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SOIL HEALTH CARD PROGRAMME IN GUJARAT:
Implementation, Impacts and Impediments

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S. S. Kalamkar

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Foreword

The phenomenal growth in agricultural production in India since the Green Revolution period in the late 1960s has been triggered by higher input use, particularly purchased inputs as well as technology induced productivity enhancement, massive extension efforts, improved farm practices and above all, ingenuity and hard work of Indian farmers. Among the inputs, significant increase in use of fertiliser has helped to enhance crop output and farmers' income. The average consumption of fertilisers has increased from 6.9 kg per ha (of gross cropped area) in 1966-67 to 139.7 kg per ha in 2011-12. However, indiscriminate use of chemical fertilisers by farmers has led to deterioration of soil structure, wastage of nutrients, destruction of soil microorganisms and scorching of plants at the extreme cases. Therefore, various initiatives have been taken at national as well as regional level to encourage the farmers for balanced use of fertilisers. Gujarat has been a leading state in taking up such initiatives, among which Soil Health Card (SHC) Programme was a major one. The Soil Health Card Programme in Gujarat is a unique on line Programme making transfer of technology more scientific, precise, easy, and need based between Scientist-Extension Officer- Farmers and input output dealers effectively. With this background, the present study on *'Soil Health Card Programme in Gujarat: Implementation, Impact and Impediments'* sponsored by Centre for International Projects Trust (CIPT), New Delhi was undertaken at our Centre to evaluate the implementation of programme after 10 years of its operation in Gujarat.

The study is based on both primary and secondary level data. The study results show that SHC scheme has benefited the farmers in many ways, however, there are some gray areas where more attention is required to be given. Importantly, training should be provided to the farmers in the State on scientific method of collection of soil sample as well as reading and application of recommendations given on SHC. On the basis of the findings, relevant policy suggestions have been made.

I am thankful to authors and their research team for putting in a lot of efforts to complete this excellent piece of work. I also thank CIPT, New Delhi for the unstinted cooperation and support. I hope this report will be useful for those who are interested in soil health, balanced use of fertiliser and performance of SHC programme in Gujarat.

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We have benefited immensely from various scholars and officials from different government departments while carrying out this study. At the outset, we would like to thank **Dr. Harish Padh**, Vice Chancellor of our University and Chairman, AERC Governing Body as well as **Dr. Mahesh Pathak**, Honorary Advisor of our Centre for their constant encouragement and support for undertaking such research activity at the Centre. We are grateful to **Dr. Kamal Vatta**, Director, CIPT, New Delhi, **Mr. Sandip Dixit**, Programme Manager, CIPT, and **Mr. Nikunj Parekh**, Project Coordinator, CIPT, New Delhi for providing required support and guidance for smooth conduct of the study.

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List of Abbreviations

AEZ	Agro-Ecological Zones
APC	Agricultural Prices Commission
APMC	Agricultural Produce Marketing Committee
Av.	Average
B	Boron
C.I.	Cropping Intensity
CACP	Commission for Agricultural Costs and Prices
CAGR	Compound Annual Growth Rate
CCS	Cost of Cultivation Scheme
CDAP	Comprehensive District Agricultural Plan
CGR	Compound Growth Rate
CMS	Cooperative Marketing Society
CoC	Cost of Cultivation
Cu	Copper
DAO	District Agriculture Officer
DAP	Diammonium Phosphate
DDO	District Development Officer
DES	Directorate of Economics and Statistics
DOC	Division of Cooperation
DOC	Division of Cooperation
DPAP	Drought Prone Area Programme
Ec	Electro-conductivity
FAO	Food & Agriculture Organization
FAI	Fertilisers Association of India
Fe	Ferrous (Iron)
GCA	Gross Cropped Area
GIS	Geographic Information System
GDP	Gross Domestic Product
GIA	Gross Irrigated Area
GOG	Government of Gujarat
GOI	Government of India
GSDP	Gross State Domestic Product
GSFCL	Gujarat State Fertilizers Company Limited
GSLDB	Gujarat State Cooperative Land Development Bank
ha	Hectare
HYV	High Yielding Variety
I.I.	Irrigation Intensity
kg	kilograms

mha	Million hectares
MIP	Market Intervention Price
MIS	Market Intervention Scheme
Mn	Manganese
MOA	Ministry of Agriculture
MOP	Muriate of Potash
mt	Metric Tonnes
NABARD	National Bank for Agriculture and Rural Development
NBS	Nutrient Based Subsidy
NCA	Net Cropped Area
NFSB	National Food Security Bill
NGO	Non Government Organization
NIA	Net Irrigated Area
NPK	Nitrogen (N), Phosphorus (P), and Potassium (K)
NPMSF	National Project on Management of Soil Health& Fertility
NSA	Net Sown Area
PDS	Targeted Public Distribution System
PIM	Participatory Irrigation Management
PSS	Price Support Scheme
R & D	Research and Development
RRB	Regional Rural Banks
SHC	Soil Health Card
SHC-AAU	Soil Health Card-Anand Agricultural University
SHC-GOG	Soil Health Card-Government of Gujarat
SHC-KVK	Soil Health Card-Krishi Vigyan Kendra
SRR	Seed Replacement Ratio
STLs	Soil Testing Laboratories
TE	Triennium Ending
Zn	Zinc

Chapter I

Introduction

1.1 Background

Agriculture in India has undergone considerable transformation over time. Some aspects of this transformation are seen in the form of changes in agrarian structure, technological interventions, cropping pattern, enterprise mix and marketing system. During early phases of agricultural development, much emphasis was placed on increasing agricultural production through adoption of high yielding varieties along with use of chemical fertilisers and pesticides. This had led to intensive use of land and agricultural inputs particularly in the regions endowed with irrigation facilities. The more use of HYVs necessitated the more application of chemical fertilizers. The use of chemical fertilisers in India has tremendously grown since the advent of green revolution in late 1960s. With the improvement in production since green revolution period, India's position has turned from the state of net importer of agricultural products to exporter of certain agricultural commodities like rice, wheat and sugar. At farm household level also, the green revolution technology has helped to improve the livelihood pattern, nutrition and education of children. However, the technology has brought some negative aspects as well (Elumalai, 2016). Since it proved successful in irrigated areas, dry land regions and crops grown therein were left out of the process and hence had created regional disparity in rural income (Krishnaji 1975; Vaidyanathan, 1988; Rao 1996). Further, the technology has also altered traditionally followed cropping pattern, which comprised growing multiple crops every season to mono-cropping, for example cultivation of only rice in some parts of south India. This practice put the land and other resources under severe strain resulting in depletion of soil nutrients,

decline in water table, build up of pest and diseases, and micro-nutrient deficiency (Murgai et al 2001; Pingali and Shah 2001).

There are concerns about the indiscriminate use of chemical fertilisers by the farmers with a view to increase the crop yield (Bera, 2016). This has led to deterioration of soil structure, wastage of nutrients, destruction of soil micro-organisms and scorching of plants at the extreme cases. A combination of factors such as intensive cultivation of crops, differential pricing of fertilisers and subsidy might have contributed to excessive use of fertilisers by the farmers. Besides, due to lack of awareness among the farmers about balanced use of fertiliser, there are wide spread problems related to the indiscriminate use of chemical fertilisers, mismanagement of surface water and over exploitation of ground water. The over use of chemical fertilisers in most parts of India in the last few decades led to several problems affecting soil health, nutrient flow and natural environment. There is a need for promoting, among others, balanced use of fertilisers for increasing productivity of crops and for better absorption of nutrients from the applied fertilizers. The adoption of recommended doses of fertiliser either as per the State Agricultural Universities (SAU) norms or as given in the Soil Health Card (SHC) is essential.

Many initiatives have been undertaken by the government to ameliorate the above mentioned situation and encourage the farmers for balanced use of fertilisers. These initiatives included, among others, decontrol of phosphatic and potassic fertilisers, promotion of integrated nutrient management, promotion of organic manures and bio-fertilisers, National Project on Management of Soil Health and Fertility(NPMSF), and nutrient based subsidy (NBS) policy. Attempts have also been made to strengthen and revamp soil testing laboratories in various districts under NPMSF. Farmers are encouraged to test their soil periodically and apply fertilisers based on the deficiency of nutrients in soil. This is intended to ensure balanced supply of nutrients for maintaining soil health and improving crop productivity. Soil testing helps the farmers to know the

fertility status of the soil and apply optimum dose of fertilisers. Research evidence shows that soil test based fertilisation has significant impact on crop yield (Bhatt, 2013). Further, this helps to reduce operational expenditure, incidence of pests and diseases, and environmental pollution.

The soil nutrient management technology is a bundle of technology package comprising two components viz., soil testing and application of fertilisers based on soil test results. Soil testing includes collection of representative soil samples by following standard procedure, packing and transporting to soil test laboratories for testing of nutritional status. After testing of soil, soil health cards are prepared and distributed to farmers. Soil health card mainly contains details of soil fertility status and dosage of fertiliser to be applied to reference crops. Soil test values remain valid for three years and hence it is recommended that soil testing should be done once in three years. Therefore, adoption of soil nutrient management technology is sequential in nature.

1.2 Brief Review of Literature

Most of the studies focused on use of fertilisers revealed that the fertiliser consumption and food grains production in India have shown an upward trend since 1950s. Sharma and Sharma (2000) stated that the fertiliser use in India increased from 69 thousand tonnes in 1950-51 to 16.2 million tonnes in 1997-98, at an annual growth rate of over 12 per cent and the foodgrains production has also increased from about 51 million tonnes to 192.2 million tonnes in the same period, indicating a direct relationship between fertiliser use and foodgrains production. A study by Randhawa (1992) found that around 60 per cent increase in agricultural production could be attributed to fertilisers; whereas Kanwar (1997) noted that increase in food production in India due to increased input of fertilisers has been between 50-60 per cent.

Importance of Fertiliser Use for Food Production

Prasad (2000) has studied the impact of fertiliser consumption on rice and wheat productivity (tonnes per ha) in the northern states where rice-wheat cropping system has emerged as the dominant cropping system. The study clearly brought out that the five northern states (Punjab, Haryana, J&K, Uttar Pradesh and Himachal Pradesh) share the same status in productivity of rice and wheat as in consumption of fertiliser. Many other studies (Pingali, 2004; Sharma and Sharma, 2000) have established the direct relationship between fertiliser consumption and yield enhancement. Since fertiliser plays a vital role in increasing the production and productivity, per hectare consumption has substantially increased over the decades. Fertiliser Association of India (FAI, 1974) 'Survey on fertiliser use on specific crops in India' has identified that the most important reason for increased fertiliser use was the expected increase in yields and outputs. Another major reason was the wide adoption of high yielding variety seeds (HYVs). Until the period of Green Revolution in mid 1960s, commercial use of fertiliser was very low. The traditional varieties were not very responsive to high fertilisation. However, with the introduction of HYV seeds, the use of fertiliser increased dramatically (McGuirk and Mundlak 1991).

Impact of Irrigation on Fertiliser Use

Irrigation expansion has been another important factor for increased application of fertiliser. FAI (1974) studied the fertiliser use on different crops under irrigated and un-irrigated conditions. The study found that a higher per cent of irrigated area was fertilised as compared to un-irrigated area. Menon and Rao (1983) noted that over 85 per cent of the fertiliser consumption is still confined to irrigated areas which accounts for approximately 27 per cent of cropped area. The level of economic development has a bearing on the increased consumption of fertiliser. Whereas FAO (2005) noted that irrigated lands accounted for 40 per cent of total agricultural area, received 60 per cent of the fertilizer applied. Five

crops (rice, wheat, cotton, sugarcane, rapeseed mustard) consume about two thirds of the fertiliser applied. Bhattacharya (2000) compared the consumption of fertilisers between the advanced and the backward regions and observed that the advanced regions have a lead over the backward regions in terms of consumption of inputs. The effects of fertiliser demonstration programmes, availability of credit and development in infrastructural facilities including the supply of fertiliser have also contributed to growth in fertiliser use in various parts of the country.

Among various major factors, expected increase in yield has been the major driving force for substantial increase in fertiliser application. This has also resulted in overdoses of fertilisers and imbalances in soil nutrients. The application of recommended doses of fertiliser, therefore, assumes prime importance so as to maintain a good soil health.

NPK Ratio

Pingali (2004) stated that the NPK ratio at all-India level was never close to the ideal NPK ratio of 4:2:1. The variation was very high during the pre-green revolution period and post liberalization era. During the pre-green revolution era, the consumption was mainly confined to nitrogen and the ratio was on an average 10:1.6:1. After the introduction of high yielding varieties, the ratio inched towards the ideal, reaching a 5.1:1.8:1 in 1973-74. The price rise in 1974 increased the consumption of nitrogen at the expense of phosphorus, distorting the ratio to 7.7: 2:1. The ratio improved to a ratio of 6:2:1 in the seventies and the eighties after the reduction in prices. After decontrol of phosphoric and potassic fertilisers in August 1992, the ratio worsened to 9.5:3.2:1 in 1992-93 and to 9.68:2.94:1 in 1993-94. Thus the imbalance in prices of N, P and K were mainly responsible for the imbalance in their use. Generally, the farmers substitute one fertiliser for the other in order to maximise their revenue.]

Inter-state Variations in Fertiliser Use

Among states, Punjab took a very big and early lean in fertiliser application. Inter-state variation in per hectare application of fertiliser declined after early 1980s, but large difference still exists (Chand and Pandey, 2008). Among different parts of the country, the distortion of NPK ratio was the worst in North India where the application of nitrogen was much higher than phosphorus and potash. Punjab, UP and Rajasthan had deviated significantly from the recommended NPK ratio of 4:2:1 while West Bengal, Tamil Nadu, Karnataka have been hovering around the recommended NPK ratio (Pingali, 2004). The fertliser consumption intensity varies greatly between the regions, from 40.5 kg/ha of total nutrient in Rajasthan to 184 kg/ha in Punjab. In Gujarat, the NPK use ratio was heavily tilted in favour of N during 1960-61 and 1970-71 due to price hike of phosphatic and potassic fertilizers and reduction of price of urea by 10 per cent (Pathak et al, 1993). As an immediate reaction to fertilizers price hike, notable decline in per hectare consumption of nutrients was also observed for various irrigated crops in the State. Since the marginal and small farmers were exempted from price hike, per hectare consumption of fertilizer in case of marginal farmers increased as usual. However, small farmers did not report normal growth in fertilizer consumption. While per hectare consumption of NPK for medium (2 to 4 ha) and big/large farms (6 ha & above) was stagnant, it declined significantly for large famers (4 to 6 ha) in the state. Based on the data from a field study in Haryana pertaining to two years 1990-91 and 1991-92 (rabi season), Rao and Jayasree (2000) found that fertiliser use was more in case of the small farmers too, considering all crops. In case of fertiliser application per hectare of cotton, the small farmers have been applying more fertiliser as compared to the other groups.

Deficiency in Micronutrients

The deficiency in micronutrients in soils of various parts of the country has been aptly analysed by Prasad (2000) and Singh (2001), among others. Based on 1.48 lakh soil samples from different agro-ecological zones (AEZ), Singh (2001) indicated the existence of 45, 8.3, 4.5, 3.3 and 33 per cent mean deficiency of Zinc (Zn), Iron (Fe), Manganese (Mn), Copper (Cu) and Boron (B), respectively in India. However, the level of deficiency varies widely among various AEZs. Prasad (2000) states that the mean percentage samples deficient in Zinc (Zn), Iron (Fe), Copper (Cu), Boron (B) and Manganese (Mn) in Gujarat was 24 per cent, 8 per cent, 5 per cent, 2 per cent and 1 per cent, respectively.

Constraints in Balanced Use of Fertiliser

There is a need to restore a balance in soil nutrients so as to maintain a good soil health. The application of recommended doses of fertiliser, therefore, assumes prime importance. However, there are several factors that force the farmers not to adopt the recommended doses of fertiliser. Rastogi and Annamalai (1981) studied the adoption of recommended practices in dryland area and found that shortage of capital and fear of losses was the main reasons for not adopting these practices. Among other factors, high prices of fertiliser, lack of knowledge about the recommended doses and their benefits, and non-availability of irrigation water and desired fertilisers were the major ones.

Soil Testing Services and Soil Health Card Scheme

A study on 'Soil Testing Services in Rajasthan' was carried out by Sevak (1982). The study has examined the organizational set up and working of soil testing service in Rajasthan on the basis of available secondary data and a field survey covering 60 beneficiary households and 40 non-beneficiary households for the reference year 1979-80. The study revealed that the fertilizers had not been used on any of the soil tested plots as per the recommendations. Similarly, the yield rates were found to be higher

on farms using less than the recommended doses of NPK nutrients. This study had suggested that these results deserve to be looked into more carefully for making this service more effective. This study had provided several specific recommendations for improving the working of this service in Rajasthan.

Swain et al. (2014) undertook a study in Gujarat that examined the level of adoption and constraints in the application of recommended doses of fertilisers based on soil test (through Soil Health Card Scheme) by the farmers in the state. The study was conducted on two major crops grown in the state (groundnut and cotton), following a cluster approach on a sample of160 control farmers (no soil test) and 240 soil test farmers from four districts (Surendranagar and Rajkot for cotton and Jamnagar and Junagarh for groundnut).

The study found that the level of adoption of recommended doses by the soil test farmers was reasonably less (around 40 per cent for both cotton and groundnut groups) among the sample farmers. However, the adoption of recommended doses of fertiliser based on soil test has helped the farmers in increasing the agricultural productivity and income. The crop yield after soil tests has increased by 23.8 per cent and 22.9 per cent in case of groundnut and cotton respectively. The low adoption of recommended doses of fertilizers by the soil test farmers was due to various constraints, viz. difficulty in understanding and following application of recommended doses as stated in Soil Health Cards, unavailability of technical advice on method and time of fertiliser application, high prices of fertilisers and unavailability of required fertilisers in adequate quantity. The quality of implementation of the programme was found unsatisfactory due to focus on target achievement ignoring quality norms, inadequate staff strength, unavailability of required number of soil test laboratories (STLs) and mobile STLs and lack of upgradation of skills of the personnel involved in the implementation of the programme.

1.3 Growing Emphasis on Soil Health Card Programme

'Soil Health Card (SHC) Scheme', a Central Scheme that provides information about soils and the kind of crops to be grown in various regions, has been launched in February 2015 by the Union Government that has aimed at issuing 14 crore Soil Health Cards to the farmers in the country over the next 3 years to check the excess use of fertilizers and to improve the soil health (GOI, 2015a). It has been approved for implementation during the remaining period of 12th Plan with an outlay of Rs 568.54 crore. This scheme is being promoted by the Department of Agriculture & Co-operation under the Ministry of Agriculture & Farmers Welfare. It is being implemented through the Department of Agriculture of all the State and Union Territory Governments.

Since the year 2015 was celebrated by the United Nations as the 'International Year of the Soils', it was decided by Government of India to issue soil health cards to as many farmers as possible during the corresponding year. Hence, it was decided to complete the first cycle in 2 years instead of 3 years. The target for 2015-16 was revised from the initial 84 lakh samples to 100 lakh samples to issue an estimated number of 5 crore soil health cards to the farmers. The remaining 153 lakh samples have been targeted to be covered in 2016-17. The 5th December, 2015 has been celebrated as 'World Soil Day' on which the MOA has celebrated the same by organizing events at State, District and Block levels by issuing soil health cards to invited farmers and also educate them and create greater awareness about the importance of soil health. The Department also planned a media campaign and organize training programmes at various State Agricultural Universities and Krishi Vigyan Kendras, as also at the national & state levels.

A SHC is meant to be given to each farmer to make him/her aware of soil nutrient status of his/her land holding and advice him/her on the dosage of fertilizers and also the needed soil amendments, that s/he should apply to maintain soil health in the long run. SHC is a printed report that a farmer is handed over for each of his holdings. It contains

the status of his soil with respect to 12 parameters, namely N, P, K (Macro-nutrients); S (Secondary- nutrient); Zn, Fe, Cu, Mn, Bo (Micro - nutrients); and pH, EC, OC (Physical parameters). Based on this, the SHC also indicates fertilizer recommendations and soil amendment required for the farm. The card contains an advisory based on the soil nutrient status of a farmer's holding. It shows recommendations on dosage of different nutrients needed. Further, it advises the farmer on the fertilizers and their quantities s/he should apply, and also the soil amendments that he should undertake, so as to realize optimal yields.

SHCs are made available once in a cycle of 3 years, which indicates the status of soil health of a farmer's holding for that particular period. The SHC given in the next cycle of 3 years will be able to record the changes in the soil health for that subsequent period. As per the present norms (GOI, 2015b), the soil samples are to be drawn in a grid of 2.5 ha in irrigated area and 10 ha in rainfed area with the help of GPS tools and revenue maps.

The State Governments have been given the responsibility to collect samples through the staff of their departments or through the staff of an outsourced agency. The State Government may also involve the students of local Agriculture / Science Colleges.

Collection and Testing of Soil Samples

As per the Government of India norms, the soil samples are taken generally two times in a year, after harvesting of Rabi and Kharif Crop respectively or when there is no standing crop in the field. Soil Samples are collected by a trained person from a depth of 15-20 cm by cutting the soil in a "V" shape. The soil sub-samples are collected from four corners and the centre of the field and mixed thoroughly and a part of this picked up as a sample. Areas with shade, ploughed or disturbed fields, very moist or flooded by rains are avoided, while taking soil samples. The sample chosen are bagged and coded. It is then transferred to soil test laboratory (STL) for analysis. The soil samples are tested as per the approved

standards for all the agreed 12 parameters in the approved STLs as follows:

i. At the STLs owned by the Department of Agriculture and by their own staff.
ii. At the STLs owned by the Department of Agriculture but by the staff of the outsourced agency.
iii. At the STLs owned by the outsourced agency and by their staff.
iv. At ICAR Institutions including KVKs and SAUs.
v. At the laboratories of the Science Colleges/Universities by the students under supervision of a Professor/ Scientist.

Implementation of SHC Programme

Central Government has been providing assistance to State Governments for setting up more number of Soil Testing Laboratories so as to issue Soil Health Cards to farmers at their doorsteps within the stipulated time periods. State Governments have adopted innovative practices like involvement of agricultural students, NGOs and private sector in soil testing, determining average soil health of villages, etc., to issue Soil Health Cards.

Among various states, Gujarat has been a leading State in streamlining the Soil Health Card (SHC) Programme for the benefit of farmers at grass-root level. So far, a total of 53.69 lakh soil health cards have been generated and given to farmers by the end of 2013-14. Out of which, 6.26 lakh soil health cards have been distributed in the year 2013-14 alone (Swain et. al, 2014). The programme has generated alternative crop planning and recommendations for 229 Talukas and 24324 villages and generated all Talukas and Villages Model Action Plans (GOG, 2013).

So far, there is a dearth of systematic studies undertaken to examine the problems and prospects in implementation of SHC programme in various parts of the country. It is necessary to examine the effectiveness of the programme in assuring better soil health, more crop productivity and problems and prospects in adoption of recommended doses of fertilisers by farmers in the country. Since the Gujarat state is

one of the front runners in implementation of the scheme well before (2003-04) the launch of the Scheme at all-India level, the present study attempts to undertake a detailed systematic study to address all these issues in the context of Gujarat state.

1.4. Major Objectives/Agenda of the Study

The objectives of the study are as follows:

1. To assess the progress in implementation of Soil Health Card Programme in Gujarat;

2. To evaluate the quality of implementation of the programme in terms of quality of soil sample collection, soil testing for different nutrients, generation and timely delivery of soil health cards, and the extent of use and acceptability of the SHCs by the farmers;

3. To examine the level of adoption and constraints in the adoption of recommended doses of fertilizers based on soil test reports by the farmers; and

4. To analyse the impact of adoption of recommended doses of fertilisers on soil health, crop productivity and returns.

1.5. Data and Methodology

The present study is based on both secondary and primary level data. The reference year for the study based on primary data collection and analysis is 2014-15. The farmers who got their soil tested during the last three years period (2012-13 to 2014-15) were covered under the survey. About 11 districts covering all 8 agro climatic zones (ACZ) of the state were included for the detailed study (Map-1.1 & Map 1.2). Number of districts from each ACZ was determined according to size of corresponding ACZ. Number of talukas/tehsils (16 in total) and sample size from various

districts were drawn in proportion of size of the district, i.e., more talukas and households were covered from the district having more area in the state (Table 1.1).

A sample of 30 soil test farmers and 15 non-soil test farmers per taluka were selected randomly from each district. Thus, the total sample size was 720, out of which 480 were the soil test farmers and 240 were the non-soil test farmers.

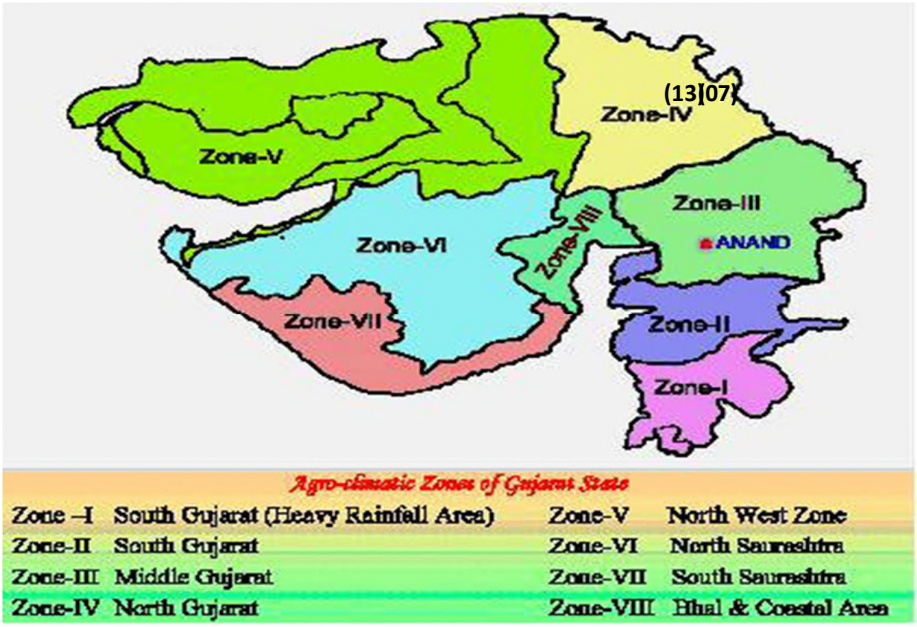
Table 1.1: Selection of Sample Farmers from different Agro-Climatic Zones of Gujarat

Zone	Agro-climatic Zones	Total No. of Talukas	No. of Talukas selected for	Name of selected Talukas	Name of selected districts	Total sample farmers to be surveyed			
						Soil Test	Non-Soil test	Total	% Distribution
I	South Gujarat (Heavy rain area)	2	1	Songarh	Tapi	30	15	45	6.25
II	South Gujarat Zone	2	1	Valia	Bharuch	30	15	45	6.25
III	Middle Gujarat Zone	7	2	Jhalod, Limkheda	Dahod	60	30	90	12.5
IV	North Gujarat Zone	13	3	Vijapur, Petlad, Vasad	Anand, Mahesana	90	45	135	18.75
V	Bhal and Coastal Area Zone	3	1	Ghogha	Bhavnagar	30	15	45	6.25
VI	South Saurashtra Zone	13	3	Gondal, Atkot, Manavadar	Junagadh, Rajkot	90	45	135	18.75
VII	North Saurashtra Zone	12	3	Kalavad, Lalpur and Jamjodhpur /Bedi	Jamnagar	90	45	135	18.75
VIII	North West Zone	8	2	Mandvi, Dhantiwada	Kachchh, Banaskantha	60	30	90	12.5
	Gujarat	**60**	**16**	-	**11**	**480**	**240**	**720**	100

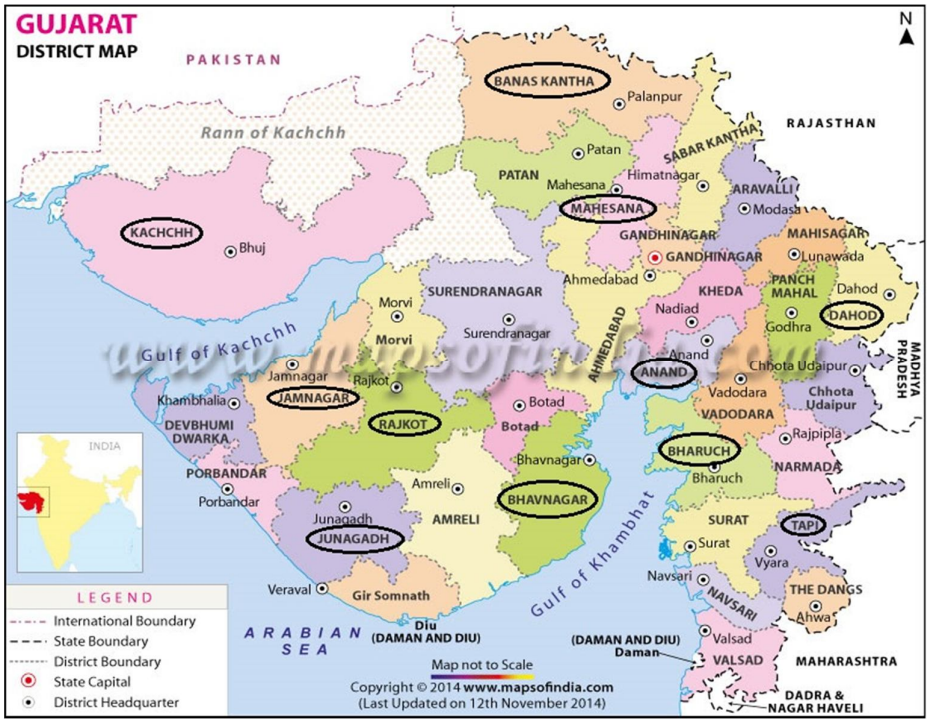
The sample farmers were further classified into different farm size groups post-survey as per the size of net operated area. Soils of selected farmers were tested separately. The test results were used to make a comparative analysis on Soil Health Programme in the state. The soil test results were compared with data given on SHCs available with farmers and

also with SHCs in the names of corresponding farmers uploaded on SHC portal maintained at AAU, Anand.

Map 1.1: Agro-Climatic Zones in Gujarat



Map 1.2: Location Map of Study Districts in Gujarat, India



The cluster approach was followed to ensure that adequate soil test farmers are available for the survey. Further, passable measures were taken to ensure that the selected villages fall under the same agro-climatic conditions of sample districts and that the selected villages have certain common characteristics such as soil type, irrigation and crop variety.

The multi-stage sampling method was used to select the districts, blocks and farm households. At first stage, 11 districts of Gujarat were selected from 8 ACZs. At second stage, 16 blocks/talukas were selected from 11 study districts. At third stage, desired number of sample households (720) representing different farm categories (MF: Marginal farmers (0-1 ha); SF: Small farmers (1-2 ha); SMF: Semi Medium farmers (2-4ha); MDF: Medium farmers (4- 6 ha); LF: Large farmers (>6 ha)) were selected from the study talukas. The sample farmers were classified into different farm size groups post-survey as per the size of net operated area.

Soil samples of selected farmers in the soil test group were collected and tested separately at Krishi Vigyan Kendra (KVK), Kheda, Gujarat. The test results were used to make a comparative analysis on Soil Health Card Programme in the state. The soil test results were compared with data given on SHCs available with the farmers (issued under SHC Programme by the Government) and also with SHCs in the names of corresponding farmers uploaded on SHC portal maintained at AAU, Anand. Thus, following three types of Soil Health Cards (SHCs) were used for comparative analysis:

- SHCs available with the farmers (issued under SHC Programme by the Government of Gujarat (SHC-GOG)
- SHCs in the names of corresponding farmers uploaded on SHC portal maintained at AAU, Anand (SHC-AAU)
- SHCs generated afresh by Krishi Vigyan Kendra (KVK), Kheda (SHC-KVK)

1.6 Limitation of the Study

As per the study design, copy of soil health card from each selected farmer was to be collected. In some cases, some farmers did not have the same with them. Second, most of soil tested farmers were not aware about their soil test results. Third, comparing and interpreting soil test results under different scenarios was a difficult task since the quality of soil samples is very delicate that can vary from place to place even within the same plot, or over a period of time. The soil quality can be affected by a number of factors which may not be controllable within a period of time.

1.7 Organization of the Report

The present report is organized in seven chapters. The introductory chapter discusses the rationale, objectives of the study and methodology used for data collection and data analysis. The coverage, sampling design and conceptual framework of the study have been discussed in this chapter followed by the chapter scheme of the report.

The second chapter analyses the progress in soil health card programme in Gujarat state. The overview of socio-economic profile of sample households/farmers, main features of the sample households including land ownership pattern, cropping pattern, sources of irrigation, area under HYV and value of output, farm assets holdings and the details of agricultural credit availed have been analyzed in Chapter III. The fourth chapter assesses the performance of Soil Health Card Programme in the state with the help of household level data. The details of soil testing and recommended doses of fertilisers adopted by the sample farmers and the source of information about soil testing by soil test farmers, reasons for soil testing by soil test farmers, reasons for not testing soil by control farmers, status of soil health on the sample soil test farms, and recommended doses of fertilisers applied by the sample farmers on soil test basis, and the extent of variations in soil test results given in various SHCs produced by government and other agencies have been discussed in this chapter.

The next chapter (i.e., Chapter V) examines the extent of adoption of recommended doses of fertilisers as per the SHC and its constraints. The determinants of adoption of recommended doses of fertilisers have been analysed with the use of a Logit Model. The sources of information about recommended doses of fertilisers by control farmers, application of actual quantity of fertilisers by sample households, method of application of chemical fertilisers by sample farmers, and the extent of use of organic fertilisers by the sample households have been discussed in this chapter. The impacts of adoption of recommended doses of fertilisers have been discussed in Chapter VI. The last chapter (i.e., Chapter VII) presents the summary, concluding observations and policy implications of the study.

1.8 Stakeholders in the Research Project

The present study on *'Soil Health Card Programme in Gujarat: Implementation, Impact and Impediments'* was sponsored by Centre for International Projects Trust (CIPT), New Delhi and was undertaken at our Centre, i.e., Agro-Economic Research Centre, Sardar Patel University, Vallabh Vidyanagar, Gujarat, India.

Photo 1A & 1B: Training on Soil Sample Collection to Field Staff

Photo 2A & 2B: Training of Research Team on Soil Testing and SHC at KVK Kheda

Photo 3: Soil Sample Collection from the Farmer's field

Photo 4: Soil Sample Preparation before packing

Chapter II

Progress in Soil Health Card Programme in Gujarat

2.1 Implementation of Soil Health Card Programme in Gujarat

Gujarat is a leading state in India in streamlining the Soil Health Card (SHC) Programme. This is an only one of its kind information project prepared and initiated by the Government of Gujarat for the benefit of farmers at the grass-root level since 2004-05. The programme was implemented in a phased manner. During the initial phases (2004-05 to 2011-12), 38.43 lakhs farmers (out of total of 46.61 lakhs in Gujarat) were provided Soil Health Cards (SHCs), covering about 85.5 per cent of total farmers in Gujarat. The Second phase was started from 2012-13, aiming to cover 25% farm holding (11.50 Lakh) every year. During last two years (2012-13 and 2013-14), about 15.26 lakh farmers have been provided the SHCs. Thus, since the inception, a total of 53.69 lakh soil health cards have been given to farmers by the end of 2013-14 (Table 2.1 & Figure 2.1). The programme has generated alternative crop planning and recommendations for 229 talukas and 24324 villages and generated all Taluka and Village Model Action Plans (GoG, 2013).

Figure 2.1: Progress in Soil Health Card Programme in Gujarat, India

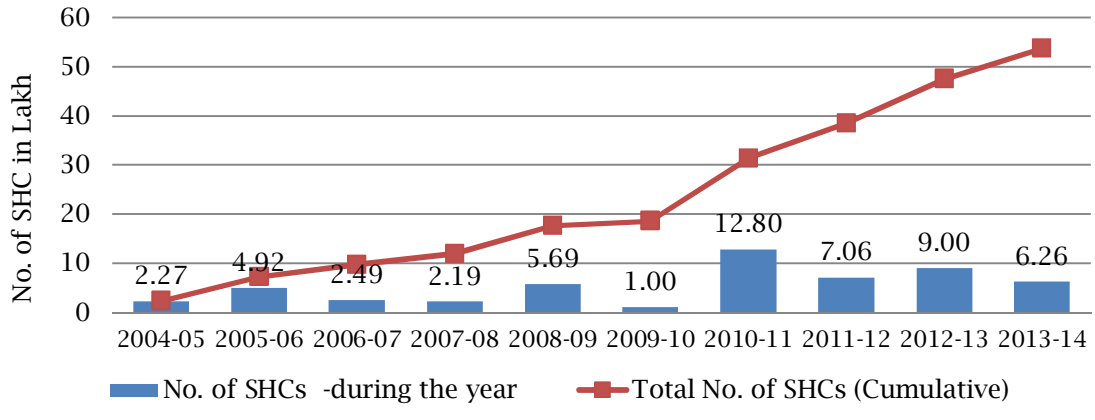


Table 2.1: Progress in Soil Health Card Programme in Gujarat, India

Year	Soil Testing Laboratories under	Number of soil testing laboratories			Annual analyzing capacity	No. of sample analyzed	Capacity Utilized (%)	No. of dist. having STL	No. of SHCs made available to farmers	
		Static	Mobile	Total					During the year	Cumulative Total
1	2	3	4	5	6	7	8	9	10	11
2004-05	(i) State Government	16	4	20	184000	184893	100.5	18	227425	
	(ii) Public Sector Undertaking	3	1	4	50000	138089	276.2	0		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	19	5	24	234000	322982	138.0	18	227425	227425
2005-06	(i) State Government	16	4	20	184000	188596	102.5	18	492200	
	(ii) Public Sector Undertaking	3	1	4	60000	125583	209.3	0		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	19	5	24	244000	314179	128.8	18	492200	719625
2006-07	(i) State Government	18	2	20	190000	211691	111.4	18	249186	
	(ii) Public Sector Undertaking	3	1	4	50000	99677	199.4	3		
	(iii) Private Sector						0.0			
	(iv) Total	21	3	24	240000	311368	129.7	21	249186	968811
2007-08	(i) State Government	18	2	20	190000	142692	75.1	18	219000	
	(ii) Public Sector Undertaking	3	1	4	50000	84789	169.6	3		
	(iii) Private Sector						0.0			
	(iv) Total	21	3	24	240000	227481	94.8	21	219000	1187811
2008-09	(i) State Government	18	2	20	190000	158224	83.3	18	568614	
	(ii) Public Sector Undertaking	3	1	4	50000	83819	167.6	3		
	(iii) Private Sector						0.0			
	(iv) Total	21	3	24	240000	242043	100.9	21	568614	1756425
2009-10	(i) State Government	18	2	20	190000	307348	161.8	19	100000	
	(ii) Public Sector Undertaking	3		3	50000	104733	209.5	3		
	(iii) Private Sector						0.0			
	(iv) Total	21	2	23	240000	412081	171.7	22	100000	1856425
2010-11*	(i) State Government	18	2	20	210000	650000	309.5	19	1279968	
	(ii) Public Sector Undertaking	70	0	70	1430223	1401646	98.0	24		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	88	2	90	1640223	2051646	125.1	26	1279968	3136393
2011-12	(i) State Government	20	2	22	220000	136408	62.0	21	706241	
	(ii) Public Sector Undertaking	81	0	81	810000	353625	43.7	24		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	101	2	103	1030000	490033	47.6	24	706241	3842634

Table 2.1 Continued…

1	2	3	4	5	6	7	8	9	10	11
2012-13	(i) State Government	20	2	22	220000	278931	126.8	21	900095	
	(ii) Public Sector Undertaking	81	0	81	810000	607421	75.0	24		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	101	2	103	1030000	886352	86.1	26	900095	4742729
2013-14	(i) State Government	20	2	22	220000	203725	92.6	21	626362	
	(ii) Public Sector Undertaking	112	0	112	810000	560099	69.1	24		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	132	2	134	1030000	763824	74.2	26	626362	5369091
CAGR (2004-05 to 2013-14)	(i) State Government	2.5	-7.4	1.1	2.0	1.1	-0.9	1.7	11.9	
	(ii) Public Sector Undertaking	49.5	-100.0	44.8	36.3	16.8	-14.3			
	(iii) Private Sector									
	(iv) Total	24.0	-9.7	21.1	17.9	10.0	-6.7	4.2	11.9	42.1

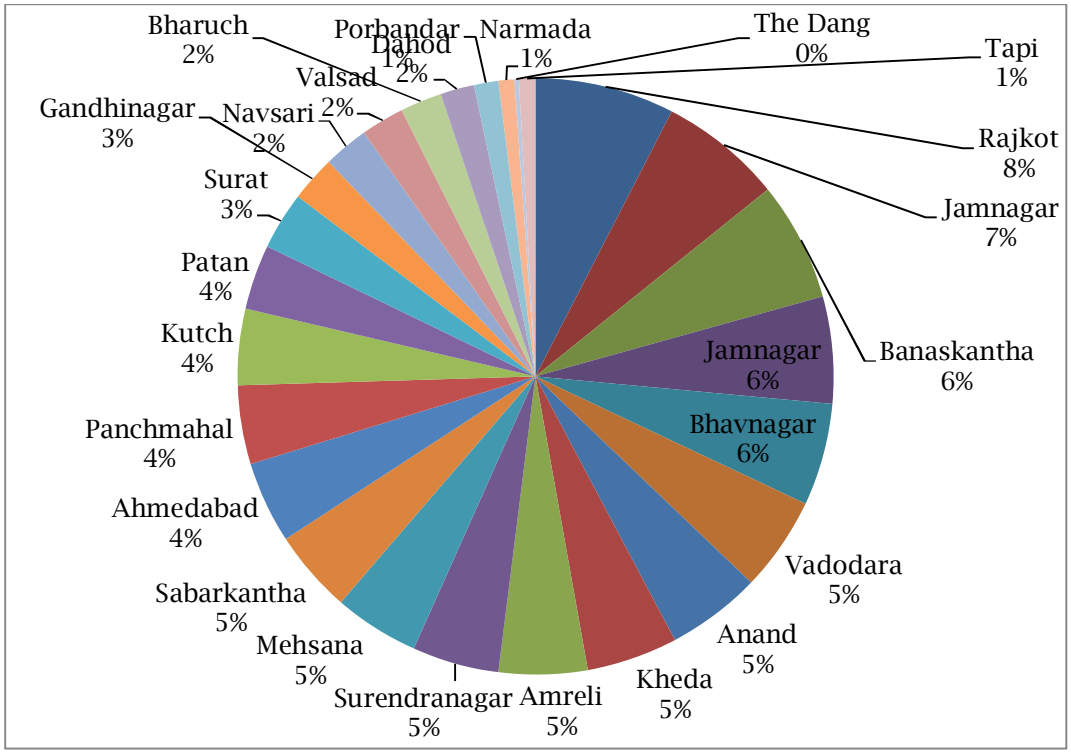
Notes: *During 2010-11, other than 70 PSU, analysis work done in 55 science colleges to meet the Golden Goal 739431 samples were analysed by science colleges. Analysis work was outsourced to private agencies by State Government STLs to meet the Golden Goal and work was done in two shifts. Soil samples were analysed by Public Sector Undertakings such as APMCs, Govt. supported Corporation Labs, Govt supported Sugar cooperatives labs) and Science Colleges.

Source: Department of Agriculture, Government of Gujarat

Along with increase in cumulative number of SHCs distributed to farmers from 2.27 lakh in 2004-05 to 53.69 lakh in 2013-14, the number of soil testing labs (STL) has also increased from 20 in 2004-05 to 134 in 2013-14 at the rate of 17.9 per cent per annum. Similarly, the annual soil sample analysing capacity has increased from 2.34 lakh in 2004-05 to 10.3 lakh in 2013-14. The actual soil sample analyzed has increased at the rate of 10.0 per cent per annum, i.e. from 3.23 lakh in 2004-05 to 7.64 lakh in 2013-14. During 2015-16, the 9, 20,000 cards have been distributed against the target of 68, 30,000 in the state (GOI, 2016).

The district wise distribution of SHCs has been presented in Figure 2.2. The distribution has been more or less even across districts in Gujarat. The share varies mostly from 3 per cent to 6 per cent depending on the size of the districts.

Figure 2.2. Distribution of SHCs across districts in Gujarat (2012-13)

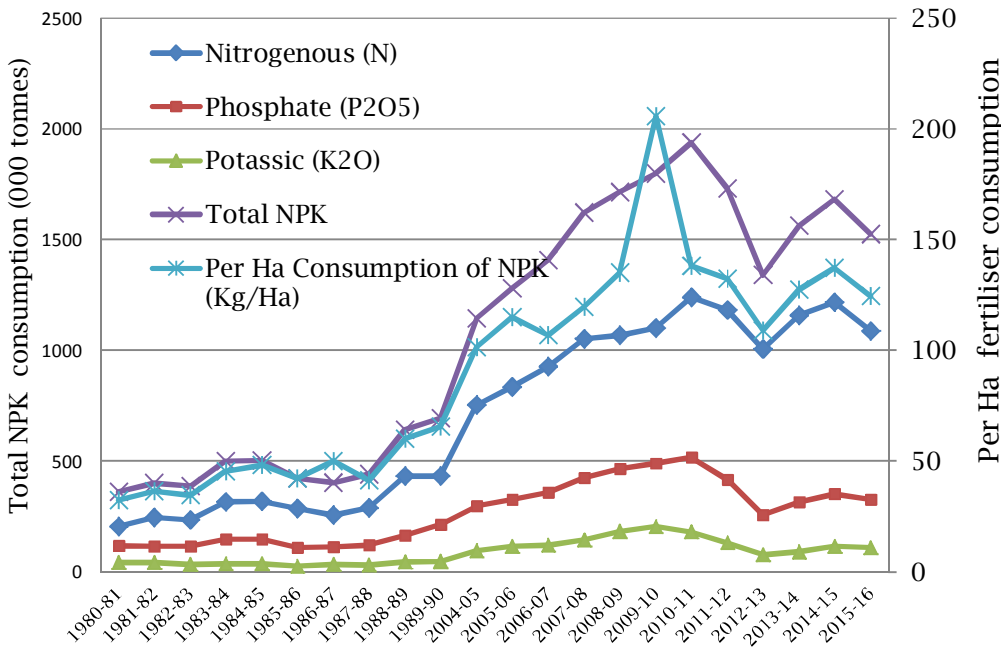


2.2 Effect of SHC Programme on Fertiliser Consumption by Nutrients

The increase in use of fertiliser was one of the major factors that changed the complexion of agriculture since Green Revolution period. More adoption of HYV seeds was supported by increased application of chemical fertilisers to raise agricultural output substantially across the country. As Shah (1989) pointed out, Gujarat has experienced substantial increase in fertiliser use during the period of post green revolution (1966-1985). Similar trend was also observed to continue during the period of wider technology dissemination (1985-2000) (Swain, 2013). The per hectare consumption of fertiliser was the highest in Western India compared to other parts of the country (Sharma and Sharma, 2000). It may be noted from Table 2.2 and Figure 2.3 that consumption of NPK in Gujarat state has increased from 3.57 lakh metric tonnes in 1980-81 to 19.39 lakh metric tonnes in 2010-11, implying an increase by 5.4 times. The NPK consumption per hectare of gross cropped area (GCA) has also

increased by 16.5 per cent, from 32.6 kg in 1980-81 to 138.1 kg in 2010-11. But it has declined thereafter to 109.0 kg/ha in 2012-13. The total consumption of NPK in the state has also decreased from 19.39 lakh metric tonnes in 2010-11 to 13.42 lakh metric tonnes in 2012-13.However, it was further increased to 15.2642 lakh metric tonnes in 2015-16.

Figure 2.3 Trends in Fertiliser Consumption in Gujarat



The decline in fertiliser consumption during the recent past may be partly due to increased awareness generated by the Soil Health Card (SHC) programme in the state about the negative consequences of application of overdoses of fertiliser and positive effects of balanced fertiliser application on soil health. However, it is estimated that per hectare use of fertiliser has increased to about 127.7 kg/ha in 2013-14, indicating the reversal of trend in fertiliser use in the state.

It may be seen from the Table 2.2 that the NPK ratio has fluctuated a lot over a period of 1980-81 to 2015-16. The ratio has been gradually diverged from the ideal NPK ratio of 4:2:1. It has diverged from 4.9:2.8:1.0

during 1980-81 to around 10.0:8.0:1.0 during 2015-16, in spite of implementation of SHC Scheme in the state since 2003-04.

Table 2.2: Fertilizer Consumption and NPK Ratio in Gujarat (1980-81 to 2015-16)

(In 000' tonnes)

Sr. No	Year	Fertiliser use					NPK Ratio		
		Nitrogenous (N)	Phosphate (P2O5)	Potassic (K2O)	Total NPK	Per Ha Consumption of NPK (Kg/Ha)	N	P	K
1	1980-81	204.12	117.22	41.42	362.76	32.58	4.9	2.8	1.0
		(56.3)	(32.3)	(11.4)	(100.0)				
2	1990-91	430.75	217.15	58.49	706.39	67.26	7.4	3.7	1.0
		(61.0)	(30.7)	(8.3)	(100.0)				
3	2000-01	498.96	195.67	56.01	750.64	69.56	8.9	3.5	1.0
		(66.5)	(26.1)	(7.5)	(100.0)				
4	2005-06	834.73	328.46	116.73	1279.92	114.99	7.2	2.8	1.0
		(65.2)	(25.7)	(9.1)	(100.0)				
5	2010-11	1241.22	518.00	179.94	1939.16	138.08	6.9	2.9	1.0
		(64.0)	(26.7)	(9.3)	(100.0)				
6	2011-12	1183.30	417.02	132.74	1733.06	132.59	8.9	3.1	1.0
		(68.3)	(24.1)	(7.7)	(100.0)				
7	2012-13	1007.70	257.82	76.46	1341.97	108.99	13.2	3.4	1.0
		(75.1)	(19.2)	(5.7)	(100.0)				
8	2013-14	1158.93	315.37	90.60	156.90	127.65	12.8	3.5	1.0
		(738.6)	(201.0)	(57.7)	(100.0)				
9	2014-15	1217.51	351.99	114.51	1684.00	NA	10.6	3.1	1.0
		(72.3)	(20.9)	(6.8)	(100.0)				
10	2015-16	1088.61	328.14	109.26	1526.01	NA	10.0	3.0	1.0
		(71.3)	(21.5)	(7.2)	(100.0)				
CAGR (1980-81 to 1990-91) %		7.8	6.4	3.5	6.9	7.5	4.1	2.8	0.0
CAGR (1990-91 to 2000-01) %		1.5	-1.0	-0.4	0.6	0.3	1.9	-0.6	0.0
CAGR (2000-01 to 2010-11) %		9.5	10.2	12.4	10.0	7.1	-2.5	-1.9	0.0
CAGR (1980-81 to 2015-16) %		4.9	3.0	2.8	4.2	4.0	2.0	0.2	0.0

Note: Figures in parentheses are the percentages of total.

Sources: GOG (1991) various issues; GOG (2009);GOG (2016)

The district wise analysis of fertiliser use in Gujarat has been presented in Table 2.3 and Figure 2.4. A wide variation in per hectare consumption of NPK is observed across districts during 2013-14. The top five districts having high consumption of fertilisers were Surat (300.6 kg/ha), Navsari (287.8 kg/ha), Rajkot (218.5 kg/ha), Anand (207.5 kg/ha) and Bhavnagar (163.3 kg/ha). The bottom five districts having very low

level of consumption of fertilisers were Dangs (4.9 kg/ha), Dahod (57.4kg/ha), Patan (61.9 kg/ha), Kutch (70.1 kg/ha) and Surendranagar (85.1 kg/ha). Almost half of the districts of the state (16 districts, viz. Surat, Navsari, Rajkot, Anand, Bhavnagar, Kheda, Bharuch, Valsad, Junagadh, Vadodara, Gandhinagar, Amreli) have recorded higher use of fertiliser than State average of 127.7 kg/ha. It indicates the large variation in use of fertiliser across the districts in the state.

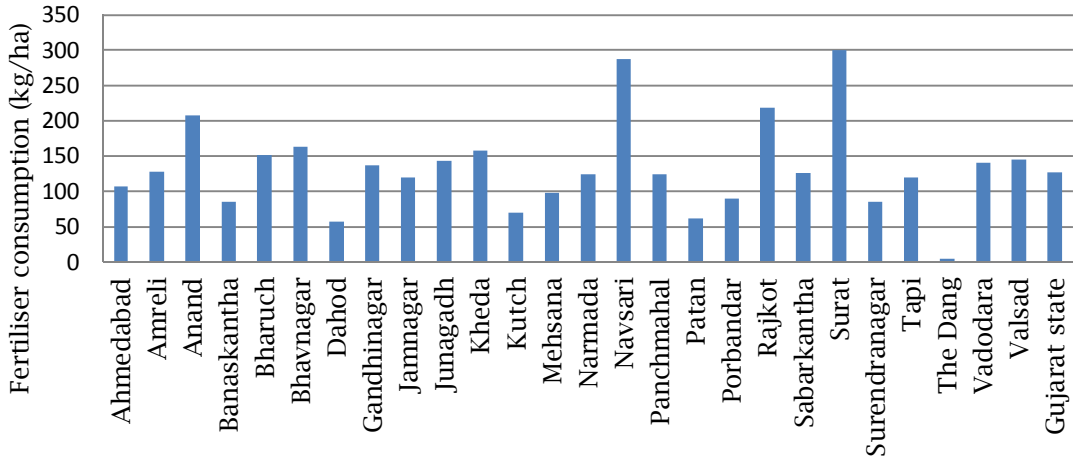
Table 2.3: District-wise Per Hectare Consumption of Fertilisers (2013-14)

(in Kg/ha.)

Sl. No.	District	N	P	K	NPK
1	Ahmedabad	82.29	20.26	4.62	107.17
2	Amreli	82.62	40.40	5.31	128.33
3	Anand	170.74	25.19	11.53	207.46
4	Banaskantha	63.41	18.08	3.66	85.14
5	Bharuch	106.81	28.78	15.10	150.69
6	Bhavnagar	104.76	51.01	7.48	163.25
7	Dahod	41.35	12.62	3.07	57.04
8	Gandhinagar	101.54	25.18	9.51	136.23
9	Jamnagar	78.94	35.22	5.76	119.92
10	Junagadh	95.20	41.49	6.59	143.28
11	Kheda	129.46	21.51	6.64	157.61
12	Kutch	53.75	15.52	0.84	70.12
13	Mehsana	75.27	19.95	2.83	98.05
14	Narmada	89.28	20.78	13.52	123.58
15	Navsari	169.89	66.14	51.79	287.83
16	Panchmahal	102.73	18.19	3.20	124.13
17	Patan	48.55	12.70	0.73	61.98
18	Porbandar	55.49	29.92	4.29	89.70
19	Rajkot	145.11	59.03	14.36	218.50
20	Sabarkantha	86.64	27.32	12.07	126.04
21	Surat	167.64	81.74	51.18	300.57
22	Surendranagar	63.82	19.67	1.60	85.09
23	Tapi	74.48	26.29	18.51	119.28
24	Dang	3.44	0.67	0.80	4.91
25	Vadodara	102.69	22.54	15.63	140.86
26	Valsad	88.42	34.41	22.46	145.29
27	Gujarat state	89.91	29.36	8.37	127.65

Source: GOG (2016).

Fig. 2.4: District-wise Per Hectare Consumption of Fertilisers (2013-14)



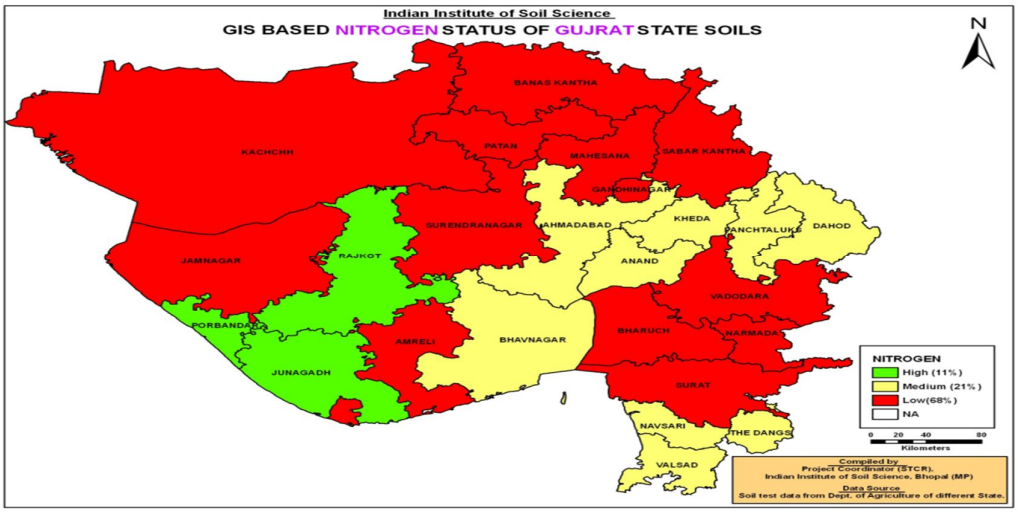
The district wise soil fertility status in Gujarat has been presented in Table 2.4 (also see Maps 2.1 to 2.3). About 15 districts out of 26 districts in the state were found to have low soil fertility in terms of nitrogenous fertilisers. Only three districts (Rajkot, Porbandar and Junagadh) were having high nitrogen status. The phosphorous status was found to be low in 11 districts and medium in the rest of the districts. The potassium status was found be very high in the state. It was found to be high in about 22 districts. The medium status of potassium was found in only 4 districts. No districts in the state recorded low fertility status in terms of potassium.

Table 2.4: District wise Fertility Status in Gujarat

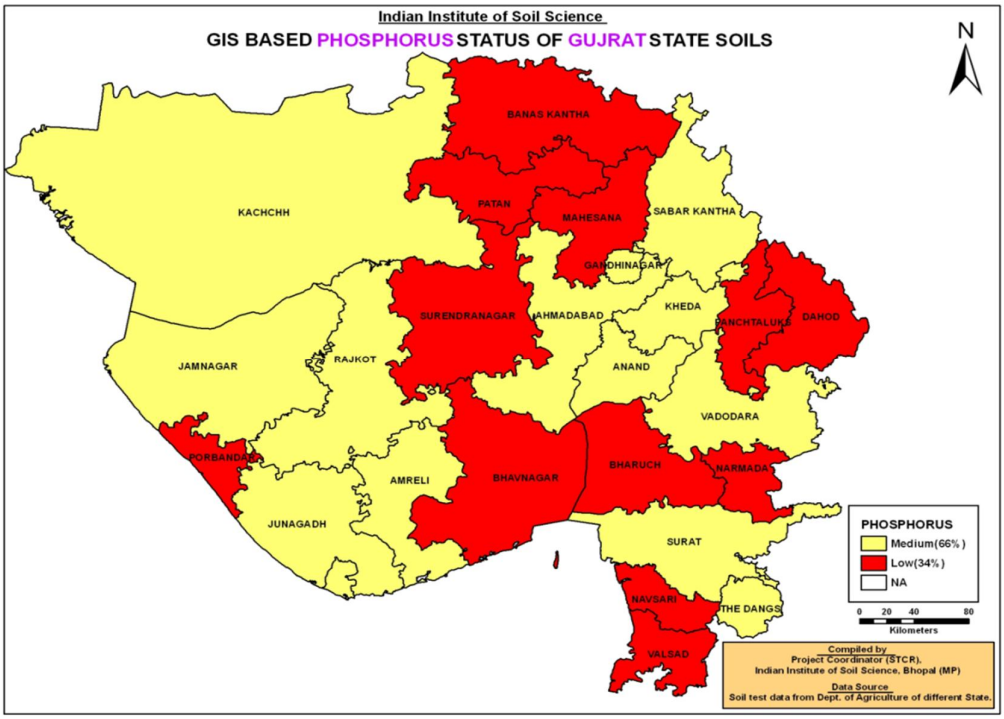
Sr. No.	Name of the districts	Nutrient Status		
		N	P	K
1	Ahmedabad	M	M	H
2	Amreli	L	M	H
3	Anand	M	M	H
4	Banaskantha	L	L	M
5	Bharuch	L	L	H
6	Bhavnagar	M	L	H
7	Dahod	M	L	H
8	Dang	M	M	H
9	Gandhinagar	L	M	H
10	Jamnagar	L	M	H
11	Junagadh	H	M	H
12	Kheda	M	M	H
13	Kutch	L	M	M
14	Mahesana	L	L	H
15	Narmada	L	L	H
16	Navsari	M	L	H
17	Panchmahal	M	L	H
18	Patan	L	L	H
19	Porbandar	H	L	H
20	Rajkot	H	M	H
21	Sabarkantha	L	M	M
22	Surat	L	M	H
23	Surendranagar	L	L	H
24	Vadodara	L	M	M
25	Valsad	M	L	H

Note: 'M' denotes Medium, 'H' denotes High and 'L' denotes Low level of nutrients
Source: http://www.iiss.nic.in/showmapD.asp?state=Gujarat&level=District

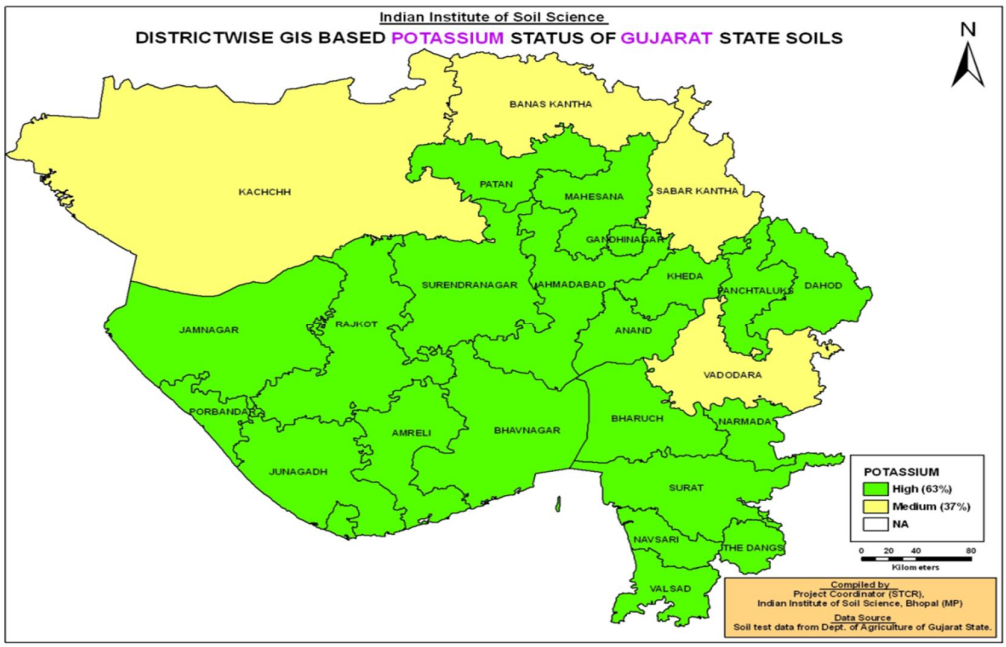
Map 2.1: Nitrogen Status of Soils in Gujarat



Map 2.2: Phosphorous Status of Soils in Gujarat



Map 2.3: Potassium Status of Soils in Gujarat



Chapter III

Socio-Economic Characteristics of Sample Households

3.1 Introduction

The primary level data pertaining to selected farmers, their classification as per the land holdings and their other socio-economic characteristics have been discussed in this Chapter. The household level analysis was conducted following a cluster approach on a sample of 240 control farmers (non-soil test) and 480 soil test farmers for assessing the extent of adoption and use of SHCs, adoption of recommended doses of fertilisers and their impacts on crop production and productivity.

3.2 Distribution of Sample Households by Farm Size

The distribution of sample households is presented in Table 3.1. Among the farmers, the marginal and small farmers together constituted about 47.9 per cent of total soil test farmers and 38.3 per cent of total control farmers. The remaining sample households were the medium and large farmers.

Table 3.1 : Distribution of Sample Households by Farm Size Category

(Number of households)

Farmer category	Soil test farmers		Control farmers		Total	
Marginal	111	(23.1)	44	(18.3)	155	(21.53)
Small	119	(24.8)	48	(20.0)	167	(23.19)
Semi Medium	108	(22.5)	84	(35.0)	192	(26.67)
Medium	87	(18.1)	38	(15.8)	125	(17.36)
Large	55	(11.5)	26	(10.8)	81	(11.25)
Total	480	(100.0)	240	(100.0)	720	100.00

Notes: 1. Farmer categories:- MF: Marginal farmers (0-1 Ha); SF: Small farmers (1-2 Ha); SMF: Semi Medium farmers (2-4Ha); MDF: Medium farmers (4- 6 Ha); LF: Large farmers (>6Ha), as per the methodology followed for Cost of Cultivation Scheme.
2. Figures in parentheses are the percentages of total.

Source: Field Survey data

3.3 Socio-Economic Characteristics of Households

The socio-economic characteristics of sample households are presented in Table 3.2. It can be seen from the table that the average age of respondent of selected farmer households was around 53 years for both soil test and control farmers. The years of education were more (8.7 years) for soil test farmers compared to control farmers (6.8 years). The soil test farmers also depicted better results with respect to average number of people engaged in agriculture, average years of experience in farming and participation in village level organizations. More than half of the sample households belonged to general caste, while around 25 per cent were from other backward classes (OBCs) and remaining are the SC/ST households in both the groups. Thus, the soil test farmers were relatively older, more educated and experienced than the control farmers.

Table 3.2 Socio-economic Characteristics of sample Households

Sr. No.	Particulars	Soil Test Farmers	Control Farmers
1	Number of sample farmer households	480	240
2	Average age of respondent (years)	53.49	52.83
3	Average years of respondent education	8.70	6.83
4	Agriculture as main occupation (% of respondents)	90.63	97.08
5	Gender (% of respondents):		
	Male	95.21	99.58
	Female	4.79	0.42
6	Average family size (No.)	6.67	6.05
7	Average number of people engaged in agriculture	3.05	2.86
8	Average years of experience in farming	31.76	30.77
9	% of farmers being a member of any association	37.29	32.92
10	Caste (% of households):		
	SC	3.13	4.17
	ST	19.58	14.58
	OBC	27.08	24.58
	General	50.21	56.67

Source: Field Survey data

3.4 Details of Operational Land Holdings

The details of land holding pattern of the sample households have been presented in Table 3.3. The average size of land holding was 2.98 ha per household, out of which 2.65 ha of land was under irrigation. The soil test farmers enjoyed better irrigation facility compared to non-soil test farmers. The gross cropped area for soil test farmers and control farmers was 3.85 ha and 3.65 ha respectively. The cropping intensity for soil test farmers and control farmers was estimated to be 128.7 per cent and 123.8 per cent respectively. Thus, cropping intensity for soil test group was higher than control farmer. The land leased-in tendency was found more in case of control group farmers than soil test farmers.

Table 3.3. Operational Landholding of the Sample Households

(Ha/ household)

Particulars	Soil Test Farmers	Control Farmers	Overall
Owned Land	2.79	2.60	2.72
Leased –in	0.22	0.36	0.27
Leased-out	0.02	0.01	0.01
Uncultivated /Fellow	0.00	0.00	0.00
Net operated area (NOA)	2.99	2.95	2.98
Net irrigated area	2.71	2.54	2.65
Net unirrigated area	0.29	0.41	0.33
Gross Cropped area(GCA)	3.85	3.65	3.78
Cropping intensity (%)	128.67	123.80	127.06

Source: Field Survey data

3.5 Sources of Irrigation

Among the sources of irrigation, bore wells and open wells/dug wells were the major sources of irrigation for the sample households (Table 3.4). For both groups of farmers, bore wells were found to be the major sources contributing about 69.2 per cent of total irrigated area. Thus, groundwater was the main source of irrigation for the selected sample households. The canal, tank, river/pond and other water sources accounts meager share in irrigating crops of sample farmers.

Table 3.4: Sources of Irrigation

(% of net irrigated area)

Particulars	Soil Test Farmers	Control Farmers	Overall
Open/ dug well	33.2	25.4	30.7
Bore well	66.9	73.8	69.2
Canal	14.6	11.9	13.7
Tank	0.2	1.1	0.5
River / Ponds and Others	1.6	1.3	1.5
Total	100.0	100.0	100.0

Source: Field Survey data

3.6 Cropping Pattern and Crop Production

As mentioned earlier, among the selected crops, the cropping intensity was better for soil test farmers as compared to control farmers. The proportion of area under more remunerative Rabi crops was also found to be higher (31.4% of GCA) in case of soil test farmers as compared to control farmers (Table 3.5). Thus the proportion of area under Kharif was more among control farmers (74.5%) over soil-test farmers (73.0%).

Table 3.5 : Cropping Pattern of the Sample Household

(Area in Hectare/HH)

SI. No.	Season /Crop	Soil Test Farmers		Control Farmers		Overall	
A	Kharif Crops						
	Paddy	0.16	(4.2)	0.22	(6.1)	0.18	(4.8)
	Bajra	0.09	(2.4)	0.04	(1.0)	0.07	(2.0)
	Maize	0.11	(2.8)	0.18	(4.9)	0.13	(3.5)
	Jowar	0.06	(1.5)	0.05	(1.4)	0.06	(1.5)
	Other Cereals	0.00	(0.0)	0.00	(0.0)	0.00	(0.0)
1	Total Cereals	0.42	(10.9)	0.49	(13.3)	0.44	(11.7)
2	Total Kharif Pulses	0.08	(2.0)	0.13	(3.7)	0.10	(2.5)
	Groundnut	0.62	(16.2)	0.51	(14.0)	0.59	(15.5)
	Sesamum	0.03	(0.7)	0.01	(0.4)	0.02	(0.6)
	Castor	0.12	(3.2)	0.21	(5.7)	0.15	(4.0)
	Other Kharif oilseeds	0.00	(0.0)	0.03	(0.7)	0.01	(0.2)
3	Total Kharif oilseeds	0.77	(20.1)	0.76	(20.8)	0.77	(20.3)
	Cotton	0.88	(22.8)	0.85	(23.2)	0.87	(22.9)
4	Kharif Vegetables	0.07	(1.9)	0.04	(1.1)	0.06	(1.6)
	Kharif Fodder	0.08	(2.2)	0.11	(3.0)	0.09	(2.5)
	Kharif Guar	0.05	(1.2)	0.06	(1.7)	0.05	(1.4)
5	Other Kharif Crops	0.45	(11.8)	0.28	(7.7)	0.40	(10.5)
6	Total Kharif Crops	2.81	(73.0)	2.72	(74.5)	2.78	(73.4)

Table 3.5 continued….

SI. No.	Season /Crop	Soil Test Farmers		Control Farmers		Overall	
B	Rabi Crops						
	Wheat	0.29	(7.6)	0.23	(6.4)	0.27	(7.2)
	Maize	0.06	(1.6)	0.06	(1.7)	0.06	(1.7)
	Jowar	0.01	(0.3)	0.01	(0.3)	0.01	(0.3)
7	Total Rabi Cereals	0.37	(9.5)	0.31	(8.4)	0.35	(9.2)
	Gram	0.03	(0.8)	0.03	(0.8)	0.03	(0.8)
8	Total Rabi Pulses	0.03	(0.8)	0.03	(0.8)	0.03	(0.8)
9	Total Rabi Oilseeds	0.00	(0.1)	0.01	(0.3)	0.01	(0.2)
	Cumin	0.03	(0.7)	0.01	(0.4)	0.02	(0.6)
	Other spices	0.13	(3.3)	0.14	(3.8)	0.13	(3.5)
10	Total Spices	0.16	(4.0)	0.15	(4.1)	0.15	(4.1)
11	Total Vegetable	0.14	(3.6)	0.08	(2.1)	0.12	(3.1)
12	Fodder	0.02	(0.4)	0.00	(0.0)	0.01	(0.3)
	Other Rabi Crops	0.11	(2.9)	0.09	(2.5)	0.10	(2.8)
13	Total Rabi Crops	0.82	(21.3)	0.67	(18.3)	0.77	(20.3)
C	Summer Crops						
	Bajra	0.09	(2.4)	0.08	(2.2)	0.09	(2.3)
	Other Summer crops	0.02	(0.5)	0.12	(3.3)	0.05	(1.4)
14	Total Summer Cereals	0.11	(2.9)	0.20	(5.5)	0.14	(3.7)
	Groundnut	0.00	(0.1)	0.02	(0.4)	0.01	(0.2)
15	Total Oilseeds	0.00	(0.1)	0.03	(0.8)	0.01	(0.3)
	Total Vegetable	0.02	(0.5)	0.01	(0.2)	0.02	(0.4)
	Other summer crops	0.09	(2.3)	0.03	(0.8)	0.07	(1.8)
16	Total summer Crops	0.22	(5.8)	0.27	(7.3)	0.24	(6.2)
D	Gross Cropped area	3.85	(100.0)	3.65	(100.0)	3.78	(100.0)

Note: Figures in parentheses are the percentage of GCA.
Source: Field Survey data

Among the Kharif crops grown by sample farmers, cotton (22.9%), kharif oilseeds such as castor (4.0%) and paddy (4.8%) were the major crops. Among the Rabi crops, wheat (7.2%) and maize (1.7%) were the

major crops. Total summer crops contributed about 6.2 per cent of GCA of the sample farmers.

The variations in crop productivity of various crops between soil test and control farmers have been presented in Table 3.6. It may be observed that, except few crops like groundnut, mung and cumin, soil test farmers had enjoyed better crop yields as compared to control farmers.

Table 3.6: Crop Production of the Sample Household

(Quintal/Ha)

SI. No.	Season /Crop	Soil Test Farmers (ST)	Control Farmers (Non-ST)	% Change for ST over Non-ST farmers
A	Kharif Crops			
1	Paddy	21.1	19.2	10.0
2	Bajra	23.7	20.8	14.3
3	Maize	9.2	9.4	-1.6
4	Jowar	158.4	142.3	11.4
5	Udad	4.9	4.4	10.9
6	Tur	16.2	14.0	15.3
7	Mung	3.7	4.7	-21.8
8	Groundnut	17.1	18.7	-9.0
9	Sesamum	5.3	5.3	0.6
10	Castor	18.6	16.2	14.4
11	Cotton	21.1	16.9	25.1
12	Banana	627.0	487.0	28.7
13	Guar	11.3	10.8	5.0
B	Rabi Crops			
14	Wheat	29.7	29.3	1.3
15	Maize	13.3	13.6	-1.9
16	Jowar	130.9	93.9	39.4
17	Gram	8.3	7.6	9.5
18	Cumin	8.0	9.8	-17.9
19	Tobacco	48.7	27.5	76.9
20	Other spices	1.8	1.3	33.1
C	Summer Crops			
21	Bajra	36.4	31.6	15.2
22	Groundnut	10.9	14.0	-21.7
23	Summer paddy	57.0	23.7	140.9

Source: Field Survey data

3.7 Details of Farm Assets Holding

The details on distribution of farm assets by soil-test and control farmers are presented in Table 3.7. It can be seen from the table that the soil-test farmers were more mechanized as compared to control farmers. It can be seen that the number of tractor, rotavator, cultivator, diesel engine and lazor land leveler was found higher for soil test farmers to their counterpart. In case of control farmers, except number of electric motor, no other assets were found in more numbers compared to soil-test farmers. The soil test farmers were found to be more progressive and enterprising, thus level of adoption of farm implements is better in case of soil test farmers.

Table 3.7 : Distribution of Farm Assets

(Number / household)

Particulars	Soil Test Farmers	Control Farmers
Tractor	0.28	0.20
Rotavator	0.10	0.06
Cultivator	0.25	0.19
Lazor Land Leveler	0.08	0.04
Electric motor	0.62	0.69
Diesel motor	0.29	0.27
Any others*	0.17	0.16

Notes: *Any others include Trolley, Bullock cart, Blade, plough, Potato planer, Hoe, Sickle, spade, pumpset, Sprayer manual/power operated
Source: Field Survey data

Chapter IV

Performance of Soil Health Card Programme at Micro Level

4.1 Background

As mentioned earlier, Soil Health Cards are being provided to all farmers in the country at an interval of 3 years so as to enable the farmers to apply appropriate recommended doses of nutrients to realize improved and sustainable soil health and fertility status and also higher per unit yields. As part of this massive programme, soil samples testing and distribution of SHC to farmers are carried out on a regular basis as per the norms. The success of these services depends on how scientifically the soil samples have been collected. Several factors such as technical expertise of the people engaged in collecting and testing soil samples, instruments used, depth of the soil collected and number of spots for soil collection are important for the efficiency of this service. Apart from scientific soil testing, optimum fertilizer application depends upon several other factors as follows: whether the reports of soil sample reach the farmers? If they reach to farmers, whether the farmers understand them? Again, whether farmers adopt the fertilizer recommendations fully or not?

The Soil Health Cards (SHC) Programme in Gujarat was aimed at providing the soil testing facilities to the farmers in the most convenient way. The ultimate objective was to increase the level of adoption of recommended doses of fertiliser by the sample farmers that would eventually lead to reduction in imbalances in fertilizer application. The programme facilitates the collection of soil samples from the farmers' field[1] and test the soil health in the nearest soil test laboratories (STLs).

[1] The soil sample collection activity was out sourced by hiring farmers' friends (Gram Mitras) hired under ATMA Programme, who collect the soil sample at the rate of Rs 15 per sample which includes collection charges, primary requirement like Sample bag, woven bag, Forms, Marker pens as well as transportation charges of samples. Village level workers (VLWs) supervise the work at village level and District Agriculture Officer and District Panchayat supervise the work at district

Different institutions such as Agriculture Department of the State government, Public Sector Undertakings (such as Government supported APMCs, Govt. corporation managed Soil Testing Labs, Government supported Sugar cooperatives labs) and Science Colleges were involved in testing the soil samples and generating the soil health cards. The tests on major nutrients like N, P, K, Ph etc were done at all 101 STLs. However, the tests on micronutrients were done at only at designated 50 STLs and Agricultural Universities in the state. Some of the Science Colleges were also given the responsibility of soil testing through their students. The test results were used for generating SHCs at respective STLs and the SHCs were then handed over to District Agriculture Officers for distribution of the same among farmers within a stipulated time period. Anand Agricultural University, Anand was given the responsibility for uploading all these SHCs in its website through e-Krishi Kiran Programme. Thus, the results of soil test were digitized, uploaded on the website and same were communicated to farmers in the form of Soil Health Cards (SHC) for easy access by the farmers.

4.2 Details of Soil Testing

As discussed in earlier chapters, soil testing was carried out for 480 farmers as presented in Table 1.1 and Table 3.1. The details on the soil testing and related parameters based on SHC-GOG are presented in Table 4.1. The cost of soil test was nil for all soil test farmers since it was provided free of cost by the Government. Some of the progressive farmers were also provided the detailed soil test analysis by the cooperatives through private soil testing labs. The cost of soil test through private soil testing labs varied from Rs 50 to Rs 273 per sample depending on nature of soil tests undertaken. In case of our sample farmers, these charges were borne by the some of the sugar cooperatives.

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level. The Samples collected from villages are aggregated at taluka level and sent to designate Soil Testing Laboratory (STL).

The average distance travelled to soil test lab (STL) varied between 43.5 km to 79.3 km. From every selected plot, 4 to 5 samples were taken for soil testing. It may be noted from Table 4.2 and Figure 4.1 that the majority of samples were not collected by designated personnel, i.e., Gram Mitras or Gram Sevaks. There is no information about 49.4 per cent of personnel involved in collection of soil samples from farmers' field. About half of the farmers expressed that Soil sample was not taken from their lands in their knowledge. The average distance of soil tested plots from the villages was around 2.0 km. None of the sample farmers could get the services of Mobile Soil Testing Vans. The area covered as a percentage of net operated area varied from 11.9 per cent to 25.8 per cent across farmer categories. Surprisingly, the proportion of soil tested area varied inversely with size classes of the farmers, i.e., large farmers had lowest proportion of their lands tested and vice -versa. It may be noted that the average duration for getting SHC from the date of sample collection was 72 days. It was maximum in case of semi medium farmers (90.1 days) and lowest for large farmers (55.4 days).

Table 4.1: Details of Soil Testing by Sample Farmers

Particulars	MF	SF	SMF	MDF	LF	All
% of farmers tested their soil in last three years	100	100	100	100	100	100
Average cost of soil testing- Govt (Rs/sample)	0.0	0.0	0.0	0.0	0.0	0.0
Average cost of soil testing -Private (Rs/sample)	-	50	-	-	273.3	43.9
Average distance from field to soil testing lab (km)	43.5	65.9	79.3	68.7	69.7	64.2
Average number of soil Samples taken per plot	4.8	4.4	4.9	5.0	6.3	4.9
Average no. of plots considered for soil testing	1.1	1.2	1.1	1.2	1.1	1.1
Average area covered under soil test (Ha)	1.0	1.2	1.6	2.1	2.4	1.5
Average distance of soil tested plot/s from the village (km)	1.8	1.9	1.8	2.1	2.0	1.9
Area cover as % of net operated area	25.8	24.0	23.5	14.8	11.9	21.6
Soil sample was taken from my land in my knowledge	33.9	55.7	53.5	70.4	48.2	50.8
Average duration for getting SHC from the date of sample collection (days)	65.5	78.3	90.1	61.6	55.4	72.5

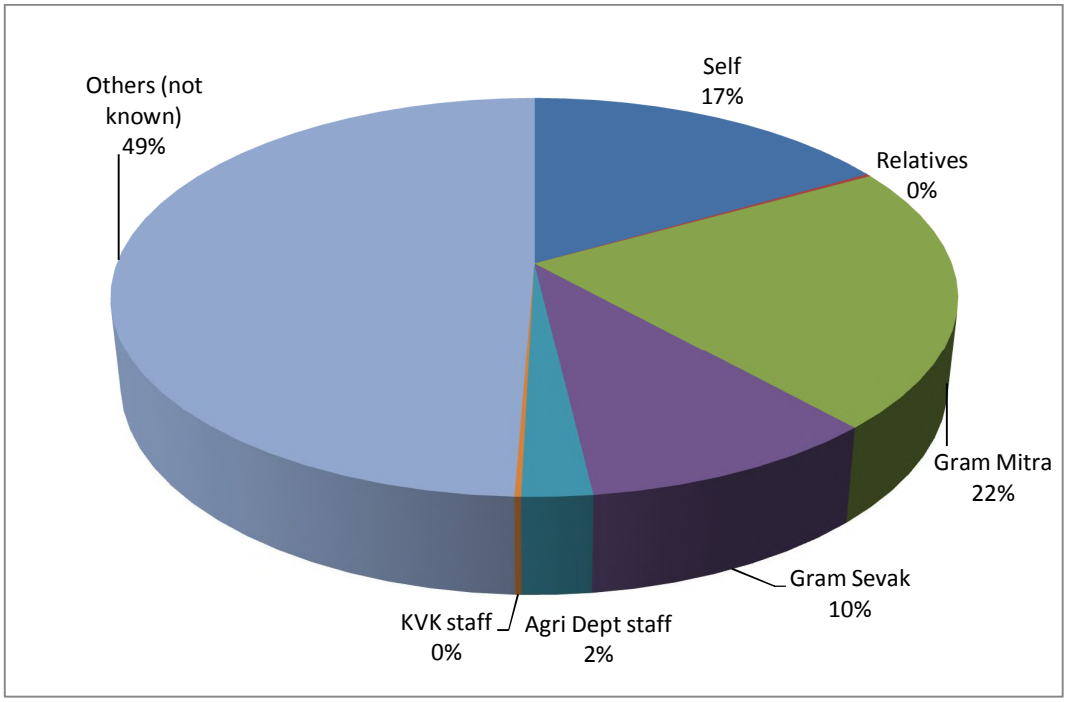
Note: All the information pertained in the table are based on the SHCs kept with sample farmers, which were provided by Government of Gujarat (SHC-GOG). Samples for testing at KVK Kheda were taken from the same plots for which farmers had SHC-GOG.
Source: Field Survey data

Table. 4.2. Soil Samples Collection by Type of Personnel and their Training Status

Sr.No	Particulars	% personnel who collected soil samples	% of them Trained
1	Self	16.67	60.00
2	Relatives	0.21	100.00
4	Gram Mitra	21.46	96.12
5	Gram Sevak	9.79	100.00
6	Agri-Dept staff	2.29	100.00
7	KVK Staff	0.21	100.00
8	Others (Not known)	49.38	0.00

Source: Field Survey data

Figure 4.1: Soil samples collection by type of personnel

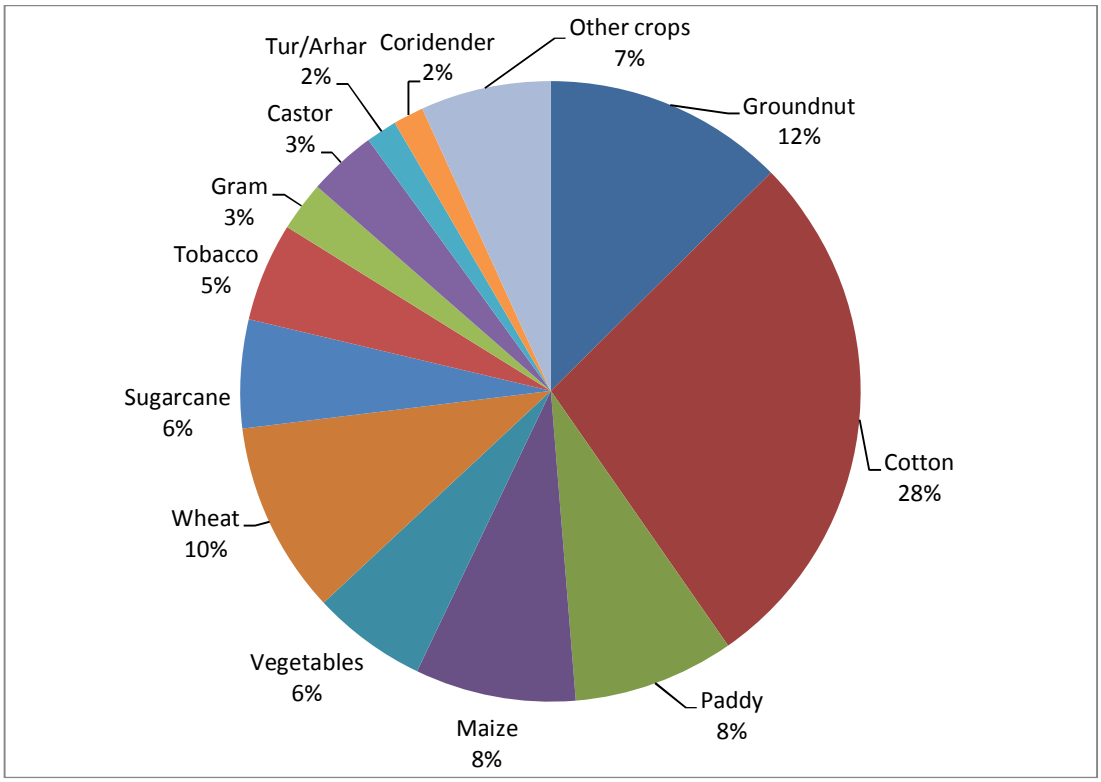


It may be seen from Table 4.2 and Figure 4.1 that there was no information on who collected the soil samples from farmers' field in case of about half of the sample farmers. The collection of soil for soil sample is scientific and systematic process which requires the training of same. Thus, the trained staff should have collected all soil samples in order to facilitate reliable test results about soil health. The selected farmers opined that acute shortage of departmental staff forced them to collect

the soil samples by themselves. They further opined that the inadequate number of soil testing labs (STLs) has severely affected the quality of testing service provided to them by these agencies.

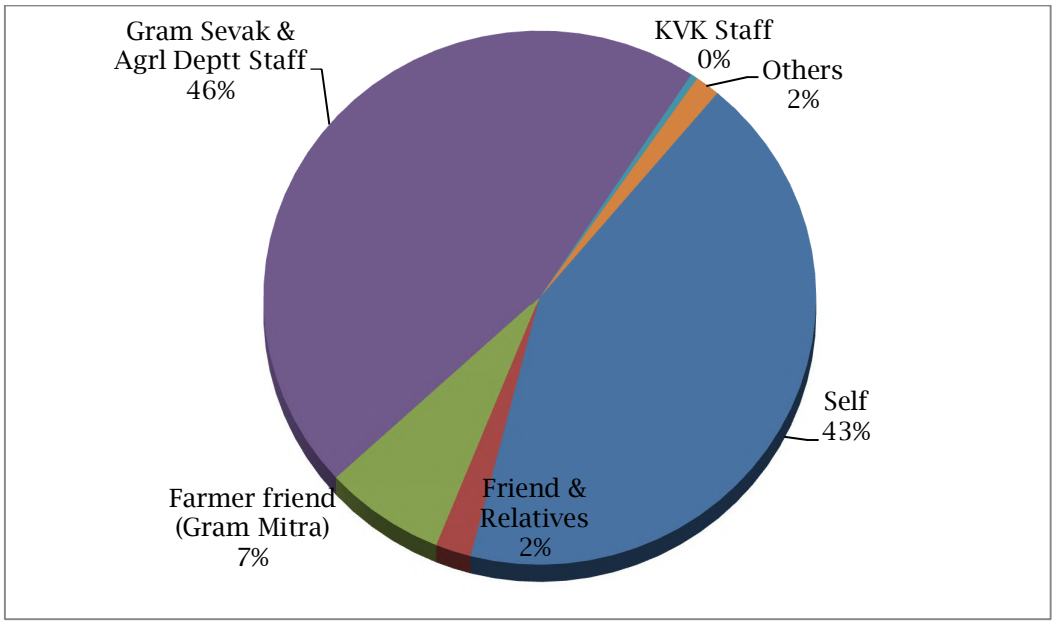
It may be seen from Figure 4.2 that the major crops like groundnut, cotton, wheat, paddy and maize were grown on the soil tested plots by the farmers. The share of cotton, groundnut and wheat was 28 per cent, 12per cent and 10 per cent, respectively.

Figure 4.2. Crops grown on soil tested plots



As per the norms, the SHCs should be handed over to farmers immediately after the preparation of the same based on soil test results, preferably within one month of collection of soil sample. Farmers will be able to use the same as and when required. Unless it is kept with the farmers, it has no meaning. It may be noted from Figure 4.3, in majority of cases (57%), it was found that the SHCs were not with farmer. Those were kept together somewhere with some officials such as Gram Sevaks, Agriculture Department staff etc. Thus, it was no use to the farmer/s.

Figure 4.3. Who Keeps SHCs of Farmers?



It was disappointing to find that about 67 per cent of farmers did not understand anything about soil health cards (Figure 4.4). Only 15 per cent of farmers could manage to understand the content of SHC fully. Among the farmers who could not understand the content of farmers, 78 per cent of them could not understand all parts of the SHC and about 17 per cent of them could not understand how to calculate the recommended doses of fertilisers, as mentioned in the back side of SHCs.

Figure 4.4. Extent of Farmers' Understanding about the Content in a SHC

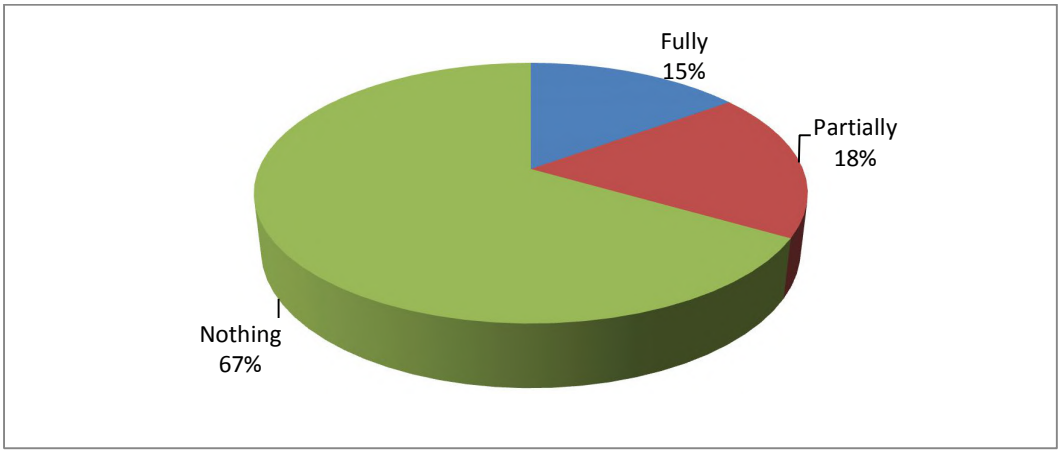
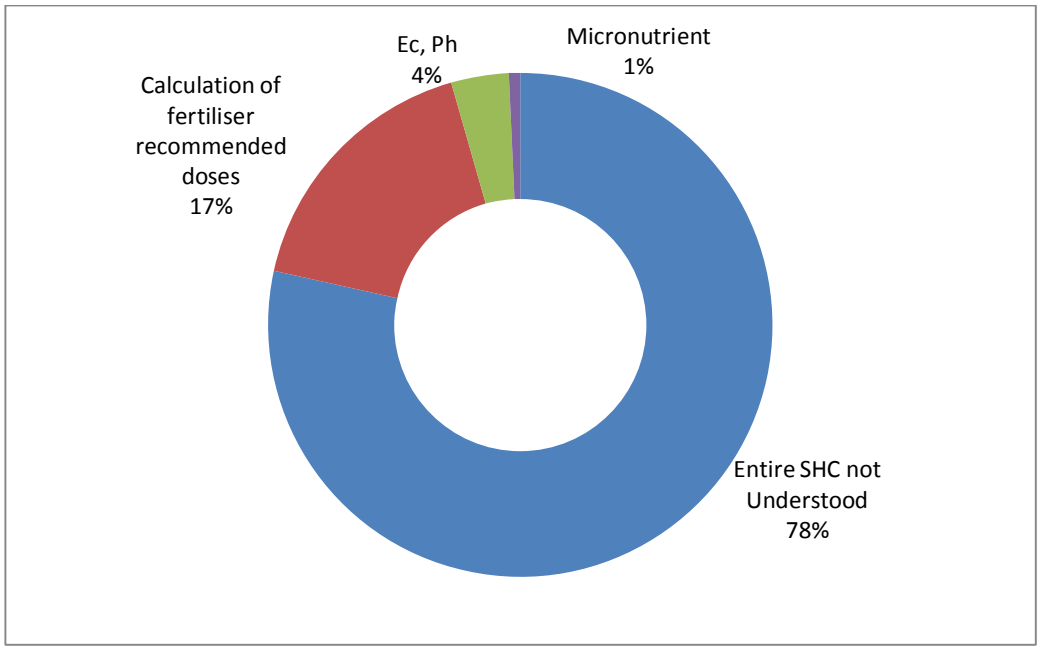


Figure 4.5. Part of SHC not Understood by the Farmers



4.3 Sources of Information about Soil Testing (Soil Test Farmers)

The major sources of information about the SHC programme were the government officials at grass root level (Gram Sevek, Gram Mitra and Extension Officers). About 84 per cent of all farmers were appraised by these government officials (Table 4.3). The State Agricultural Universities/Krishi Vghyan Kendras, friends, neighbours and fellow farmers were the next major sources of information for the sample farmers.

Table 4.3: Sources of Information about Soil Testing

(% farmers aware)

Source of information	%
Gram Sevak	74.6
Gram Mitra	3.8
Agri Dept staff	5.0
Relative & Friends	2.5
Private Companies	1.5
Others (SAUs/KVK etc.)	12.7

Source: Field Survey data

4.4 Reasons for Testing the Soil by Soil Test Farmers

The farmers had shown keen interest in getting their soil tested for several reasons as presented in Table 4.4. The major reason behind the soil testing by the farmers was that it was available free of cost (67.1%). Other motivational factors were to maintain better soil health (57.9%), increase in crop yield (57.7%), got motivated from village demonstration/training/exposure visits to places with best farming practices (11.5%).

Table 4.4 : Reasons for Soil Testing by Sample Households (Soil Test Farmers)

(% of Farmers)

Reasons	% farmers agreed	Rank-1	Rank-2	Rank-3	Rank-4
Soil testing facility was provided free of cost	67.1	48.4	16.1	29.2	6.2
For availing benefit under subsidy scheme	17.3	14.5	38.6	28.9	18.1
To maintain better soil health	57.9	25.5	42.1	28.4	4.0
To increase crop yield	57.7	34.3	41.5	15.2	9.0
Motivation from village demonstration/ training /exposure visits to places with best practices	11.5	14.5	12.7	34.5	38.2
Peer farmers' group pressure	19.4	36.6	28.0	17.2	18.3
Since it was a new technological practice	3.8	11.1	16.7	33.3	38.9
Any other	12.7	90.2	6.6	0.0	3.3

Notes: 1. Rank 1 stands for most important and Rank 4 stands for least important.
2. Total exceeds 100 due to multiple responses.

Source: Field Survey data

4.5 Reasons for Not Testing Soil by Control Farmers

There are some farmers who had not tested their farm soil. It is because of the fact that spread of SHC programme was limited due to lack of awareness among the farmers. Among non-soil test farmers, about 72.0 per cent farmers expressed that they were not aware about whom to contact for details on testing; whereas another 60.0 per cent farmers mentioned that they were not aware about the benefits of this programme

(Table 4.5). About 29 per cent of farmers expressed that they don't know how to take soil samples. Thus, lack of awareness, lack of trust on expert's recommendations, interest and low level of education has kept away majority of sample control farmers from soil test. The long distance of STL from villages was another de-motivating factor for about 13.3 per cent of farmers.

Table 4.5 : Reasons for not Testing by Sample Households

(Control Farmers)

	% of farmers
Do not know whom to contact for details on testing	72.08
Not aware about the benefit of the programme	60.00
Do not know how to take soil sample	28.75
Soil testing laboratories are located far away	13.33
soil testing not required for my field as crop yield is good	12.50
Don't trust expert's recommendations	13.75
Trust on fellow farmers suggestion for not to go the soil test	7.50

Note: Sum of total exceeds 100 because of multiple responses.

Source: Field Survey data

4.6 Status of Soil Health of the Sample Soil Test Farms

The classification of nutrient content of various soil nutrients has been based on Government of India norms (GOI, 2011) as presented in Table 4.6. The results of soil test are presented in the Tables 4.7, 4.8 and 4.9. It can be seen from the tables that the overall soil quality of farm plots of sample farmers was good. The majority of farmers had normal level of primary nutrients (NPK) and physical parameters (pH, Ec). Such kind of pattern was noticed in all three kinds of SHCs, i.e., SHCs supplied by Government of Gujarat (GOG-SHC), SHCs downloaded from Anand

Agricultural University (AAU-SHC) and SHCs generated by KVK Kheda (KVK-SHC), with some exceptions. For example, KVK-SHCs reported prevalence of low level of N content in the case of majority of farmers (63.5%), while GOG-SHCs reported that about 31.0 per cent farmers had low level of N content in their soils. Only 19 per cent high content of Potassium was found in GOG-SHC reports compared to corresponding figure of 72.3 per cent in KVK-SHC reports.

As far as secondary nutrients (S, Mg, Ca) and micronutrients (Zn, Fe, Cu, Mn) in the soils of the farmers are concerned, varied results were reported in different SHC reports. In case of KVK-SHC, there was no mention of secondary nutrition as they did not do the soil tests on the same. However, they had tested the soils for all major and micro nutrients, depending on facilities available in their Lab.

Table 4.6: Criteria for Determining Nutrient Status as reported in Soil Health Card

(All fertilisers are in kg/ha)

Sr. No	Nutrients	Normal	Low	High	Remarks
1	pH	6.5-8.2	<6.5	>8.2	Acidic if <6.5, Alkaline if >8.5
2	Ec	<1.0	-	>3.0	Harmful if >3.0
3	Organic Carbon/Nitrogen(N)	0.5-.75	<0.5	>0.75	
4	Phosphorus (P)	28-56	<28	>56	
5	Potassium (K)	140-280	<140	>280	
6	Magnesium (Mg)	1.0-2.0	<1	>2	
7	Calcium (Ca)	1.5-3.0	<1.5	>3.0	
8	Sulphur (S)	10 - 20	<10	>20	
9	Zinc (Zn)	0.5 - 1.0	<0.5	>1.0	
10	Iron (Fe)	5-10	<5	>10	
11	Manganese (Mn)	5-10	<5	>10	
12	Copper (Cu)	0.2 - 0.4	<0.2	>0.4	

Source: As per the GOI norms (GOI, 2011).

Table 4.7 : Status of Soil Health in terms of Nutrients on the Sample Soil Test Farms (GOG-SHC as collected from Sample Farmers supplied by the government)

(Percentage of farmers, N=480)

Nutrients	Nutrient type	No. of farmer having test results	Normal	High	Low	% of SHCs with no information
pH Value		472	77.1	20.8	0.4	1.7
Ec	Physical	397	82.1	0.2	0.4	17.3
Nitrogen		480	68.1	0.8	31.0	0.0
Phosphorus	Major	480	54.2	1.9	44.0	0.0
Potassium		480	65.0	19.0	16.0	0.0
Sulphur (S)		108	18.3	0.2	4.0	77.5
Magnesium (mg)	Secondary	108	21.7	0.2	0.6	77.5
Calcium (Ca)		108	21.7	0.4	0.4	77.5
Zinc		107	19.4	0.4	2.5	77.7
Iron	Micro	106	15.4	0.6	6.0	77.9
Manganese		106	20.4	0.4	1.3	77.9
Copper		106	20.8	0.6	0.6	77.9

Source: Field Survey data

Table 4.8 : Status of Soil Health in terms of Nutrients on the Sample Soil Test Farms (AAU-SHC as uploaded in AAU website by GOG for the farmers)

(Percentage of farmers, N=480)

Fertilisers	Nutrient type	No. of farmer having test results	Normal	High	Low	% of SHCs with no information
pH Value		367	76.3	0.2	0.0	23.5
Ec	Physical	455	94.8	0.0	0.0	5.2
Nitrogen		454	72.9	0.0	21.7	5.4
Phosphorus	Major	454	60.2	0.0	34.4	5.4
Potassium		454	80.2	0.0	14.4	5.4
Sulphur (S)		104	17.9	0.0	3.8	78.3
Magnesium (mg)	Secondary	104	21.5	0.0	0.2	78.3
Calcium (Ca)		104	21.7	0.0	0.0	78.3
Zinc		104	19.6	0.0	2.1	78.3
Iron	Micro	104	15.4	0.0	6.3	78.3
Manganese		104	20.6	0.0	1.0	78.3
Copper		104	21.0	0.0	0.6	78.3

Notes: Soil Health Card downloaded from website of ITC, AAU, Anand

Source: http://shc.aau.in/

Table 4.9 : Status of Soil Health in terms of Nutrients on the Sample Soil Test Farms (KVK–SHCs-as generated by KVK, Kheda)

(Percentage of farmers, N=480)

Fertilisers	Nutrient type	No. of farmer having test results	Normal	High	Low	% of SHCs with no information
pH Value		480	38.1	61.7	0.2	0.0
Ec	Physical	473	86.0	12.5	0.0	1.5
Nitrogen		480	36.5	0.0	63.5	0.0
Phosphorus	Major	480	56.5	4.0	39.6	0.0
Potassium		480	24.6	72.3	3.1	0.0
Zinc		480	31.0	57.7	11.3	0.0
Iron	Micro	480	40.0	57.1	2.9	0.0
Manganese		480	18.5	81.0	0.4	0.0
Copper		480	0.4	99.4	0.2	0.0

Note: Soil Health Cards generated by KVK , Kheda

Source: KVK , Kheda

It is worth-mentioning that the status of secondary and micronutrients was not mentioned in about 76 per cent to 80 per cent SHCs generated by GOG (GOG-SHC). In the remaining 20 percent of GOG-SHCs with information on secondary and micro-nutrients, the content of micronutrient and secondary nutrients were found normal in about 90 per cent SHCs. This is in sharp contrast to KVV-SHCs in which, the content of micronutrients such as Copper and Manganese was found very high in the majority of SHCs of sample farmers (81% and 99.4%, respectively). The Zinc and Iron content in the soils was found normal in case of 31 per cent and 40 per cent of farmers respectively, as reported by KVK-SHCs. In contrast, the same situation was found in more than 90 per cent of SHCs, as per the GOG-SHC recommendations.

4.7 Recommended Doses of Fertilisers on Soil Test Basis

The poor soil health has been mainly due to application of unbalanced doses of fertilisers. It is necessary to adopt the recommended doses of fertiliser for maintaining better soil health. However, the application of recommended doses of fertiliser depends on many factors such as soil

type, variety, sowing time of the crop and availability of irrigation provisions, prices and availability of fertilisers etc. The average quantities of recommended dose of fertilisers based on soil test have been presented in Tables 4.10, 4.11 and 4.12 corresponding to findings of GOG-SHC, AAU-SHC and KVK-SHC, respectively.

It may be noted that the quantity of recommended doses of Urea, DAP/SSP and MOP is slightly higher in case of KVK-SHC compared to GOG-SHC, particularly, in case of cotton, maize and bajra. In case of cotton crop, the low level of nitrogen content in soils was found in case of about 64 per cent of farmers as per KVK-SHC compared to 31 per cent as per GOG-SHC. Thus, the recommended doses of Urea has been more (832.6 kg/ha) in KVK-SHC reports for cotton.

Table 4.10:Crop-wise Recommended Doses of Fertilisers Based on Soil Test
(GOG-SHCs as collected from Sample Farmers supplied to them by the government)

(Kg/Ha)

Crop	Urea	DAP	MOP	FYM (ton/ha)	Zinc Sulphate	Manganese Sulphate	Ferrous Sulphate	Copper	Calcium
Cotton	363.6	2.7	1.6	10.1	8.0	13.2	15.0	7.4	31.5
Groundnut	26.1	49.3	0.0	10.0	25.0	26.0	32.5	0.0	0.0
Maize	201.7	104.8	0.0	5.0	0.0	0.0	0.0	0.0	0.0
Tobacco	438.4	0.0	0.0	11.5	13.0	12.0	26.7	9.5	0.0
Paddy	211.9	97.3	30.7	6.3	8.0	12.0	15.0	0.0	0.0
Sugarcane	795.8	426.1	271.7	25.0	27.1	0.0	0.0	0.0	0.0
Wheat	271.7	121.3	0.0	13.0	0.0	0.0	0.0	0.0	0.0
Bajra	199.3	73.8	0.0	13.0	16.5	12.0	15.0	6.0	0.0

Note: Data reported as per the SHCs collected from Sample Farmers

Source: Field Survey data

Table 4.11: Recommended Quantity of Fertilisers Based on Soil Test
(AAU-SHC as uploaded in AAU website by GOG for the farmers)

(Kg/Ha)

Crop	Urea	DAP	MOP	FYM (ton/ha)	Zinc sulphate	Manganese Sulphate	Ferrous Sulphate	Copper	Calcium
Cotton	368.1	-	-	10.0	6.5	11.3	12.1	0.0	28.0
Groundnut	6.0	52.7	-	10.0	22.5	20.7	30.5	0.0	0.0
Maize	173.1	116.3	-	5.0	0.0	0.0	0.0	0.0	0.0
Tobacco	466.8	-	-	9.7	10.8	9.8	24.3	8.0	0.0
Paddy	162.5	53.5	-	5.9	9.5	13.2	15.4	0.0	0.0
Sugarcane	441.1	290.5	153.1	25.0	27.1	0.0	0.0	0.0	0.0
Wheat	230.0	131.0	-	9.5	0.0	0.0	0.0	0.0	0.0
Bajra	149.9	84.1	-	12.7	13.9	10.8	14.5	6.0	0.0

Note: Data reported as per the SHCs downloaded from website of ITC, AAU, Anand
Source: Estimated from data collected from http://shc.aau.in

It may be noted that the quantity of recommended doses of fertilisers as per the GOG-SHC and AAU-SHC are more or less close, with some discrepancies. For example, there are recommended doses of MOP for cotton, paddy and sugarcane have been mentioned in GOG-SHC reports, which are completely absent in AAU-SHC reports. Also other figures noted on these two group of reports should have been exactly the same, had the same SHCs uploaded on the website, which were distributed to the farmers. There are some evidences that cards uploaded on the AAU website don't exactly match including SHC reference numbers. Some variations and discrepancies (may be due to typographical errors)[2] were also noticed in recommendation and calculation of fertiliser doses on the GOG-SHCs uploaded on AAU website.

[2] For example, in some GOG-SHCs, the normal level of Organic Carbon content was stated as 0.5 to 1.5 instead of 0.5 to 0.75.

Table 4.12: Crop-wise Recommended Quantity of Fertilisers Based on Soil Test
(As per the SHCs generated by KVK , Kheda)

(Kg/Ha)

Crop	Urea	SSP	MOP	Ammonium Sulphate	Zinc Sulphate	Ferrous Sulphate	Manganese Sulphate
Cotton	832.6	453.5	275.6	0.0	3.7	8.0	2.3
Groundnut	8.5	241.9	-	87.9	10.0	10.6	2.2
Maize	229.0	306.4	0.0	0.0	1.3	2.7	0.4
Tobacco	430.0	5.7	0.0	0.0	5.9	62.8	4.3
Paddy	185.3	171.5	0.0	0.0	5.9	7.8	0.8
Sugarcane	614.7	855.8	177.0	0.0	0.3	3.7	12.6
Bajra	241.2	332.2	0.0	0.0	10.9	17.4	1.4

Note: Data reported as per the SHCs generated by KVK, Kheda.

Source: Field Survey data

Photo 5: Soil Sample handling at Soil Test Laboratory (STL), KVK Kheda

Photo 6: Soil Testing at Soil Test Laboratory, KVK Kheda

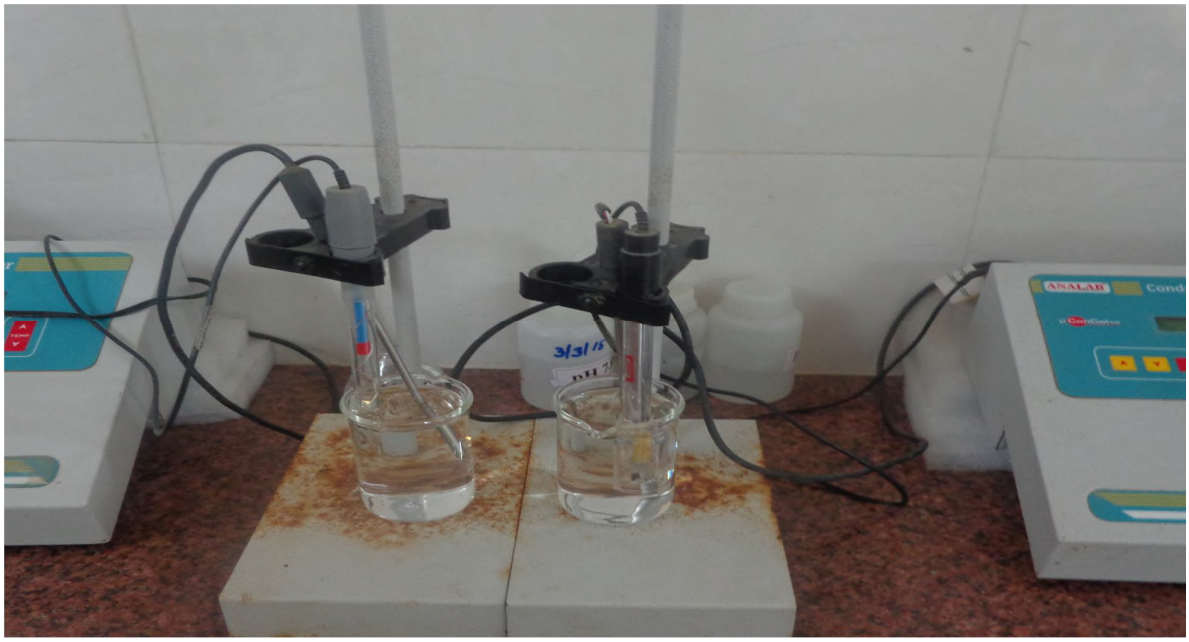


Photo 7A and 7B: Soil Testing Instruments at Soil Test Laboratory, KVK Kheda

Photo 8A & 8B: Discussion with Scientist (Soil) at Soil Test Laboratory, KVK Kheda

Chapter V

Adoption and Constraints in Use of Soil Health Cards

5.1 Background

To facilitate and promote Integrated Nutrient Management (INM) through judicious use of chemical fertilizers, including secondary and micro nutrients, in conjunction with organic manures and bio-fertilizers, the farmers' awareness and adoptability to recommended doses are necessary. The increase in level of adoptability will surely help in improving soil health and its productivity. The Government of Gujarat had therefore planned and implemented the Soil Health Card (SHC) Programme in a phased manner so as to provide Soil Health Card to all farmers. By the year 2013-14, more than 53 lakh farmers had been provided the SHC in the state. However, it was observed during field survey that there are many farmers who got their soils tested and obtained the SHCs but didn't apply the recommended doses of fertiliser on field. There are also many farmers who did not want to have soil health cards. There are number of reasons for demand supply mismatch which are discussed in this Chapter. Before analyzing these constraints, let's first discuss the various aspects of adoptability of recommended doses especially after soil testing.

5.2 Application of Recommended Doses of Fertilisers by Soil Test Farmers

The level of adoption of recommended doses were examined from three different angles: (i) farmers own perception, (ii) deviation of fertiliser use from the recommended doses and (iii) deviation from the recommended doses in terms of nutrient content (NPK). It was observed that the number of fertiliser products used by the farmers varied a lot among the farmers. Some farmers used DAP and some farmers used SSP or NPK mixture

instead. Some farmers used MOP and some farmers used Potassium Sulphate. Since the NPK ration varies across various fertiliser products and farmers were using a variety of fertiliser products, it was difficult to make a comparative assessment on their adoption of recommended doses. To make it simple, all the fertiliser products recommended were expressed in terms of major nutrients (N, P, K).

As far as the findings on adoption level is concerned, it may be noted that the level of adoption of recommended doses by the soil test farmers was found to be very less. As per the perception of farmers, it was around 15.4 per farmers (Table 5.1). However, with a method of taking a deviation of 15% from recommended doses of NPK, the level of adoption varied from as low as 0.6 per cent to 12.3 per cent for N, P and K nutrients, as per the GOG-SHC reports. The level of adoption was found to be further lower while we used the KVK-SHC data. In terms of later datasets, the level of adoption of NPK nutrients varied from nil to 8.8 per cent.

Table 5.1: Application of Recommended Doses of Fertilisers (Soil Test Farmers)

Particulars	Type of recommendation	N	P	K	Overall
% Farmers applied recommended doses of fertiliser (as per the farmers perception)					15.4
% Farmers applied recommended doses of fertiliser (as estimated with 15% range)	GOG-SHC	12.3	3.5	0.6	5.5
	KVK-Kheda	8.8	4.4	0.0	4.4
% Farmers applied recommended doses of fertiliser (as estimated with 25% range)	GOG-SHC	20.0	6.0	1.5	9.2
	KVK-Kheda	13.5	7.9	1.7	7.7

Source: Field survey

The attempts were also made to broaden the range to 25 per cent. However, there was no much significant change in adoption level. With 25

per cent range, the level of adoption of NPK nutrients varied from as low as 1.5 per cent to 20.0 per cent as per the GOG-SHC reports; and from 1.7 per cent to 13.5 per cent as per the KVK-SHC reports.

Those farmers, who adopted the recommended doses, were asked about the underlying reasons for application of recommended doses of fertilizers. It may be noted from Table 5.2 that about 13.1 per cent farmers believed that the cost on fertiliser use and thus cost of production would be reduced by adopting the recommended doses, since it may reduce the quantity of recommended doses of fertilisers. About 14.0 per cent farmers expressed that they wanted to apply recommended doses to maintain better soil health and to increase crop yield.

Table 5.2: Underlying Reasons for Application of Recommended Doses of Fertilizers

(% of Farmers)

Particulars	% farmers agreed	Rank-1	Rank-2	Rank-3	Rank-4
To reduce cost on fertiliser use, thus cost of production	13.1	42.9	11.1	23.8	22.2
To optimize/ balance the use of available fertiliser	11.0	9.4	24.5	43.4	22.6
To maintain better soil health	14.0	20.9	43.3	28.4	7.5
To increase crop yield	14.0	41.8	28.4	13.4	16.4
Have trust on advice given by extension officer	2.9	0.0	21.4	35.7	42.9
Have trust on advice given by fellow farmers	1.0	20.0	0.0	0.0	80.0
Any other, specify	0.2	100.0	0.0	0.0	0.0

Note: Rank 1 stands for most important and Rank 4 stands for least important.
Source: Field Survey data

5.3 Determinants of Adoption of SHC Recommended Doses of Fertilizers

In this section, we have analysed the influence of various factors those have contributed to adoption of SHC by the sample households in the state. A logistic regression model was fitted to assess the influence of various predictor variables on decision to adopt recommended doses as

prescribed in SHC (SHC-GOG) as a binary outcome variable. The predictor variables are net sown area (ha), total area under soil tested plots (ha), education of the farmers (number of years) and length of farming experience (number of years). Some categorical variables such as expected reduction in cost, expected higher yield and expected better soil health as a result of adoption of recommended doses of fertilisers were also primarily included in the model. However, they were excluded from the final logit model since their inclusion did not yield better results. The final model was fitted with intercept. The findings of the logit model are stated in Table 5.3.

Table 5.3: Determinants of Adoption of SHC recommended doses of fertilizers (Logit function)

(Dependent variable: Adopted recommended doses, Yes=1, No=0)

Predictor Variables	Coefficient	Exponentiated value of coefficients	Std Error	Z value	Pr (>|z|)	
Intercept	-3.264005	0.03823494	0.55383	5.894	0.00000	***
Net Sown Area (Ha)	0.173127	1.18901692	0.04723	3.666	0.00025	***
Soil Tested Area (Ha.)	-0.272340	0.76159530	0.13667	-1.993	0.04630	*
Farmer's Education (Yrs)	0.132241	1.14138300	0.03067	4.312	0.00000	***
Length of experience in farming (Yr)	0.009999	1.01004902	0.01049	0.953	0.34045	
Nagelkerke's Pseudo R^2 = 14.23						
X^2 (Likelihood Ratio Test)= 41.313		DF=4	P value= 0.0000			

Notes: Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.'

Source: Computed (using R) from field data

The logistic regression coefficients give the change in the log odds of the outcome for one unit increase in the predictor variable. Three predictor variables (net sown area (ha), total area under soil tested plots

(ha), years of education of the farmers) and intercept were found to significantly influence the Adoption of SHC (SHC-GOG) recommended doses of fertilizers, whereas the length of farming experience was found insignificantly influence the decision to adopt recommended doses of fertiliser. The Chi-square value of 41.313 with 4 degrees of freedom and an associated p-value of about 0.0 confirmed that our model as a whole fitted significantly better than an empty model.

The results of the model indicated that, for every one unit change in net sown area, the log odds of adoption of recommended doses of fertiliser increases by 0.173. However, the soil tested area has exhibited negative contribution towards the adoption of recommended doses of fertiliser. It may be due to the fact that the soil testing activities including soil sample collection from soil tested plots were not undertaken properly. As a result, this variable could not positively contribute the adoption of recommended doses of fertiliser. On the other hand, education of farmers has positively and significantly contributed to the adoption of recommended doses of fertiliser as mentioned in soil health cards. For every one year additional education, the log odds of adoption of recommended doses of fertiliser increases by 0.132.

5.4 Constraints in Application of Recommended Doses of Fertilisers (Soil Test Farmers)

The soil test farmers have faced several difficulties in applying recommended doses of fertiliser. Among these constraints, difficulty in understanding and following the instructions on SHCs regarding application of recommended doses, unavailability of technical advice on method and time of fertiliser application, high prices of fertilisers and unavailability of required fertilisers in adequate quantity were the major ones (Table 5.4). About 45 per cent farmers expressed that no technical advice on method and time of fertiliser application were given to them. About 41 per cent farmers stated the difficulty in understanding and

following application of recommended doses as their major problem in applying recommended doses. About 35 per cent farmers stated higher price as their main constraints; while 31.3 per cent farmers stated lack of money to purchase fertilisers as their main constraints.

Table 5.4: Constraints in Applying Recommended Doses of Fertilisers

(% of Farmers)

Constraints	% farmers agreed	Rank- 1	Rank-2	Rank- 3	Rank-4
No technical advice on method and time of fertiliser application	44.8	26.5	37.2	24.2	12.1
Difficult to understand and follow the recommended does	40.8	46.9	33.2	12.2	7.7
Adequate quantity of fertiliser not available	35.8	8.7	33.1	39.5	18.6
Fertiliser prices are high	34.6	12.0	31.3	34.9	21.7
Lack of money to purchase fertilisers	31.3	12.7	36.7	42.7	8.0
Trust on their own experiences/ practices	17.9	43.0	33.7	14.0	9.3
Any other	31.9	90.2	3.9	5.2	0.7

Note: Rank 1 stands for most important and Rank 4 stands for least important.

Source: Field Survey data

5.5 Application of Actual Quantity of Fertilisers

The details on actual quantity of fertilisers applied by the sample farmers during the reference year are presented in Table 5.4 and Table 5.5. It can be seen from the tables that the selected soil test farmers have applied more quantity of major fertilisers than the control group farmers. In case of some major crops grown in Gujarat such as cotton, bajra tobacco and castor, the soil test farmers have applied more urea and DAP than that of control farmers. The urea and DAP have been applied more by a range of 5.3 per cent to 35.2 per cent (Table 5.5). However, in case of groundnut, maize, wheat and sugarcane, the control farmers have applied more fertilisers compared to soil test farmers. It may be noted that the recommended doses of fertilisers by GOG-SHC and KVK-SHC varied a lot in case of some crops like cotton and groundnut, basically due to no

distinction made among various varieties of these crops. Cotton irrigated crop requires about double quantity of fertiliser what is needed for unirrigated cotton. Since no separate analysis has been made within crop categories and varieties, the exact distinction in recommended doses between these two set of data have not been captured properly.

Table 5.5: Actual Quantity of Fertilisers Applied by the Sample Farmers

(Kg/Ha)

Fertilisers	Cotton	Groundnut	Maize	Tobacco	Paddy	Sugarcane	Bajra	wheat	castor
Soil Test Farmers									
Urea	203.5	15.2	84.6	535.9	267.0	504.3	164.9	191.1	220.7
DAP	84.6	50.4	23.5	210.9	406.1	185.3	99.2	43.3	79.8
MOP	9.1	0.0	0.0	7.6	12.3	163.8	16.2	0.0	0.0
SSP	13.1	3.9	0.0	22.3	73.6	80.3	0.0	0.0	17.1
NPK Mixture	37.4	19.4	0.0	0.0	7.5	22.7	0.0	4.7	0.0
FYM (Ton/ha)	7.5	8.6	4.2	25.1	10.4	15.5	11.7	7.0	5.7
Organic fertiliser	27.1	2.3	0.0	255.9	41.5	385.8	926.7	0.0	1.2
ASP	5.2	49.1	0.0	340.5	133.6	45.5	0.0	0.0	0.0
Others	6.7	6.6	0.0	418.1	205.2	719.6	24.0	0.0	0.0
Control Farmers									
Urea	182.4	36.3	94.9	476.1	273.5	809.9	147.3	180.4	165.1
DAP	72.2	51.1	40.6	136.7	174.0	175.5	52.5	48.2	60.2
MOP	5.1	0.0	0.0	86.9	0.0	103.2	12.5	0.0	0.0
SSP	15.0	3.9	0.0	191.1	8.7	13.7	0.0	0.0	11.7
NPK Mixture	13.6	2.6	0.0	0.0	34.8	30.8	0.0	0.0	0.0
FYM (Ton/ha)	6.8	7.5	4.6	15.4	14.0	7.0	13.6	2.3	4.7
Organic fertilizers	90.3	0.0	0.0	180.2	199.8	213.4	0.0	0.0	0.0
Others	19.2	22.6	0.0	69.5	235.0	139.7	0.0	0.0	0.0

Note: ASP: Ammonium Sulphate; DAP: Di-ammonium Phosphate; SSP: Single Super Phosphate; MOP: Murate of Potash
Source: Field Survey data

Table 5.6 : Percentage Departure of Actual Quantity of Fertilisers Applied by Control Farmers from that Applied by Soil Test Farmers

(% deviation from Soil test group)

Fertilisers	Cotton	Groundnut	Maize	Tobacco	Paddy	Sugarcane	Bajra	wheat	castor
Urea	10.4	-139.6	-12.1	11.2	-2.4	-60.6	10.7	5.6	25.2
DAP	14.6	-1.4	-72.7	35.2	57.2	5.3	47.1	-11.2	24.6
MOP	44.4	ND	ND	-1045.8	100.0	37.0	22.7	ND	ND
SSP	-14.4	0.6	ND	-756.1	88.2	82.9	ND	ND	31.6
NPK Mixture	63.7	86.6	ND	ND	-361.5	-35.4	ND	100.0	ND
FYM (Ton/ha)	9.0	12.8	-10.0	38.5	-34.4	54.6	-15.9	67.5	16.8
Organic fertiliser	-233.1	100.0	ND	29.6	-381.4	44.7	100.0	ND	100.0
Others	100.0	100.0	ND	100.0	100.0	100.0	100.0	ND	ND

Note: ND implies no deviation or not available
Source: Field Survey data

5.7 Use of Organic Fertilisers

The details on use of organic fertilizers by sample farmers are presented in Table 5.7. It can be seen from the table that most of soil-test as well as control farmers had used farm yard manure (FYM), as expected. About 70 per cent of soil test farmers and 64 per cent of control farmers applied FYM on their soil. About 39 per cent of net cropped area of soil test farmers and 36.5 per cent of net cropped area of control farmers was covered with FYM. Easy availability and relatively low price of the FYM may be the reason behind its high adoptability in crop cultivation.

Table 5.7 : Use of Organic Fertilizers by the Sample farmers

Particulars	Farmyard manure	Vermi compost/Biogas waste	Bio-Fertiliser	Green manure	Other organic manure
Soil Test Farmers					
% farmers applied	69.58	1.04	0.21	1.67	3.75
Quantity applied (Kg/Ha)	12943	3590	37500	3608.75	6428
Price (Rs/Kg)	1.06	143.27	1.35	19.84	9.97
Area covered (Ha/household)	1.15	0.02	0.01	0.02	0.05
Area covered (% of net cropped area)	38.51	0.67	0.42	0.61	1.71
Control Farmers					
% farmers applied	64.17	0.00	0.42	0.42	5.42
Quantity applied (Kg/Ha)	13589	0	20	45	3782
Price (Rs/Kg)	1.06	0.00	550		6.23
Area covered (Ha/household)	1	0.00	0.01	0.00	0.09
Area covered (% of net cropped area)	36.50	0.00	0.45	0.10	3.02

Source: Field Survey data

Photo 9: Discussion with Officials and farmers at STL, Borsad, Anand

Photo 10: Discussion with the farmers during Field visit

Chapter VI

Assessing Impact of Adoption of SHC Recommended Doses of Fertilisers

6.1 Introduction

The adoption of recommended doses is believed to benefit the farmers in terms of improvement in yield, net returns and better soil health. In this chapter, an attempt has been made to examine these aspects. The changes observed after the application of recommended doses of fertilisers on reference crops have been analysed in detail.

6.2 Crop Yield Differences between Soil Test and Control farmers

The adoption of recommended doses may not lead to more yields compared to non-adopters. Sometimes, application of higher fertiliser doses irrespective of recommended doses results in more yield ignoring the implications for soil health. The application of recommended doses necessarily required to promote sustainable agriculture with better soil health along with reasonable level of yield. The implications of adoption of recommended doses of fertiliser on change in crop yield can be seen in Table 6.1.

It is revealed that the soil test group realized better average yield compared to the control group. Thus, overall yield impact was better in case of soil test farmers. Crop wise analysis reveals that out of thirteen crops during Kharif season, only two crops have experienced fall in yield while ten crops such as cotton, tobacco, castor, maize, paddy, bajra, udad, jowar, tur, guar and banana have experienced increase in yield by soil test group of farmers, while comparing the same with non-soil test group of farmers. Looking at this angle, it is evident that the soil test has helped the farmers in stabilizing their individual crop yields, as expected. Overall, all soil test farmers have experienced higher yield over control or non-soil test farmers.

Table 6.1 : Crop Yield Differences between Soil Test farmers and Control farmers

(Quintal/Ha)

SI. No.	Season /Crop	Soil Test Farmers (ST)	Control Farmers (Non-ST)	% Change for ST over Non-ST farmers
A	Kharif Crops			
1	Paddy	21.1	19.2	10.0
2	Bajra	23.7	20.8	14.3
3	Maize	9.2	9.4	-1.6
4	Jowar	158.4	142.3	11.4
5	Udad	4.9	4.4	10.9
6	Tur	16.2	14.0	15.3
7	Mung	3.7	4.7	-21.8
8	Groundnut	17.1	18.7	-9.0
9	Sesamum	5.3	5.3	0.6
10	Castor	18.6	16.2	14.4
11	Cotton	21.1	16.9	25.1
12	Banana	627.0	487.0	28.7
13	Guar	11.3	10.8	5.0
B	Rabi Crops			
14	Wheat	29.7	29.3	1.3
15	Maize	13.3	13.6	-1.9
16	Jowar	130.9	93.9	39.4
17	Gram	8.3	7.6	9.5
18	Cumin	8.0	9.8	-17.9
19	Tobacco	48.7	27.5	76.9
20	Other spices	1.8	1.3	33.1
C	Summer Crops			
21	Bajra	36.4	31.6	15.2
22	Groundnut	10.9	14.0	-21.7
23	Summer paddy	57.0	23.7	140.9

Source: Field survey data

6.3 Impact of Application of Recommended Doses of Fertilisers on Reference Crops (before and after)

It would be important to see the impact of application of recommended doses of fertiliser on yield of particular crop, i.e. change in crop yield after application of recommended doses of fertilizers. It was observed that the selected farmers had realized better crop yield may be because of adoption of recommended doses of fertiliser. As presented in Table 6.2, the yield level of soil-test farmers has increased by 19.0 per cent after application of recommended doses of fertiliser. Unlike the analysis on soil test vs. control farmers, the analysis on before and after adoption of recommended doses yields very positive results on soil testing implications on crop yield. As could be seen in Table 6.2, the yield of all eleven crops has experienced increase in yield level after application of recommended doses of fertiliser. Moreover, all soil test farmers in different farm categories have experienced higher yield after application of recommended doses of fertiliser compared to pre-adoption period (Table 6.3).

Table 6.2 : Impact of Application of Recommended Doses of Fertilisers on Crop Yield (Soil Test Farmers)

Particulars	Average Yield (Quintal /Ha)		
	Before	After	% Change in yield
Cotton	17.1	21.1	23.7
Groundnut	13.6	19.0	39.4
Castor	15.6	19.9	27.4
Maize	10.8	13.3	23.7
Tobacco	30.8	48.7	57.8
Paddy	14.9	21.4	44.2
Bajra	20.5	23.7	15.8
Banana	484.0	627.0	29.5
wheat	27.6	29.7	7.5
Cumin	6.5	8.8	35.1

Source: Field Survey data

Table 6.3 : Farmer category wise Changes in Crop Yield (Soil Test Farmers)

Major Crops	Farmer category	Average Yield (Quintal /Ha)		
		Before	After	% Change in yield
Cotton	Marginal	15.0	18.0	20.0
	Small	15.3	19.2	26.1
	Semi medium	24.4	28.9	18.5
	Medium	13.0	15.8	21.2
	Large	19.2	24.9	29.9
	All farmers	17.1	21.1	23.7
Groundnut	Marginal	9.4	15.6	66.4
	Small	10.1	12.5	23.8
	Semi medium	18.9	24.1	27.8
	Medium	18.1	25.9	42.9
	Large	10.8	15.3	41.4
	All farmers	13.6	19.0	39.4
Wheat	Marginal	24.8	25.9	4.2
	Small	34.5	38.9	12.8
	Semi medium	29.9	34.5	15.3
	Medium	29.5	32.0	8.5
	Large	30.5	31.5	3.3
	All farmers	27.6	29.7	7.5

Source: Field Survey data

In addition to increase in crop yield, several other changes have been observed after the application of recommended doses of fertilisers on reference crops by the sample farmers (Table 6.4). Reduction in cost on fertilisers, improvement in soil texture, improvement in crop growth, improvement in grain filling, decrease in application of other inputs like seed, labour, pesticide etc. and fewer incidences of pest and diseases were the major benefits experienced by the sample farmers.

Table 6.4. Changes Observed after the Application of Recommended Doses of Fertilisers on Reference Crops

Reasons	% HHs agreed	Rank- 1	Rank-2	Rank- 3	Rank-4
Cost on fertiliser has declined	12.3	49.2	20.3	10.2	20.3
Maintained better soil health	12.9	16.1	50.0	21.0	12.9
Improvement in soil texture	10.8	7.7	30.8	46.2	15.4
Improvement in crop growth	13.1	36.5	14.3	23.8	25.4
Adopted other modern agricultural practices	3.1	13.3	0.0	46.7	40.0
Awareness level on agricultural practices and government programmes has increased	0.8	0.0	0.0	0.0	100.0
Visit of extension officers/fellow farmers has increased	0.4	0.0	100.0	0.0	0.0
Improvement in grain filling	1.3	0.0	0.0	33.3	66.7
Less incidence of pest and diseases	0.6	0.0	33.3	0.0	66.7
Decrease in application of other inputs like seed, labour, pesticide etc.	12.5	5.0	35.0	60.0	0.0

Source: Field Survey data

Photo 11A & 11B: Data Collection from farmers with SHC

Chapter VII

Summary and Conclusions

7.1 Introduction

Since green revolution period, the fertiliser application has tremendously increased. The indiscriminate use of chemical fertilisers by farmers has led to deterioration of soil structure, wastage of nutrients, destruction of soil microorganisms and scorching of plants at the extreme cases. The Government of India has undertaken initiatives to encourage the farmers for balanced use of fertilisers. Among various states of India, Gujarat has been a leading state in streamlining these programmes, among which Soil Health Card Programme is a major one. Under this programme, Soil Health Cards are being provided to all farmers in the country at an interval of 3 years so as to enable the farmers to apply appropriate recommended doses of nutrients to realize improved and sustainable soil health and fertility status and also higher per unit yields. As part of this massive programme, soil samples testing and distribution of SHC to farmers are carried out on a regular basis as per the norms.

Since the programme has been implemented on a larger scale, it is necessary to evaluate its implementation, extent of soil testing for mapping nutrient deficiency and adoption of recommended doses of fertilisers by the farmers based on the soil tests and the effects of the programme on crop productivity. Since the Gujarat state is one of the front runners in implementation of the scheme well before (2003-04) the launch of the Scheme at all-India level (2015-16), the present study attempts to undertake a detailed systematic study (1) to assess the progress in implementation of Soil Health Card Programme in Gujarat; (2) to evaluate the quality of implementation of the programme in terms of quality of soil sample collection, soil testing for different nutrients, generation and timely delivery of soil health cards, and the extent of use

and acceptability of the SHCs by the farmers; (3) to examine the level of adoption and constraints in the application of recommended doses of fertilizers based on soil test reports by the farmers; and (4) to analyse the impact of adoption of recommended doses of fertilisers on soil health, crop productivity and returns.

The present study is based on both secondary and primary level data. The reference year for the study based on primary data collection and analysis is 2014-15. 11 districts covering all 8 agro climatic zones (ACZ) of the state were included for the detailed study. The total sample size was 720, out of which 480 were the soil test farmers and 240 were the non-soil test farmers. Following three types of Soil Health Cards (SHCs) were used for comparative analysis:

- SHCs available with the farmers (issued under SHC Programme by the Government of Gujarat (SHC-GOG)
- SHCs in the names of corresponding farmers uploaded on SHC portal maintained at AAU, Anand (SHC-AAU)
- SHCs generated afresh at Krishi Vigyan Kendra (KVK), Kheda (SHC-KVK)

7.2 Progress in Soil Health Card Programme in Gujarat

Gujarat is the leading state in India in streamlining the Soil Health Card (SHC) Programme for the benefit of farmers at the grass-root level. So far, a total of 53.69 lakh soil health cards have been generated and given to farmers by the end of 2013-14. Out of which, 6.26 lakh soil health cards have been distributed in the year 2013-14 alone. Along with increase in number of SHCs distributed to farmers from 2.27 lakh in 2004-05 to 53.69 lakh in 2013-14, the number of soil testing labs (STL) has also increased from 20 in 2004-05 to 134 in 2013-14 at the rate of 17.9 per cent per annum. Similarly, the annual soil sample analyzing capacity has increased from 2.34 lakh in 2004-05 to 10.3 lakh in 2013-14.

7.3 Effect of SHC Programme on Fertiliser Consumption

The consumption of NPK in Gujarat has increased from 3.57 lakh metric tonnes in 1980-81 to 19.39 lakh metric tonnes in 2010-11, implying an increase by 5.4 times. The NPK consumption per hectare of gross cropped area (GCA) has also increased by 16.5 per cent, from 32.6 kg in 1980-81 to 138.1 kg in 2010-11. But it has declined thereafter to 109.0 kg/ha in 2012-13. The total consumption of NPK in the state has also decreased from 19.39 lakh metric tonnes in 2010-11 to 13.42 lakh metric tonnes in 2012-13. The decline in fertiliser consumption during the later period may be partly due to increased awareness generated by the Soil Health Card (SHC) programme in the state about the negative consequences of application of overdoses of fertiliser and positive effects of balanced fertiliser application on soil health. However, the NPK ratio has been gradually diverged from the ideal ratio of 4:2:1. It has diverged from 4.9:2.8:1.0 during 1980-81 to around 10.0:8.0:1.0 during 2015-16, in spite of implementation of SHC Scheme in the state since 2003-04.

7.4 Summary of Findings from Field Data

Soil Test Facilities and Test results

- The cost of soil test was nil for all soil test farmers since it was provided by the free of cost by the Government. Some of the progressive farmers were also provided the detailed soil test analysis by the cooperatives through private soil testing labs. However, the average distance travelled to soil test lab (STL) by the farmers was 69.7 km. The area covered under soil test as a percentage of net operated area varied from 11.9 per cent to 25.8 per cent across farmer categories. Surprisingly, the proportion of soil tested area varied inversely with size classes of the farmers, i.e., large farmers had lowest proportion of their lands tested and vice -versa.
- It was very surprising to note that the majority of samples were not collected by designated personnel, i.e., Gram Mitras or Gram Sevaks.

There is no information about 49.4 per cent of personnel involved in collection of soil samples from farmers' field. The collection of soil sample is scientific and systematic process which requires the training of same. Thus, the trained staff should have been collected all soil sample to have correct results about soil health. The selected farmers opined that inadequate number of STLs and staff shortages have affected the quality of soil testing service provided by these agencies.

- About half of the farmers expressed that Soil sample was not taken from their lands in their knowledge. The average distance of soil tested plots from the villages was around 2.0 km. None of the sample farmers could get the services of Mobile Soil Testing Vans.
- The major sources of information about the SHC programme were the government officials at grass root level (Gram Sevek, Gram Mitra and Extension Officers). About 84 per cent of all farmers were appraised by these government officials. The State Agricultural Universities/Krishi Vghyan Kendras, friends, neighbours and fellow farmers were the next major sources of information for the sample farmers.
- The major reason behind the soil testing by the farmers was that it was available free of cost (67.1%). Other motivational factors were to maintain better soil health (57.9%), increase in crop yield (57.7%), got motivated from village demonstration/training/exposure visits to places with best farming practices (11.5%).
- There are some farmers who had not tested their farm soil. It is because of the fact that spread of SHC programme was limited due to lack of awareness among the farmers. Among non-soil test farmers, about 72.0 per cent farmers expressed that they were not aware about whom to contact for details on soil testing; whereas another 60.0 per cent farmers mentioned that they were not aware about the benefits of this programme. The larger distance of STL

from villages was another de-motivating factor for about 13.3 per cent of farmers.

- The overall soil quality of farm plots of sample farmers was good. The majority of farmers had normal level of physical parameters (pH, Ec) and primary nutrients (NPK). Such kind of pattern was noticed in all three kinds of SHCs, i.e., SHCs supplied by Government of Gujarat (GOG-SHC), SHCs downloaded from Anand Agricultural University (AAU-SHC) and SHCs generated by KVK Kheda (KVK-SHC), with some exceptions.
- As far as secondary nutrients (S, Mg, Ca) and micronutrients (Zn, Fe, Cu, Mn) in the soils of the farmers are concerned, varied results were reported in different SHC reports. The status of secondary and micronutrients was not mentioned in about 76 per cent to 80 per cent SHCs generated by GOG (GOG-SHC). In the remaining 20 percent of GOG-SHCs with information on secondary and micro-nutrients, the content of micronutrient and secondary nutrients were found normal in about 90 per cent SHCs. This is in sharp contrast to KVV-SHCs in which, the content of micronutrients such Copper and Manganese was found very high in the majority of SHCs of sample farmers (81% and 99.4%, respectively). The Zinc and Iron content in the soils was found normal in case of 31 per cent and 40 per cent of farmers respectively, as reported by KVK-SHCs. In contrast, the same situation was found in more than 90 per cent of SHCs, as per the GOG-SHC recommendations.

Recommended Doses of Fertilisers on Soil Test Basis

- The quantity of recommended doses of Urea, DAP/SSP and MOP was slightly higher in case of KVK-SHC compared to GOG-SHC, particularly, in case of cotton, maize and bajra. In case of cotton crop, the low level of nitrogen was found in case of about 64 per cent of farmers as per KVK-SHC compared to 31 per cent as per GOG-SHC.

- The quantity of recommended doses of fertilisers as per the GOG-SHC and AAU-SHC are more or less close, with some discrepancies. For example, there is recommended doses of MOP for cotton, paddy and sugarcane as per GOG-SHC reports, which are completely absent in AAU-SHC reports. Also other figures between these two group of reports should have been exactly the same, had the same SHCs uploaded on the website, which were distributed to the farmers. There are some other evidences that cards uploaded on the AAU websites don't exactly match including SHC reference numbers.

Adoption of Recommended Doses of Fertilisers and Its Constraints

- The level of adoption of recommended doses were examined from three different angles: (i) farmers own perception, (ii) deviation of fertiliser use from the recommended doses of fertilisers and (iii) deviation from the recommended doses in terms of nutrient content (NPK). It was observed that the number of fertiliser products used by the farmers varied a lot among the farmers. To make it simple, all the fertiliser products recommended were expressed in terms of major nutrients (N, P, K).
- As per the perception of farmers, the level of adoption of recommended doses by the soil test farmers was only 15.4 per farmers. However, with a method of taking a deviation of 15% from recommended doses of NPK, the level of adoption of NPK nutrients varied from 0.6 per cent to 12.3 per cent, as per the GOG-SHC reports. The level of adoption of NPK nutrients was found to be further lower while we used the KVK-SHC data. In terms of later datasets, the level of adoption of NPK nutrients varied from nil to 8.8 per cent.
- The attempts were also made to broaden the range to 25 per cent. However, there was no much significant change in adoption level.

With 25 per cent range, the level of adoption of NPK nutrients varied from as low as 1.5 per cent to 20.0 per cent, as per the GOG-SHC reports; and from 1.7 per cent to 13.5 per cent, as per the KVK-SHC reports.

Underlying Reasons for Adoption or Non-adoption of Recommended Doses of Fertilizers

- Those farmers, who adopted the recommended doses, were asked about the underlying reasons for application of recommended doses of fertilizers. About 13.1 per cent farmers believed that the cost on fertiliser use and thus cost of production would be reduced by adopting the recommended doses, since it may reduce the quantity of recommended doses of fertilisers. About 14.0 per cent farmers expressed that they wanted to apply recommended doses to maintain better soil health and to increase crop yield. The fitted Logit Model finds that, net sown area, total soil tested area and education level of farmers influenced the decision to adopt the recommended doses of fertilisers as suggested in SHCs.
- The soil test farmers have faced several difficulties in applying recommended doses of fertiliser. Among these constraints, difficulty in understanding and following application of recommended doses, unavailability of technical advice on method and time of fertiliser application, high prices of fertilisers and unavailability of required fertilisers in adequate quantity were the major ones.
- As regards the use of organic fertilizers by sample farmers, most of soil-test as well as control farmers had used farm yard manure (FYM). Among soil-test farmers, about 69.6 per cent of soil test farmers and 64.2 per cent of control farmers applied FYM on their soil. About 38.5 per cent of net cropped area of soil test farmers and 36.5 per cent of net cropped area of control farmers was covered with FYM. Easy availability and relatively low price of the

FYM may be the reason behind its high and dominant use in crop cultivation.

Impacts of Adoption of Recommended Doses of Fertilisers

- The soil test group realized better average yield compared to the control group. Out of thirteen crops during Kharif season, only two crops have experienced fall in yield while ten crops such as cotton, tobacco, castor, maize, paddy, bajra, udad, jowar, tur, guar and banana have experienced increase in yield by soil test group of farmers, while comparing the same with non-soil test group.
- The analysis of crop yield before and after soil tests revealed that the yield level of soil-test farmers has increased by about 30 per cent after application of recommended doses of fertilizer. All soil test farmers in different farm categories have experienced higher yield after application of recommended doses of fertilizer compared to pre-adoption period.
- In addition to increase in crop yield, several other changes have been observed after the application of recommended doses of fertilisers on reference crops by the sample farmers. Reduction in cost on fertilisers, improvement in soil texture, improvement in crop growth, improvement in grain filling, decrease in application of other inputs like seed, labour, pesticide etc. and fewer incidences of pest and diseases were the major benefits experienced by the sample farmers.

7.5 Policy Implications

- The Soil Health Card (SHC) programme is highly beneficial programme for sustainable growth in agriculture. However, there have been a number of shortcomings in implementation of the programme which need to be taken care of for strengthening this farmer friendly programme.

- It was noticed that, in view to achieve the quantity targets fixed for some period/s, quality norms were not given proper attention. As a result, a majority of farmers did not use the cards judiciously. They could not attach more importance to it over their own long experiences of farming.
- In majority of cases, it was found that the SHCs were not given to the farmer or these were not in custody of farmers. Those were kept together somewhere with some officials or local leaders. Thus, in true sense, it was no use to the farmers.
- It was observed that many farmers even failed to understand the content of the card. They failed to calculate the recommended doses of various fertilisers required for their pieces of lands. Thus, the information on SHC should be provided in simple format and understandable language.
- The level of adoption of recommended doses by the soil test farmers was reasonably less due to various constraints, viz. difficulty in understanding and following application of recommended doses as stated in Soil Health Cards, unavailability of technical advice on method and time of fertiliser application, and high prices of fertilisers. Adequate efforts should be made to eliminate such constraints in order to increase the adoption level of recommended doses of fertilizers.
- Activities of Soil health Card Programme may be organised in a particular village in campaign mode. All stakeholders [such as farmers, farmer friends (Gram Mitras), village level workers (VLWs), Block level officers fertilizer industries, Co-op Society, SAU students (as part of their internship of farmer's field /village for technical exposure), people representatives] should be brought to common platforms on some occasions so as to bring qualitative improvements and to raise the level of awareness in the villages.
- The inadequate number of Soil Testing Lab (STLs) in the State has severely affected the quality of service provided to the farmers, as

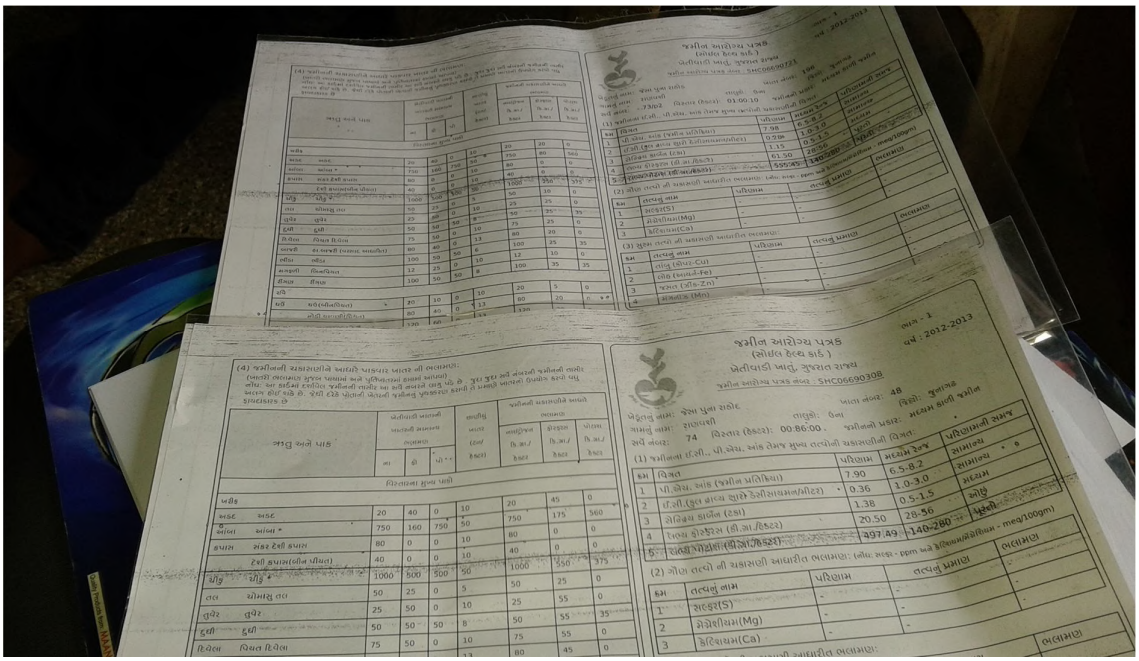
opined by the most of the sample farmers. Therefore, adequate STL facility should be created/made available in nearby areas, at least at the Taluka level.

- The daunting task ahead can be gauged by the fact that it would cost at least Rs.3 crore to set up a new STL. The number of new STLs is not growing at the rate the targets have been increasing to generate and distribute SHCs, which is not feasible. The special annual targets must be set and monitored to establish or increase number of STLs and associated staff strength and to renovate the existing STLs with regular training and capacity building activities.
- Looking at existing situation of inadequate staff in implementation of scheme, the involvement of non-governmental organizations and public private partnership (PPP) mode of operation may be promoted for the benefits of the farmers. Alternatively, establishment of private STLs should be encouraged/ promoted with some government incentives/support.
- The soil samples collection need to be monitored properly since about 50 per cent of soil test farmers did not know when the soil samples from their lands were collected. Some of the farmers during discussion reported that samples had been collected from a single plot but had been shown for a large number of plots. Such findings raises questions about the reliability of the soil test results and debilitating farmers' confidence on the recommendations given in the SHCs. Therefore, necessary steps to be taken to ensure quality implementation so as to raise the confidence level of the farmers.
- One way to raise the level of confidence of the farmers is to demonstrate the usefulness of the recommendations by applying recommended doses of fertiliser on experimental plots at every village or at least at Gram Panchayat level. If the better results can be demonstrated on the experimental plots compared to farmers' field, farmers will be self-motivated to have SHCs.

- The infrastructural facilities available, the methodology and technology used to test and generate the SHCs are varying among the existing STLs significantly. Even the results generated by two different STLs on existing nutrient status and recommended doses are varying a lot. Thus, there is a need of establishing proper coordination among the institutions involved in soil testing, generating SHCs and distribution of SHCs. The knowledge sharing and regular training of staff engaged in these activities for their capacity building and regular monitoring of these activities are essential to bridge the gaps in implementation.
- It was observed that information provided in SHC available with farmers as well as information uploaded on the AAU website differs to some extent. Even the data available on the Government of India website also don't match (For example, Gujarat total in Annexure VI and VII). Thus, the quality of data/statistics on SHC programme as collected by various agencies needs improvement. The coordination among agencies involved is essential for generating a reliable, timely and quality database since such databases on various government programmes like SHC programme is required for undertaking regular evaluation and policy relevant research.
- Due to imbalances in fertiliser application fueled by high fertiliser subsidy on nitrogenous fertilisers, the NPK ratio has diverged a lot from the ideal ratio of 4:2:1. It is unlikely that one scheme on will change the behaviour of farmers and by spending just Rs.40 per farmer (Rs.568 crore for 140 million farmers). To change the pattern of fertilizer use, the entire ecosystem, including pricing policy of inputs and crops, needs an overhaul.
- So far, the SHC Programme has remained a target oriented supply driven programme. Unless it is turned into demand driven programme by generating interests in the farmers and building their confidence on the soil test results, it would be very difficult to enforce adoption of recommended doses among farmers.

Photo 12: Verification of information given in SHC available with Farmers

Photo 13: Copies of Soil Health Cards available with the farmers



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ANNEXURE TABLES

Annexure I: Salient Features of Agro Climatic Zones of Gujarat State

Zone	Climate	Districts Covered	Rainfall (mm)	Major Crops	Soil
South Gujarat (Heavy Rain Area.)	Semi-arid to dry sub-humid	Navsari, Dang, Valsad and Valod, Vyara, songadh and Mahuva taluks of Surat.	1500 and more	Rice, Sorghum, Ragi, Kodra, Seasamum, Pigeonpea, Groundnut, Cotton, Sugarcane, Chilli, Wheat, Gram	Deep black with few patches of coastal alluvial, laterite and medium black
South Gujarat	Semi-arid to dry sub-humid	Surat and Amod, Ankleshwar, Broach, Dekdopada, Honsot, Jhagadia, Nanded, Sagbara and Valia talukas of Bharuch.	1000-1500	Rice, Wheat, Gram, Perlmillets,Sorghum, Maize, Kodra, Ragi, Pigeonpea, groundnut, Sesamum, Castor, Cotton, Sugarcane, Chillies,	Deep black clayey
Middle Gujarat	Semi-arid	Panchmahals, Baroda and Anand, Balasinor, Borsad, Kapadvanj, Kheda, Matar, Ahmedabad, Nadiad, Petlad and Thasara and taluks of Kheda.	800-1000	Rice, Wheat, Gram, Perlmillets,Sorghum, Maize, Kodra, Ragi, Pigeonpea, groundnut, Sesamum, Castor, Cotton, Sugarcane, Potato, Rapeseed & Mustard.	Deep black, medium black to loamy sand
North Gujarat	Arid to semi-arid	Sabarkantha, Gandhinagar, Dehgam, Daskroi, Sanand talukas of Ahmedabad, Deesa, Dhenera, Palanpur, Dandta, Wadgam taluks of Banaskantha and Chanasma, Kadi, Kalol, Kheralu, Mehsana, Patan, Sidhpur, Visnagar, Vijapur taluks and Mehsana.	625-875	Rice, Wheat, Gram, Perlmillet, Sorghum, Maize, groundnut, Sesamum, Castor, Cotton, Sugarcane, Cumin, Rapeseed & Mustard.	Sandy loam to sandy
Bhal & Coastal Area	Dry sub-humid	Bhavnagar (Vallabhipur, Bhavnagar talukas), Ahmedabad (Dholka, Dhanduka talukas), and Vagra, Jambusa talukas of Bharuch.	625-1000	Rice, Pearlmillet.	Medium black, poorly drained and saline

Annexure I Continued…

South Saurashtra	Dry sub-humid	Junagadh, Ghodhra, Talaja, Mahuva talukas of Bhavnagar Kodinar, Rajula and Jafrabad talukas of Amerli and Dhoraji, Jetpur, Upleta talukas of Rajkot.	625-750	Rice, Maize, Sugarcane Wheat, Gram Pearl millets ,Sorghum, Groundnut, Seasamum, Cotton, Pulses, rapeseed & mustard	Shallow medium black calcareous
North Saurashtra	Dry sub-humid	Jamnagar, Rajkot, Chotila, Limdi, Lakhtar, Muli, Sayla, Wadhwan talukas of Surendranagar and Gadheda, Umrala, Botad, Kundla, Dihor, Garidhar, Palitana talukas of Bhavnagar and Amreli, Babra, Lathi, Lalia, Kunkavav, Khamba, Dhari taluks of Amreli.	400-700	Pearlmillet, Sorghum, Groundnut, Seasamum, Castor, Cotton, Pulses.	Shallow medium black
North West Zone	Arid to semi-arid	Kutch, Rajkot, Malia Halvad, Dhrangdhra, Dasada taluks of Surendranagar, Sami and Harij taluks of Mahsana, Santhalpur, Radhanpur, Kankrej, Deodar, Vav, Tharad talukas of Banaskantha and Viramgam taluka of Ahmedabad.	250	Rice, Wheat, Gram, Perlmillet, Sorghum, Maize, Pigeon pea, groundnut, Sesamum, Castor, Cotton, Rapeseed & Mustard , barley.	Sandy and saline

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Government of Gujarat, Gandhinagar

Annexure II: Fertilizer Consumption in Gujarat State Year 1980-81 to 2015-16

(In 000' tonnes)

Sr. No	Year	Fertiliser consumption					NPK Ratio		
		Nitrogenous (N)	Phosphate (P2O5)	Potassic (K2O)	Total NPK	Per Ha Consumption of NPK (Kg/Ha)	N	P	K
1	1980-81	204.12	117.22	0.00	356.86	32.58	NA	NA	NA
2	1981-82	245.40	114.64	41.42	401.46	36.50	5.9	2.8	1.0
3	1982-83	236.39	115.73	34.31	386.43	34.66	6.9	3.4	1.0
4	1983-84	317.04	147.35	37.96	502.35	45.60	8.4	3.9	1.0
5	1984-85	320.31	148.78	35.47	504.56	48.33	9.0	4.2	1.0
6	1985-86	286.51	109.30	25.50	421.31	42.23	11.2	4.3	1.0
7	1986-87	255.61	111.77	34.91	402.29	50.05	7.3	3.2	1.0
8	1987-88	290.15	120.30	31.83	442.28	41.32	9.1	3.8	1.0
9	1988-89	434.74	164.46	44.27	643.47	60.23	9.8	3.7	1.0
10	1989-90	434.40	213.86	47.12	695.38	65.72	9.2	4.5	1.0
11	1990-91	430.75	217.15	58.49	706.39	67.26	7.4	3.7	1.0
12	1991-92	456.59	216.98	59.68	733.26	66.64	7.7	3.6	1.0
13	1992-93	496.17	181.14	39.29	716.60	66.79	12.6	4.6	1.0
14	1993-94	472.89	157.01	39.17	669.08	59.50	12.1	4.0	1.0
15	1994-95	572.27	195.64	50.38	818.29	74.42	11.4	3.9	1.0
16	1995-96	551.92	160.16	41.41	753.49	68.15	13.3	3.9	1.0
17	1996-97	596.65	175.62	41.27	813.54	72.55	14.5	4.3	1.0
18	1997-98	702.77	264.83	60.29	1027.89	91.78	11.7	4.4	1.0
19	1998-99	690.73	267.57	61.36	1019.66	95.28	11.3	4.4	1.0
20	1999-00	632.13	264.73	68.75	965.61	91.99	9.2	3.9	1.0
21	2000-01	498.96	195.67	56.01	750.64	69.56	8.9	3.5	1.0
22	2001-02	605.64	240.23	69.36	915.23	86.09	8.7	3.5	1.0
23	2002-03	510.80	207.04	71.59	789.43	69.12	7.1	2.9	1.0
24	2003-04	687.55	255.28	73.50	1016.33	92.32	9.4	3.5	1.0
25	2004-05	754.00	296.26	96.22	1146.48	101.42	7.8	3.1	1.0
26	2005-06	834.73	328.46	116.73	1279.92	114.99	7.2	2.8	1.0
27	2006-07	927.57	361.13	120.09	1408.79	106.78	7.7	3.0	1.0
28	2007-08	1052.63	424.52	146.11	1623.26	119.78	7.2	2.9	1.0
29	2008-09	1068.83	465.17	182.98	1716.98	135.09	5.8	2.5	1.0
30	2009-10	1101.60	491.67	206.45	1799.72	205.86	5.3	2.4	1.0
31	2010-11	1241.22	518.00	179.94	1939.16	138.08	6.9	2.9	1.0
32	2011-12	1183.30	417.02	132.74	1733.06	132.59	8.9	3.1	1.0
33	2012-13	1007.70	257.82	76.46	1341.97	108.99	13.2	3.4	1.0
34	2013-14	1158.93	315.37	90.60	156.90	127.65	12.8	3.5	1.0
35	2014-15	1217.51	351.99	114.51	1684.00	NA	10.6	3.1	1.0
36	2015-16	1088.61	328.14	109.26	1526.01	NA	10.0	3.0	1.0

Sources: Statistical Outline of Gujarat (1980-81 to 1990-91) and Statistical Abstract 2009, Directorate of Economics and Statistics, Department of Gujarat, Gandhinagar.

Annexure III: District-wise Availability of Soil Health Cards (SHCs) in Gujarat (2010-11 to 2012-13)

Sl. No.	District Name	Total No. of SHCs					
		2010-11		2011-12		2012-13	
1	Rajkot	170712	(9.8)	86947	(7.5)	87005	(7.5)
2	Jamnagar	156225	(9.0)	58572	(5.1)	76627	(6.6)
3	Banaskantha	52544	(3.0)	67815	(5.9)	74668	(6.5)
4	Jamnagar	124182	(7.1)	73723	(6.4)	66693	(5.8)
5	Bhavnagar	76270	(4.4)	48921	(4.2)	63965	(5.5)
6	Vadodara	117332	(6.8)	67098	(5.8)	59079	(5.1)
7	Anand	81087	(4.7)	67654	(5.9)	58965	(5.1)
8	Kheda	67264	(3.9)	69195	(6.0)	56991	(4.9)
9	Amreli	133667	(7.7)	58324	(5.1)	55511	(4.8)
10	Surendranagar	115458	(6.6)	50355	(4.4)	54047	(4.7)
11	Mehsana	138366	(8.0)	54753	(4.7)	53184	(4.6)
12	Sabarkantha	85199	(4.9)	40331	(3.5)	52145	(4.5)
13	Ahmedabad	59435	(3.4)	46293	(4.0)	50885	(4.4)
14	Panchmahal	27095	(1.6)	73019	(6.3)	49427	(4.3)
15	Kutch	101092	(5.8)	48428	(4.2)	47711	(4.1)
16	Patan	58198	(3.3)	22798	(2.0)	40619	(3.5)
17	Surat	30520	(1.8)	53890	(4.7)	35744	(3.1)
18	Gandhinagar	37291	(2.1)	26163	(2.3)	28820	(2.5)
19	Navsari	6321	(0.4)	28762	(2.5)	28308	(2.5)
20	Valsad	17090	(1.0)	24754	(2.1)	27029	(2.3)
21	Bharuch	21670	(1.2)	31899	(2.8)	25867	(2.2)
22	Dahod	19193	(1.1)	25953	(2.2)	21145	(1.8)
23	Porbandar	33284	(1.9)	13319	(1.2)	15214	(1.3)
24	Narmada	2522	(0.1)	12356	(1.1)	9955	(0.9)
25	The Dang	6068	(0.3)	2791	(0.2)	2901	(0.3)
26	Tapi					10249	
	State Total	1738085	(100.0)	1154113	(100.0)	1152754	(100.0)

Source: Information Technology Center, Anand Agricultural University, Anand, Gujarat

Annexure IV: Status of Implementation of Soil Health Card scheme in India (as on 12.01.2016)

(Figures in lakh)

Name of State	Total Target of issue of soil health card	Total target of collection of soil samples	No of samples collected	No of samples collected/Percent progress	Balance number of samples to be collected	No of soil samples tested	No of soil samples tested/Percent progress	Balance number of samples to be tested
Sikkim	13000	0.13	0.65	0.65 (100 > %)	0	0.65	0.65 (100 > %)	0
Andhra Pradesh	400000	4.00	4.02	4.02 (100.4 %)	0.00	4.02	4.02 (100.4 %)	0.00
Gujarat	**1366000**	**13.66**	**13.30**	**13.30 (97.4 %)**	**0.36**	**12.03**	**12.03 (88.1 %)**	**1.63**
Tamil Nadu	426000	4.26	3.67	3.67 (86.1 %)	0.59	3.27	3.27 (76.8 %)	0.99
Nagaland	11141	0.11	0.09	0.09 (81.8 %)	0.02	0.08	0.08 (72.7 %)	0.03
Maharashtra	911000	9.11	8.06	8.06 (88.5 %)	1.05	4.16	4.16 (45.7 %)	4.95
Meghalaya	22000	0.22	0.19	0.19 (88.3 %)	0.03	0.11	0.11 (48.1 %)	0.11
Punjab	176000	1.76	1.68	1.68 (95.2 %)	0.08	0.79	0.79 (45.0 %)	0.97
Bihar	448000	4.48	3.87	3.87 (86.4 %)	0.61	1.89	1.89 (42.3 %)	2.59
Himachal Pradesh	69635	0.70	0.60	0.60 (85.6 %)	0.10	0.31	0.31 (44.0 %)	0.39
Goa	25000	0.25	0.14	0.14 (56.0 %)	0.11	0.00	0 (0 %)	0.25
Telangana	584000	5.84	3.59	3.59 (61.5 %)	2.25	2.69	2.69 (46.0 %)	3.15
Rajasthan	904000	9.04	6.08	6.08 (67.3 %)	2.96	2.41	2.41 (26.7 %)	6.63
Kerala	63800	0.64	0.37	0.37 (58.6 %)	0.26	0.17	0.17 (26.9 %)	0.47
Tripura	10912	0.11	0.08	0.08 (73.3 %)	0.03	0.06	0.06 (55.0 %)	0.05
Jharkhand	47850	0.48	0.27	0.27 (55.9 %)	0.21	0.07	0.07 (15.1 %)	0.41
Madhya Pradesh	805000	8.05	4.05	4.05 (50.4 %)	4.00	2.90	2.90 (36.1 %)	5.15
Uttarakhand	67607	0.68	0.37	0.37 (54.1 %)	0.31	0.24	0.24 (34.9 %)	0.44
Uttar Pradesh	1800000	18.00	11.11	11.11 (61.7 %)	6.89	2.01	2.01 (11.1 %)	15.99
J & K	55106	0.55	0.29	0.29 (52.1 %)	0.26	0.09	0.09(16.7 %)	0.46
Haryana	400000	4.00	2.48	2.48 (62.0 %)	1.52	0.26	0.26 (6.4 %)	3.74
Chattisgarh	292588	2.93	1.10	1.10 (37.4 %)	1.83	0.85	0.85 (29.1 %)	2.07
Odisha	310000	3.10	1.34	1.34 (43.3 %)	1.76	1.01	1.01 (32.5 %)	2.09
West Bengal	310000	3.10	1.22	1.22 (39.4 %)	1.88	0.37	0.37 (11.9 %)	2.73
Manipur	11000	0.11	0.03	0.03 (27.3 %)	0.08	0.00	0 (0 %)	0.11
Mizoram	9671	0.10	0.02	0.02 (20.7 %)	0.08	0.02	0.02 (20.7 %)	0.08
Assam	180000	1.80	0.30	0.30 (16.8 %)	1.50	0.11	0.11 (6.3 %)	1.69
Karnataka	533000	5.33	0.29	0.29 (5.5 %)	5.04	0.13	0.13 (2.5 %)	5.20
Arunachal Pradesh	9000	0.09	0.00	0 (0 %)	0.09	0.00	0 (0 %)	0.09
Total All India	**10261310**	**100.00**	**69.26**	**69.26 (69.3 %)**	**33.89**	**40.70**	**40.70 (40.70 %**	**62.45**

Source: http://www.soilhealth.dac.gov.in/

Annexure V: Progress in Issue of Soil Health Cards in India (up to 12th January 2016)

(Figures in lakh)

Name of State	Tentative target for issue of Soil Health Cards	Issue of Soil Health Cards to grid farmers	Percentages of targets achieved
Andhra Pradesh	20.00	15.00	75.0
Tamil Nadu	21.30	10.88	51.1
Sikkim	0.65	0.00	0.0
Nagaland	0.55	0.05	9.9
Bihar	22.40	7.18	32.0
Uttarakhand	3.40	0.79	23.3
Telangana	29.20	5.43	18.6
Himachal Pradesh	3.50	0.39	11.3
Jharkhand	2.40	0.24	9.9
Maharashtra	45.55	15.50	34.0
West Bengal	15.50	0.16	1.0
J & K	2.75	0.10	3.7
Punjab	8.80	0.95	10.8
Gujarat	**68.30**	**9.20**	**13.5**
Meghalaya	1.10	0.16	14.2
Rajasthan	45.20	3.03	6.7
Odisha	15.50	2.43	15.7
Kerala	3.20	0.07	2.1
Madhya Pradesh	40.25	3.02	7.5
Chhattisgarh	14.65	0.90	6.1
Haryana	20.00	0.20	1.0
Uttar Pr	90.00	3.12	3.5
Tripura	0.55	0.07	12.6
Mizoram	0.50	0.00	0.0
Assam	9.00	0.09	1.0
Karnataka	26.65	0.06	0.2
Arunachal Pradesh	0.45	0.00	0.0
Goa	1.25	0.00	0.0
Manipur	0.55	0.00	0.0
Total All India	513.15	79.01	15.4

Source: http://www.soilhealth.dac.gov.in/

Annexure VI: District wise Progress in soil health card programme in Gujarat (2015-16)

District	Target (No. of samples)			Samples Entered	Samples Collected	Sample Tested	SHCs Printed	SHCs Distributed
	Kharif	Rabi	Total					
Ahemdabad	489,709	0	489,709	0	400,671	0	0	0
Amrelli	565,994	52,272	618,266	0	463,086	0	0	0
Anand	396000	246026	642026	0	234000	0	0	0
Banaskantha	598,583	149,258	747,841	9	454,977	0	0	0
Bharuch	236,985	189,541	426,526	882	421,146	0	0	0
Bhavnagar	527417	109472	636889	0	462726	0	0	0
Dang	26,694	0	26,694	2,644	9,180	0	0	0
Dahod	26,694	0	26,694	2,644	9,180	0	0	0
Gandhinagar	275,495	0	275,495	198	246,393	40,500	0	0
Jamnagar	234,540	0	234,540	3,015	234,540	0	0	0
Kutch	526,042	0	526,042	0	426,042	0	0	0
Junagadh	718,204	0	718,204	9	945,882	0	0	0
Kheda	688,215	125,961	814,176	0	475,137	27,000	0	0
Mehsana	416,299	0	416,299	1,422	410,632	0	0	0
Narmada	60,319	0	60,319	558	60,057	18,774	0	0
Navsari	234,540	0	234,540	3,015	234,540	0	0	0
Panchmahal	440,231	89,441	529,672	0	308,529	37,710	0	0
Patan	471,306	0	471,306	0	385,614	36,000	0	0
Porbandar	110,000	81,290	191,290	0	79,299	0	0	0
Rajkot	868,131	119,218	987,349	0	586,971	0	0	0
Sabarkantha	710,289	257,795	968,084	63	462,663	0	0	0
Surat	195,243	0	195,243	1,521	178,335	18,000	0	0
Surendranagar	589,424	88,341	677,765	0	446,976	0	0	0
Tapi	123,140	0	123,140	252	114,786	36,000	0	0
Vadodara	915,729	86,504	1,002,233	9	748,908	7,416	0	0
Valsad	231,443	106,403	337,846	477	66,825	0	0	0
Gujarat Total	**10,676,666**	**1,701,522**	**12,378,188**	**16,718**	**8,867,095**	**221,400**	**0**	**0**

Source: http://www.soilhealth.dac.gov.in/

Annexure VII: Month wise Progress in soil health card programme in Gujarat (2015-16)

Month	Target (No. of samples)			Samples Entered	Samples Collected	Sample Tested	SHCs Printed	SHCs Distributed
	Kharif	Rabi	Total					
April	883,281	130,860	1,014,141	2	0	0	0	0
May	883,281	130,860	1,014,141	2	0	0	0	0
June	1,022,590	159,978	1,182,568	1,073	989,818	24,600	0	0
July	1,072,030	159,978	1,232,008	1,248	1,041,147	24,600	0	0
August	1,072,030	159,978	1,232,008	1,248	1,041,147	24,600	0	0
September	1,072,030	159,978	1,232,008	1,248	1,041,147	24,600	0	0
Octomber	1,072,030	159,978	1,232,008	1,248	1,041,147	24,600	0	0
November	1,072,030	159,978	1,232,008	1,248	1,041,147	24,600	0	0
December	1,072,030	159,978	1,232,008	1,248	1,041,147	24,600	0	0
January	1,072,030	159,978	1,232,008	1,247	1,041,147	24,600	0	0
February	0	0	0	0	0	0	0	0
March	1,072,030	159,978	1,232,008	1,247	1,041,147	24,600	0	0
Gujarat Total	11,365,392	1,701,522	13,066,914	11,059	9,318,994	221,400	0	0

Source: http://www.soilhealth.dac.gov.in/

Annexure VIII: Soil Health Card scheme in India(Road Map 2015-16)

Samples Collected							
					Plan of Work		
Sl. No.	State	Target No of samples 2015-16	No. of samples collected	Balance as on date 12.01.2016	Jan-16	Feb-16	Mar-16
I.	SOUTH ZONE						
1	Andhra Pr	400000	401782	0	0	0	0
2	Karnataka	533000	29283	503717	151115	151115	201487
3	Kerala	63800	37394	26406	7922	7922	10562
4	Tamil Nadu	426000	366603	59397	17819	17819	23759
5	Telangana	584000	359015	224985	67496	67496	89994
II.	WEST ZONE						
6	**Gujarat**	**1366000**	**1330000**	**36000**	**10800**	**10800**	**14400**
7	Madhya Pr	805000	405430	399570	119871	119871	159828
8	Maharashtra	911000	806000	105000	31500	31500	42000
9	Rajasthan	904000	608000	296000	88800	88800	118400
10	Chhattisgarh	292588	109500	183088	54926	54926	73235
11	Goa	25000	13993	11007	3302	3302	4403
III.	NORTH ZONE						
12	Haryana	400000	247956	152044	45613	45613	60818
13	Punjab	176000	167600	8400	2520	2520	3360
14	Uttarakhand	67607	36579	31028	9308	9308	12411
15	Uttar Pr	1800000	1111348	688652	206596	206596	275461
16	Himachal Pr	69635	59612	10023	3007	3007	4009
17	J & K	55106	28706	26400	7920	7920	10560
IV.	EAST ZONE						
18	Bihar	448000	387086	60914	18274	18274	24366
19	Jharkhand	47850	26746	21104	6331	6331	8442
20	Odisha	310000	134262	175738	52721	52721	70295
21	West Bengal	310000	122000	188000	56400	56400	75200
V.	NE ZONE						
22	Arunachal Pr	9000	0	9000	2700	2700	3600
23	Assam	180000	30172	149828	44948	44948	59931
24	Manipur	11000	3000	8000	2400	2400	3200
25	Meghalaya	22000	19432	2568	770	770	1027
26	Mizoram	9671	2000	7671	2301	2301	3068
27	Nagaland	11141	9400	1741	522	522	696
28	Sikkim	13000	65000	0	0	0	0
29	Tripura	10912	8388	2524	757	757	1010
	TOTAL	10000000	6926287	3388805	1016642	1016642	1355522

Source: http://www.soilhealth.dac.gov.in/

Annexure VIII continued…

Samples Tested

Sl. No.	State	No. of samples tested	Balance as on date 12.01.2016	Plan of Work		
				Jan-16	Feb-16	Mar-16
I.	SOUTH ZONE					
1	Andhra Pr	401610	0	0	0	0
2	Karnataka	13109	519891	155967	155967	207956
3	Kerala	17154	46646	13994	13994	18658
4	Tamil Nadu	327241	98759	29628	29628	39504
5	Telangana	268720	315280	94584	94584	126112
II.	WEST ZONE					
6	**Gujarat**	**1203000**	**163000**	**48900**	**48900**	**65200**
7	Madhya Pr	290300	514700	154410	154410	205880
8	Maharashtra	416000	495000	148500	148500	198000
9	Rajasthan	241000	663000	198900	198900	265200
10	Chhattisgarh	85200	207388	62216	62216	82955
11	Goa	210	24790	7437	7437	9916
III.	NORTH ZONE					
12	Haryana	25772	374228	112268	112268	149691
13	Punjab	79246	96754	29026	29026	38702
14	Uttarakhand	23574	44033	13210	13210	17613
15	Uttar Pr	200521	1599479	479844	479844	639792
16	Himachal Pr	30630	39005	11702	11702	15602
17	J & K	9228	45878	13763	13763	18351
IV.	EAST ZONE					
18	Bihar	189477	258523	77557	77557	103409
19	Jharkhand	7234	40616	12185	12185	16246
20	Odisha	100837	209163	62749	62749	83665
21	West Bengal	37000	273000	81900	81900	109200
V.	NE ZONE					
22	Arunachal Pr	0	9000	2700	2700	3600
23	Assam	11358	168642	50593	50593	67457
24	Manipur	0	11000	3300	3300	4400
25	Meghalaya	10589	11411	3423	3423	4564
26	Mizoram	2000	7671	2301	2301	3068
27	Nagaland	8400	2741	822	822	1096
28	Sikkim	65000	0	0	0	0
29	Tripura	6391	4521	1356	1356	1808
	TOTAL	4070801	6244119	1873236	1873236	2497648

Source: http://www.soilhealth.dac.gov.in/

Annexure VIII continued…

SHC generation & distribution

Sl. No.	State	Target	No. of SHCs issued	Balance as on date 12.01.2016	Plan of Work		
					Jan-16	Feb-16	Mar-16
I.	SOUTH ZONE						
1	Andhra Pr	2000000	1500000	500000	150000	150000	200000
2	Karnataka	2665000	6325	2658675	797603	797603	1063470
3	Kerala	319000	6844	312156	93647	93647	124862
4	Tamil Nadu	2130000	1087759	1042241	312672	312672	416896
5	Telangana	2920000	543280	2376720	713016	713016	950688
II.	WEST ZONE						
6	**Gujarat**	**6830000**	**920000**	**5910000**	**1773000**	**1773000**	**2364000**
7	Madhya Pr	4025000	301500	3723500	1117050	1117050	1489400
8	Maharashtra	4555000	1550000	3005000	901500	901500	1202000
9	Rajasthan	4520000	303000	4217000	1265100	1265100	1686800
10	Chhattisgarh	1462940	89500	1373440	412032	412032	549376
11	Goa	125000	0	125000	37500	37500	50000
III.	NORTH ZONE						
12	Haryana	2000000	19813	1980187	594056	594056	792075
13	Punjab	880000	95385	784615	235385	235385	313846
14	Uttarakhand	338035	79300	258735	77621	77621	103494
15	Uttar Pr	9000000	311933	8688067	2606420	2606420	3475227
16	Himachal Pr	348175	39435	308740	92622	92622	123496
17	J & K	275530	10120	265410	79623	79623	106164
IV.	EAST ZONE						
18	Bihar	2240000	717554	1522446	456734	456734	608978
19	Jharkhand	239250	23840	215410	64623	64623	86164
20	Odisha	1550000	242622	1307378	392213	392213	522951
21	West Bengal	1550000	16000	1534000	460200	460200	613600
V.	NE ZONE						
22	Arunachal Pr	45000	0	45000	13500	13500	18000
23	Assam	900000	9177	890823	267247	267247	356329
24	Manipur	55000	0	55000	16500	16500	22000
25	Meghalaya	110000	15668	94332	28300	28300	37733
26	Mizoram	48355		48355	14507	14507	19342
27	Nagaland	55705	5470	50235	15071	15071	20094
28	Sikkim	65000	0	65000	19500	19500	26000
29	Tripura	54560	6950	47610	14283	14283	19044
	TOTAL	50000000	7901475	43405075	13021523	13021523	17362030

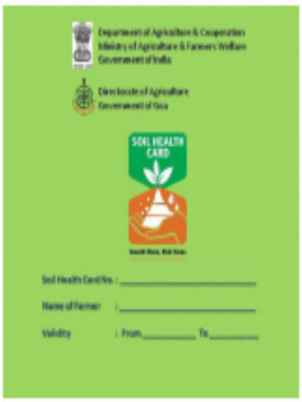
Source: http://www.soilhealth.dac.gov.in/

Annexure IX: Soil Health Card scheme in India (Road Map 2016- 17)

Sl. No.	State	Total Target (No of samples) 2016 -17	Target for the					
			10% of Total Target (No of samples) April-2016	20% of Total Target (No of samples)	20% of Total Target (No of samples) June-2016	20% of Total Target (No of samples) November-2016	20% of Total Target (No of samples) December-2016	10% of Total Target (No of samples) January-2017
I.	SOUTH ZONE							
1	Andhra Pradesh	815808	81580.80	163161.60	163161.60	163161.60	163161.60	81580.80
2	Karnataka	1007834	100783.40	201566.80	201566.80	201566.80	201566.80	100783.40
3	Kerala	77192	7719.20	15438.40	15438.40	15438.40	15438.40	7719.20
4	Tamil Nadu	771129	77112.90	154225.80	154225.80	154225.80	154225.80	77112.90
5	Telangana	626009	62600.90	125201.80	125201.80	125201.80	125201.80	62600.90
II.	WEST ZONE							
6	Gujarat	961532	96153.20	192306.40	192306.40	192306.40	192306.40	96153.20
7	Madhya Pradesh	1400020	140002.00	280004.00	280004.00	280004.00	280004.00	140002.00
8	Maharashtra	1420073	142007.30	284014.60	284014.60	284014.60	284014.60	142007.30
9	Rajasthan	1396412	139641.20	279282.40	279282.40	279282.40	279282.40	139641.20
10	Chhattisgarh	425752	42575.20	85150.40	85150.40	85150.40	85150.40	42575.20
11	Goa	8476	847.60	1695.20	1695.20	1695.20	1695.20	847.60
III.	NORTH ZONE							
12	Haryana	477167	47716.70	95433.40	95433.40	95433.40	95433.40	47716.70
13	Punjab	505516	50551.60	101103.20	101103.20	101103.20	101103.20	50551.60
14	Uttarakhand	82125	8212.50	16425.00	16425.00	16425.00	16425.00	8212.50
15	Uttar Pradesh	2886223	288622.30	577244.60	577244.60	577244.60	577244.60	288622.30
16	Himachal Pradesh	42131	4213.10	8426.20	8426.20	8426.20	8426.20	4213.10
17	J & K	100022	10002.20	20004.40	20004.40	20004.40	20004.40	10002.20
IV.	EAST ZONE							
18	Bihar	791847	79184.70	158369.40	158369.40	158369.40	158369.40	79184.70
19	Jharkhand	69761	6976.10	13952.20	13952.20	13952.20	13952.20	6976.10
20	Odisha	404543	40454.30	80908.60	80908.60	80908.60	80908.60	40454.30
21	West Bengal	786747	78674.70	157349.40	157349.40	157349.40	157349.40	78674.70
V.	NE ZONE							
22	Arunachal Pradesh	12422	1242.20	2484.40	2484.40	2484.40	2484.40	1242.20
23	Assam	168625	16862.50	33725.00	33725.00	33725.00	33725.00	16862.50
24	Manipur	12532	1253.20	2506.40	2506.40	2506.40	2506.40	1253.20
25	Meghalaya	16540	1654.00	3308.00	3308.00	3308.00	3308.00	1654.00
26	Mizoram	7252	725.20	1450.40	1450.40	1450.40	1450.40	725.20
27	Nagaland	20222	2022.20	4044.40	4044.40	4044.40	4044.40	2022.20
28	Sikkim	4504	450.40	900.80	900.80	900.80	900.80	450.40
29	Tripura	19806	1980.60	3961.20	3961.20	3961.20	3961.20	1980.60
	TOTAL	15318222	1531822.20	3063644.40	3063644.40	3063644.40	3063644.40	1531822.20

Source: http://www.soilhealth.dac.gov.in/

Annexure X: New Design of Soil Health Card (2015-16) Released by Government of India



SOIL HEALTH CARD

Farmer's Details			
Name			
Address			
Village			
Sub-District			
District			
PIN			
Aadhaar Number			
Mobile Number			
Soil Sample Details			
Soil Sample Number			
Sample Collected on			
Survey No.			
Khasra No. / Dag No.			
Farm Size			
Geo Position (GPS)	Latitude:	Longitude:	
Irrigated / Rainfed			

Name of Laboratory :

SOIL TEST RESULTS

S. No.	Parameter	Test Value	Unit	Rating
1	pH			
2	EC			
3	Organic Carbon (OC)			
4	Available Nitrogen (N)			
5	Available Phosphorus (P)			
6	Available Potassium (K)			
7	Available Sulphur (S)			
8	Available Zinc (Zn)			
9	Available Boron (B)			
10	Available Iron (Fe)			
11	Available Manganese (Mn)			
12	Available Copper (Cu)			

Secondary & Micro Nutrients Recommendations

Sl. No.	Parameter	Recommendations for Soil Applications
1	Sulphur (S)	
2	Zinc (Zn)	
3	Boron (B)	
4	Iron (Fe)	
5	Manganese (Mn)	
6	Copper (Cu)	
General Recommendations		
1	Organic Manure	
2	Biofertiliser	
3	Lime / Gypsum	

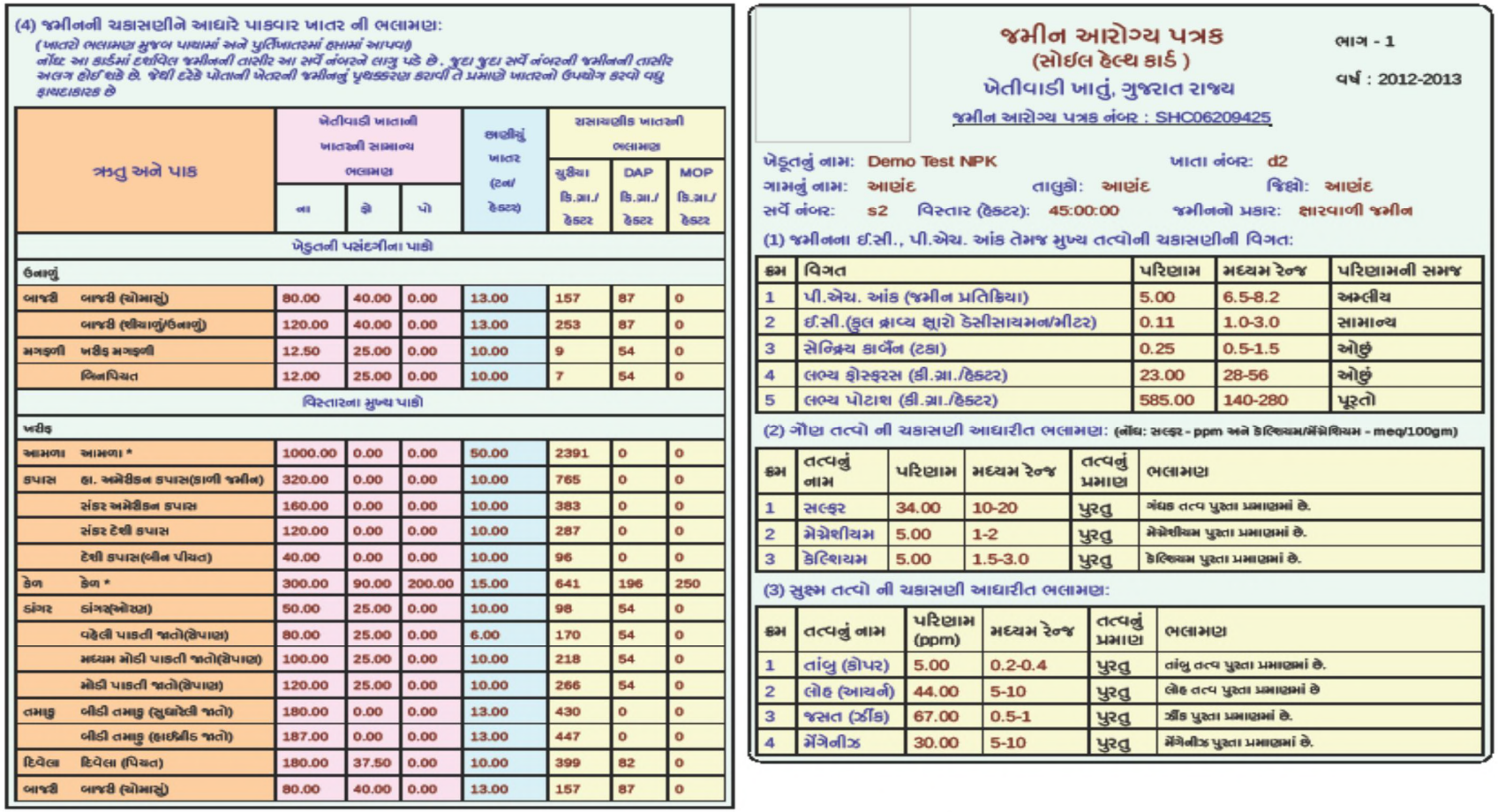
International Year of Soils 2015

Healthy Soils for a Healthy Life

Fertilizer Recommendations for Reference Yield (with Organic Manure)

Sl. No.	Crop & Variety	Reference Yield	Fertilizer Combination-1 for N P K		Fertilizer Combination-2 for N P K	
1	Paddy (Dhaan)					
2						
3						
4						
5						
6						

Annexure XI: A Copy of Soil Health Card used by Farmers in Gujarat (2012-13)



(4) જમીનની ચકાસણીને આધારે પાકવાર ખાતર ની ભલામણ:

(ખાતરો ભલામણ મુજબ પાયામાં અને પૂર્તિખાતરમાં હપ્તામાં આપવા)

નોંધ: આ કાર્ડમાં દર્શાવેલ જમીનની તારીખ આ સર્વે નંબરને લાગુ પડે છે. જુદા જુદા સર્વે નંબરની જમીનની તારીખ અલગ હોઈ શકે છે. જેથી દરેકે પોતાની ખેતરની જમીનનું પૃથક્કરણ કરાવી તે પ્રમાણે ખાતરનો ઉપયોગ કરવો વધુ ફાયદાકારક છે

ઋતુ અને પાક		ખેતીવાડી ખાતાની ખાતરની સામાન્ય ભલામણ			છાણીયું ખાતર (ટન/ હેક્ટર)	રાસાયણીક ખાતરની ભલામણ		
		ના	કે	પો		યુરીયા કિ.ગ્રા./ હેક્ટર	DAP કિ.ગ્રા./ હેક્ટર	MOP કિ.ગ્રા./ હેક્ટર
ખેડુતની પસંદગીના પાકો								
ઉનાળું								
બાજરી	બાજરી (ચોમાસું)	80.00	40.00	0.00	13.00	157	87	0
	બાજરી (શિયાળું/ઉનાળું)	120.00	40.00	0.00	13.00	253	87	0
મગફળી	ખરીફ મગફળી	12.50	25.00	0.00	10.00	9	54	0
	બિનપિયત	12.00	25.00	0.00	10.00	7	54	0
વિસ્તારના મુખ્ય પાકો								
ખરીફ								
આમળા	આમળા *	1000.00	0.00	0.00	50.00	2391	0	0
કપાસ	હા. અમેરીકન કપાસ(કાળી જમીન)	320.00	0.00	0.00	10.00	765	0	0
	સંકર અમેરીકન કપાસ	160.00	0.00	0.00	10.00	383	0	0
	સંકર દેશી કપાસ	120.00	0.00	0.00	10.00	287	0	0
	દેશી કપાસ(બીન પીયત)	40.00	0.00	0.00	10.00	96	0	0
તેળ	તેળ *	300.00	90.00	200.00	15.00	641	196	250
ડાંગર	ડાંગર(ઓરણા)	50.00	25.00	0.00	10.00	98	54	0
	વહેલી પાકતી જાતો(રોપાણ)	80.00	25.00	0.00	6.00	170	54	0
	મધ્યમ મોડી પાકતી જાતો(રોપાણ)	100.00	25.00	0.00	10.00	218	54	0
	મોડી પાકતી જાતો(રોપાણ)	120.00	25.00	0.00	10.00	266	54	0
તમાકુ	બીડી તમાકુ (સુધારેલી જાતો)	180.00	0.00	0.00	13.00	430	0	0
	બીડી તમાકુ (હાઈબ્રીડ જાતો)	187.00	0.00	0.00	13.00	447	0	0
દિવેલા	દિવેલા (પિયત)	180.00	37.50	0.00	10.00	399	82	0
બાજરી	બાજરી (ચોમાસું)	80.00	40.00	0.00	13.00	157	87	0

જમીન આરોગ્ય પત્રક

(સોઇલ હેલ્થ કાર્ડ)

ખેતીવાડી ખાતું, ગુજરાત રાજ્ય

ભાગ - 1

વર્ષ : 2012-2013

જમીન આરોગ્ય પત્રક નંબર : SHC06209425

ખેડૂતનું નામ: Demo Test NPK ખાતા નંબર: d2

ગામનું નામ: આણંદ તાલુકો: આણંદ જિલ્લો: આણંદ

સર્વે નંબર: s2 વિસ્તાર (હેક્ટર): 45:00:00 જમીનનો પ્રકાર: ક્ષારવાળી જમીન

(1) જમીનના ઈ.સી., પી.એચ. આંક તેમજ મુખ્ય તત્વોની ચકાસણીની વિગત:

ક્રમ	વિગત	પરિણામ	મધ્યમ રેન્જ	પરિણામની સમજ
1	પી.એચ. આંક (જમીન પ્રતિક્રિયા)	5.00	6.5-8.2	અમ્લીય
2	ઈ.સી.(દ્રાવ્ય ક્ષારો ડેસીસાયમન/મીટર)	0.11	1.0-3.0	સામાન્ય
3	સેન્દ્રિય કાર્બન (ટકા)	0.25	0.5-1.5	ઓછું
4	લભ્ય ફોસ્ફરસ (કી.ગ્રા./હેક્ટર)	23.00	28-56	ઓછું
5	લભ્ય પોટાશ (કી.ગ્રા./હેક્ટર)	585.00	140-280	પૂરતો

(2) ગૌણ તત્વો ની ચકાસણી આધારીત ભલામણ: (નોંધ: સલ્ફર - ppm અને કેલ્શિયમ/મેગ્નેશિયમ - meq/100gm)

ક્રમ	તત્વનું નામ	પરિણામ	મધ્યમ રેન્જ	તત્વનું પ્રમાણ	ભલામણ
1	સલ્ફર	34.00	10-20	પુરતુ	ગંધક તત્વ પુરતા પ્રમાણમાં છે.
2	મેગ્નેશીયમ	5.00	1-2	પુરતુ	મેગ્નેશીયમ પુરતા પ્રમાણમાં છે.
3	કેલ્શિયમ	5.00	1.5-3.0	પુરતુ	કેલ્શિયમ પુરતા પ્રમાણમાં છે.

(3) સુક્ષ્મ તત્વો ની ચકાસણી આધારીત ભલામણ:

ક્રમ	તત્વનું નામ	પરિણામ (ppm)	મધ્યમ રેન્જ	તત્વનું પ્રમાણ	ભલામણ
1	તાંબુ (કોપર)	5.00	0.2-0.4	પુરતુ	તાંબુ તત્વ પુરતા પ્રમાણમાં છે.
2	લોહ (આયર્ન)	44.00	5-10	પુરતુ	લોહ તત્વ પુરતા પ્રમાણમાં છે
3	જસત (ઝીંક)	67.00	0.5-1	પુરતુ	ઝીંક પુરતા પ્રમાણમાં છે.
4	મેંગેનીઝ	30.00	5-10	પુરતુ	મેંગેનીઝ પુરતા પ્રમાણમાં છે.

@ Information Technology Center, Anand Agricultural University, Anand. http://aau.in, http://shc.aau.in, http://shc.gujarat.gov.in

Annexure XII: A Table Printed on back side of SHC to calculate the fertiliser (2012-13)

Table for calculation of fertilizers

Recommended dose of nutrient for 1 hectare (kg)	Percentage of Nitrogen, Phosphorus and Potash described on the bag of chemical fertilizer (for basal dose of fertilizer)																				
	10%	11%	12%	14%	15%	16%	17%	18%	19%	20%	22%	25%	26%	28%	32%	35%	36%	45%	46%	50%	60%
1	10	9.1	8.3	7.1	6.7	6.3	5.9	5.6	5.3	5.0	4.5	4.0	3.8	3.6	3.1	2.9	2.8	2.2	2.2	2.0	1.7
2	20	18.2	16.7	14.3	13.3	12.5	11.8	11.1	10.5	10.0	9.1	8.0	7.7	7.1	6.3	5.7	5.6	4.4	4.4	4.0	3.3
5	50	46	42	36	33	31	29	28	26	25	23	20	19	18	16	14	14	11	11	10	8
10	100	91	83	71	67	63	59	56	53	50	45	40	38	36	31	29	28	22	22	20	17
15	150	136	125	107	100	94	88	83	79	75	68	60	58	54	47	43	42	33	33	30	25
20	200	182	167	143	133	125	118	111	105	100	91	80	77	71	63	57	56	44	44	40	33
30	300	273	250	214	200	188	176	167	158	150	136	120	115	107	94	86	83	67	65	60	50
50	500	455	417	357	333	313	294	278	263	250	227	200	192	179	156	143	139	111	109	100	83
60	600	546	500	429	400	375	353	333	316	300	273	240	231	214	188	171	167	133	130	120	100
75	750	682	625	536	500	469	441	417	395	375	341	300	288	268	234	214	208	167	163	150	125
80	800	727	667	571	533	500	471	444	421	400	364	320	308	286	250	229	222	178	174	160	133
100	1000	909	833	714	667	625	588	556	526	500	455	400	385	357	313	286	278	222	217	200	167

Table Explanation : The percentage of different nutrients printed on the bag of chemical fertilizer is given in the first horizontal row, while the recommended nutrients (in kg) are given in the first column. Now as per the percentage mentioned on the bag you have selected for chemical fertilizer move vertically and select the recommended quantity of fertilizer from the row and move horizontally. Where the horizontal and vertical lines are crossed, that will be your recommended quantity of fertilizer in kilogram. Apply that quantity per hectare.

Example:

1. Suppose the recommended dose of fertilizer is 100:50:50 N-P-K kg/ha. If the source of nitrogen is Urea, then urea contents 46 % Nitrogen. So, select 46% from the first row and select 100 kg from the first column. Where both are crossing shows 217 kg, that means for applying 100 kg nitrogen /ha through urea, one should apply 217 kg Urea/ha. Similarly, 313 kg Super Phosphate (16% P_2O_5) and 83 kg Muriate of Potash (60 % K_2O) is required for 50 kg of P_2O_5 and K_2O each, respectively.
2. Suppose the recommended dose of fertilizer is 100:50:00 N-P-K kg/ha and the sources of fertilizers are DAP and Urea. Then, first one has to calculate the dose of phosphorus from DAP (as it is a compound fertilizer). Select the first row at 46% and first column at 50 kg, the lines cross at 109. that means, for applying 50 kg P_2O_5 through DAP, one should apply 109 kg DAP. Now DAP is a compound fertilizer, contains 18 % N and 46 % P_2O_5. That means, 109 kg DAP will supply 109 x 18/100 = 19.62 ≈20 kg N /ha. In this example, one needs 100 kg N/ha. So, after applying 109 kg DAP, one requires 100 – 20 = 80 kg N/ha. Now, again select 46% from the first row and 80 kg from the first column and where these lines are crossing i.e.174 kg Urea/ha. should be applied .

Note : While calculating doses of fertilizers, first calculate potassic fertilizers, then phosphatic fertilizers and lastly, nitrogenous fertilizers. So that one can subtract phosphorus and nitrogen available from the potassic fertilizers and nitrogen from the phosphatic fertilizers.

Annexure XIII: Soil Heath Card format- 2008-09

(7) Crop wise Fertilizer Recommendation on the basis of soil analysis.

(Supply recommended fertilizers as basal dose and in top dressing)

Note: Soil characteristics illustrated in this card is pertaining to this survey number only. Soil characteristics vary for different survey numbers. Use of fertilizers in accordance with soil analysis of individual field is more beneficial.

Season / Crop	General recommendation of fertilizers by Dept. of Agriculture (kg/ha) N	P_2O_5	K_2O	FYM (Tones/ha)	Recommendation on the basis of soil analysis (kg/ha) N (kg/ha)	P_2O_5 (kg/ha)	K_2O (kg/ha)
Kharif Banana					*(*FYM-kg/plant, NPK : gm/plant)*		
Banana*	180	90	180	15	200	90	180
Kharif Paddy							
Paddy (Drilled)	80	20	0	6	90	20	0
Medium late (T.P.)	50	25	0	10	55	25	0
Early Maturing (T.P.)	100	25	0	10	110	25	0
Late Maturing (T.P.)	120	30	0	10	130	30	0
Kharif Tobacco							
Bidi Tobacco (Hybrid)	220	0	0	13	240	0	0
Bidi Tobacco (Improved)	180	0	0	13	200	0	0
Kharif Castor							
Irri. Castor	75	50	0	10	85	50	0
Kharif Pearl millet							
Hy. Pearl millet (Rain fed)	80	40	0	13	90	40	0
Kharif Chilly							
Chilly	100	50	50	10	110	50	50
Rabi Culcutti Tobacco							
Guj. Culcutti-1	200	0	0	10	240	0	0
Guj. Culcutti-2	150	0	0	10	165	0	0
Rabi Wheat							
Late sowing	80	40	0	13	90	40	0
Timely sowing	120	60	0	13	130	60	0
Rabi Chickpea							
Chickpea	20	40	0	10	25	40	0
Rabi Potato							
Potato	200	100	200	25	220	100	200
Summer Paddy							
Summer Paddy	100	30	0	10	110	30	0

SOIL HEALTH CARD

DEPARTMENT OF AGRICULTURE
GUJARAT STATE

Year : 2008

SOIL HEALTH CARD NO.: SHC00027842

(1) Farmer's Name : Pursotambhai Hirabhai Patel

(2) Village : Zarolla **Taluka :** Borsad **District :** Anand

(3) Account No : 280

(4) Land / Soil detail as per account :

Serial	Survey No.	Area (Ha.)	Soil Type
1	1004-2	00 : 40 : 00	Sandy loam
2			
3			
4			
5			

(5) Fertility class as per soil analysis of the village :

Serial	Fertility Class	Nitrogen	Phosphorus	Potash
1	Low	✓		
2	Medium		✓	
3	High			✓

(6) Details of individual soil analysis : Survey No. : 1004-2

Sr.	Detail	Result	Interpretation of Result
1	pH (Soil Reaction)	7.20	Normal
2	E.C. (Total Dissolve Salts: dSm/m)	0.49	Normal
3	Organic Carbon (%)	0.26	Low
4	Available Phosphorus (kg/ha)	43.00	Medium
5	Available Potash (kg/ha)	254.00	Medium

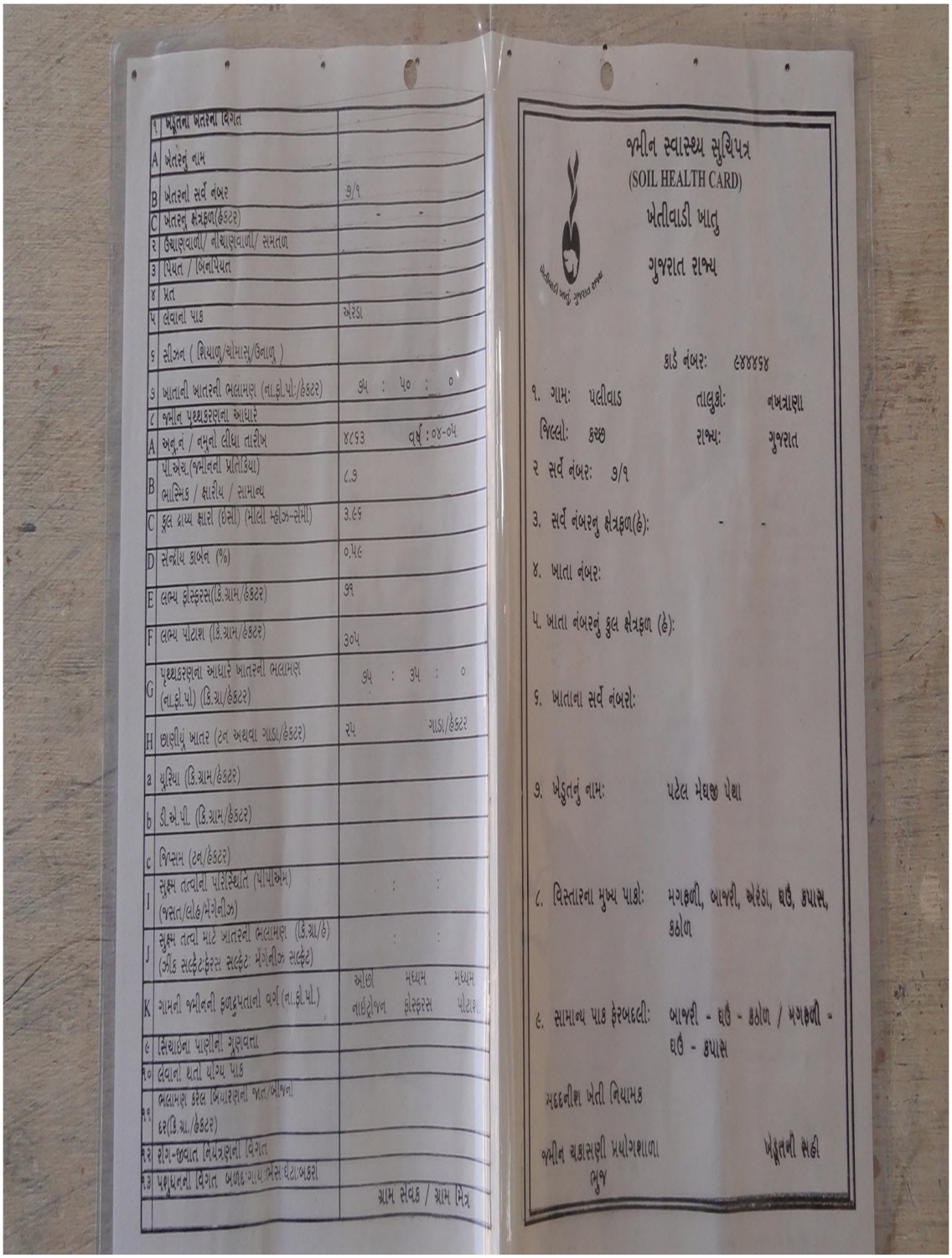
pH

Acidity : 6.5 or less
Normal : 6.5 - 8.2
Alkaline: 8.2 or high

E.C. (Electric Conductivity)

Normal : Less than 1.0
Medium: 1.0 to 3.0
Harmful : 3.0 or high

Annexure XIV: Soil Heath Card format- 2003-04



૧	ખેડૂતના ખેતરનો વિગત	
A	ખેતરનું નામ	
B	ખેતરનો સર્વે નંબર	૭/૧
C	ખેતરનું ક્ષેત્રફળ(હેક્ટર)	- -
૨	ઉંચાણવાળી/ નીચાણવાળી/ સમતળ	
૩	પિયત / બિનપિયત	
૪	પ્રત	
૫	લેવાનો પાક	એરંડા
૬	સીઝન (શિયાળુ/ચોમાસુ/ઉનાળુ)	
૭	ખાતાની ખાતરની ભલામણ (ના.ફો.પો./હેક્ટર)	૭૫ : ૫૦ : ૦
૮	જમીન પૃથ્થકરણના આધારે	
A	અનુ.નં / નમૂનો લીધા તારીખ	૪૮૬૩ વર્ષ : ૦૪-૦૫
B	પી.એચ.(જમીનનો પ્રતિક્રિયા) ભાસ્મિક / ક્ષારીય / સામાન્ય	૮.૭
C	કુલ દ્રાવ્ય ક્ષારો (ઈસી) (મિલી મહોઝ-સેમી)	૩.૯૬
D	સેન્દ્રીય કાર્બન (%)	૦.૫૯
E	લભ્ય ફોસ્ફરસ(કિ.ગ્રામ/હેક્ટર)	૭૧
F	લભ્ય પોટાશ (કિ.ગ્રામ/હેક્ટર)	૩૦૫
G	પૃથ્થકરણના આધારે ખાતરની ભલામણ (ના.ફો.પો) (કિ.ગ્રા./હેક્ટર)	૭૫ : ૩૫ : ૦
H	છાણીયું ખાતર (ટન અથવા ગાડા/હેક્ટર)	૨૫ ગાડા/હેક્ટર
a	યુરિયા (કિ.ગ્રામ/હેક્ટર)	
b	ડી.એ.પી. (કિ.ગ્રામ/હેક્ટર)	
c	જિપ્સમ (ટન/હેક્ટર)	
I	સૂક્ષ્મ તત્વોની પરિસ્થિતિ (પી.એચ.એમ) (બ્રસ્ત/લો/મેગ્નીઝ)	: :
J	સૂક્ષ્મ તત્વ માટે ખાતરની ભલામણ (કિ.ગ્રા/હે) (ઝીંક સલ્ફેટ/ફેરસ સલ્ફેટ મેંગેનીઝ સલ્ફેટ)	: :
K	ગામની જમીનની ફળદ્રુપતાનો વર્ગ (ના.ફો.પો.)	ઓછો મધ્યમ મધ્યમ નાઈટ્રોજન ફોસ્ફરસ પોટાશ
૯	સિંચાઈના પાણીનો ગુણવત્તા	
૧૦	લેવાનો થતો ઉત્પાદ પાક	
૧૧	ભલામણ કરેલ બિયારણનો જાત/બીજનો દર(કિ.ગ્રા./હેક્ટર)	
૧૨	રોગ-જીવાત નિયંત્રણનો વિગત	
૧૩	પશુધનનો વિગત બળદ:ગા.ય:ભેંસ:ઘેટા:બકરા	
		ગ્રામ સેવક / ગ્રામ મિત્ર

જમીન સ્વાસ્થ્ય સુચિપત્ર
(SOIL HEALTH CARD)
ખેતીવાડી ખાતુ
ગુજરાત રાજ્ય

કાર્ડ નંબર: ૯૪૪૪૬૪

૧. ગામ: પલીવાડ તાલુકો: નખત્રાણા
જિલ્લો: કચ્છ રાજ્ય: ગુજરાત

૨ સર્વે નંબર: ૭/૧

૩. સર્વે નંબરનુ ક્ષેત્રફળ(હે): - -

૪. ખાતા નંબર:

૫. ખાતા નંબરનું કુલ ક્ષેત્રફળ (હે):

૬. ખાતાના સર્વે નંબરો:

૭. ખેડુતનું નામ: પટેલ મેઘજી પેથા

૮. વિસ્તારના મુખ્ય પાકો: મગફળી, બાજરી, એરંડા, ઘઉં, કપાસ, કઠોળ

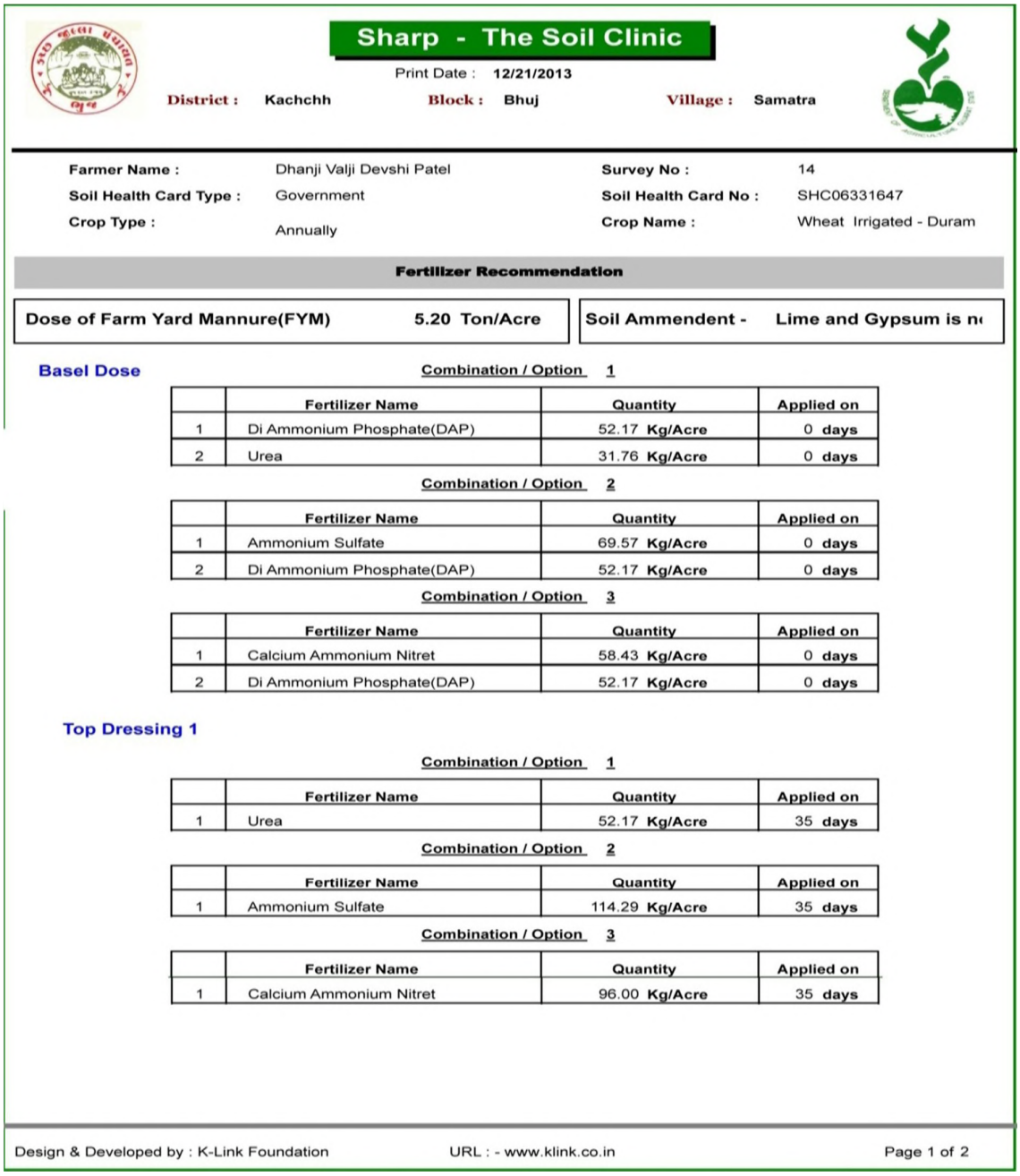
૯. સામાન્ય પાક ફેરબદલી: બાજરી - ઘઉં - કઠોળ / મગફળી - ઘઉં - કપાસ

માર્ગદર્શક ખેતી નિયામક

જમીન ચકાસણી પ્રયોગશાળા ભુજ

ખેડૂતની સહી

Annexure XV: SHARP- The Soil Clinic in Gujarat



Sharp - The Soil Clinic

Print Date : 12/21/2013

District : Kachchh Block : Bhuj Village : Samatra

Farmer Name :	Dhanji Valji Devshi Patel	**Survey No :**	14
Soil Health Card Type :	Government	**Soil Health Card No :**	SHC06331647
Crop Type :	Annually	**Crop Name :**	Wheat Irrigated - Duram

Fertilizer Recommendation

Dose of Farm Yard Mannure(FYM)	**5.20 Ton/Acre**
Soil Ammendent -	**Lime and Gypsum is n**

Basel Dose

Combination / Option 1

	Fertilizer Name	Quantity	Applied on
1	Di Ammonium Phosphate(DAP)	52.17 Kg/Acre	0 days
2	Urea	31.76 Kg/Acre	0 days

Combination / Option 2

	Fertilizer Name	Quantity	Applied on
1	Ammonium Sulfate	69.57 Kg/Acre	0 days
2	Di Ammonium Phosphate(DAP)	52.17 Kg/Acre	0 days

Combination / Option 3

	Fertilizer Name	Quantity	Applied on
1	Calcium Ammonium Nitret	58.43 Kg/Acre	0 days
2	Di Ammonium Phosphate(DAP)	52.17 Kg/Acre	0 days

Top Dressing 1

Combination / Option 1

	Fertilizer Name	Quantity	Applied on
1	Urea	52.17 Kg/Acre	35 days

Combination / Option 2

	Fertilizer Name	Quantity	Applied on
1	Ammonium Sulfate	114.29 Kg/Acre	35 days

Combination / Option 3

	Fertilizer Name	Quantity	Applied on
1	Calcium Ammonium Nitret	96.00 Kg/Acre	35 days

Design & Developed by : K-Link Foundation URL : - www.klink.co.in Page 1 of 2

Annexure XVI: Household Schedule (Soil Test Farmers)

Household Code: Soil Sample Survey No: SHC No:

Agro-Economic Research Centre

(Ministry of Agriculture& Farmers Welfare, Govt. of India)

Sardar Patel University, Vallabh Vidyanagar 388120

"SOIL HEALTH CARD PROGRAMME IN GUJARAT: IMPLEMENTATION, IMPACTS AND IMPEDIMENTS"

HOUSEHOLD SCHEDULE (SOIL TEST FARMERS)

Reference Period: 2014-15 **Name of the Interviewer:**

_____

Village Name		Taluka/Tehsil	
District		State	Gujarat

1. General Information

1. Name of Head of the household (HH)	
2. Name of the respondent	
3. Whether the respondent is head of the HH (Yes-1, No-2)	
4. Head of HH's age (Yrs)	
5. Head of HH's educational level (Yrs)	
6. Head of HH's caste (Tick)	SC / ST / OBC (SEBC) / General
7. Head of HH's gender (Tick)	Male/ Female
8. Head of HH's occupation*	Main:_____ Subsidiary:_____
9. Total number of family members	
10. No. of people engaged in farming	
11. HH Head's experience in farming (Yrs)	
12. Are you a member of any group/society/institutions?	Yes/No. If yes, group/society name_____
13. Respondent's contact number	

*** Code:** Agriculture-1, Livestock/dairy-2, Agricultural labour-3, Self employed in household industry-4, Self employed in services-5, Non-agricultural casual labour-6, Salaried work-7, Household work-8, Pensioner-9, Unemployed-10, Other-11

2. Operational Land Holdings (in Biga*): Total area (Net) _____

Particulars	Irrigated	Un-irrigated	Total	Source of irrigation
Owned (cultivable)				
Leased in				
Leased out				
Total operational holding (1+2-3)				

Note: * 1 Ha = _____ Biga

3. Cropping Pattern (Gross area for 2014-15)

Crop	Area (Biga)		Production (Mann)	
	Irrig	Unirrig	Irrig	Unirrig
Kharif (2014)				
Groundnut				
Cotton				
Bajra				
Paddy				
Maize				
Ragi				
Millets/Jowar				
Castor				
Tur/Arhar				
Udad				
Moong				
Rabi (2014-15)				
Wheat				
Jowar				
Maize				
Gram				
Moong				
Rape & mustard				
Summer (2015)				
Groundnut				
Bajra				
Paddy				
Maize				
Annual and Perennials				

Notes (1) 1 Mann= 20kg

4. Farm Machinery and Buildings

S. No	Type	Number
1	Tractor	
3	Harrow and cultivator	
2	Electric motor	
3	Diesel Engine	
9	Drip system (Area____Biga)	
	Sprinkler system (Area____Biga)	
12	Any other, specify_____	

5. Details of Soil Testing

5.1. Mention the sources of information about soil testing (Tick √):

SAUs/KVKs/Private Companies/ Relatives & Friends /Gram Mitra/ Gram Sevak /
Agrl Dept staff/ KVK Staff/ Others (Name :_____)

5.2. Please provide the following details on soil testing:

(a) When was your soil tested? : Year: _____Month:_____

(b) Place of soil test lab (STL) : _____(c) Distance of STL from village____ (km)

(d) No of plots from which soil samples were taken : _____

(e) No. of samples taken from each plot for soil testing: _____

(f) Name the nutrients for which you have tested your soil sample (Tick): (i) N, P, K
(ii): Calcium(C)/Magnesium (Mg) Sulphur(S)/
(iii): Zinc (Zn)/Iron (Fe)/Boron (B)/Manganese (Mn)/Copper (Cu)

(g) Cost of soil testing : (i) Rs/sample (NPK): ___ (ii) Rs/sample (Micro-nutrients): ___
(iii) Total cost on all plots (Rs):_____

(h) Area covered under soil test (all plots) :_____ Biga

(i) Average distance of soil tested plots from the village (km): _____

(j) Do you know when the soil sample was taken from your land? (Tick): Yes/No

(k) If yes, the month and year the sample was taken : Year: _____Month:_____

(l) Average duration for getting SHC from the date of sample collection (days):

(m) Who collected the soil sample? (Tick): Self/ Relatives & Friends /Gram Mitra/ Gram Sevak /Agrl Dept staff/ KVK Staff/ Others (Name :_____)

(n) Crops that you had grown on soil tested plots: (1) ____ (2) _____ (3) _____ (4) _____

(o) Have you availed the services of Mobile Soil Testing Van? Yes ☐ No ☐

(p) If yes, (a) No. of plots/samples tested: ___; (b) Cost of mobile soil testing/Sample: (Rs) ___

(q) Number of Soil Health Cards (SHC) you own (No.): 2012-13 ☐ 2013-14 ☐ 2014-15 ☐

(r) Who keeps your SHC? (Tick) : Self/ Relatives & Friends /Gram Mitra/ Gram Sevak / Agrl Dept staff/ KVK Staff/ Others (Name :_____)

(s) Do you understand what written on SHC? (Tick) : Fully/Partially/To some extent/Nothing

(t) Which part on SHC you don't follow/understand? _____

(u) Characteristics of soil tested (Tick):

(i) Moisture of soil two days after heavy rain: Soil is very dry, Soil is very wet, Soil is somewhat dry or muddy, Soil is moist, but not muddy

(ii) Type of soil: Shallow medium black-1, Deep black with alluvial-2, Deep black clayey soil-3, Sandy soils-4, Stony soils-5

5.3. Mention the reasons/motivation for testing your soil

S. No.	Reasons	Tick (√) the reasons
1	Soil testing facility was provided free of cost	
2	For availing benefit under subsidy scheme	
3	To maintain better soil health	
4	To increase crop yield	
5	Motivation from village demonstration/training/exposure visits to places with best farming practices	
6	Peer farmers' group pressure	
7	Since it was a new technological practice	
8	Any other, specify_____	

5.4. Provide the soil health status (nutrients) as reported in Soil Health Card (SHC) Code: Normal-1, High-2, Medium-3, Low-4

Particulars	Nutrients status (code)	Particulars	Nutrients status (code)
Area (Biga):		pH value	
Crop name:		Zinc (Zn)	
Nitrogen (N)		Iron (Fe)	
Phosphorus (P)		Boron (B)	
Potassium (K)		Manganese (Mn)	
Sulphur (S)		Copper (Cu)	
Magnesium (Mg)			
Calcium (Ca)			

6. Provide actual quantity of chemical fertiliser applied for a Major crop (_____) during the reference year

Reference Crop Name: _____ Area:_____Biga

Sr. No	Fertilisers	Total Quantity (Kg)	Price that you paid (Rs/50 Kg bag)
1	Urea		
2	DAP (Diammonium phosphate)		
3	MOP (Muriate of Potash)		
4	SSP (Single Super Phosphate)		
5	Complex*_____		
6	Organic fertiliser (1)		
	Organic fertiliser (2)		
7	Other, specify_____		

* **Complex fertilisers** contain varying ratios of two or three macronutrients (nitrogen, phosphorous and potassium).

7. Application of Recommended Doses of Fertilisers for the major crops

7.1. Mention the Recommended Quantity of Fertilisers Based on Soil Test (as reported in the soil health card)

(Kg/Ha)

Crop	Urea	DAP	SSP	Potash	Gypsum	Zinc Sulphate	Any other, specify___
Main crops:							
2.							

7.2a. Did you apply recommended doses of fertilisers? Yes ☐ **No** ☐

7.2b. Will you continue to apply recommended doses of fertilisers? Yes/No. (Tick √)

If **No, provide the reasons for not applying recommended doses:**

S. No.	Reasons	Tick (√) the reasons
1	Adequate quantity of fertilisers not available	
2	Prices of fertilisers are high	
3	Lack of money to purchase fertilisers	
4	No technical advice on method and time of fertiliser application	
5	Difficult to understand and follow the recommended doses	
6	Trust on their own experiences/practices	
7	Any other, specify_____	

8. What was the yield before and after application of recommended doses?

Major Crops	Year	Season	Yield (Quintal/Biga)	
			Before	After
1.				
2.				
3.				

9. Visible changes observed and benefits realised after the application of recommended doses

Particulars		Tick (√) the changes	Rank as most imp-1, important-2, least imp-3
Increase in crop yield			
Improvement in soil texture			
Improvement in crop growth			
Improvement in grain filling			
Less incidence of pest and diseases			
Changes in application of other inputs like seed, labour, pesticide etc.	(a) Increase		
	(b) Decrease		
	(c) No change		
Cost of production on fertilisers has declined			
Availed benefit under subsidy schemes			
Adopted other modern agricultural practices			
Visit of extension officers/fellow farmers has increased			
Maintained better soil health			
Awareness level on agricultural practices and government programmes has increased			
Any other, specify_____			

10. Use of organic fertilizers

Main Crop (Name): _____

S. No	Organic fertiliser	Area (Biga)	Quantity applied (Kg)	Price (Rs/kg)
1	Farmyard manure			
2	Vermi-compost/Biogas waste			
3	Bio-fertilizer*, specify___			
4	Green manure, (seed/leaves) specify____			
5	Other organic manure, specify____			

Note: *Some of bio-fertilizers are (1) Rhizobium, Azotobactor, Azospirillum, blue green algae (BGA)

11. What are your suggestions to improve soil health card programme in your locality.

_____

_____

_____

_____

_____

_____

_____

_____

_____

12. Whether a copy of actual soil health card of the sample farmer is collected by the investigator: Yes/No

(Put Tick (√)

Sign and Name of the Investigator:

Date:

Annexure XVII: Household Schedule (Non-Soil Test Farmers)

Household Code:

Agro-Economic Research Centre

(Ministry of Agriculture & Farmers Welfare, Govt. of India)

Sardar Patel University, Vallabh Vidyanagar 388120

"SOIL HEALTH CARD PROGRAMME IN GUJARAT: IMPLEMENTATION, IMPACTS AND IMPEDIMENTS"

HOUSEHOLD SCHEDULE (NON-SOIL TEST FARMERS)

Reference Period: 2014-15 **Name of the Interviewer: _____**

Village Name		Taluka/Tehsil	
District		State	Gujarat

1. General Information

1. Name of Head of the household (HH)	
2. Name of the respondent	
3. Whether the respondent is head of the HH (Yes-1, No-2)	
4. Head of HH's age (Yrs)	
5. Head of HH's educational level (Yrs)	
6. Head of HH's caste (Tick)	SC / ST / OBC (SEBC) / General
7. Head of HH's gender (Tick)	Male/ Female
8. Head of HH's occupation*	Main:_____ Subsidiary:_____
9. Total number of family members	
10. No. of people engaged in farming	
11. HH Head's experience in farming (Yrs)	
12. Are you a member of any group/society/institutions?	Yes/No. If yes, group/society name_____
13. Respondent's contact number	

*** Code:** Agriculture-1, Livestock/dairy-2, Agricultural labour-3, Self employed in household industry-4, Self employed in services-5, Non-agricultural casual labour-6, Salaried work-7, Household work-8, Pensioner-9, Unemployed-10, Other-11

2. Operational Land Holdings (in Biga*): Total area (Net) _____

Particulars	Irrigated	Un-irrigated	Total	Source of irrigation
Owned (cultivable)				
Leased in				
Leased out				
Total operational holding (1+2-3)				

Note: * 1 Ha = _____ Biga

3. Cropping Pattern (Gross area for 2014-15)

Crop	Area (Biga)		Production (Mann)	
	Irrig	Unirrig	Irrig	Unirrig
Kharif (2014)				
Groundnut				
Cotton				
Bajra				
Paddy				
Maize				
Ragi				
Millets/Jowar				
Castor				
Tur/Arhar				
Udad				
Moong				
Rabi (2014-15)				
Wheat				
Jowar				
Maize				
Gram				
Moong				
Rape & mustard				
Summer (2015)				
Groundnut				
Bajra				
Paddy				
Maize				
Annual and Perennials				

Notes (1) 1 Mann= 20kg

4. Farm Machinery and Buildings

S. No	Type	Number
1	Tractor	
3	Harrow and cultivator	
2	Electric motor	
3	Diesel Engine	
9	Drip system (Area____Biga)	
	Sprinkler system (Area____Biga)	
12	Any other, specify_____	

5. Are you aware of soil testing? Yes ☐ **No** ☐

6. Mention the reasons for not testing soil in the last three years

S. No.	Reasons	Tick (√) the reasons
1	Do not know how to take soil samples	
2	Do not know whom to contact for details on testing	
3	Soil testing laboratories are located far away	
4	Soil testing not required for my field as crop yield is good	
5	Don't trust expert's recommendations	
6	Poor education/awareness level	
7	Trust on fellow farmers suggestion for not to go the soil test	
8	Any other, specify_____	

7. Do you know the recommended quantity of fertilizer for reference crops? Yes ☐ No ☐

If yes, who recommended it?* _____

***Codes**: Department of Agriculture-1, Agriculture University-2, Cooperatives/ Growers' Association-3, Private dealers/retailers-4, Fellow Farmers-5, NGO-6, Others-7(specify_____)

8. Provide actual quantity of chemical fertiliser applied for a Major crop (_____) during the reference year

Major Crop Name: _____ Area: _____Biga

Sr. No	Fertilisers	Total Quantity (Kg)	Price that you paid (Rs/50 Kg bag)
1	Urea		
2	DAP (Diammonium phosphate)		
3	MOP (Muriate of Potash)		
4	SSP (Single Super Phosphate)		
5	Complex*_____		
6	Organic fertiliser (1)		
	Organic fertiliser (2)		
7	Other, specify_____		

* **Complex fertilisers** contain varying ratios of two or three macronutrients (nitrogen, phosphorous and potassium).

9. Use of organic fertilizers

Main Crop (Name): _____

S. No	Organic fertiliser	Area (Biga)	Quantity applied (Kg)	Price (Rs/kg)
1	Farmyard manure			
2	Vermi-compost/Biogas waste			
3	Bio-fertilizer*, specify___			
4	Green manure, (seed/leaves) specify____			
5	Other organic manure, specify____			

Note: *Some of bio-fertilizers are (1) Rhizobium, Azotobactor, Azospirillum, blue green algae(BGA)

10. What are your suggestions to improve soil health card programme in your locality.

_____

_____

Sign and Name of the Investigator:

Date: