Reasons for not using improved seeds

Sl. No.	Expressed reasons	RESPONSE	
		Frequ- ency	Percen- tage
1.	High cost of improved seeds	143	89.37
2.	Unsuitability of improved seeds under moisture-stress condition	141	88.12
3.	Unavailability of improved seeds	129	80.62
4.	Lack of knowledge about improved seeds	125	78.12
5.	Poor performance of improved seeds without fertilizer	109	68.12
6.	Inferior to local varieties for domestic consumption	94	58.75
7.	Susceptibility of improved seeds to pests and diseases	49	30.62
8.	Poor credibility of seed dealers	25	15.02

The farmers listed as many as eight different reasons for not using improved seeds as given in Table 5.7. But the reasons shared by an overwhelming majority of the respondents were high cost, unsuitability under moisture-stress condition, unavailability and lack of knowledge. The reason given by 68.12 per cent of the respondents was poor performance of improved seeds without fertilizer application. Nearly 59 per cent of them opined that improved seeds were inferior to local varieties for domestic consumption. To some farmers, susceptibility of

improved seeds to pest and diseases and poor credibility of seed dealers were also the reasons for not using improved seeds.

It is clear from Table 5.7 that all the factors involved in non-adoption of improved seeds are manipulative. These factors suggest the need for improving the supply position and educating, convincing and motivating the farmers to use improved seeds.

The farmers in general seemed to be very much convinced about the high-yielding potential of the recommended varieties of wheat and bajra. There was not much problem in so far as the availability of these seeds was concerned. This is a very happy situation and should be taken advantage of in promoting adoption of improved seeds.

4.2.7 Seed rate

Proper seed rate constitutes an important item in the package of practices recommended for exploiting yield potential of a variety. This is one aspect on which agronomists have been conducting experiments right from the very beginning of research in agriculture. There is increasing realization that optimum plant population is a pre-requisite for yield maximisation of a crop.

The information on seed rates mostly used by the respondents for the five important crops, namely, bajra, jowar, guar, wheat and mustard, were gathered. The same is presented in Table 5.8.

TABLE 5.8: Distribution of farmers by seed rates used in different crops

Crop	Seed rate in kg, acre	Frequ- ency	Percen- tage	Recommended seed rate kg/acre
Bajra	1.5	64	40.00	2.00
	2.0	52	32.50	
	2.5	26	16.25	
	3.0	18	11.25	
Jowar	10 - 12	48	30.00	20.00
	13 - 15	75	46.88	
	Above 15	37	23.12	
Guar	10 - 12	89	55.63	16.00
	13 - 15	61	38.12	
	Above 15	10	6.25	
Wheat	30 - 40	67	41.88	40 - 50
	41 - 50	88	55.00	
	Above 50	5	3.12	
Mustard	1.5	103	64.38	1.5 - 2.0
	2.0	37	23.12	
	2.5	11	6.87	
	3.0	9	5.63	

In all the kharif crops, the seed rate followed by majority of farmers was lower than the recommended one. In bajra, only 32.50 per cent of the farmers followed the recommended seed rate (2 kg/acre), while 27.50 per cent of them used more and the remaining 40.00 per cent less than the recommended seed rate. In jowar and guar, very few farmers followed the recommendations in respect of seed rate. As regards wheat and mustard, the seed rates used by majority of the farmers were as per recommendation.

The difference between the recommended and the actual seed rates practised by the farmers might be due to, among others, lack of knowledge. The specific reasons for using higher or lower seed rates and the rationality involved, if any, need to be critically investigated into. In view of low cost or non-monetary inputs, the importance of proper seed rate can not be overemphasized.

4.2.8 Time of sowing

Time of sowing of a crop has much to do with crop stand and yield. Its importance is appreciated both by the farmers and the agricultural scientists. This, being a 'no cost' technology, becomes all the more important for dryland agriculture, in the present context of rural development emphasizing the involvement of the weaker sections of the farming community. The position in respect of time of sowing of different crops in practice vis-a-vis the ones recommended by the scientists is given in Table 5.9.

TABLE 5.9: Distribution of farmers by sowing time in different crops

Crop	Sowing time	Frequ- ency	Percen- tage	Recommended optimum time of sowing
Bajra	First week of June to third week of June	27	16.87	
	Last week of June to mid July	53	33.13	Last week of June to mid July
	After mid July	80	50.00	
Jowar	Upto third week of June	33	20.63	
	Last week of June to mid July	61	38.12	June-July preferably between June 25 to July 10
	After mid July	66	41.25	
Guar	Up to mid July	54	33.75	First July to mid July. However, it can be sown up to second week of August
	Mid July to last week of July	47	29.37	
	First August to mid of August	59	36.88	

Contd.....

TABLE 5.9 (CONTD.)

Crop	Sowing time	Frequ ency	Percen- tage	Recommended optimum time of sowing
Wheat	Up to mid November	64	40.00	Barani condition: 25th October to 7th November Dwarf varieties: First November to 25th November Late sowing: 25th November to 25th December
	Mid of November to mid of December	82	51.25	
	After mid December	14	8.75	
Mustard	Up to third week of September	59	36.88	25th September to 10th October
	Last week of September to mid October	71	44.38	
	Mid October to last week of October	30	18.75	

Only 31.13 per cent, 38.12 per cent and 33.75 per cent of the farmers were found following the normal sowing time in bajra, jowar and guar respectively. Majority of the farmers sowed their kharif crop after normal sowing time. Uncertainty of monsoon rain was one of the reasons for delayed ^{sowing} of kharif crops as expressed by the farmers.

The time of sowing reported for wheat and mustard, the two major rabi crops, was very close to the optimum sowing time recommended, perhaps because of less uncertainties involved in rabi crops. These crops were normally raised on the conserved moisture from the monsoon rains. Wheat was reported sown up to mid November by 40 per cent of the farmers, mid November to mid December by 51.25 per cent and after mid December by rest of them. Similarly, mustard was reported sown up to third week of September by 36.88 per cent, last week of September to mid October by 44.38 per cent and between mid October to last week of October by the remaining 18.75 per cent.

4.2.9 Method of sowing

Method of sowing is also an important factor which determines good crop stand and ultimately the crop yield, especially in dryland where soil moisture is a limiting factor. The information on method of sowing mostly practised by the farmers for different seasons was elicited and is presented in Table 5.10.

It is evident from Table 5.10 that broadcasting was the most common method of sowing in kharif season which was practised by all the respondents. Though the scientists recommended transplanting of bajra instead of direct sowing by broadcasting, not a single farmer practised this recommendation. Interestingly, the farmers were aware of the fact that transplanted bajra

TABLE 5.10: Distribution of farmers as per the sowing methods followed in different seasons

Season	Recommended methods	Adopted method of sowing	Mar - ginal	Small	Medium	Big
Kharif	Broadcasting	Broadcasting	44	61	20	35
	Pora					
	Kera					
Rabi	Broadcasting	Pora	44	60	18	27
	Pora					
	Kera					
	Seed-drill	Seed-drill	-	1	2	8

ensures better crop stand and yield. Yet, due to uncertainties of subsequent rains after transplanting, they were not prepared to take this risk involved in transplanted crop.

In rabi, majority of the farmers practised pora method of sowing. Only 8 big farmers, 2 medium farmers and one small farmer appeared to use seed drill for sowing of rabi crops. The situation with respect to method of sowing was, on the whole, satisfactory in rabi crops. Additional information as to why the farmers use broadcasting method of sowing in kharif crops might have been revealing.

4.2.10 Conservation of moisture in soil

Dry farming is a game of absorption and conservation of moisture in soil. Its success or failure lies on the success or failure in effectively achieving this task. Naturally, absorption and conservation of soil moisture constitutes a major part of the dry-farming technology, and rest of the technology matters only if the first part is accomplished at least reasonably well.

Discussed below are the existing techniques and practices used by the farmers for proper absorption and conservation of soil moisture as presented in Table 5.11.

TABLE 5.11: Distribution of farmers by rain water conservation practices

Sl. No.	Practices followed	Respondents reporting	
		Frequency	Percentage
1.	Initial tillage	134	83.75
2.	Ploughing the field after every effective shower	116	72.50
3.	Stirring the fields with every light shower	113	70.62
4.	Keeping the fields weed free	63	39.37
5.	Plot to plot bunding	15	9.38

Initial tillage: The practice which is strongly recommended and also invariably followed by 83.75 per cent of the farmers is 'initial tillage'. Some also call it summer ploughing. The main rationale behind this operation is that it increases the moisture absorption capacity of the soil. Other purposes that it serve are: killing of insects, warming up of the soil and also preparatory tillage.

The actual initial tillage practice followed by the respondents was somewhat different from the recommended one. As they reported, against the recommendation of carrying out this operation in the second half of June, they start doing it right from April (immediately after the harvest of the rabi crops). They felt that they might not be able to complete this in a fortnights' time and did not see any harm in starting this operation right from April. They were not at all able to appreciate the consequential wind erosion of soil.

The recommendation was to do this ploughing as deep as possible by a soil-turning plough, while the majority of the farmers used a country plough which is not a soil-turning one but is specially designed to go deep into the soil.

Ploughing the fields with every effective shower

The fields kept fallow in kharif and earmarked for rabi sowing were ploughed by 72.5 per cent of the respondents with every effective shower, obviously for more absorption and

better conservation of rain water. This also killed the weeds. the last ploughing was followed by planking. A local country plough was used for this. The number of such ploughings normally ranged from one to two against the scientists' recommendation of only one. The experts felt that the number of ploughings in excess of one was not likely to add substantially to the water absorption capacity of the soil.

Stirring the fields with light showers

As stated above, ploughing of fields was done only with heavy showers, the probability of which was very low in the area under study. In the event of getting light showers in the fields fallow in kharif and ear-marked for rabi sowing, the upper 2 to 3 inches soil layer was generally opened. This was done by an implement, which is called 'Banda' or 'Pati'. It has a rectangular blade of approximately 2x1 feet size at the bottom, which is made by the local balack-smith. It scarps the upper 2" soil, making the lower soil compact and destroying the soil capillaries and, thereby, preventing the evaporation of valuable sub-soil stored moisture. The scrapped layer of soil, on one hand, conserves the water from further light showers and on the other hand serves as a soil mulch. It also helps in keeping the fields free from weeds. This beneficial practice was followed by 70.62 per cent farmers. This implement, therefore, needs to be studied in comparison to the recommended interculture implement (Harrow) for its relative effectiveness.

Keeping the fields weed free

For absorption and conservation of soil moisture, it is important that fields are kept free from weeds. However, only 39.37 per cent of the respondents appeared to be conscious of the loss of water because of water loving weeds.

Plot to plot bunding: Less than 10.00 per cent of the farmers reported having divided their land into a number of plots of an acre or so maintaining 6 to 9 inches high bund around such plots. They did not seem to realise the importance of preventing runoff of rain water from their lands. This might be the reason for not having plot to plot bunding.

SECTION III

4.3 Resource utilization

4.3.1 Place of purchase of fertilizer

An important consideration in promoting fertilizer use is availability of this important input. It is in this context that the sources the farmers purchase fertilizers from bear significance. Trustworthiness of the sources as to the quality and quantity of fertilizers supplied matters a lot in promoting fertilizer use. Trustworthiness in respect of timely supply of needed fertilizers in adequate quantities is also important.

TABLE 6.1: Distribution of fertilizer users by sources of purchasing fertilizer

Sources	Number of farmers				
	Marginal n=14	Small n=48	Medium n=19	Big n=33	Total N=114
Co-operative	4 (28.57)	7 (14.58)	2 (10.52)	2 (6.06)	15 (9.37)
Private fertilizer dealers	10 (71.14)	42 (87.50)	17 (89.47)	29 (87.88)	98 (61.25)
HAFED	2 (14.28)	7 (14.58)	5 (26.31)	10 (30.00)	24 (15.00)

Figures in parentheses indicate percentage.

It is evident from the above table that private fertilizer dealers were the major source from which majority of the respondents purchased fertilizers regardless of land holding size. It is surprising to find that only 9.37 per cent of them took fertilizer from co-operative societies. The low percentage of farmers purchasing fertilizers from co-operative societies might be because of inefficient co-operative system in that area. Another reason might be that there were very few co-operative societies dealing in fertilizers. The state government has fertilizer depot known as HAFED (Haryana Agriculture Federation). But as it appears from Table 6.1, only 15 per cent of the total fertilizer users preferred to purchase fertilizer from HAFED. During informal discussion with the respondents, it was revealed

that they were motivated to take fertilizers from private fertilizers dealers for two reasons. Firstly, they could get fertilizers any time they wanted, even in odd hours. Secondly they could get fertilizers easily on credit.

4.3.2 Means of transport

Transport and communication facilities have a great bearing on fertilizer use. Better the facilities, more likely it is that the farmers will take to fertilizer use. Depending on how well is a village connected to the place where fertilizers are available, the farmers use one and/or the other conveyance to carry fertilizers. The means of transport used by the respondents to carry fertilizers from fertilizer depot to their respective villages are indicated in Table 6.2.

A glance at Table 6.2 clearly indicates that most of the marginal farmers used bicycle (64.28%), followed by bus/auto (35.71%) and own bullock cart (14.28%) for carrying fertilizers from the sale point to the village. Almost similar was the situation even in case of small farmers. But in addition to the above mentioned transport means, they also used hired bullock card (8.33%) and own tractor (2.08%). Majority of the farmers (42.10%) used own bullock cart followed by bus/auto (31.58%), hired bullock cart (21.05%) and own tractor (10.52%). So was the case even in case of big farmers.

Table 6.2 further reveals that bus/auto was extensively used by almost all the four categories of farmers, but relatively

TABLE 6.2: Distribution of fertilizer users by means of transportation

Means of transportation	Number of farmers				
	Marginal n=14	Small n=48	Medium n=19	Big n=33	Total N=114
1. Own bullock cart	2 (14.28)	10 (20.83)	8 (42.10)	14 (42.42)	34 (21.25)
2. Hired bullock cart	-	4 (8.33)	4 (21.05)	4 (12.12)	12 (7.50)
3. Bus/Auto	5 (35.71)	17 (35.41)	6 (31.58)	9 (27.27)	37 (23.12)
4. Own tractor	-	1 (2.08)	2 (10.52)	8 (24.24)	11 (6.87)
5. Bicycle	9 (64.28)	23 (47.91)	-	-	32 (20.00)

Figures in parentheses indicate percentage.

more by marginal and small farmers. Own bullock cart was mainly used by medium and big farmers and less by marginal and small farmers. Relatively low percentage of marginal and small farmers using own bullock cart was probably because many of them could not afford to maintain bullocks. They possibly found it more economical to hire any other transport means as and when needed. While majority of the marginal and small farmers used bicycle as a means of transport for carrying fertilizers, medium

and big farmers never used the same. This might be because the requirement of fertilizer by marginal and small farmers was comparatively less in comparison to medium and big farmers. Moreover, their poor economic condition might not be permitting them to invest on transportation of fertilizers.

4.3.3 Loan taken by farmers

As the dryland farmers are generally economically weak, they badly require money for agricultural and other purposes. They are eligible for three types of loan from the government for agricultural purposes. Short term loan, known as crop loan, is given for increasing crop production by way of adopting improved seeds, fertilizers and plant protection chemicals. It is the loan given for 6 months with 10-12 per cent interest rate. Medium term loan is given for permanent improvement of the farm, viz., land reclamation, tubewell, pumpsets, pucca irrigation channel, etc. It is given for 5 years. Long term loan is generally given to the farmers to purchase tractor. An analysis of different types of loans taken by different categories of farmers is given in Table 6.3.

Table 6.3 shows that 36.36 and 29.54 per cent of the marginal farmers had taken loan in kharif and rabi respectively. Out of them, 15.91 and 18.18 per cent had taken for crop loan. The percentage of small farmers who took loan was 26.23 in kharif and 42.62 in rabi. Crop loan alone was taken by 14.76 per cent of them in kharif and 19.67 of them in rabi. The percentage of medium farmers who took short term loan in kharif and rabi taken

TABLE 6.3: Distribution of farmers by different types of agricultural loan taken

Category of farmers	Number of farmers			
	Kharif		Rabi	
	Short term loan	Medium term loan	Long term loan	Total
Marginal	7 (15.91)	8 (18.18)	1 (2.27)	16 (36.36)
			8 (18.18)	5 (11.36)
			-	13 (29.54)
Small	- (14.76)	6 (9.83)	1 (1.64)	16 (26.23)
			12 (19.67)	14 (22.95)
				26 (42.62)
Medium	3 (15.00)	5 (25.00)	1 (5.00)	9 (45.00)
			5 (25.00)	4 (20.00)
				1 (5.00)
				10 (50.00)
Big	3 (8.58)	8 (22.86)	4 (11.43)	15 (42.87)
			6 (17.14)	5 (14.28)
				1 (2.86)
				12 (34.28)
Total	22 (13.75)	27 (16.87)	7 (4.37)	56 (35.00)
			31 (19.37)	28 (17.50)
			2 (1.25)	61 (38.12)

Figures in parentheses indicate percentage.

together was as high as 40. The corresponding percentage in case of big farmers was only 25.72.

Table 6.3 further reveals that a relatively larger percentage of the farmers of all the four categories took loan in rabi. This indicates that the farmers in general invested more in rabi crops, might be because they found these crops less risky and hence more remunerative in comparison to kharif crops. The percentage of farmers who took medium term loan was maximum in case of medium farmers, followed by big, small and marginal ones. Long term loan was taken by maximum number of big farmers (5%) followed by medium ones (10%). Only one marginal and one small farmer had taken long term loan.

4.3.4 Purpose of taking loan

We have already analysed the types of loan taken by different categories of farmers. It is now worthwhile analysing the purposes for which loans were taken. Necessary information in this regard is given in Table 6.4.

It is evident from Table 6.4 that while 28 per cent of the marginal farmers took loan for purchase of seeds and milch/draft animals each, 21.31 and 29.51 per cent of the small farmers took loan for seeds and milch/draft animals. About 25.00 per cent of the medium and big farmers each reported having taken loan for improved implements/pumpsets. Loans were taken for milch/draft animals by 20 and 11.43 per cent of the medium and big farmers respectively. Loans for purposes other than seeds and milch/draft animals were taken by comparatively less number

TABLE 6.4: Distribution of farmers by purposes for taking agricultural loan

Sl. No.	Purposes	Number of farmers				
		Marginal	Small	Medium	Big	Total
1.	Seeds	12 (27.28)	13 (21.31)	3 (15.00)	3 (8.58)	31 (19.37)
2.	Fertilizers	3 (6.82)	5 (8.20)	3 (15.00)	4 (11.43)	15 (9.37)
3.	Plant protection chemicals	-	3 (4.92)	2 (10.00)	2 (5.71)	7 (14.37)
4.	Improved implements/pumpsets	1 (2.27)	2 (3.28)	5 (25.00)	9 (25.71)	17 (10.62)
5.	Milch/draft animals	12 (27.27)	18 (29.51)	4 (20.00)	4 (11.43)	38 (23.75)
6.	Tractors	1 (2.27)	1 (1.64)	2 (10.00)	5 (14.28)	9 (5.62)

Figures in parentheses indicate percentage.

of marginal and small farmers. The percentage of medium and big farmers who took loan for improved implements/pumpsets were relatively higher than those who took loan for other purposes.

Table 6.4 further reveals that all the four categories of farmers taken together, 19.37 per cent took loan for seeds, 9.37 per cent for fertilizers and only 4.37 per cent for plant protection chemicals. This clearly shows that the farmers did not attach as much importance to fertilizers as to seeds.

Only about 11 per cent of the farmers had taken loan for improved implements/pumpsets. This means that they were using mostly indigenous implements.

Maximum percentage (23.75%) of the farmers had taken loan for purchase of milch/draft animals. Particularly for marginal and small farmers, milch animals are an additional sources of income. This is more so in dryland areas. Only 22 and 11.43 per cent of the medium and big farmers respectively took loan for milch/draft animals. Loan for tractor was taken by only 5.62 per cent of the farmers. Out of them, 14.28 per cent were big and 10 per cent medium farmers.

4.3.5 Borrowing pattern

Scientific commercial farming is very capital intensive. It requires huge capital. It is only the subsistant farming that can be managed with little investment. It is a known fact that even when farming is at its best, per rupee return from it is usually much lower than the return from other areas of capital investment. It is, therefore, rightly said that capital is shy in agriculture. Even in U.S.A. which is the richest

country having very advanced agriculture, a lot of provisions have to be made by the extension agencies in the form of co-operative credits, etc. to finance agriculture in the country. While examining the causes of low production on farmers' fields, Kovilpetti (1975) reported that the main cause of low production was the lack of finance with the farmer to acquire the proper inputs required for high level of crop production. The importance of agricultural credit, therefore, cannot be over-emphasized in India and particularly in the poor areas of the country. The dry farming research scientists have developed a ridger seeder. This single device is capable of raising the yield of dry farming crops by about 27 per cent. But this is not in practice in that area due to its high cost. This is just one example to illustrate that even in the area under study, a lot of capital needs to be provided so that the farmers could know and decide to adopt these recommended scientific practices.

Singh et al. (1966) observed that the farmers' own capital was often insufficient to meet the needs of investment. The data collected as to the existing borrowing pattern in the villages under study have been presented in Table 6.5.

It is clear from just a look at Table 6.5 that almost all the farmers had to borrow money. Majority of them preferred to borrow from friends/neighbours/relatives (54.37%) followed by Gramin bank (41.87%). Other sources that they

TABLE 6.5: Distribution of farmers by sources of borrowing and reasons for preference

Sl. No.	Particulars	Frequency	Percentage
A SOURCES			
1.	Fellow farmers/friends/relatives	87	54.37
2.	Gramin bank	67	41.87
3.	Commercial bank	23	14.37
4.	Co-operative society	15	9.37
5.	Land development bank	9	5.62
6.	Money lender	29	18.12
B. SOURCE WISE PREFERRED REASONS			
1.	Fellow farmers/friends /relatives		
	i) Interest-free loan	53	33.12
	ii) Secrecy maintained	73	45.62
	iii) Timely loan not available from government	26	16.25
	iv) Harrasement if government loan not paid in time	37	23.12
	v) Borrowing repayment not time-bound	47	29.37
	vi) Dishonesty and cheating by government financing staff	27	16.87

contd.....

TABLE 6.5 (CONTD.)

Sl. No.	Particulars	Freq- uency	Perce- m- tage
2.	Co-operative/LDB/Gramin/Bank/Commercial bank		
	i) Reliable government sources with less interest rate	73	45.62
	ii) Repayment on instalment basis	55	34.37
3.	Money lender		
	i) Easily available, even in odd hours	29	18.12
	ii) Faith in money lender	11	6.87

depended on for credit were money lender (18.12%) and commercial bank (14.37%). Quite a few took credit from co-operative societies and land development bank. It is, thus, clear that there were only two main sources, i.e., fellow farmers/friends/relatives and Gramin bank which were preferred by about 50 per cent of the farmers.

Co-operative societies and nationalised banks are expected to play a very important role in meeting the credit requirements of farmers. But surprisingly, not even 15 per cent of the respondents reported having taken loans from these institutions. The findings of Krishnaswami (1972) that the role played by commercial banks in the field of rural finance

was generally nominal and sporadic and that of Sisodia (1971) that commercial banks were still not a vital source of loans for the mechanised farmers are somewhat in agreement with what this study revealed. Borrowing from fellow farmers is indicative of a bond of community feeling which is a good sign. However, it must be realised that such borrowings being interest free usually involve small sums, which are inadequate to meet the total credit needs of the farmers. Gramin banks do help the farmers a great deal in meeting their credit needs. But they alone can not fulfill the total needs of the entire farming community. Therefore, the ultimate solution of the problems lies in rationalising agricultural credit through co-operatives and commercial banks. As given in Table 6.5, the respondents preferred fellow farmers to other sources of credit for several reasons. The most important reason stated by the farmers was that they wanted to maintain secrecy of the transaction which was possible only if it was among themselves. This clearly shows that taking loan was considered something bad. This is certainly not a 'social value' which will help agricultural development. The farmers need to be educated that taking loan for productive purposes shows progressiveness and that it is not an indispensable activity of commercial enterprises only. Instances of big traders, and even industrialists, taking loan from governmental agencies need to be quoted. It is, of course, bad to take loan for unproductive purposes. The farmers have also to be educated in this regard.

Nearly one-third of the respondents reported interest free loan as the reason for preferring fellow farmers/friends/relatives to other sources of credit. Other reasons for taking loan from this source were stated to be harrassement involved in non-payment of government loan in time and no date-bound nature of repayment of loan taken from the fellow farmers/friends/relatives. Both these reasons are somewhat similar. Nearly 17 per cent of the farmers complained that they did not get government loan in time and there was dishonesty and cheating by government staff. Because of all this, they preferred taking loans from fellow farmers/friends/relatives.

The merits that the farmers found with institutional loan (column 2 of the Table 6.5) were reliability and less interest.

It is very surprising to note that even with the advancement of credit system, 18.12 per cent of the farmers preferred professional money lenders and they gave two reasons for their preference - easy availability of loan even in odd hours and faith in money lenders

The above facts underline the need to promote institutional credit for farming through co-operatives and banks. This requires action on two fronts. The co-operatives need to be strengthened and made popular simplifying the procedures of advancement and repayment to suit the convenience of the farmers. Another front on which action needs to be taken

is education of the farmers who usually take loans from fellow farmers. The distinct advantages of co-operatives must be brought home to them. They have to be convinced that taking loan is a sign of progressiveness. It was noted that the persons who believed in taking loans from fellow farmers were mostly 'Muslims'. Not only taking but even giving loan is considered something very bad in this community and hence the need for education to bring about change in the value system that the changing situation demands.

4.3.6 Tiding over the economic crisis

If one happens to visit the dryland villages of the state where this study was conducted, he just wonders how men and animals survive in the precarious situation. the area is very hot, dry and dusty, marked by very conspicuous sand dunes. Even drinking water is scarce. In the event of good rains, the conditions change dramatically. It looks all green and pleasant on sand dunes. One finds a beautiful crop of bajra. But good rains are not regular. Based on observations made over a number of decades, it is estimated that two years in every five years are drought years. In these years, the farmers are not able to get back even the seed they sow. It is important to know as to how the people in dryland areas tide over the recurrent crisis. This was a question posed to the farmers interviewed. The worst ever drought they faced was in 1987-88. They were just asked to

indicate how they managed that crisis. Their replies appear in Table 6.6.

TABLE 6.6: Distribution of farmers by ways of resolving financial problems during drought

Sl. No.	Sources	Frequency	Percentage
1.	Borrowing from fellow farmers	27	16.87
2.	Loan from co-operative/baks	84	52.50
3.	Disposing land	11	6.87
4.	Disposing milch/draft animals	33	20.62
5.	Income from subsidiary occupation	15	9.38
6.	Help from service family members	22	13.75
7.	Income from selling animal products	25	15.63
8.	Selling family ornaments	8	5.00
9.	Loan from money lenders	29	18.12
10.	Extra wage earning	54	33.75
11.	Savings from previous years	14	8.75

It is clear from the above table that only 8.75 per cent of the farmers had enough savings to meet the crisis. The rest had to take recourse to one or the other sources to manage the crisis. While 5 per cent of the farmers had to sell their ornaments, nearly 7 per cent were compelled to dispose of some land to tide over the crisis. Just possible,

some more families might have resorted to sale of ornaments and disposal of land. They normally do not disclose such actions on their part because selling of lands and ornaments is considered a sign of extreme poverty which lowers the social prestige of the family.

The fact that only 9.38 per cent of the farmers reported having taken to subsidiary occupation to tide over the crisis, shows that subsidiary occupation was not common in the area and this might be due to poor economic condition of the people. The proportion of the farmers who took help from their family members in service was 13.75 per cent. The investigator observed that there were not many service holders in the villages under study. Dry land areas restrict animal rearing and that is why the proportion of farmers who sold their milch/draft animals was only 15.63 per cent.

Between 17 to 18 per cent of the farmers had to borrow from fellow farmers and money lenders. There are obviously some economically well off people even in dryland areas, who come to the rescue of others in hours of crisis.

About one-third of the respondents had to depend on extra labour to mitigate their suffering during the drought period. Even the marginal farmers and other economically handicapped people in the villages supplement their meagre income from other sources by putting extra labour.

It is heartening to find that majority of the respondents were advanced loans by cooperatives/banks in a

situation when they needed the same most. It is expected that the credit-giving institutions became extra liberal in helping the farmers when they are hardly hit by natural calamities like drought and flood.

SECTION IV

4.4 Nature and extent of fertilizer use

4.4.1 Crop-wise users of fertilizers

It is worth while knowing crop-wise use of fertilizers by different categories of farmers. The information collected in this regard is presented in Table 7.1.

TABLE 7.1: Crop-wise users of fertilizers belonging to different land-holding categories

Sl. No.	Crop	Number of farmers using fertilizer				
		Marginal	Small	Medium	Big	Total
1.	Wheat only	6 (13.63)	13 (21.31)	4 (20.00)	4 (11.43)	27 (16.87)
2.	Bajra, wheat and mustard	-	8 (13.11)	12 (60.00)	23 (65.71)	43 (26.87)
3.	Bajra and wheat	5 (11.36)	9 (14.75)	2 (10.00)	4 (11.43)	20 (12.50)
4.	Wheat and mustard	3 (6.82)	18 (29.50)	1 (5.00)	2 (5.71)	24 (15.00)
5.	In none	30 (68.18)	13 (21.31)	1 (5.00)	2 (5.71)	46 (28.75)

Figures in parentheses indicate percentage.

It is evident from Table 7.1 that no farmer applied any fertilizer to jowar and guar crops. Only about one-third of the marginal farmers applied fertilizer in bajra, wheat and mustard. Out of them, 13.63 per cent applied to wheat, only 11.36 per cent to both bajra and wheat and only 6.82 per cent to both wheat and mustard. As high as 78.69 per cent of the small farmers applied fertilizers in bajra, wheat and mustard. Out of them, 21.31 per cent applied to wheat only, 14.75 to bajra and wheat and 29.50 per cent to wheat and mustard. Only 13.11 per cent of the small farmers applied fertilizers in all the three crops, namely, bajra, wheat and mustard.

In case of medium and big farmers, more than 90.00 per cent applied fertilizers and out of them, more than 60.00 per cent applied in all the three crops including bajra, wheat and mustard.

Thus, we find that wheat was the only crop to which fertilizer was applied by majority (71.25%) of the farmers. Only 41.87 and 39.37 per cent of the farmers applied fertilizer to mustard and bajra respectively. As the farmers expressed during informal interview, they did not use any fertilizer in bajra which is a kharif crop because of more risk and less return. As regards mustard, their feeling was that it gives reasonable yield even without application of any fertilizer. They were, however, emphatic about the use of fertilizers in wheat. Wheat can not give good yield without fertilizer application, most of them asserted.

Desai et al. (1973) stated that over 80.00 per cent of the farmers applied fertilizers to only one crop in the year of adoption and none applied fertilizers in more than three crops. The findings of this study is in line with the observations made by the above authors.

4.4.2 Crop-wise combination of fertilizers used

Even if farmers use mixed fertilizer, balanced fertilization necessitates use of more than one fertilizer in any crop so that it gets required inputs in proper combination. However, many farmers were found using only one of the available fertilizers. Where do the farmers under study stand in this regard was one of the questions that this study tried to answer. Table 7.2 deals with crop-wise users of different kinds of fertilizer singly or in combination.

It appears from Table 7.2 that out of 93.12 per cent of the respondents growing bajra, only 42.28 per cent used one or the other fertilizers in this crop. It deserves mention here that more than 80.00 per cent of the farmers applied only nitrogenous fertilizers in the form of either urea or CAN (Calcium ammonium nitrate). Only 17.46 per cent used urea along with DAP (Di-Ammonium phosphate) in bajra.

Ninety five per cent of the farmers were growing wheat, out of which 75.00 per cent applied fertilizers. Nearly 61.00 per cent of them applied the combination of urea + DAP and nearly 24.00 per cent CAN + DAP. Between 6.00 to 8.00 per

TABLE 7.2: Crop-wise use of different kinds of fertilizers singly or in combination

Crop	Frequency of respondents growing crops	Kinds/combinations of fertilizers used					Percentage of farmers used fertilizer
		Frequency of respondents					
		Only urea	Only CAN	Only DAP	Urea+DAP	CAN+DAP	
Bajra	149 (93.12)	43 (68.25)	9 (14.28)	- -	11 (17.46)	-	42.28
Wheat	152 (95.00)	9 (7.89)	7 (6.14)	-	69 (60.52)	27 (23.68)	75.00
Mustard	138 (86.25)	26 (38.80)	9 (13.43)	13 (19.40)	14 (20.89)	5 (7.46)	48.55

Figures in parentheses indicate percentage.

cent of the farmers used either urea or CAN only.

The percentage of mustard growers was as high as 86.25 per cent, but only 48.55 per cent of them applied fertilizer to the crop. Among the fertilizer users, 38.80 per cent used only urea and 13.43 per cent only CAN. The proportions of those using urea + DAP and CAN + DAP were only 20.89 and 7.46 per cent respectively. It bears significance that mustard was the only crop in which some of the farmers (19.40%) used just DAP.

It may be concluded that out of the three kharif crops being grown, only bajra was fertilized and that too mostly with nitrogenous fertilizers only. As regards rabi crops, wheat received the major share of fertilizers, obviously because this was a much safer crop unlike mustard which involved a lot of risk.

4.4.3 Period of fertilizer use

The distribution of respondents by period of fertilizer used is presented in Table 7.3.

It is obvious from Table 7.3 that 45.61 per cent of the farmers had been using fertilizer for 0-5 years. The percentage of users varied from 64.28 per cent in case of marginal farmers to 27.27 per cent in case of big farmers. Nearly 39 per cent of the farmers had been using fertilizers for 6 to 10 years, 11.40 per cent for 11-15 years and only 4.38 per cent for more than 15 years.

TABLE 7.3: Experience (in years) of different categories of farmers in fertilizer use

Category of farmers	Period of fertilizer use (in years)				Total
	0 - 5	6 - 10	11 - 15	More than 15	
Marginal	9 (64.28)	5 (35.00)	-	-	14 (31.82)
Small	28 (58.33)	16 (33.33)	4 (8.33)	-	48 (78.68)
Medium	6 (31.57)	8 (42.10)	3 (15.78)	2 (10.52)	19 (95.00)
Big	9 (27.27)	15 (45.45)	6 (18.18)	3 (9.09)	33 (94.28)
Total	52 (45.61)	44 (38.59)	13 (11.40)	5 (4.38)	114 (71.25)

Figures in parentheses indicate percentage.

The category-wise analysis further reveals that out of 31.82 per cent of the fertilizer users among marginal farmers, more than 60 per cent have been using for 0-5 years and the rest for 6-10 years. Among the small farmers, 78.68 per cent were fertilizer users and out of them, more than 50 per cent had been using for 0-5 years, 33.35 per cent for 6 to 10 years and only 8.33 per cent for 11 to 15 years. Amongst the medium and big farmers, as high as about 45 per cent had been using

fertilizer for 6 to 10¹ years, about 16 per cent for 11 - 15 years, nearly 10 per cent for more than 15 years and the rest for only 0 to 5 years. None of the marginal and small farmers had been using fertilizer for more than 15 years.

4.4.4 Extent of fertilizer use

It is worthwhile knowing the extent of fertilizer (N,P,K) use by different categories of farmers. The data regarding the extent of fertilizer (N,P,K) use per acre by different categories of farmers along with category-wise national average as also per acre, state (Haryana) and national average consumption of N,P,K are presented in Table 7.4.

TABLE 7.4: Average use of fertilizer (N,P,K) per acre among different categories of farmers

Category of farmers	Nutrient applied (kg/acre)				All India per acre nutrient consumption by land holding size
	N	P	K	Total	
Marginal	18.34	5.13	-	23.47	30.40
Small	17.80	5.09	-	22.89	25.62
Medium	17.29	4.98	-	22.27	23.85
Big	16.54	4.32	-	20.86	20.16
Average	17.49	4.88	-	22.37	25.01
Haryana	23.28	5.83	0.40	29.51	
All India	12.99	4.73	1.98	19.72	

An analysis of the data presented in Table 7.4 reveals that fertilizer consumption per acre in terms of nutrient, all the four categories of farmers were somewhat at par with each other. However, there was a slight decrease with increase in size of holding. Apparently, it looks that the big farmers used less fertilizers per acre than even the marginal farmers. The reality, however, must have been otherwise. What happens is that the farmers having larger holding particularly in dry-lad areas do not grow crops in their entire holding and assuming they do, they do not fertilize the entire area under different crops. They do not at all fertilize some crops, may be because they can not afford to invest much on fertilizer or because they do not find profitable to use fertilizer in some crops

When per acre fertilizer consumption by different categories of farmers was compared with the national average by respective categories, it was observed that marginal and small farmers used less than the national average, while medium and big farmers used almost as much as the national average. It was thus, because of larger holding size that per acre fertilizer use in case of big farmers worked out to be less than that in case of even marginal farmers.

It is also obvious that nutrient consumption per acre in the state is almost twice for nitrogen and equal for phosphorus but less than one fourth for potash as compared to the national averages. Higher consumption of nitrogen was probably

because of its better response and more clearly visible effect. Another reason may be lack of extension efforts to educate the farmers about balanced fertilization. Any way, it was beyond the purview of this study to ascertain the reasons as to why the farmers used more or less of different crop nutrients.

When the average consumption of fertilizer per acre in the area surveyed was compared with that of state average, it was found that nitrogen and phosphorus consumption was slightly below, while potash consumption was nil. The total nutrient consumption in the surveyed area was also less than the state average. This was obviously because of the area investigated being dryland tract. The farmers are generally illiterate and have poor resource base. Moreover, nearly 50 per cent of the farmers belonging to Muslim community for whom farming is not a traditional occupation.

The per unit area average consumption of different nutrients singly or combined in the surveyed area was higher than the national average. However, there still remains tremendous scope to further increase fertilizer use.

4.4.5 Level of fertilizer use

As borne out by the experiences of other countries which have had limited land for cultivation and were confronted with population pressure, the quickest way to increase agricultural production in India is to promote a rapid increase of fertilizer

use. But inspite of much emphasis on fertilizer use, the fact remains that even today a significant number of farmers are not using fertilizers specially in dryland areas and a vast majority of those using are much below the recommended level of fertilizer use in different crops by different categories of farmers is presented in Table 7.5.

As the data presented in Table 7.5 shows, only 11.36 per cent of the marginal farmers applied fertilizer in bajra and out of them 60.00 per cent applied N_2 below the recommended level. Among the small farmers, 27.87 per cent were users of fertilizers in bajra and nearly sixty per cent of them applied N_2 below the recommended level. As high as about 70.00 per cent of the medium and big farmers used fertilizer in bajra and nearly 35.00 per cent of them applied N_2 as per recommendation. It is very surprising to note that the percentage of those using phosphatic fertilizers in bajra as per recommendation was less than 20.00 per cent in all the four categories of farmers.

In wheat, the percentage of fertilizer users was considerably high. Nearly 32.00 per cent of the marginal farmers fertilized wheat crop and more than 60.00 per cent of them applied N_2 as per recommendation. As high as 79.00 per cent of the small farmers and more than 90.00 per cent of the medium and big farmers applied fertilizers in wheat crop and out of them, 60.42 per cent of the small, 55.00 per cent of the medium and less than 50.00 per cent of the big farmers did

TABLE 7.5: Distribution of fertilizer-users belonging to different land-holding categories by different levels of fertilizer use

Crops	Category of farmers	Total area	Area fertilized	No. of farmers using fertilizer	Nutrient level		
					N		P
					Less than recommended	More than recommended	Less than recommended More than recommended
Bajra	Marginal	44.00	4.50	5 (11.36)	3 (60.00)	2 (40.00)	1 (20.00) 1 (20.00)
	Small	89.00	20.00	17 (27.87)	10 (58.82)	7 (41.18)	5 (29.41) 3 (17.64)
	Medium	52.00	17.50	14 (70.00)	9 (64.29)	5 (35.71)	7 (50.00) 2 (14.28)
	Big	139.00	47.00	27 (77.14)	18 (66.67)	9 (33.33)	6 (22.22) 4 (14.81)

contd.....

TABLE 7.5 (CONTD.)

Crops	Category of farmers	Total area	Area fertilized	No. farmers using fertilizers	Nutrient level			
					N		P	
					Less than recommended	More than recommended	Less than recommended	More than recommended
					ended		ended	
Wheat	Marginal	25.50	12.50	14 (31.82)	5 (35.72)	9 (64.28)	3 (21.43)	6 (42.56)
	Small	90.50	76.50	48 (78.69)	19 (39.58)	29 (60.42)	26 (54.16)	20 (41.66)
	Medium	49.00	49.00	19 (95.00)	8 (40.00)	11 (55.00)	11 (55.00)	7 (35.00)
	Big	184.50	166.00	33 (94.28)	17 (51.51)	16 (48.48)	21 (63.63)	11 (33.33)
Mustard	Marginal	20.50	2.00	3 (6.82)	1 (33.33)	1 (33.33)	2 (66.66)	-
	Small	78.50	40.50	26 (42.62)	18 (69.23)	8 (30.77)	12 (46.15)	3 (11.54)
	Medium	36.00	22.00	13 (65.00)	8 (61.54)	5 (38.46)	7 (53.84)	2 (15.38)
	Big	219.00	79.00	25 (71.43)	16 (64.00)	9 (36.00)	14 (56.00)	3 (12.00)

Figures in parentheses indicate percentages to the total number of farmers applying fertilizer in each category.

use N_2 in recommended dose. With respect to application of P_2O_5 , about 40.00 per cent of the marginal and small and nearly 35.00 per cent of the medium and big farmers used the recommended dose. It is very interesting to note that nearly 4.00 per cent of the small, 5 per cent of the medium and about 3 per cent of the big farmers applied higher dose of P_2O_5 , higher than what is recommended. This might be either because of their lack of knowledge about the recommended dose of fertilizer or because they found good response of P_2O_5 . This also might have happened because of use of DAP.

In mustard, the percentage of fertilizer users varied between as high as 71.43 per cent of the big to as low as 6.82 per cent of the marginal farmers. Out of them, less than 40.00 per cent in all the four categories applied the recommended dose of N_2 . However, none of the marginal farmers and very few of the small, medium and big farmers applied P_2O_5 as per recommendation.

The overall analysis of crop-wise fertilizer use further reveals that nearly 40.00 per cent of the farmers applied fertilizers in bajra crop and out of them about 65 per cent used N_2 less than the recommended dose. In case of wheat, nearly 75.00 per cent of the farmers applied fertilizer and more than 55.00 per cent of them used the recommended dose of N_2 and about 40.00 per cent the recommended dose of P_2O_5 . On the whole 41.87 per cent of the farmers fertilized mustard crop and 34.43 per cent of them applied N_2 and 31.43 per cent P_2O_5 in the recommended dose.

Thus, we find the percentage of fertilizer users in wheat was comparatively higher than that in bajra and mustard. The percentage of those using the recommended dose was also much higher in case of wheat as compared to bajra and mustard. The differences in crop-wise proportions of fertilizer users and the level of fertilizer use may be explained in terms of the users' perception and experience regarding risk involved in and return obtained from different crops as a result of fertilizer application. The farmers in general feel that bajra is a risky and low-return crop. Similarly they feel that whereas mustard gives a reasonably good yield even without fertilizer application, wheat can not give good yield without fertilizer application.

Shetty (1965) found a wide variation in the extent of doses of fertilizers used. He also observed very high seasonal variations in the use of fertilizers. Most of the farmers did not use even half of the recommended dose of fertilizers. Rao (1969) and Sharma (1969) in their respective studies on the use of fertilizer for HYVP (IR-8) of paddy reported that application of nutrients to the crop was much below the recommended levels. Nair (1969) found in his study that 90.00 per cent of the participants in HYVP applied even less than half the recommended dose. All these findings lend support to the findings of the study.

SECTION - V

4.5 Knowledge and opinion about fertilizer use4.5.1 Knowledge about fertilizers

It is an established fact that the users' knowledge and opinion about any technology are among the major factors which determine the extent of adoption of that technology. Having that in view, these variables were included in the present study. The distribution of respondents by land holding size and, level of knowledge about fertilizers is presented in Table 8.1. Based on knowledge scores, the respondents were classified into four categories depending on whether they had poor (upto 25%), average (26-50%), good (51-75%) and very good (more than 75%) knowledge about fertilizers.

TABLE 8.1: Distribution of farmers by level of knowledge about fertilizer use

Category of knowledge	Frequencies of farmers			
	Marginal	Small	Medium	Big
Poor (1-25%)	31 (70.45)	33 (54.10)	5 (25.00)	7 (20.00)
Average (26-50%)	11 (25.00)	21 (34.43)	10 (50.00)	15 (42.86)
Good (51-75%)	2 (4.55)	7 (11.47)	4 (20.00)	10 (28.57)
Very good (Above 75%)	-	-	1 (5.00)	3 (8.57)
Total	44 (100.00)	61 (100.00)	20 (100.00)	35 (100.00)

Figures in parentheses indicate percentages.

A perusal of Table 8.1 reveals that 70.45 per cent of the marginal farmers and 54.10 per cent of the small farmers had poor knowledge about fertilizers, while the corresponding percentages in case of medium and big farmers were only 25 and 20 respectively.

In the category of average knowledge, the proportion of medium farmers was maximum. They were followed by big, small and marginal farmers. As high as 28.57 per cent of the big farmers and as low as 4.55 per cent of the marginal farmers had good knowledge about fertilizers. Only one medium and three big farmers had very good knowledge about fertilizers.

It is very interesting to note that not even a single marginal and small farmer had very good knowledge about fertilizers. In fact, the situation was not at all satisfactory even in case of medium and big farmers. Even in good knowledge category, the percentage of medium and big farmers was less than 30.00 per cent.

When the mean knowledge scores (Table 8.2) was taken into account, the marginal and small farmers had lower mean score as compared to medium and big farmers. It confirms to the general expectation that relatively, marginal and small farmers were less informed about different aspects of fertilizers. Medium and big farmers had better knowledge about fertilizers.

TABLE 8.2: Mean knowledge score of different categories of farmers

Category of farmers	n	$\bar{X}$	S
Marginal	44	12.295	7.076
Small	61	14.213	8.027
Medium	20	21.000	9.119
Big	35	23.685	10.220

Based on what the data given in Table 8.1 and Table 8.2 speak, it can be concluded that farmers in general lacked knowledge about fertilizers. This underlines the need for educating the farmers so as to promote fertilizer use.

4.5.2 Difference in knowledge about fertilizers in different categories of farmers

The medium and big farmers are likely to have comparatively more knowledge about fertilizers than marginal and small farmers. The statistical results support this proposition. In order to find out if there was any difference in knowledge between different categories of farmers, the mean knowledge score of each category was worked out and 't' test was applied as shown in Table 8.3.

TABLE 8.3: Test of significance of differences among mean knowledge scores of different categories of farmers

Category of farmers	't' value
Marginal vs. small	1.274 ^{NS}
Marginal vs. medium	4.153*
Marginal vs. big	5.859*
Small vs. medium	3.18*
Small vs. big	5.103*
Medium vs. big	0.974 ^{NS}

*Significant at 5 per cent level.

NS - Nonsignificant.

The above mentioned table shows that neither marginal and small nor medium and big farmers differed significantly in respect of their knowledge about fertilizers. However, there was significant difference between marginal and medium, marginal and big, small and medium and small and big farmers with respect to knowledge about different types of fertilizers, its method and time of application and the recommended dose for different crops.

The nonsignificant difference in case of marginal and small farmers is indicative of the fact that both had equally poor knowledge about fertilizers. Because of small land

holding size and poor economic condition, they might not be using fertilizers and hence not interested in seeking information about the same. The medium and big farmers had relatively better knowledge possibly because of better educational, social and economic status.

4.5.3 Opinion of the farmers about fertilizer use

It goes without saying that increasing fertilizer use is more than an economic problem and the farmers' opinion about fertilizer use is an important consideration. There is reason to believe that if one can change a farmers' opinion about fertilizer, a corresponding increase in fertilizer use will result. But before making systematic efforts to raise the level of fertilizer use by changing the opinion of farmers, it becomes imperative to determine what opinion they have about fertilizer use. As regards the respondents of this study, their reaction to the individual opinion statements are given in Table 8.4.

The percentage of different responses to the individual statements as presented in Table 8.4 indicates the intensity of the respondents' opinion about different aspects covering fertilizer use. The item which elicited the most favourable opinion of the farmers about fertilizers stated that "use of fertilizer is essential for maximising crop yield". As high as 71.25 per cent of the farmers were in favour of this statements, indicating that they were quite

TABLE 8.4: Opinion of farmers about fertilizer use

Sl. No.	Statements	Favou- able	Neutral	Unfavou- rable
1.	Continuous use of fertilizer makes the soil poor	46 (28.75)	33 (20.63)	81 (50.62)
2.	If used judiciously, fertilizer can increase yield in dry-land even during the year of scanty rainfall	76 (47.50)	25 (21.87)	49 (30.63)
3.	Use of fertilizer is essential for maximising crop yield	114 (71.25)	15 (9.38)	31 (19.37)
4.	Fertilized food crops have harmful effects on health	92 (57.50)	27 (16.88)	41 (25.62)
5.	Use of fertilizers deteriorate the taste of good grains	72 (45.00)	25 (15.63)	63 (39.37)
6.	Use of fertilizer is not much profitable in relation to cost involved	74 (46.25)	61 (38.12)	25 (15.63)
7.	Since adequate quantity of organic manures like FYM is not available, use of fertilizer is essential	102 (63.70)	18 (11.25)	44 (27.50)
8.	The effect of fertilizer is seen only in the crops for which it is applied; there is no residual effect	44 (27.50)	47 (29.37)	69 (43.13)
9.	Fertilizers give the crop enough stability to fight against adverse conditions	49 (30.63)	61 (38.12)	50 (31.25)
		46.25	22.36	31.19

Figures in parentheses indicate percentages.

aware of the importance of fertilizer in crop production.

Nearly 64 per cent of the farmers agreed that "since adequate quantity of organic manures like FYM is not available, use of fertilizer is a must". It appears that the farmers possibly preferred FYM than fertilizers, but because FYM was not available in adequate quantities, they very much felt the need of fertilizers. The National Council of Applied Economic Research (1964) found that one of the reasons that prevented the farmers from using fertilizers was their preference for organic manures.

Regarding the effect of fertilizers on health 57.50 per cent of the farmers of this study expressed their view against the belief that "fertilized food crops have harmful effect on health", and the proportion of those who indicated unfavourable opinion about fertilizers with respect to their effect on health were only 25.62 per cent. About 17 per cent of the farmers were undecided as to whether the use of chemical fertilizer in food crops was harmful for health.

About 48 per cent of the farmers were in agreement that "if used judiciously, fertilizer can increase yields in dryland even in an year of scanty rainfall". While 30.63 of them expressed their disagreement with the above statement, 21.87 per cent seemed to be indecisive as to whether fertilizer can increase yield in dryland under moisture-stress condition.

Nearly 47.00 per cent of the farmers rejected the notion that "use of fertilizer is not much profitable in relation to cost involved". Rahudkar (1958) found that "out of 337 cases studied, 79 per cent of the cultivators had a feeling that the cost of fertilizer was very high in relation to the extra profit they expected to derive from the use of fertilizers. But it was surprising to note that about 75 per cent of the cultivators were still willing to purchase fertilizers. After having the experience of using fertilizers, very few farmers (1.77%) felt that application of fertilizers to crop was not profitable". In the present study, it was found that only 15.60 per cent of the farmers felt that application of fertilizer to crop was not profitable and as much as 38.12 per cent were unaware about the cost benefit ratio.

As to the effects of fertilizer application on taste of food grains, 45.00 per cent of the farmers were negative to the idea that "use of fertilizer deteriorate the taste of good grains". However, nearly 40.00 per cent of them subscribed to the above view. Thus, a fairly high percentage of the farmers felt that fertilizers had adverse effects on taste of food grains.

Nearly 31.00 per cent of the farmers held the opinion that "fertilizers give the crop enough stability to fight against adverse condition". But somehow, the percentage of

farmers who were neither in agreement nor in disagreement with the above statement was higher, reflecting lack of their knowledge and experience regarding fertilizer use.

As high as 43.13 per cent of the farmers were of the opinion that "the effect of fertilizer is seen only in crops to which it is applied; it has no residual effect". But 27.50 per cent of them perhaps felt otherwise.

The item to which majority of the respondents expressed unfavourable opinion about fertilizers stated that "continuous use of fertilizer makes the soil poor". Only 28.75 per cent of them reacted against this belief, and as high as 50.62 per cent conformed to it. Sethi (1957), Programme Evaluation Organisation (1958) and the National Council of Applied Economic Research (1964) also observed such feeling on the part of the farmers.

Analysing the responses of the farmers to all the opinion statement taken together, it is obvious (Table 8.4) that nearly 47 per cent of them had favourable opinion, 31.19 per cent unfavourable opinion and the rest neither favourable nor unfavourable opinion about fertilizers. The fact that majority of the farmers had either unfavourable or neutral reaction to fertilizer use underlines the need for added efforts for promoting fertilizer use.

The mean opinion scores obtained by different categories of farmers with respect to fertilizer use are presented

in Table 8.5. The scores are indicative of how favourable or unfavourable opinion the farmers had about fertilizer use.

TABLE 8.5: Mean score and theoretical mid-point (neutral) score of different categories of farmers

Category of farmers	Theoretical mid point score	Mean score	Opinion
Marginal	18	16.05	Unfavourable
Small	18	16.60	Unfavourable
Medium	18	22.70	Favourable
Big	18	23.37	Favourable

As Table 8.5 shows, the mean scores of marginal and small farmers were less than the theoretical mid-point, indicating that they had unfavourable opinion about fertilizer use. In case of medium and big farmers, the mean scores were much higher than the theoretical mid-point score. This means that unlike those belonging to the marginal and small land holding categories, they had quite favourable opinion about fertilizer use.

The significance of difference in the opinion about fertilizer use held by different categories of farmers is shown in Table 8.6.

TABLE 8.6: Test of significance of differences in opinion of different categories of farmers about fertilizer use.

Category of farmers	't' value
Marginal vs. small	1.84 ^{NS}
Marginal vs. medium	10.08*
Marginal vs. big	20.69*
Small vs. medium	14.99*
Small vs. big	20.46*
Medium vs. big	1.44 ^{NS}

*Significant at 5 per cent level

NS - Nonsignificant.

It is obvious from the 't' values given in Table 8.6 that except between medium and big farmers, the difference in opinion about fertilizer use between any other two groups was significant.

The nonsignificant difference in case of marginal and small farmers is indicative of the fact that both the categories of farmers had equally unfavourable opinion about fertilizer use. Similarly, the nonsignificant difference between medium and big farmers shows that both these groups had equally favourable opinion about fertilizer use.

SECTION VI

4.6 Efforts in promotion of fertilizer use4.6.1 Sources of information used by different categories of farmers

Agricultural planners have rightly called for a regular flow of communication for rapid rural transformation. A farmer can get information from a variety of sources available. It was considered necessary to know as to which sources were mostly utilized by the farmers. A critical analysis of information source pattern utilized by the farmers may help in working out a better strategy for speedy and effective transfer of technology in dryland areas.

With a view to having an idea regarding information sources which are utilized by the farmers in dryland areas under study, the respondents were asked as to how often they used different sources of information about fertilizer use. Their responses are summarised in Table 9.1

A perusal of Table 9.2 reveals significant differences among the four categories of farmers with respect to all but one of the 10 different sources of information. Coming to the inter-pair differences (Table 9.3), marginal and small farmers differed significantly from each other with respect to neighbours/friends/relatives, progressive farmers, private

TABLE 9.1: Intensity of use of personal sources of information about fertilizer use by different categories of farmers

Sl. No.	Sources	Average weighted score of different sources and their rank							
		Marginal	Rank	Small	Rank	Medium	Rank	Big	Rank
1.	Neighbours/friends/relatives	1.18	I	0.69	III	0.30	VIII	0.20	X
2.	Progressive farmers	0.61	III	1.41	I	1.35	III	1.23	II
3.	Private fertilizer dealers	0.29	V	0.68	IV	1.05	IV	0.83	IV
4.	Representatives of fertilizer firms	-	-	-	-	0.40	VII	0.46	VI
5.	Co-operative personnel dealing in fertilizer	-	-	-	-	0.20	IX	0.43	VIII
6.	Specialists/scientists of Agricultural universities	-	-	-	-	0.55	VI	0.45	VII
7.	Specialists/scientists of I.C.A.R. Institutes	-	-	-	-	0.15	X	0.26	IX
8.	Agricultural Development Officer (A.D.O.)	0.32	IV	0.65	V	1.45	I	1.48	I
9.	Village Extension worker (VEW)	1.00	II	1.38	II	1.36	II	1.03	III
10.	Subject Matter Specialists	-	-	0.09	VI	0.56	V	0.60	V

TABLE 9.2: Variance between different categories of farmers
one each personal source

Sl. No.	Sources of information	S.S.	M.S.	'F'
1.	Neighbours/friends/relatives	22.01 77.44	7.33 0.49	14.78*
2.	Progressive farmers	17.79 87.91	5.93 0.56	10.59*
3.	Private fertilizer dealers	9.94 70.16	3.31 0.45	7.35*
4.	Co-operative personnel dealing in fertilizers	4.98 15.77	1.66 0.10	16.6*
5.	Representatives of fertilizer firms	6.91 14.49	2.30 0.11	20.90*
6.	Specialists/scientists of Agri- cultural universities	8.26 19.52	2.75 0.13	21.15*
7.	Specialists/scientists of I.C.A.R. Institutes	1.86 9.24	0.62 0.06	10.33*
8.,	Agricultural Development Officer (A.D.O.)	96.08 79.02	12.02 0.50	24.05*
9.	Village Extension Worker (V.E.W.)	5.15 75.85	1.72 0.48	3.58 ^{NS}
10.	SMS of the state department of Agriculture	10.21 24.75	3.40 0.16	21.55*

*Significant at 1 per cent level
NS - Nonsignificant.

TABLE 9.3: Test of significance of differences among mean knowledge scores of different categories of farmers

Sl. No.	Sources of information	Marginal-small		Marginal-medium		Marginal-big		Small-medium		Small-big		Medium-big	
		C.D.	M.D.	C.D.	M.D.	C.D.	M.D.	C.D.	M.D.	C.D.	M.D.	C.D.	M.D.
1.	Neighbours/friends/relatives	0.27	0.49*	0.37	0.88*	0.31	0.98*	0.35	0.39*	0.29	0.49*	0.39	0.10 ^{NS}
2.	Progressive farmers	0.29	0.80*	0.39	0.74*	0.34	0.62*	0.38	0.06 ^{NS}	0.31	0.18 ^{NS}	0.41	0.12 ^{NS}
3.	Private fertilizer dealer	0.26	0.40*	0.35	0.76*	0.31	0.54*	0.34	0.36*	0.28	0.14 ^{NS}	0.37	0.22 ^{NS}
4.	Co-operative personnel dealing in fertilizers	0.12	0.00 ^{NS}	0.16	0.20*	0.14	0.43*	0.16	0.20*	0.13	0.43*	0.17	0.23*
5.	Representatives of fertilizer firm	0.13	0.00 ^{NS}	0.17	0.40*	0.15	0.46*	0.16	0.40*	0.14	0.46*	0.18	0.06 ^{NS}
6.	Specialist/scientists of agricultural universities	0.14	0.00 ^{NS}	0.19	0.55*	0.16	0.43*	0.18	0.55*	0.15	0.43*	0.20	0.12 ^{NS}
7.	Specialists/scientists of ICAR Institutes	0.05	0.00 ^{NS}	0.13	0.15*	0.11	0.26*	0.12	0.15*	0.10	0.26*	0.13	0.11 ^{NS}
8.	A.D.O.	0.27	0.33*	0.04	1.13*	0.32	0.16*	0.35	0.80*	0.30	0.83*	0.39	0.03 ^{NS}
9.	S.M.S.	0.15	0.09 ^{NS}	0.21	0.55*	0.57	0.60*	0.20	0.46*	0.17	0.51*	0.22	0.05 ^{NS}
*Significant at 5 per cent level												C.D - Critical difference	
NS - Nonsignificant												M.D. - Difference of mean.	

fertilizer dealers and agricultural development officers. Between marginal and medium as well as marginal and big, the differences were found significant with respect to all the nine sources of information used.

Except with respect to progressive farmers in case of small and medium farmers and progressive farmers as well as private fertilizer dealers in case of small and big farmers, the small farmers differed significantly from the medium and big farmers with respect to all other sources of information. Between medium and big farmers, the difference was found significant in case of only one source of information, i.e. co-operative personnel dealing in fertilizers. The differences between marginal and small farmers were found significant with respect to four sources of information including neighbours/friends/relatives, progressive farmers, private fertilizer dealers and Agricultural Development Officers.

It is evident from Table 9.1 that all the four categories of farmers taken together, Village Extension Worker was the most important source of information about fertilizer use. Being the grass root extension functionary, the VEW is easily available to the farmers. His area of operation is very small under the T&V system which also covers the area under study. The VEW's contact with different categories of farmers shows no significant difference indicating unbiased effect of the source.

A perusal of Table 9.1 further reveals that the source of information most frequently used by marginal farmers was neighbours/friends/relatives, other sources of contact in descending order being VEW, progressive farmers, A.D.O. and private fertilizer dealers. The most frequently used source of information in case of small farmers was progressive farmers, followed by VEW, neighbours/friends/relatives, private fertilizer dealers, A.D.O. and SMS of state department of agriculture. Among all the sources of information, the one used most by medium farmers was A.D.O., followed in order by VEW, SMS, specialists/scientists of agricultural universities, representatives of fertilizer firms, neighbours/friends/relatives, co-operatives personnel dealing in fertilizers and specialists/scientists of I.C.A.R. Institutes. As regards big farmers, they were found using most A.D.O. for information about fertilizer use. Other sources of information used by them in order of contact were progressive farmers, VEW, private fertilizer dealers, SMS of state department of agriculture, representatives of fertilizer firms, specialists/scientists of agricultural university, co-operative personnel dealing in fertilizers, specialists/scientists of I.C.A.R. Institutes and neighbours/friends/relatives.

SMSs of the State Department of Agriculture were ranked fifth by medium and big farmers and sixth by small farmers, whereas specialists/scientists of agricultural university were ranked sixth and seventh by medium and big farmers respectively.

SMS, and specialists/scientists of agricultural university got low rank possibly because they were inaccessible to the farmers of the area.

Other sources of information had very low average weighted score in case of medium and big farmers and these sources were not at all used by marginal and small farmers.

Having very small land holdings, the marginal farmers can not sustain their families by farm income alone. They have to supplement their income from other sources. Since farming is not their main source of income, they do not feel immediate need to have information about farming from outside sources. They also lack contact with such sources because of poor resource base and illiteracy. Small farmers in general are relatively more involved in farming. But they also lack contact with outside sources and hence seek advice from progressive farmers. Unlike both these groups, medium and big farmers have good contact also with outside sources because of larger holding size, better resources, better education and more influence in the community. It is in terms of all these factors that the difference in frequency of use of different sources of information by different categories of farmers may be explained.

One reason why cosmopolite sources of information about fertilizer did not find a mention by many farmers might be that they had been using fertilizer for last so many years and hence did not consider these sources very important in promoting

fertilizer use. Possibly thinking in this light. Wilkening (1950) commented, "... those farm operations, which have been followed in community for an extended period of time have a body of folk knowledge built around them. This is not true for those operations which have been recently introduced into the community. Sources of information about these new types of operations are not usually neighbourhood and community associates but agricultural agencies, farm magazines and extra community sources".

The Indian Institute of Mass Communication (1968) also found village level workers as the most important source of information. Sankariah (1969) reported that progressive farmers were consulted by the farmers of non-progressive villages as their second most important source, next only to demonstration. He also reported that even in the progressive villages, farmers perceived the progressive farmers as their third important source in order of importance. These findings therefore, support the present findings.

Private fertilizer dealers were ranked fifth by marginal farmers and fourth by small, medium and big farmers. These dealers lack credibility and hence are not among the most used sources of information.

4.6.2 Exposure to impersonal sources of information

It appears from Table 9.4 that all the four categories of farmers perceived demonstration as the most common

TABLE 9.4: Distribution of farmers as per their exposure to impersonal sources of information on fertilizer use

Sl. No.	Extension methods	Frequency of participation				
		Marginal	Small	Medium	Big	Total
1.	Demonstration	8 (18.18)	19 (31.15)	16 (80.00)	27 (77.14)	70 (43.75)
2.	Kisan mela/exhibition	5 (11.36)	11 (18.03)	17 (85.00)	30 (85.71)	63 (39.38)
3.	Field day	-	5 (8.19)	11 (55.00)	17 (48.57)	33 (20.62)
4.	Film-show	-	- (15.00)	3 (15.00)	4 (11.43)	7 (4.37)
5.	Educational tour to Agricultural universities/I.C.A.R. Institutes/KVK Centres	-	7 (11.47)	4 (20.00)	9 (25.71)	20 (12.50)

Figures in parentheses indicate percentages.

impersonal source of information. About 80 per cent of the medium and big farmers participated in demonstration as against only 18.18 and 31.15 per cent respectively of marginal and small farmers. Almost similar pattern was also observed in case of visit to Kisan Mela/exhibition. About 85 per cent of the medium and big farmers

reported having visited kisan mela/exhibition, while only 11.36 per cent of the marginal and 18.03 per cent of small farmers had visited the same. About 50 per cent of the medium and big farmers and only 8.19 per cent of the small farmers participated in field day. Very few medium and big farmers happened to see film show on fertilizer. Only 25.71 per cent of the small farmers went on educational tour to agricultural universities/ICAR Institutes and KVK centres. None of the respondents ever took part in fertilizer festivals, village meeting for fertilizer promotion and group discussion meeting.

The above table further reveals that maximum participation of big farmers was in Kisan mela/exhibition followed by demonstration, field day, educational tour of agricultural universities/ICAR Institutes/KVK centres and film show. Almost similar pattern was observed in case of medium farmers. In case of small farmers, maximum participation was observed in demonstration followed by kisan mela/exhibition, educational tour of agricultural universities/ICAR Institutes/KVK centres and field day. Very few marginal farmers had access to impersonal sources of information and that too to only demonstration and kisan mela/exhibition.

On the whole, maximum participation of farmers was observed in demonstration (43.75%) followed by kisan mela/exhibition (39.38%), field day (20.62%), educational tour of agricultural universities/ICAR Institutes/KVK centres (12.5%)

and film show (4.37%).

The findings revealed that demonstration was the most common impersonal source of information about fertilizer use to all the four categories of farmers. It was possibly because fertilizer application requires some skill on the part of the farmers. Demonstration gives an opportunity to the farmers to acquire necessary skill in relation to fertilizer application. The finding of this study is supported by the findings of Reddy and Kelvin (1968), Singh (1968), Roy et al. (1969), Sankariah (1968), Sandhu (1970) and Singh (1971) who reported that demonstration was the most common extension activities in case of fertilizer information.

Visit to kisan mela/exhibition was more in case of medium and big farmers and less in case of marginal and small farmers possibly because of differences in their economic condition and contact with extension personnel. None of the marginal and small farmers and very few of the medium and big farmers participated in Field Day, may be because it is not very popular in that area. The possible reason for differences in participation by different groups in educational tour to agricultural universities/ICAR Institutes/KVK centres might be the same as that in case of visit to Kisan mela/exhibition.

Field Day, fertilizer festivals, village meeting for fertilizer promotion and group discussion meeting did not seem to be popular in that area and hence there was little

no participation of the farmers in these activities.

Speedy and effective transfer of technology is basic for agricultural development. It is in this context that participation in extension activities assumes great significance. Higher level of participation in extension activities are expected to create an impact and improve the farming situation. Therefore, the State Department of Agriculture should organise more and more such activities involving different categories of farmers therein.

4.6.3 Extent of use of service facilities

It can be observed from Table 9.5 that out of the three major service facilities available to the farmers, soil-testing facility was relatively more utilized. The other two service facilities in respect of fertilizer promotion were irrigation water testing facilities and supply of fertilizers on credit. It can be further noted that only 42.50 per cent of the farmers under study used soil testing facility. While 39.38 percent of them used this facility only once, less than two per cent used twice and thrice during the last two years. With respect to irrigation water testing and fertilizer on credit, it is observed that 15.63 per cent and 9.38 per cent of the respondents respectively used these facilities only once during the last two years. None of the respondents used irrigation water testing and credit for fertilizer even twice.

TABLE 9.5: Distribution of farmers by frequency of use of different services

Sl. No.	Kind of service facilities	Number of times used by the farmers during last two years				Extent of use
		Never	Once	Twice	Three and more	
1.	Soil testing	92 (57.00)	63 (39.38)	3 (1.87)	2 (1.25)	68 (42.50)
2.	Irrigation water testing	135 (84.37)	25 (15.63)	-	-	25 (15.63)
3.	Fertilizer on credit	145 (90.62)	15 (9.38)	-	-	15 (9.38)

Figures in parentheses indicate percentages.

The findings revealed that the extent of use of services by the farmers in general was very poor. This is indicated by the fact that soil testing, which is very basic to the efficient use of fertilizers, was used only by 42.5 per cent of the farmers. It indicates that either soil testing facility is not available within easy distance and if available, the service provided is not satisfactory. Still another reason for poor use of this service may be lack of faith on the part of the farmers in soil testing report. The low use of credit might be because of non-payment of previous loan and/or bitter experience in taking loan and its repayment.

4.6.4 Extent of access to different mass-media

Now a days, mass-media are considered to be very important sources of communication for every section of the society. Radio, T.V. and printed materials come under mass media sources. Because of low literacy level, the use of newspapers is still very limited. On the other hand, T.V. is still to become a medium of the mass in the society. High cost of TV sets and low purchasing power of people are mainly responsible for this medium not being used by the masses. No doubt, radio is a very popular mass medium but somehow people use it generally for entertainment and current news.

It can be observed from Table 9.6 that the farmers belonging to the medium land-holding category were ahead of the other three categories in terms of access to radio. They were followed by big, small and marginal farmers. Almost similar trend was also observed with respect to TV and printed materials. However, medium farmers were exposed to TV, more than big ones.

The group-wise analysis further indicates that the extent of exposure of all the four categories of farmers was maximum to radio. But while the small, medium and big category farmers were exposed more to printed materials than to TV, it was just the reverse in case of marginal farmers obviously because most of them were illiterate.

TABLE 9.6: Extent of exposure to different mass media

Category of farmers	Radio		Television		Printed material	
	Total weighted score	Average weighted score	Total weighted score	Average weighted score	Total weighted score	Average weighted score
Marginal	30	0.681	3	0.068	1	0.022
Small	63	1.032	7	0.114	14	0.229
Medium	34	1.78	12	0.631	16	0.842
Big	38	1.08	9	0.257	23	0.657

4.6.5 Major institutions and their promotional activities

The attack on rural poverty is an attack on the way of life of the people. The best approach to making the life of poor farmers fuller and richer is indirect and continuous educational process of guiding, motivating and inducing them to adopt modern agricultural practices. Awareness must be increased, interest created and action promoted on their part for change from subsistence to modern farming by providing them not only relevant technical know-how and the needed supplies and services but also necessary incentives and safeguards. All this is possible through various agricultural services and promotional activities. There are a number of agencies and organisations which carry out these promotional activities. In the district of Gurgaon where this study was made, the following organisations are involved in various promotional activities with a view to helping the farmers adopt the recommended package of farm practices including fertiliser use.

1. IFFCO
2. KRIBHCO
3. KGK (Haryana Agriculture University, Hisar)
4. KVR (Indian Agricultural Research Institute,
New Delhi)
5. State Department of Agriculture

Of the five organisations, KGK conducts a relatively larger number of fertiliser - related promotional activities

for the benefit of farmers, viz., result demonstrations, method demonstrations, farmers meetings, field days, campaigns, fairs and exhibitions, training programmes, film shows and special projects.

Nex to KGK is IFFCO. It plays a vital role in agricultural development. It has its extension network spread almost throughout the country. Its field staff are deeply involved in a number of promotional activities like demonstrations, field days, farmers meetings, crop seminars, distribution of seed-cum-fertilizer drills, and other equipments, campaigns, soil-testing. It has also adopted some villages for intensive extension work.

Besides imparting training to farmers, KVK is also carrying out various promotional activities like block demonstrations, field days. It also helps the farmers in arranging necessary inputs like seeds, fertilizers, pesticides, etc.

In line with IFFCO, KRIBHCO is also engaged in some promotional activities like farmers meetings, field days, block demonstrations and group discussion. A special 'Crash programme' is also undertaken by this organisation. The main focus in this programme is on sale and use of fertilizer, making the farmers aware about the availability and price of fertilizers. 'This programme also highlights special problems of the area twice in a year - before every kharif and rabi season, suggesting remedial measures.

The promotional activities of the State Department of Agriculture include mini-kit distribution, training, free distribution of extension publications, soil and water testing, supply of necessary inputs and services including availability of credit and subsidy. The state government also give short-term agricultural loan through mini bank, known as Central Co-operative Bank. Through these banks, loan is given in cash for seed and irrigation and in kind of fertilizer.

Gurgaon Gramin Bank is also operating in the area under study, providing crop loan to the farmers in addition to medium and long-term loans.

SECTION VII

4.7 Inhibitors and promoters of fertilizers use

4.7.1 Constraints to fertilizer use as perceived by the farmers and remedial measures suggested by them

As given in methodology chapter, a list of 22 problems in fertilizer use was prepared and the farmers were asked to indicate against each whether it was 'very much a constraint', 'somewhat a constraint' and 'not a constraint'. The weightage given to these response categories was 3, 2 and 1 respectively. All the problems were ranked on the basis of average weighted scores.

The farmers were just able to suggest measures to overcome the constraints to fertilizer use.

While Table 10.1 presents the problems faced by marginal-small and medium-big farmers, Table 10.2 gives the suggestion made by the two groups for promoting fertilizer use in dry-land. In view of the similarity in responses, marginal farmers were clubbed with small and medium with big farmers.

A perusal of Table 10.1 reveals that among the problems faced, 'poor-economic condition' was ranked first by marginal-small farmers and fifth by medium-big farmers.

It is worth mentioning here that 'unavailability of fertilizers within easy reach' was assigned first rank by medium-big farmers and as low as thirteenth rank by marginal-small farmers. 'High cost of fertilizers' and 'nonavailability of crop loan in time' were respectively ranked second and third by marginal-small farmers and third and fourth by medium-big farmers. While 'unavailability of fertilizers in time' was given as high as second rank medium-big farmers, it got as low as fourteenth rank by marginal-small farmers.

'Lack of knowledge about which fertilizer to use in a particular crop, in what quantity, when and how' was the third most important problem in case of marginal-small farmers. It was however, given as low as tenth rank by medium-big farmers.

TABLE 10.1: Constraints to fertilizer use as perceived by different categories of farmers

Sl. No.	Problems perceived	Marginal & small farmers (N=105)			Medium & big farmers (N=55)		
		Total weighed score	Average weighed score	Rank order	Total weighed score	Average weighed score	Rank order
1.	Poor economic condition of the farmers	210	2.00	I	95	1.72	V
2.	High cost of fertilizer	208	1.98	II	104	1.89	III
3.	Nonavailability of crop loan in time	203	1.93	III	97	1.76	IV
4.	Lack of knowledge about which fertilizer to use in a particular crop, in what quantity, when and how	191	1.82	IV	65	1.18	X
5.	Inadequate subsidy on fertilizers	185	1.76	V	64	1.16	XI
6.	Low price of farm produce	181	1.72	VI	74	1.34	VIII
7.	Poor economic return from fertilizer use	175	1.66	VII	72	1.30	IX
8.	Uncertainty of subsequent rain	170	1.61	VIII	89	1.61	VI
9.	Risk of crop failure	165	1.57	IX	85	1.54	VII
10.	Burning effect of fertilizers on crops	159	1.51	X	25	0.45	XIX
11.	Adverse effect of fertilizers on soil fertility	143	1.36	XI	39	0.70	XVII
12.	Lack of transport facilities	127	1.20	XII	46	0.83	XV

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TABLE 10.1 (CONTD.)

Sl. No.	Problems perceived	Marginal & small farmers (N=105)			Medium & big farmers (N=55)		
		Total weighed score	Average weighed score	Rank order	Total weighed score	Average weighed score	Rank order
13.	Unavailability of fertilizer within easy reach	111	1.06	XIII	109	1.98	I
14.	Lack of guidance by extension workers about fertilizer use	106	1.01	XVI	49	0.89	XIV
15.	Susceptibility of fertilized crop to pests and diseases	82	0.78	XV	55	1.00	XIII
16.	Unavailability of short-duration, drought-resistant and fertilizer-responsive varieties	53	0.50	XVI	41	0.74	XVI
17.	Unavailability of fertilizers in time	39	0.37	XVII	108	1.96	II
18.	Unavailability of fertilizers in required quantities	23	0.27	XVIII	22	0.40	XX
19.	Lack of moisture in the soil at the time of sowing	15	0.14	XIX	26	0.47	XVIII
20.	Under-bagging and adulteration	9	0.08	XX	59	1.07	XII
21.	Poor mass-media coverage of fertilizer promotion programme	-	-	-	19	0.34	XXI
22.	Lack of low-cost bullock-drawn light implements for fertilizer placement	-	-	-	13	0.23	XXII

TABLE 10.2: Suggestions given by different categories of farmers for promoting fertilizer use

Sl. No.	Suggestions	Marginal & small farmers (N=105)			Medium & big farmers (N=55)		
		Fre- quen- cy	Per- cent- age	Rank order	Fre- quen- cy	Per- cent- age	Rank order
1.	Fertilizer should be made available within easy reach	105	100.00	I	54	98.18	I
2.	Adequate subsidy should be given	101	96.10	II	49	89.09	IV
3.	Fertilizer should be made available to the farmers of dryland area at cheaper price	96	91.42	III	51	92.72	III
4.	Procedures involved in grant of crop loan should be simplified	91	86.66	IV	85.45		V
5.	Crop loan should be given to the farmers entirely in cash	87	82.85	V	39	70.90	VII
6.	Concerned officers should camp in the village to dispose off loan application of the farmers	81	77.14	VI	29	52.72	X
7.	Training on all aspects of fertilizers use should be given to the farmers at suitable intervals right in the villages	80	76.19	VII	42	72.36	VI
8.	Fertilizer depots should be opened even in far-flung remote areas	78	74.28	VIII	37	67.27	VIII

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TABLE 10.2 (CONTD.)

Sl. No.	Suggestions	Marginal & small farmers (N=105)			Medium & big farmers (N=55)		
		Frequency	Percentage	Rank order	Frequency	Percentage	Rank order
9.	Fertilizer should be made available in time	75	71.42	IX	53	96.36	II
10.	Marginal & small farmers should be eligible for fresh loans even if they fail to repay earlier loans for a year or two under adverse conditions	74	70.47	X	-	-	-
11.	Crop insurance against all natural calamities like drought, frost, hail-storm and serious pest incidence should be introduced at normal premium	68	64.76	XI	32	50.18	-
12.	Free extension literature in regional languages should be distributed	44	41.90	XII	27	49.09	XII
13.	More and more successful fertilizer demonstration on farmers' fields should be conducted	-	-	-	25	4.545	XIII
14.	Radio and T.V. should have more coverage of fertilizer programme	-	-	-	16	29.09	XIV
15.	Low-cost bullock-drawn light implements for fertilizer placement should be made available	-	-	-	28	50.90	XI

'Inadequate subsidy on fertilizers' was given fifth and eleventh rank by marginal-small and medium-big farmers respectively.

Similarly 'low price farm produce' and 'poor economic return from fertilizer use' were assigned sixth and eleventh and eighth and ninth ranks respectively by marginal-small and medium-big farmers.

The differences in ranking of the problems referred to above by marginal-small and medium-big farmers may be explained mainly in terms of differences in their resource base and educational level. Having poor resource base and low educational level, marginal-small farmers obviously consider economic and educational problems more important as compared to medium-big farmers who have relatively better economic resources and are more educated. All this signifies the need for better economic incentives and education for marginal-small farmers. Several studies have also found poor economic condition and lack of knowledge about fertilizers to be the main factors responsible for low level of fertilizer use.

Among all the inputs required for modernization of agriculture, fertilizers are decidedly the costliest one. It is difficult for marginal-small farmers in general and those in dryland areas in particular to apply fertilizers

to their crops unless they are given incentives by way of adequate subsidy, easy credit at lower rate of interest, reasonable price for their farm produce and things like that. It is equally important that they are imparted necessary knowledge about and skill in fertilizer use.

'Uncertainty of subsequent rain' and 'risk of crop failure' get eighth and ninth ranks in case of marginal-small farmers and sixth and seventh ranks in case of medium-big farmers respectively. These problems were given higher ranks by medium-big farmers as compared to marginal-small ones possibly because they stand to lose more when their crop fails. Viewing from another angle, the above problems were considered less important by marginal-small farmers because they hardly use any fertilizers.

Interestingly, 'burning effect of fertilizers on crops' and their 'adverse effect on soil fertility' ranked tenth and eleventh in case of marginal-small farmers and nineteenth and seventeenth in case of medium-big farmers. It clearly shows that the farmers using fertilizers do not feel so strong about the adverse effects of fertilizers on crops and soil fertility. It is also because of such wrong notions that marginal-small farmers do not take to the use of fertilizers.

Among other not-so-important problems in fertilizer use which found mention by both the group of farmers were:

'lack of guidance by the extension workers about fertilizer use', 'susceptibility of fertilized crops to pests and diseases', 'lack of moisture in the soil at the time of sowing' and 'underbagging and adulteration'. 'Poor mass-media coverage of fertilizer promotion programme' and 'lack of low-cost bullock-drawn light implements for fertilizer placement' as problems in fertilizer use found mention by medium-big farmers.

In all, fifteen suggestions were made by the respondents for promoting fertilizer use. Based on the frequency of the respondents making a suggestions, all the suggestions were ranked from 1 to 15 in order of importance. Higher the frequency of respondents mentioning a problem, more important was considered that particular problem. Somehow, the pattern of ranking of suggestions was not similar to that of corresponding problems faced by the two groups of respondents. There was only one problem and that too in case of medium-big farmers which was given first rank and was accordingly given suggestion by the highest percentage of this group. Of the fifteen suggestions, one found a mention by only marginal-small farmers and three by only medium-big farmers. Further, no suggestion was made by any of the two groups for seven out of twenty two problems.

The suggestions that 'fertilizer should be made available within easy reach' and 'fertilizer should be made

available to the farmers of dryland areas at cheaper price' were ranked first and third respectively by medium-big farmers. In terms of frequency, the second most important suggestion given by marginal-small farmers was with respect to subsidy on fertilizer, whereas this suggestion got fourth rank in case of medium-big farmers. The suggestion that the 'procedures involved in grant of crop loan should be simplified' was the fourth and fifth most important suggestion coming from marginal-small and medium-big farmers respectively. It deserves special mention here that the second most important suggestion made by medium-big farmers was in respect of timely availability of fertilizer. It, however, got ninth rank among the suggestions made by marginal-small farmers possibly because they hardly made use of any fertilizers. Any way, regardless of differential importance of the problems in fertilizer use the farmers are faced with and the suggestions they make to overcome the same, any effective fertilizer-promoting extension strategy has to take into account all these problems and suggestions.

4.7.2 Factors responsible for low use of fertilizer in dryland as perceived by scientists and extension personnel and suggestions made by them to overcome the same

There are multitudes of factors responsible for low fertilizer use. An exhaustive list of these factors emanating from studies and accumulated field experiences can be prepared. However, these factors are not operative everywhere

and with every group of farmers - small and big, resource poor and resource rich, illiterate and literate. While most of these factors are common in both irrigated and rainfed areas, some are specific to dryland areas. It therefore, bears significance to know as to what factors affect fertilizer use in a specific dryland area. An attempt was made in this study to find out these factors as perceived by scientists and extension personnel. The information obtained in this regard is summarized in Table 10.3.

It is clear from a look at Table 10.3 that all the 23 factors responsible for low fertilizer use found mention by both scientists as well as extension personnel. If the percentage of respondents mentioning a particular factor is indicative of its importance, we find that both the groups perceived all but a few factors differently as to their importance. 'Poor economic condition' of the farmers was considered as the most important factor for low fertilizer use not only by extension personnel but by scientists as well. Similarly, 'unavailability of crop loan in time' and low adoption of recommended fertilizer-response varieties were ranked sixth and seventh respectively, 'high cost of fertilizer' and 'risk of crop failure due to drought/dry spell/low soil moisture' were viewed almost equally important by both the groups. They seemed to have differential perception regarding the relative importance of all other

TABLE 10.3: Factors responsible for low use of fertilizer in dryland as perceived by scientists and extension personnel

Sl. No.	Factors	Scientists (N=50)		Extension personnel (N=100)	
		Frequ- ency	Rank order	Frequ- ency	Rank order
1.	Poor economic condition of the farmers	40 (80.00)	I	90 (90.00)	I
2.	Lack of knowledge about dose, time and method of fertilizer application	33 (78.00)	II	71 (71.00)	V
3.	High cost of fertilizer	37 (74.00)	III	82 (82.00)	II
4.	Risk of crop failure due to drought/dry spell/low soil moisture	35 (70.00)	IV	78 (78.00)	III
5.	Unavailability of short-duration drought-resistant and fertilizer-responsive varieties	27 (54.00)	V	57 (57.00)	VIII
6.	Unavailability of crop loan in time	26 (52.00)	VI	70 (70.00)	VI
7.	Low adoption of recommended fertilizer responsive varieties	25 (50.00)	VII	60 (60.00)	VII
8.	Lack of demonstration on use of fertilizer	24 (48.00)	VIII	30 (30.00)	XIV

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TABLE 10.3 (CONTD.)

Sl. No.	Factors	Scientists (N=50)		Extension personnel (N=100)	
		Freq- uency	Rank	Freq- quency	Rank
9.	Inadequate and erratic distribu- tion of rainfall	23 (46.00)	IX	76 (76.00)	IV
10.	Poor diffusion of dryland tech- nology	21 (42.00)	X	25 (25.00)	XVIII
11.	Farmers' wrong notion about injurious effect of fertilizer on dryland crops	18 (36.00)	XI	32 (32.00)	XIII
12.	Predominance of low-value <u>kharif</u> crops like jowar, bajra, guar, etc.	17 (34.00)	XII	28 (28.00)	XVI
13.	Lack of improved implements for drylands	16 (32.00)	XIII	24 (24.00)	XIX
14.	Lack of knowledge about moisture- conservation and water-harvesting techniques	15 (30.00)	XIV	16 (16.00)	XXII
15.	Nonavailability of fertilizers at right time and within easy reach	13 (26.00)	XV	51 (51.00)	X
16.	Procedural complexities involved in availing credit	12 (24.00)	XVI	54 (54.00)	IX
17.	Illiteracy of the farmers	11 (22.00)	XVII	29 (29.00)	XV
18.	Inadequate mass-media coverage of fertilizer promotion programme	10 (20.00)	XVIII	7 (7.00)	XXIII
19.	Low risk-bearing capacity of the farmers	9 (18.00)	XIX	27 (27.00)	XVII
20.	Red-tapism in grant of subsidy	8 (16.00)	XX	48 (48.00)	XI

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TABLE 10.3 (CONTD.)

Sl. No.	Factors	Scientists N=50)		Extension personnel (N=100)	
		Fre- quency	Rank	Fre quency	Rank
21.	Brackish underground water	7 (14.00)	XXI	38 (38.00)	XII
22.	Lack of moisture in the soil at the time of sowing	6 (12.00)	XXII	21 (21.00)	XX
23.	Poor transport facility	5 (10.00)	XXIII	19 (19.00)	XXI

factors affecting fertilizer use. One factor that makes for the difference in their perception is that unlike scientists, extension personnel are in close contact with farmers and as such, are better aware of the specific problems in fertilizer use the farmers are faced with. Any way, the difference in perception of scientists and extension personnel may be attributed to a number of factors.

The suggestions given by scientists and extension personnel for promoting fertilizer use in dryland areas are presented in Table 10.4.

TABLE 10.4: Measures to promote fertilizer use in dryland as suggested by scientists and extension personnel

Sl. No.	Suggestions	Scientists (N=50)		Extension personnel (N=100)	
		Fre- quency	Rank order	Fre quency	Rank order
1.	Adequate subsidy on fertilizer and improved seeds	35 (70.00)	I	92 (92.00)	I
2.	Simplification of crop loan procedures	32 (64.00)	II	58 (58.00)	V
3.	Periodic organisation of workshops, symposia, etc. on efficient use of fertilizer under dryland conditions	31 (62.00)	III	60 (60.00)	IV
4.	Crop insurance against all natural calamities including drought, frost, hailstorm, and attack of insects pests and diseases	28 (56.00)	IV	46 (46.00)	VII
5.	Periodic organisation of farmers' fair, show and exhibition at lower levels	27 (54.00)	V	63 (63.00)	II
6.	Free distribution of extension literature in regional languages among the farmers	27 (54.00)	V	40 (40.00)	X
7.	Effective use of water-harvesting and conservation measures	26 (52.00)	VI	32 (32.00)	XIII
8.	Timely availability of good quality fertilizers within easy reach	23 (46.00)	VII	55 (55.00)	VI
9.	Distribution of minikit seeds of short duration drought resistant varieties	23 (46.00)	VII	41 (41.00)	IX
10.	Proper guidance to the farmers through demonstrations, field days and crop competitions on economics of fertilizer use in dryland conditions	22 (44.00)	VIII	23 (23.00)	XVIII

contd.....

TABLE 10.4 (CONTD.)

Sl. No.	Suggestions	Scientists (N=50)		Extension personnel (N=100)	
		Fre- quency	Rank order	Fre- quency	Rank order
11.	Farmers' visit to nearby demon- strations, research farms, KVKs' farms and progressive farmers' field	22 (44.00)	VIII	29 (29.00)	XIV
12.	Easy availability of credit in time at reasonable rate of interest	22 (44.00)	VIII	61 (61.00)	III
13.	More effective use of mass media for fertilizer promotion	21 (42.00)	IX	37 (37.00)	XII
14.	Imparting peripatetic training to farmers on fertilizer use under dryland conditions	21 (42.00)	IX	45 (45.00)	VIII
15.	Intensive extension efforts to make the farmers aware that soils are more hungry than thirsty	20 (40.00)	X	12 (12.00)	XXVI
16.	Research on efficient use of fer- tilizer under dryland conditions	19 (38.00)	XI	18 (18.00)	XXII
17.	Incentives on fertilizer use under dryland conditions	18 (36.00)	XII	27 (27.00)	XVI
18.	Speedy and effective transfer of dry farming technology	17 (34.00)	XIII	21 (21.00)	21
19.	Operational Research Project in dryland areas	17 (34.00)	XIII	16 (16.00)	XXIII
20.	Long-term fertilizer experiment in dryland	16 (32.00)	XIV	11 (11.00)	XXVII
21.	Evolving suitable cropping/farm- ing systems and agronomic prac- tices for dryland	16 (32.00)	XIV	19 (19.00)	XXI

contd.....

TABLE 10.4 (CONTD.)

Sl. No.	Suggestions	Scientists (N=50)		Extension personnel (N=100)	
		Fre- quency	Rank order	Fre- quency	Rank order
22.	Training to the field officers and farmers in improved dryland technology	14 (28.00)	XV	38 (38.00)	XI
23.	Availabilitky of soil and water-testing laboratories within easy reach	13 (26.00)	XVI	21 (21.00)	XX
24.	Proper linkage between extension and research	13 (26.00)	XVI	10 (10.00)	XXVIII
25.	Extensive coverage of dryland areas under water-shed management	12 (24.00)	XVII	-	
26.	Proper guidance to farmers for fertilizer use on soil and water-test basis	11 (22.00)	XVIII	5 (5.00)	XXX
27.	Occasional organisation of campaign and drive to educate and motivate the farmers about fertilizer use under dryland conditions	10 (20.00)	XIX	22 (22.00)	XIX
28.	Availability of suitable animal-drawn machines/implements for fertilizer placement	10 (20.00)	XIX	8 (8.00)	XXIX
29.	Establishment of agro-service centres with single-window system in remote areas	9 (18.00)	XX	12 (12.00)	XXVIX
30.	Effective implementation of support price scheme for ensuring easy procurement of crop produce in the event of market price going below the support price	8 (16.00)	XXI	-	

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TABLE 10.4 (CONTD.)

Sl. No.	Suggestions	Scientist (N=50)		Extension personnel (N=100)	
		Fre- quency	Rank order	Fre- quency	Rank order
31.	Emphasis on dryland farming technology in monthly workshop and fortnightly training under T&V system	7 (14.00)	XXII	28 (28.00)	XV
32.	Yield maximisation trials on farmers' fields	7 (14.00)	XXII	24 (24.00)	XVII
33.	Village adoption for fertilizer promotion by government, autonomous and voluntary agencies	6 (12.00)	XXIII	13 (13.00)	XXV
34.	Reduction in fertilizer price	6 (12.00)	XXIII	15 (15.00)	XXIV
35.	Initiation and enforcement of fertilizer quality control regulations	5 (10.00)	XXIV	-	
36.	Forecast of weather conditions with specific suggestions regarding farm operation	5 (10.00)	XXIV	-	

In all, 32 suggestions were made by extension personnel. But in addition to these, four more suggestions were made by scientists. The suggestions made by each group were also ranked on the basis of percentage of respondents making a suggestion. For instance, the suggestion made by the highest percentage of respondents was assigned first rank. All other suggestions were accordingly ranked in descending order of

percentage of the respondents. It is clear from the pattern of ranking that scientists and extension personnel had differential perception even with respect to the importance of suggestions made to promote fertilizer use.

Out of 36 suggestions made by the scientists, four suggestions including 'extensive coverage of dryland areas under watershed management', 'effective implementation of support price scheme for ensuring easy procurement of crop produce in the event of market price going below the support price', 'initiation and enforcement of fertilizer quality control regulations' and 'forecast of weather conditions with specific suggestions regarding farm operations', were not made by the extension personnel.

If we critically look into the factors responsible for low use of fertilizer and corresponding suggestions made to overcome them, we find some similarity in ranking in case of scientists. It was interesting to note that there was a high degree of coincidence between ranks of factors and suggestions. But the same was not true in case of extension personnel.

But whatever it may be, all the suggestions assume significance, and hence need to be taken care of in promoting fertilizer use in the dryland areas under study. This is however, not to say that all the suggestions are equally important and deserve equal attention.

The economic factor, for instance, are decidedly most important. This means the actions that these factors suggest for promoting fertilizer use need to be prioritised. In terms of importance, next to economic factors may be educational factors underlying the need to educate the farmers on all aspects of fertilizer use through appropriate extension methods and approaches. The third broad category may include factors concerning supplies and services suggesting that efforts be made to ensure timely availability of needed fertilizers in convenient packs within easy reach of the farmers, preferably at their doorsteps.

CHAPTER V

SUMMARY AND CONCLUSIONS

Despite great and sustained emphasis on irrigation during all the seven successive Five-Year Plans, Indian agriculture is still very much dependent on rains. More than three-fourth of the cultivated area is even today un-irrigated and it accounts for only 15 per cent of the total fertilizer consumption in the country.

Emphasising the importance of fertilizers, the Noble Laureate agricultural scientist Norman Borlaug (1971) observed: "If the high-yielding dwarf wheat and rice varieties are the catalysts that have ignited the 'Green Revolution' then the chemical fertilizer is the fuel that has powered its forward thrust".

The area under high-yielding varieties has been fast increasing since mid-sixties which marked the beginning of Green Revolution era. The consumption of fertilizers per unit of arable land has also increased manifold over the years. However, the situations in this regard particularly with respect to balanced fertilizer use is far from satisfactory and more so in dryland areas.

It has been estimated that even when the entire water resources are fully exploited, over 50 per cent of the total cropped area in our country will remain rainfed for all time to come. It is in view of this fact that much emphasis is being laid these days on raising the level of crop productivity in dryland/rainfed areas. It is in the fitness of things that dryland agriculture is engaging serious attention of all concerned including policy makers, planners, administrators, scientists and change agents.

It goes without saying that fertilizer is a key factor in maximising production even in dryland/rainfed areas. Concentrated efforts, therefore, need to be made to promote optimum and efficient use of balanced fertilizers in these areas which have suffered utter neglect in the past. Even with the present level of advancement in dryland agriculture including fertilizer use, the productivity of crops grown in dryland areas can be increased significantly.

Sivaraman (1972) rightly said that the Indian socio-economic scene is very much dependent on agriculture and the Indian agriculture is very much dependent on fertilizers.

Fertilizer consumption in India does not confirm to a definite pattern within the country although it has been steadily increasing every year. Fertilizer consumption per hectare of gross cropped area in the states varies from 1.8 kg in Nagaland to 370.5 kg in Pondicherry.

As most of the evaluation studies such as Directorate of Evaluation and Programme Evaluation Organisation have consistently reported, majority of farmers are not using balanced dose of fertilizer specially in dryland crops. This is evidently uncondusive for agricultural development.

A large number of Indian and foreign studies are available on adoption of fertilizers. Most of these studies, however, have been conducted in irrigated areas. There is hardly any study on factors influencing the adoption of fertilizers in dryland which is so crucial for agricultural development.

In order to promote fertilizer use in dryland areas, it is important to critically analyse the factors responsible for low fertilizer application in these areas so that proper strategy may accordingly be worked out. It was with this idea in view that the present study was designed. The specific objectives of the study were as follows:

1. To assess the nature and extent of fertilizer use in different crops.
2. To ascertain the level of knowledge and opinion of farmers about the recommendations regarding fertilizer use.
3. To analyse the efforts being made to promote fertilizer use.

4. To identify inhibitors and promoters of fertilizer use.

The study was conducted in two sub-divisions, namely, Gurgaon and Nuh of Gurgaon district in Haryana. One block from each sub-division was randomly selected. The blocks selected were Farrukhnagar and Nuh. From each of these two blocks, two villages comprising Mohammedpur - Sadhrana and Adwar-Nangali respectively were selected at random.

The total farmers of each of the four selected villages were classified into four land holding groups - marginal, small, medium and big. A proportionate random sample of 40 farmers was drawn from different land-holding groups from each village. Thus, a total of 160 families formed the sample of the study.

The relevant data as per the objectives of the study were collected from the sample farmers by personally interviewing them with the help of a structured schedule. They were asked a series of questions on different aspects concerning fertilizer use so as to have necessary and relevant information. Before finally administering the schedule, the same was pre- tested in area other than the sample area and necessary modifications were accordingly made in the final schedule. Other relevant information about the locale of the study was collected from records and available reports.

The data collection work was done from October to December, 1988. The simple statistical methods used in this

study for precise and meaningful analysis and interpretation of data collected included frequency, percentage, average, 't' test and 'F' test.

Some salient findings

1. Socio-economic profile of selected farmers

1.1 Majority of the farmers using fertilizer belonged to the age group fo 21-40 years. Most of them had relatively larger land holdings. On the whole, fertilizer use was not uniform among the farmers from different age and land holding categories.

1.2 Majority of the respondents belonged to upper caste group followed by backward and scheduled castes. The proportions of users of fertilizers were more in upper caste group irrespective of land holding size.

1.3 Illiteracy or low level of education prevailed mostly among the marginal and small farmers and the percentage of fertilizer users increased with increasing level of education.

1.4 Medium and big farmers had more access to draft power than marginal and small farmers. More than half of the marginal and small farmers had no draft animal at all. Very few farmers had more than one pair of draft animals.

1.5 Medium and big farmers possessed more number of milch animals as compared to marginal and small farmers. Majority of the marginal and small farmers possessed 1-2 milch animals and none of them had more than 2 milch animals.

1.6 Almost equal number of families had 2-3 adult men and adult women engaged full time in farming. Amongst the girls (15-20 years), almost similar trend was observed. Very few boys (15-20 years) were engaged full time in agriculture.

1.7 Majority of the farmers were equipped with country-made tools and implements like chaff cutter, deshi plough, leveller, seed drill and bullock cart which are less costly. Implements and tools like improved ploughs, dusters and sprayers were possessed by very few farmers.

1.8 Farming was the main occupation of about 80 per cent of the respondents. The proportions of those engaged in labour work, business and independent profession was very less. Among the secondary non-farming occupations, labour topped the list.

1.9 Majority of the marginal and small farmers belonged to low-annual income group, while more than 50 per cent of the big and 25 per cent of the medium farmers belonged to high-annual-income group.

2. Land use pattern

2.1 Marginal and small farmers had comparatively smaller average land holding size than medium and big farmers.

The percentage of irrigated area to the total cultivated area was highest in case of small farmers and lowest in marginal farmers.

2.2 The average cropped area was found consistently increasing from marginal to big farmers. The average area under high-yielding varieties of wheat and mustard was higher than that under bajra. In case of jowar and guar, the farmers were not found growing any high-yielding/improved variety.

2.3 The cultivated area under rabi crop was higher than that under kharif crops. Bajra had about 50 per cent of the area under rainfed crops in kharif season. Mustard and wheat were the only rabi crops grown in the area under study and both the crops occupied almost equal area.

2.4 In the event of delayed onset of monsoon, 30 per cent of the farmers preferred to sow bajra, others leaving the land fallow.

In the event of incessant rains during July and early August, 45.62 per cent of the farmers preferred to

leave the field fallow. Of the remaining 54.38 per cent, 30 per cent went in for sowing jowar or guar in August and 24.38 per cent for bajra sowing even during rains.

In the event of pre-monsoon or early onset of monsoon, 53.12 per cent of the farmers went in for bajra sowing in April or May and 46.88 per cent for usual sowing of bajra, jowar or guar.

2.5 In case of rabi crops, majority of the respondents went in for only one ploughing which was less than the recommended number. The number of pre-sowing ploughings given by the majority of respondents was very much in line with what is recommended.

2.6 Very much in line with national trend, the high-yielding varieties of bajra and wheat were used by a large number of farmers. But not even a single farmer was found using any recommended varieties of jowar and guar. The users of high-yielding varieties were more in medium and big as compared to marginal and small land-holding groups. In case of wheat, all the medium and big farmers reported using improved seeds. The main reasons given to justify the use of local seeds by those not using high-yielding/improved seeds were high cost of improved seeds, unsuitability of improved seeds under moisture-stress conditions and unavailability of improved seeds.

2.7 In all the kharif crops, the seed rate followed by majority of the farmers was lower than the recommended one. As regards wheat and mustard, the seed rates used by majority of the farmers were as per recommendations.

2.8 Majority of the farmers sowed their kharif crop after normal sowing time. The time of sowing reported for wheat and mustard, the two major rabi crops, was very close to the optimum sowing time recommended.

2.9 Broadcasting was the most common method of sowing in kharif season which was practised by all the respondents. In rabi, majority of the farmers practised pona method of sowing.

2.10 Majority of the farmers practised initial tillage for rain water conservation. The fields kept fallow in kharif and earmarked for rabi sowing were ploughed with effective shower (72.50%) and stirred (70.62%) with every light shower. This also helped them in keeping the field free from weeds. The practice of plot-to-plot bunding was followed by few of the farmers.

3. Resource utilization

3.1 Private fertilizer dealers were the major source from which majority of the respondents purchased fertilizers

regardless of land holding size. The percentage of farmers purchasing fertilizers from co-operative societies or from HAFED (Haryana Agriculture Federation) was very small.

3.2 Marginal and small farmers had little access to transport means. They mostly used bicycle for carrying fertilizer from sale point to the village. Bus/auto was extensively used by almost all the four categories of farmers, but relatively more by marginal and small farmers. Own bullock cart was mainly used by medium and big farmers.

3.3 Relatively larger percentage of the farmers of all the four categories took loan in rabi. The percentage of farmers who took medium-term loan was maximum in case of medium farmers. The overall percentage of farmers taking long-term loan was very low.

3.4 Loans for purpose other than seed and milch/draft animals were taken comparatively by less number of marginal and small farmers. The percentage of medium and big farmers who took loan for improved implements/pumpsets were relatively higher than those taking loan for other purposes. Less than 10 per cent of the farmers took loan for fertilizers. As against this, the percentage of farmers taking loan for purchase of milch/draft animal was very high.

3.5 More than half of the farmers in the event of need borrowed money from their fellow farmers/friends/relatives followed by Gramin bank. These were the two main sources which were preferred most by the farmers. A few took credit from co-operative societies, land development bank and commercial bank.

Among the important reasons for preferring fellow farmers as the source of borrowing were secrecy of transaction, no interest and easy repayment. On the other hand, institutional loan was preferred because it was a reliable source and provided for repayment on instalment basis.

3.6 Marginal and small farmers generally had the problems of tiding over the crisis caused by drought. About one-third of the respondents had to depend on extra labour to mitigate their suffering during the drought period. Even otherwise, marginal and small farmers and other economically handicapped people in the villages supplemented their meagre income by putting extra labour. Majority of respondents were advanced loan by co-operatives/banks in a situation when they needed the same most.

4. Nature and extent of fertilizer use

4.1 Not even a single farmer applied any fertilizer to jowar and guar crops. Wheat was the only crop to which

fertilizer was applied by majority of the farmers. About 40 per cent of the farmers applied fertilizer to mustard and bajra. Nearly 32 per cent of the marginal farmers were fertilizer users and 13.63 per cent of them used fertilizer in wheat only. Surprisingly, 68.18 per cent of the marginal farmers did not apply fertilizer to any crop. Among small farmers, about 80 per cent were fertilizer users but the majority of them applied fertilizer in two crops only. In case of medium and big farmers, more than 90 per cent were fertilizer users and the majority of them applied fertilizer in three crops..

4.2 Amongst the bajra growers, 42.28 per cent used one or the other fertilizers in this crop and the majority of them applied only nitrogenous fertilizers in the form of either urea or CAN.

Out of 75 per cent fertilizers users in wheat, more than 60 per cent applied both urea and DAP.

Mustard growers were as high as 86.25 per cent but only 48.55 per cent of them applied fertilizer to the crop. Majority of them used either urea or CAN only. The proportion of those using fertilizers in combination was very less. It was the only crop in which some of the farmers used just DAP.

4.3 About 50 per cent or more of the fertilizer users

among marginal and small farmers had been using fertilizer for 0-5 years. Amongst medium and big farmers, as high as about 45 per cent had been using fertilizer for 6-10 years. None of the marginal and small farmers had been using fertilizers for more than 15 years.

4.4 In terms of per acre nutrient consumption, all the four categories of farmers were somewhat at par with each other. However, there was a slight decrease with increase in size of holding. Taking the total holding size into account, per acre average consumption of plant nutrients worked out to be less in case of big farmers as compared to marginal ones.

Marginal and small farmers used less than the national average, while medium and big farmers used almost as much as the national average of fertilizer consumption.

The average nitrogen and phosphorus consumption per acre was slightly below that of the state average and the total nutrient consumption per acre in the surveyed area was also less than the state average. As against this, the per unit area average consumption of plant nutrients, singly or combined, in the surveyed area was higher than the national average.

4.5 About one-tenth of the marginal and one-fourth of the small farmers applied fertilizer in bajra but 60 per cent of

them applied nitrogen below the recommended level. As high as about 70 per cent of the medium and big farmers used fertilizer in bajra and nearly 35 per cent of them applied nitrogen as per recommendation.

In wheat, the percentage of fertilizer users was considerably high in all the four categories of farmers and more than 50 per cent of them used nitrogen as per recommendation. With respect to application of phosphatic fertilizer, about 40 per cent of them used the recommended dose.

The percentage of fertiliser users in mustard varied between as high as 71.43 per cent of the big to as low as 6.82 per cent of the marginal farmers. Out of them, less than 40 per cent in all the four categories applied the recommended dose of nitrogen.

Nearly 40 per cent of the farmers applied fertilizer in bajra crop and out of them about 65 per cent used nitrogen less than the recommended dose.

5. Knowledge and opinion about fertilizer use

5.1. About three-fourth of the marginal and half of the small farmers had poor knowledge about fertilizer use. In the category of average knowledge, the proportions of medium farmers was maximum. In good knowledge category, the percentage of

medium and big farmers was less than 30 per cent. Only one medium, three big farmers and not even a single marginal and small farmers had very good knowledge about fertilizers.

5.2 There was no significant difference in knowledge about fertilizers between marginal and small as also between medium and big farmers. However, all other inter-pair differences among the four categories of farmers with respect to knowledge about different types of fertilizers were found statistically significant.

5.3 Nearly 47 per cent of the farmers had favourable opinion, 31.9 per cent unfavourable opinion and the rest neither favourable nor unfavourable opinion about fertilizers.

Marginal and small farmers had unfavourable and medium and big farmers favourable opinion about fertilizer use.

Except between medium and big farmers, the difference in opinion about fertilizer use between any other two groups was significant.

6. Efforts in promotion of fertilizer use

6.1 Village Extension Worker was the most important source of information about fertilizers, for all the four categories of farmers. The source of information most frequently used by marginal farmers was neighbours/friends/relatives. The

most frequently used source of information in case of small farmers was progressive farmers. Among all the sources of informations, the one used most by medium and big farmers was Agricultural Development Officer. Representatives of fertiliser firms, co-operative personnel dealing in fertilizers, specialists/scientists of Agricultural university and I.C.A.R. Institutes were not at all used by marginal and small farmers.

There was significant difference among the four categories of farmers with respect to all but one (VEW) of the 10 different sources of information. Marginal and small farmers differed significantly from each other with respect to neighbours/friends/relatives, progressive farmers, private fertilizer dealers and ADO.

6.2 All the four categories of farmers perceived demonstration as the most common impersonal source of information. The maximum participation of medium and big farmers was in kisan mela/exhibition followed by demonstration and field day. In case of small farmers, maximum participation was in demonstrations followed by kisan mela/exhibition. Very few marginal farmers had access to impersonal sources of information and that too to only demonstration and kisan mela/exhibition. None of the respondents took part in fertilizer festivals, village meetings for fertilizer promotion and group discussion meetings.

6.3 Out of the three major service facilities available to the farmers, soil testing facility was relatively more utilized, but majority of them used this facility only once during the last two years and very few twice and thrice. With respect to irrigation water testing and fertilizer on credit, 15.63 and 9.38 per cent of the respondents respectively used these facilities only once during the last two years.

6.4 The farmers belonging to the medium land-holding category were ahead of the other three categories in terms of access to radio. They were followed by big, small and marginal farmers. Almost similar trend was with respect to TV and printed materials. The extent of exposure of all the four categories of farmers was maximum to radio. Small, medium and big farmers were exposed more to printed materials than to TV. It was just the reverse in case of marginal farmers.

6.5 There are a number of agencies involved in promotional activities in the area under study. Included among them are IFFCO, KRIBHCO, KGK, KVK and State Department of Agriculture. Some of the activities undertaken by them are demonstrations, field days, training, free distribution of extension literature and the like.

7. Inhibitors and promoters of fertilizer use

7.1 'Poor economic condition' was considered by the marginal-small farmers as the most important problem. Other important problems of marginal-small farmers in order of importance were: 'high cost of fertilizer'; 'nonavailability of crop-loan in time'; 'lack of knowledge about which fertilizer use in a particular crop, in what quantity and when and how'; 'inadequate subsidy on fertilizers', 'low price of the farm produce' 'poor economic return from fertilizer use'; 'uncertainty of subsequent rain'; 'risk of crop failure' and so on.

The medium-big farmers perceived 'unavailability of fertilizers within easy reach' as the most important problem in fertilizer use. Other problems in order of importance as expressed by them were 'unavailability of fertilizer in time', 'high cost of fertilizer', 'nonavailability of crop-loan in time', 'poor economic condition of the farmers', 'uncertainty of subsequent rains', 'risk of crop failure', 'poor economic return from fertilizer use' and so on.

That 'fertilizer should be made available within easy reach' was the most important suggestion made by both the groups of farmers - marginal-small and medium-big. Among other suggestions made by the marginal-small farmers in order of importance were that 'adequate subsidy should be given'; 'fertilizer should be made available to the farmers of dryland areas at cheaper price'; 'procedures involved in grant of crop-loan should be simplified' and 'crop-loan should

be given to the farmers entirely in cash'. Similarly, medium-big farmers suggested that fertilizer should be made available in time', fertilizer should be made available to the farmers of dryland area at cheaper price', 'adequate subsidy should be given', 'procedures involved in grant of crop-loan should be simplified' and so on.

'Poor economic condition of the farmers' was considered as the most important factor for low fertilizer use by the extension personnel and scientists, 'lack of knowledge about dose time and method of fertilizer application', 'high cost of fertilizer', 'risk of crop failure due to drought/dry spell/low soil moisture', unavailability of short-duration, drought-resistant and fertilizer responsive varieties', and 'unavailability of crop loan in time', were other important factors as perceived by the scientists. Other factors responsible for low use of fertilizer in dryland as expressed by extension personnel were, 'high cost of fertilizer', 'risk of crop failure due to drought/dry spell/low soil moisture', 'inadequate and erratic distribution of rainfall' and 'lack of knowledge about dose, time and method of fertilizer application'.

'Adequate subsidy on fertilizers and improved seeds' was the most important suggestion given by the scientists as well as extension personnel. Other important suggestions

made by the scientists were 'simplification of crop-loan procedures', 'periodic organisation of workshops, symposia', crop insurance against all natural calamities and so on.

'Periodic organisation of farmers', fair, show and exhibition at lower level', 'easy availability of credit in time at reasonable rate of interest', 'periodic organisation of workshops, symposia' were other important suggestions given by extension personnel.

CONCLUSIONS:

1. Fertilizer use was not uniform among the farmers belonging to different age and land-holding categories, caste and education were positively associated with fertilizer use. Possession of draft and milch animals increased with increase in land holding size. Majority of the farmers had country-made tools and implements. Very few of them had improved implements/tools. Farming was the main occupation of the farmers in the area under study and there was variation in income of different categories of farmers.

2. The average land holding size, average unirrigated area and average cropped area was found consistently increasing from marginal to big farmers. The bulk of the area was sown only once and no particular seasons, kharif or rabi, was

considered more favourable than the other. Under three different rainfall situations, the farmers had different preferences as to the crops to be sown. The economics and profitability of the different schemes of growing crop in different rainfall situations need to be studied.

There was wide variation among the farmers in respect of number of pre-sowing ploughing given for rabi crops. The farmers in general seemed to be very much convinced about high-yield potential of the recommended varieties of wheat and bajra. The practised seed rate was not in line with the recommendation. Uncertainty of monsoon rain was one of the reasons for delayed sowing of kharif crops. Perhaps because of less risk involved in rabi crops, the time of sowing followed by the farmers was very close to the optimum sowing time recommended. The situation with respect to method of sowing was, on the whole, satisfactory in rabi crops. Additional information as to why the farmers use only broadcasting method of sowing in kharif crops might be revealing. The techniques and practices used by the farmers for absorption and conservation of soil moisture were not satisfactory.

3. The farmers in general preferred to purchase fertilizer from private fertilizer dealers. All the four land-holding categories generally went in for rabi loan. It might be because they found rabi crops less risky and hence more remunerative in comparison to kharif crops. The farmers did not attach as much importance to fertilizer as to seeds. On the whole, the

farmers preferred to take loan from non-institutional sources . It underlines the need to promote institutional credit for farming through co-operatives and banks. Very few farmers had enough saving to meet the drought crisis. Majority of them had to take recourse to borrowing from one or the other sources to manage the crisis. Credit giving institutions become extra liberal in helping the farmers in the wake of natural calamities like drought and flood.

4. Majority of the farmers applied fertilizer in either one or two crops only. Very few of them were found using fertilizer in three crops. Out of the three kharif crops being grown, fertilizer was applied only in bajra and that too with nitrogenous fertilizers only. As regards rabi crops, fertilizer was used in both wheat and mustard crops. However, wheat received the major share of fertilizers. The per unit area average consumption of fertilizers in terms of nutrients, singly or combined, in the surveyed area was higher than the national average and lower than the state average. There still remains tremendous scope to further increase fertilizer use. On the whole, less than 50 per cent of the farmers were using fertilizer in bajra and mustard and more than 50 per cent of them were using less than the recommended dose. Nearly 75 per cent of the farmers were using fertilizer in wheat but the percentage of those using fertilizers as per recommendation was very small.

5. Medium and big farmers had relatively better knowledge about fertilizers than marginal and small farmers. But the farmers in general lacked knowledge about fertilizers. This underlines the need for educating the farmers so as to promote fertilizer use.

While marginal and small farmers had unfavourable opinion, medium and big farmers favourable opinion about fertilizer use. On the whole, only 47 per cent of the farmers had favourable opinion about fertilizer use. The difference in opinion about fertilizer use between any two groups was significant except between marginal and small and medium and big farmers.

6. Marginal and small farmers in general lacked contact with outside sources and hence they sought advice from friends/relatives/neighbours and progressive farmers. Unlike both these groups, medium and big farmers had good contact also with outside sources because of larger holding size, better resources, better education and more influence in the community.

Demonstration was the most common impersonal source of information about fertilizer use to all the four categories of farmers. The farmers in general had less exposure to impersonal sources of information for fertilizer use.

The extent of use of services by the farmers in general, was very poor. The extent of exposure of all the four categories of farmers was maximum to radio. The small, medium and big farmers were exposed more to printed material than to TV.

7. Both marginal-small and medium-big farmers had almost similar problems. The relative importance of these problems, however, differed between the two groups, suggesting that there can not be a blanket strategy for fertilizer promotion among the farmers in dryland areas, and for that matter any where, regardless of land holding size. It was also evident from the fact that suggestions made by the farmers belonging to different land-holding categories differed in importance attached by them.

The scientists and extension personnel seemed to have differential perception regarding the relative importance of all the factors affecting fertilizer use. They had differential perception even with respect to the importance of suggestions made to promote fertilizer use. Of the two the later being in close contact with the farmers were expected to have a more realistic picture of the factors affecting fertilizer use in actual life situation and hence their suggestions might be more relevant.

The present investigation was undertaken with the assumption that it may generate some information which could prove useful in developing a suitable strategy for promoting fertilizer use in dryland areas leading to increased crop productivity which is presently very low. The adoption of fertilizer technology has become a must in present-day modern agriculture. This necessitates adequate knowledge on the part of farmers as to what fertilizers to use, in what quantities, when and how.

As it emerged from this study, despite the fact that the farmers in general have been using fertilizers for many years, majority of them in dryland areas seem to have not only poor knowledge but also unfavourable opinion about fertilizer use. Obviously, a clear understanding and favourable opinion on the part of farmers is a must for fertilizer promotion anywhere. This study underlines the need for more vigorous promotional efforts for change in knowledge and opinion of the dryland farmers with respect to fertilizer use. The marginal and small farmers who are mostly illiterate and economically handicapped deserve special attention.

Another implication of this study is that it points out the variations in the extent of use of different components of fertilizer application, suggesting that every component of the technology has to be considered separately while educating the farmers about its use. The lack of knowledge on the part of

the farmers can be made up by imparting training on all aspects of fertilizer technology. Hence, the trainers of FTCs, KVKs and other training institutions need to take into account the specific situations and problems of the dryland farmers while imparting training to them.

The study revealed that exposure of the farmers to personal and impersonal sources of information and mass media differed from one group of farmers to another. Hence, a blanket strategy in this regard may not yield very satisfactory results.

The extent of use of services shows a very poor plight. The fertilizer promotion programmes need a lot of improvements in their various dimensions. It was surprising that only a small segment of farmers could avail, for instance, soil and water-testing facilities which are very basic to efficient use of fertilizers. Added efforts are needed in this direction.

A perusal of what the marginal-small and medium-big farmers expressed indicated that although the problems indicated and suggestions made by them with respect to fertilizer use were almost similar, they differed as to the rankings of these problems and suggestions in order of importance. All this needs careful consideration on the part of planners, policy makers, administrators and extension workers in working out an effective strategy for fertilizer promotion in dryland areas.

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APPENDIX - I

VILLAGE SCHEDULE

"DYNAMICS OF FERTILIZER USE IN DRYLAND AREAS"

INFORMATION ABOUT VILLAGE

S.No.:.....Date of enquiry.....

1. Name of the village:

2. Name of the Block:

3. Distance of the village from the following:

<u>Centres/Points</u>	<u>Distance in km</u>
1. Railway station:	
2. Metalled road:	
3. Block headquarter:	
4. Nearest Mandi/Township:	
5. Fertilizer depot:	
6. School:	
i) Primary:	
ii) Middle school:	
iii) Secondary/high secondary:	
iv) College:	
7. Co-operative society:	
8. Bank:	
9. Primary health centres:	

10. Vet. hospital:

11. A.I. Centre

4. Total population of the village:

i) Male:

ii) Female:

5. Total number of families in the village:

1. Farm families:

i) Land-owning

ii) Tenants

2. Non-farm families

6. Area of the village (in acres)

1. Cultivated:

i) Irrigated

ii) Unirrigated

2. Uncultivated:

i) Orchard

ii) Pasture

iii) Fallow

iv) Dwellings, roads, etc.

APPENDIX - II

INTERVIEW SCHEDULE

Socio-Economic characteristics of the respondents

1. S.N. of the respondent:

2. Name of the respondent:

3. Age..... years (completed):

4. Caste:

i) B.C.

ii) SC/ST

iii) Others

5. Education:

i) Illiterate

ii) Able to read and/or write

iii) Primary

iv) Middle

v) Secondary/Hr. secondary

vi) Graduate

6. Available man-power for farming:

Part-time

Full-time

1) Boys more than 15 years:

2) Girls more than 15 years:

3) Adult men (21 yrs and above):

4) Adult women (21 years and above):

5) Permanent labourers:

7. Number of draft animals:

- 1) Bullocks:
- 2) Camels:
- 3) He-bufallows:

8. Number of other farm animals:

- 1) Cows:
- 2) Bufallows:
- 3) Goats:
- 4) Sheeps:
- 5) Pigs:
- 6) Poultry:

9. Number of farm implements and machines:

- 1) Bullock cart:
- 2) Tractors:
- 3) Chaff-cutter
- 4) Leveller:
- 5) Cultivator:
- 6) Seed drill:
- 7) Seed-cum-fertilizer drill:
- 8) Duster:
- 9) Sprayer:
- 10) Deshi plough:
- 11) Improved plough:

10. Occupation:

	<u>Main</u>	<u>Secondary</u>
1) Farming:		
2) Non-farming:		
i) Labour (Agril. and non-agril.)		
ii) Cast occupation/artisans		
iii) Business		
iv) Independent profession		
v) Service		

11. Annual income of the family from various sources:

<u>Sl. No.</u>	<u>Sources</u>	<u>Income (Rs/year)</u>
1.	Agriculture	
2.	Service	
3.	Business	
4.	Cast occupation	
5.	Labour	

12. Land holding size (in acres)

- 1) Cultivated:
 - i) Irrigated:
 - ii) Unirrigated:
- 2) Uncultivated:
 - i) Orchard:
 - ii) Pasture:
 - iii) Fallow:
 - iv) Dwellings:

13. Cropping pattern and average yield

Areas in acres under			Average yield	
			kg/ha	
Local	Improved	Total	Local	HYV

Kharif

- 1) Bajra
- 2) Jowar
- 3) Guar
- 4)
- 5)

Rabi

- 1) Wheat
- 2) Mustard
- 3)
- 4)

14. Distribution of rainfed area under different crops

Crops	Area under the crop in acres
<u>Kharif</u>	
1) Bajra	
2) Jowar	
3) Guar	
<u>Rabi</u>	
1) Wheat	
2) Mustard	

15. What cropping scheme in kharif do you follow in the event of delayed onset of monsoon?

- 1)
- 2)
- 3)
- 4)

16. What cropping scheme in kharif do you follow in the event of incessant rain during July and early August?

- 1)
- 2)
- 3)
- 4)

17. What cropping scheme in kharif do you follow in the event of pre-monsoon rain or early onset of monsoon?

- 1)
- 2)
- 3)
- 4)

18. What methods of moisture conservation in drylands are recommended? Indicate the method(s) you adopt?

Sl. No.	Moisture conservation method		Remarks : reason(s) for non-adoption of the recommended method(s)
	Recommended	Adopted	
1)			
2)			
3)			
4)			
5)			
6)			
7)			

19. What methods of water-harvesting techniques in drylands are recommended? Indicate the method(s) you adopt.

Sl. No.	Water-harvesting techniques		Remarks reason(s) for non-adoption of recommended method (s)
	Recommended	Adopted	
1)			
2)			
3)			
4)			
5)			
6)			
7)			

20. What methods do you adopt for giving life-saving irrigation?

- 1)
- 2)
- 3)

21. (a) Do you prefer mixed cropping dry farming: Yes/No

- (b) If yes, give the names of the mixed crops:

- i)
- ii)
- iii)

22. Please mention the agronomic practices followed in respect of the following dryland crops.

Crops	No. of pre-sowing ploughing	Practiced seed rate (kg/ac)	Sowing time	Method of sowing
-------	-----------------------------------	-----------------------------------	----------------	---------------------

Kharif

1) Bajra

2) Jowar

3) Guar

4)

5)

Rabi

1) Wheat

2) Mustard

3)

4)

5)

23. Please name the crop-wise improved varieties grown in dryland during the last kharif and rabi seasons.

Crops	Improved varieties grown
-------	--------------------------

Kharif

1)

2)

3)

4)

5)

Rabi

1) Wheat

2) Mustard

3)

4)

24. Please give the reasons for not using improved seeds.

- i)
- ii)
- iii)
- iv)
- v)
- vi)
- vii)
- viii)

25. Since how long have you been using fertilizers in different dryland crops?

Crops	Period (in years)			
	0 - 5	6 - 10	11 - 15	More than 15

Kharif

- 1) Bajra
- 2) Jowar
- 3) Guar
- 4)
- 5)

Rabi

- 1) Wheat
 - 2) Mustard
 - 3)
 - 4)
-

26. Please give the details of fertilizers applied to different crops during the last kharif (1988-89) and rabi (1987-88) seasons

Crops	Area ferti- lized	Fertilizer applied/acre							
		Kind	Dose	Kind	Dose	Kind	Dose	Kind	Dose

Kharif

- 1) Bajra
- 2) Jowar
- 3) Guar
- 4)
- 5)

Rabi

- 1)
- 2)
- 3)
- 4)

27. Please indicate the total quantities of fertilizers you purchased and used during the last kharif and rabi season.

Sl. No.	Name of fertilizer	Quantity in kg		Total
		Kharif (1988-89)	Rabi (1987-88)	
1)	Ammonium sulphate			
2)	CAN			
3)	Urea			
4)	DAP			
5)	SSP			
6)	Murate of potash			
7)	Complex fertilizer ()			
	i) 12:12:2			
	ii) 19:19:19			
	iii) 17:17:17			
	iv) 15:15:15			
	v) 26:20:0			
	vi) 12:32:16			
	vii) 10:26:26			

28. Please tell the combination of fertilizer use in

Season and crops	Only N_2	Only P_2O_5	Only K_2O	$N_2 +$ P_2O_5	$N_2 +$ K_2O	$N_2 + P_2O_5 +$ K_2O
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Kharif

- 1) Bajra
- 2) Jowar
- 3) Guar

Rabi

- 1) Wheat
 - 2) Mustard
-

29. Please specify the crop to which you apply fertilizers

Crops	Response
-------	----------

1. Bajra only
 2. Jowar only
 3. Guar only
 4. Wheat only
 5. Mustard only
 6. Bajra, wheat and mustard
 7. Bajra and wheat
 8. Wheat and mustard
 9. In none
-

30. Items for testing the knowledge of farmers about fertilizers.

A. Nitrogenous fertilizers and their use:

(1) Please name some of the nitrogenous fertilizers that you know:

- i) CAN ()
- ii) Urea ()
- iii) Ammonium sulphate ()

(2) Please tell the recommended dose of nitrogenous fertilizer for major dryland crops.

Kharif

- i) Bajra
- ii) Jowar
- iii) Guar

Rabi

- i) Wheat
- ii) Mustard

(3) Please tell the recommended method of fertilizer application at the time of sowing.

- i) Broadcasting
- ii) Pora
- iii) Kera
- iv) Drill

(4) Nitrogenous fertilizers should be applied:

- i) Full dose at sowing
- ii) Half at sowing and half after one month
- iii) Full dose after sowing

- (5) Please indicate against each statement whether you agree or disagree with it or are undecided.

Sl. No.	statements	A	UD	D
1.	A crop looking pale yellow regains its green colour if the nitrogenous fertilizers is top dressed.			
2.	Excess dose of nitrogenous fertilizer causes lodging of crops			
3.	When you use nitrogenous fertilizer there is no need for using phosphatic and potassic fertilizer			
4.	The food value (basically protein) of the grains increases when nitrogenous fertilizer is applied			
5.	The nitrogenous fertilizer applied in one crop will not have any residual effect on subsequent crop.			
6.	All kinds of nitrogenous fertilizers can be mixed together before applying to the soil			
7.	All nitrogenous fertilizers have similar effects on different crops			
8.	Overdose of nitrogenous fertilizer causes delay in maturity of crops.			
9.	The crop in which nitrogenous fertilizers are applied become more susceptible to pests and diseases			
10.	Any nitrogenous fertilizers can be either applied to the soil or sprayed on crops			
11.	Application of nitrogenous fertilizers in the field increases the crop yield by increasing number of tillers and thereby grains			
12.	The requirement of nitrogenous fertilizers does not vary with the variation in the fertility level of the soil			

B. Phosphatic fertilizers and their use:

(1) Please name some of the phosphatic fertilizers that you know:

- i) S.S.P. ()
- ii) D.A.P. ()
- iii) Rock phosphate ()

(2) Please tell the recommended doses of the phosphatic fertilizers for different crops

Kharif

- i) Bajra
- ii) Jowar
- iii) Guar

Rabi

- i) Wheat
- ii) Mustard

(3) Please tell the recommended method of phosphatic fertilizer application at the time of sowing

- i) Broadcasting
- ii) Pora
- iii) Kera
- iv) Drill

(4) Phosphatic fertilizer should be applied

- i) Full dose at sowing
- ii) Half at sowing and half after sowing
- iii) Full dose after sowing

(5) Please indicate against each statement whether you agree or disagree with it or are undecided

- | | | |
|------|--|--------|
| i) | A crop having stunted growth and dark green colour recoups its vigour and growth if phosphatic fertilizer is applied in optimum quantity | A/UD/D |
| ii) | The lodging of crop can be checked to some extent if phosphatic fertilizer is applied in proper dose at right time and by right method | A/UD/D |
| iii) | Application of phosphatic fertilizer to any crop increases grain yield by increasing weight of grains | A/UD/D |
| iv) | Phosphatic fertilizer applied to any crop will not have any residual effect on subsequent crop | A/UD/D |

C. Potassic fertilizers and their uses:

(1) Please name some of the potassic fertilizers that you know:

- | | |
|-----|---------|
| i) | () |
| ii) | () |

(2) Please tell the recommended dose of potassic fertilizer for different crops

Kharif

- i) Bajra
- ii) Jowar
- iii) Guar

Rabi

- i) Wheat
- ii) Mustard

D. Please indicate against each statement whether you agree or disagree with it or are undecided

- (1) Continuous use of fertilizers without organic manures decreases soil fertility and thereby crop productivity
- (2) All the three types of fertilizers(N,P,K) should be applied to any crop.
- (3) All fertilizers can be used as a foliar spray
- (4) In dryland crops foliar application of urea is better than soil application
- (5) The total value of grain and straw increases by application of balanced fertilizer
- (6) Sometimes fertilizer is mixed with sand, soil or ash before application to make an even distribution of fertilizer in the field
- (7) Placement of fertilizer is less effective than the broadcasting

31. Given below are some opinion statements about fertilizer use. Please give your response to each one of them.

Sl. No.	Statements	A	UD	DA
1.	Continuous use of fertilizer makes the soil poor			
2.	If used judiciously, fertilizers can increase yields in drylands even in a year of scanty rainfall			
3.	Use of fertilizer is essential for maximizing crop yield			
4.	Fertilized food crops have harmful effect on health			
5.	Use of fertilizers deteriorates the taste of food grains			
6.	Use of fertilizer is not much profitable in relation to cost involved			

contd.....

Sl. No.	Statements	A	UD	DA
7.	Since adequate quantity of organic manures like FYM is not available, use of fertilizer is a must			
8.	The effect of fertilizer is seen only in crops for which it is applied; there is no residual effect			
9.	Fertilizer gives the crop enough stability to fight against adverse condition			
32.	What problems/constraints do you generally face in use of fertilizers?			

Sl. No.	Problems/constraints	Response of farmers		
		Very much a constraint	Somewhat a constraint	Not a constraint
1.	Fertilizers not available in sufficient quantities			
2.	Fertilizers not available at nearby places.			
3.	Poor economic condition of the farmers			
4.	High cost of fertilizer			
5.	Lack of knowledge about which fertilizer to use in a particular crop in what quantity, when and how			
6.	Non-availability of crop loan in time			
7.	Inadequate subsidy on fertilizers			
8.	Low price of farm produce			
9.	Poor economic return from fertilizer use			

contd.....

Sl. No.	Problems/constraints	Response of farmers		
		Very much a constraint	Somewhat a const- raint	Not a cons- traint
10.	Uncertainty of subsequent rain			
11.	Risk of crop failure			
12.	Burnining effect of fertilizers on crops			
13.	Adverse effect of fertilizers on soil fertility			
14.	Lack of transport facilities			
15.	Unavailability of fertilizers within easy reach			
16.	Lack of guidance by extension workers about fertilizer use			
17.	Susceptibility of fertilized crop to pests and diseases			
18.	Unavailability of short-duration, drought-resistant and fertilizer- responsive varieties			
19.	Unavailability of fertilizers in time			
20.	Unavailability of fertilizers in required quantities			
21.	Lack of moisture in the soil at the time of sowing			
22.	Under-bagging and adulteration			
23.	Poor mass-media coverage of fer- tilizer promotion programme			
24.	Lack of low-cost bullock-drawn light implements for fertilizer placement			

33. Please give suggestion for promoting fertilizer use

1)

2)

34. Whom do you consult in matters concerning fertilizer use in dryland crops and how often?

Sl. No.	Sources	Extent of contact		
		Frequ- ently	Sel- dom	Never

- 1) Neighbours/friends/relatives
- 2) Progressive farmers
- 3) Private fertilizer dealers
- 4) Co-operative personnel dealing in fertilizer
- 5) Representatives of fertilizer firms
- 6) Specialists/scientists of I.C.A.R. Institutes
- 7) Specialists/scientists of agricultural universities
- 8) Block level officers
- 9) VEW
- 10) Agricultural officers of the commercial banks

35. In which of the following extension activities concerning (directly or indirectly) fertilizer use did you participate during the last kharif and rabi seasons?
- 1) Village meeting for fertilizer promotion
 - 2) Field day
 - 3) Demonstration
 - 4) Group discussion meeting
 - 5) Visit to agricultural fair/exhibition
 - 6) Fertilizer festivals
 - 7) Film show
 - 8) Educational tour to places of agricultural importance like agricultural universities/I.C.A.R. Institutes, KVK, etc.
 - 9) Any other (specify)
36. Many service facilities with regard to fertilizer are being provided by the government and private organizations and institutions. Given below are some of these services. Please indicate the number of times you availed these services

Sl. No.	Service facilities	Number of times used by the farmer			
		Never	Once	Twice	Thrice
1.	Soil testing				
2.	Irrigation water testing				
3.	Fertilizer on credit				

37. Exposure to mass media

1) a) Do you listen to farm-based agricultural programmes on radio Yes/No

b) If yes, i) where do you listen, Home/Neighbours/community set

ii) How often do you listen to such radio programmes,

Regularly/sometimes/
rarely/never

2) a) Do you see farm based agricultural programme on TV Yes/No

b) If yes, i) where do you see?

Home/Neighbours/community set

ii) how often do you see such TV programmes?

Regularly/sometimes/rarely/never

3) a) Do you read printed materials relating to agriculture or allied subjects Yes/No

b) If yes i) of what type?

Newspaper article/farm periodical/
leaflets, pamphlets

ii) How often do you read them?

Regularly/sometimes/rarely/never

38. Where from do you get fertilizers?

Sl. No.	Places	Distance in km from your village
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1) Co-operative

2) Private fertilizer dealers

3) Agro-centres

4) NAFED

39. How do you carry fertilizers from sale point to your village?

- 1) Own bullock cart
- 2) Hired bullock cart
- 3) Bus
- 4) Own tractor
- 5) Group of farmers together hiring a tractor
- 6) Group of farmers together hiring a bullock cart
- 7) Bicycle

40. Did you take agricultural loan during the last kharif and rabi seasons?

i) If yes, give the following details

Types of loan	Crop loan received in Rs.		
	Kharif	Rabi	Total
1) Short-term			
2) Medium-term			
3) Long-term			

41. For what agricultural purpose(s) do you generally take loan?

- 1) Purchase of seeds
- 2) Purchase of fertilizer
- 3) Purchase of plant protection chemicals
- 4) Purchase of improved implements
- 5) Purchase of sprayer/duster
- 6) Purchase of milch and draft animals
- 7) Tractors

42. For what other purposes do you generally take loan?

- 1) Purchase of land
- 2) Purchase of ornaments
- 3) Purchase of clothes
- 4) Home construction/repair
- 5) Marriage
- 6) Festivals

43. If due to some reason you are forced to take loan, which of the following sources would you prefer and why?

Sl. No.	Preferred sources	Reason for the preference
1)	Fellow farmers/friends/relatives	
2)	Land mortgage bank	
3)	Commercial bank	
4)	Money lender	
5)	Cooperative	
6)	Gramin bank	

44. How do you overcome your financial problem in drought crisis?

- 1) By borrowing from fellow farmers
- 2) Loan from co-operative/bank
- 3) By disposing land
- 4) By disposing milch/draft animals
- 5) By extra labour
- 6) Income from subsidiary occupation
- 7) Help from family members in service
- 8) Income from selling animal aproducts
- 9) Selling family ornaments
- 10) Loan from moneylenders
- 11) Saving from previous years

APPENDIX III

QUESTIONNAIRE FOR SCIENTIST, SUBJECT MATTER SPECIALIST AND EXTENSION PERSONNEL

1. Name:
2. Designation:
3. Qualification:
4. Department/Section:
5. Experience:
 - i) Teaching years
 - ii) Research years
 - iii) Extention years
6. What factors do you think are responsible for low use of
fertilizer in dryland areas?
 - 1)
 - 2)
 - 3)
 - 4)
 - 5)
 - 6)
 - 7)
 - 8)
 - 9)
 - 10)

contd.....

7. What measures would you suggest to promote fertilizer use in dryland areas?

1)

2)

3)

4)

5)

6)

7)

8)

9)

10)

