SOIL FERTILITY ATLAS OF PAKISTAN

The Punjab Province

USAID FROM THE AMERICAN PEOPLE | USDA

Citation:

FAO (Food and Agriculture Organization of the United Nations). 2017. Soil Fertility Atlas of Pakistan: The Punjab Province. W. Ahmad, Y. Niino, M.H. Zia, K. Mahmood, A. Ashraf, N. Ahmad, M. Salim and M.A. Shakir (Eds.), ISBN 978-969-8304-08-9. Islamabad, Pakistan, p 115.

Note for the Readers

The objective of this Atlas is to present information regarding fertilizers, farmers' common practices, crop yields under different nutrient use scenarios and cropping practices in the Punjab province. Thus, the overall trends and inferences drawn are valid (and justified) primarily for a particular crop grown under the respective zone suitable for that crop. However, variations from the normal trends may be noticed for a crop's yield viz-a-viz fertilizer use when grown on a small area in an ecological zone not specific for that crop. Therefore, the stated patterns and conclusions may be viewed in the perspective of the available data sets, assumptions for interpretations and the methodology adopted rather than making comparisons with a given site-specific situation. All possible care has been taken in data analysis and presentation; suggestions for improvements are welcome.

SOIL FERTILITY ATLAS OF PAKISTAN

The Punjab Province

Technical Team

Nasar Hayat (Assistant Representative - Head Programme, FAO)
Waqar Ahmad (Soil/NRM Expert, FAO)
F. Alam Khan (Information Manager/Spatial Analyst, FAO)
Mehwish Ali (Information Management/GIS Analyst, FAO)
Muhammad Afzal (National Information Management Assistant, FAO)
Ajmal Jahangeer (Statistician, FAO)

Editorial Team*

Waqar Ahmad
Yuji Niino
Munir H. Zia
Khalid Mahmood
Nisar Ahmad
Muhammad Salim
Arshad Ashraf
Masood A. Shakir

*The affiliations are same as mentioned in the acknowledgements section.

Project code: GCP/PAK/130/USA

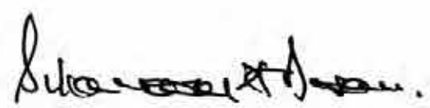
FOREWORD

Agriculture has a critical role in supporting economic growth in Pakistan. More than 67% of the country's rural population is directly or indirectly dependent on agriculture. The sector accounts for 22% of Pakistan's GDP and 45% of direct employment. The prosperity of a large portion of the population revolves around good growth in agriculture which requires timely and adequate use of inputs like certified seeds, balanced use of fertilizers along with mechanization and provision of agricultural credits. Imbalanced fertilizer use and high fertilizer prices are the major constraints to achieve sustainable crop production. 4R nutrient stewardship can help decrease the cost of production and enhance nutrient use efficiency. The Soil Fertility Atlas is a part of the project 'Soil Fertility Management for Sustainable Intensification in Pakistan: Baseline Input Atlas and Promotion of Soil Fertility with Private Sector'. The ultimate objective is to promote the use of appropriately balanced inputs and Right fertilizer/nutrient at the Right rate at the Right time in the Right place (4Rs) in partnership with the public and private sectors.

Globally, today's challenge is to produce more and healthier food in a sustainable manner. The promotion of sustainable soil management is essential if humanity's overarching need for food is to be met. Moreover, one of the major causes of the depletion of the soil fertility is the mining of essential plant nutrients from the soils due to intensive cultivation and unsustainable soil management practices. The loss of soil fertility in many developing countries poses an immediate threat to food security. Appropriate use of fertilizers on soils of low natural fertility makes it possible to grow more and promote crop diversification. Fertilizers constitute the most important scientific breakthrough in feeding the growing population of Pakistan and elsewhere. FAO, NFDC, PARC and other Research Institutes have reported up to 50% enhanced crop productivity with the use of fertilizer application. However, imbalanced use of fertilizers (Nitrogenous, Phosphatic, Potassic and Micronutrients) and low fertilizer(s) efficiency are the major constraints in enhancing crop productivity in the country. The use of fertilizers in Pakistan is imbalanced; proper ratio of fertilizers is being ignored, resulting in low income of farmers. Consequently, agricultural production has been stagnant in some of the cropping zones. On the other hand, population is increasing at an alarming rate and sustainable agriculture intensification is essential. Organic manure, which can help restore nutrient status, has great potential, but cannot meet the sizeable crop(s) nutrient requirements alone. This is especially true for soils that have been depleted of their nutrients for decades by intensive cropping.

The Soil Fertility Atlas for the Punjab Province provides a comprehensive account of the soil types and their current fertility status, native best management practices, fertilizer use trends at the farm-gate level, and management strategies for normal and constrained soils for resource based improvement. I am confident that this document will help define the soil fertility management changes required for sustainable intensification in the Punjab province initially, which would also be applicable to similar agro-ecological scenarios across the country. Hopefully, an array of stakeholders will be benefitted from this Atlas including the farmers, extension workers, soil/agriculture/environment professionals, economists and policy makers in the public as well as private sectors. Specifically, the farmers are deemed to benefit the most; they need to get involved for applying the 4R strategy for ensuring sustainable agriculture as there is a close association between soil fertility management and soil health. Additionally, the soil fertility database would provide a basis for the development of an improved capacity for monitoring and management of fertilizer use in Pakistan. This will pave the way to upscale the activities concerning 4R nutrient stewardship.

At the end let me express my deep appreciation of those involved in this undertaking of monumental national importance. I have no doubt that this document will go down as vade mecum for scientists, researchers and policy makers. This will also help develop an assertive vision for progress and prognosis in soil fertility protocol in Punjab and beyond.



Sikandar Hayat Khan Bosan
Federal Minister
National Food Security & Research
Government of Pakistan

ACKNOWLEDGEMENTS

The Soil Fertility Atlas for the Punjab Province is the result of the efforts of many institutions and individuals. The U.S. Agency for International Development (USAID) and the US Department of Agriculture (USDA) provided funding. Food and Agriculture Organization of the United Nations (FAO) implemented the project with close collaboration of the Ministry of National Food Security & Research and the Pakistan Agricultural Research Council (PARC). We acknowledge the cooperation of the following institutions and experts for their support in the process of development of this Atlas. Dr. Muhammad Anjum Ali (Director General, Agriculture Extension & Adaptive Research) was very kind to involve his extension team for conducting the rapid fertilizer use assessment/survey. Dr. Nadeem Amjad, Member Natural Resources (PARC) took keen interest to include fertilizer use assessment at farm-gate level. The team at the Climate Change, Alternate Energy and Water Resources Institute (CAEWRI), National Agricultural Research Center (NARC) included Dr. Munir Ahmad (Director), Dr. Bashir Ahmad, Dr. Arshad Ashraf, Mr. Naveed Mustafa and Mr. Muhammad Bilal Iqbal. Ms. Mehwish Ali, Mr. Muhammad Afzal and Mr. Ajmal Jahangeer (Information Management Unit (IMU), FAO) provided support in data processing, mapping and layout designing for this Atlas.

The preparation of the Punjab Soil Fertility Atlas for final publication has been led by Dr. Waqar Ahmad (Soil/NRM Expert - Project Manager, FAO). The Atlas benefited from the kind support of Dr. Nisar Ahmad, Ex-Chief of the National Fertilizer Development Center (NFDC), Planning Commission of Pakistan, Mr. Abdul Jalil Marwat (Chief NFDC), Dr. Ahmad Ali Khan (Assistant Chief NFDC) and Dr. Muhammad Islam (Assistant Chief NFDC) for sharing disaggregated data on fertilizer offtake and postulation of different hypotheses.

The support from Mr. Muhammad Alim Mian (Ex-Director General Soil Survey of Pakistan) and Dr. Muhammad Salim (Ex-Member Natural Resources, PARC) in finalizing district-wise dominant soil series, identification of soil parent material and soil classification, and development of common messages for the farming community is highly acknowledged. Dr. Thomas Reinsch, National Resources Conservation Service, USDA; Dr. Otto Gonzalez, Foreign Agricultural Service, USDA; and Dr. Arshad Ali, Director Land Resources Research Institute (NARC) were responsible for the initial discussions. National Fertilizer Companies including Fauji Fertilizer Company Limited (FFCL), Engro Fertilizers Limited, and Fatima Fertilizer Company Limited/Pak Arab Fertilizers shared information on the existence of soil and water testing facilities available across Punjab. Director General Agriculture Research, Dr. Abid Mehmood and Dr. Shahzada Munawar Mehdi (Director, Rapid Soil Fertility Survey and Soil Testing Institute, Punjab) were proactive in providing information on the existence of district-level soil and water testing laboratories. Special thanks are due to FFCL for sharing soil fertility data-sets from Farm Advisory Service Centers, operational across the Punjab province.

The editorial comments on the final product were provided by Dr. Muhammad Anjum Ali, Dr. Shahzada Munawar Mehdi, Dr. Munir H. Zia (FFCL), Dr. Muhammad Salim (PARC), Dr. Khalid Mahmood (Ex-Deputy Chief Scientist, Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad), Dr. Arshad Ashraf (NARC) and Dr. Masood A. Shakir (Ayub Agricultural Research Institute, Faisalabad). The development of this Atlas would have been difficult, if not impossible, without the leadership and oversight of Mr. Nasar Hayat (Assistant Representative - Head Programme, FAO) and Dr. Yuji Niino (Technical Officer, FAO Rome).

INTRODUCTION

The promotion of sustainable soil and crop management practices is crucial to ensure sustainable agricultural development in Pakistan. Agriculture faces the major challenge of combining intensive production with sustainability. Producing in a more sustainable way means using natural resources efficiently, recycling them as much as possible for further use, and avoiding negative impacts on the soil and environment. With respect to fertilizers/ nutrients, the objective is to minimize losses that occur, for example, through volatilization, soil fixation (due to alkaline calcareous nature, salt buildup, poor organic matter status, etc.), soil erosion and leaching, and to replenish nutrients that have been removed from the soil through plant uptake or any other process causing nutrient loss. Food and Agriculture Organization of the United Nations (FAO) in partnership with the Ministry of National Food Security & Research, Pakistan Agricultural Research Council (PARC) and US Department of Agriculture (USDA) with funding from USAID is implementing a project entitled 'Soil Fertility Management for Sustainable Intensification in Pakistan: Baseline Input Atlas and Promotion of Soil Fertility with Private Sector - GCP/PAK/130/USA'. For this, FAO is collaborating closely with both the public and private sector partners to:

- Assess district-wise soil fertility status;
- Conduct rapid fertilizer use assessment/survey;
- Identify best soil health and fertility management practices;
- Disaggregate commodity-wise fertilizer offtake/use;
- Collect soil survey and classification related information;
- Promote balanced use of inputs and 4R nutrient stewardship (commonly known as Right nutrient/fertilizer at the Right rate at the Right time in the Right place) through organizing symposia, commodity-based workshops, seminars and holding policy dialogues;
- Strengthen the provincial and national capacity to undertake sustainable soil fertility management, and visualization of data;
- Prepare the baseline atlas of current soil fertility and soil health management practices; and
- Use the outputs of these activities to support informed decision making at various scales, for example, setting provincial frameworks for Agriculture and Natural Resources Management in achieving Sustainable Development Goals (SDGs).

In order to achieve the objective, the use of appropriate balanced fertilizer inputs and 4R Nutrient Stewardship is being promoted through a series of events (workshops, seminars, dialogues) in the main centers of the country. Some of the key recommendations coming out of these events are:

- Development of a nutrient stewardship framework and manual on 4R nutrient stewardship for the farming community of Pakistan;
- Use of public-private partnership as a mechanism for sustainable agriculture intensification in the country;
- Include farmers' experience in devising soil and fertilizer management strategies for sustainable crop production; and
- Collaborative efforts are required to address such issues in the best interest of the farming community.

This Soil Fertility Atlas for the Punjab Province has four sections: 1) General Maps, 2) Rapid Fertilizer Use Assessment, 3) Mapping NFDC Fertilizer Offtake Data, and 4) Soil Fertility Status Mapping. Besides, several annexures offer details of the important parameters of the fertilizers data used. The Atlas provides use of different fertilizers/nutrients for major commodities/crops grown in the Punjab province. Yield of different commodities under different nutrient use scenarios is often not consistent, as is evident from the variable overall crop productivity viz-a-viz region-wise application of inputs/fertilizers. This clearly indicates the impact of factors, other than the material fertilizer inputs, such as soil constraints and inappropriate crop management practices. Identification of hot spots with regard to inadequate nutrient applications (over or less) coupled with low use efficiency factors would help to explain required soil fertility management changes for sustainable agriculture intensification.

Patrick T. Evans
FAORepresentative
Pakistan

METHODOLOGY

The Atlas is based on the agricultural statistics, field-based assessment and source data collected from provincial and federal departments and agencies. Series of workshops/ consultations were conducted at various locations across the Punjab province for gathering information and document experience from the national and provincial stakeholders including growers of major crops like wheat, rice, cotton, maize, and sugarcane. These consultations were aimed to highlight the significance of 4R nutrient stewardship, differentiate this relatively new concept from the balanced fertilization, identify soil and crop management constraints, and best soil health management practices for sustainable agricultural intensification in the province. Major steps involved in Atlas preparation are as follows.

Rapid Fertilizer Use Assessment

The assessment was based on the assumption that Fertilizer Offtake data (a term used by NFDC to describe fertilizer consumption based on the marketing of products) does not necessarily reflect the application of fertilizers at the farm-gate level. This community-based assessment was conducted with the involvement of the Punjab Agriculture Extension Department. A questionnaire was developed after consultation with different stakeholders and district-wise farmers' interviews were conducted. The selection of farmers was presumably skewed towards medium level progressive farmers with whom agriculture extension workers frequently interact. The sample population (farmers interviewed) was 33 per district. Overall this sample size was found representative when aggregated at crop production region and provincial scales. Further, the data so collected was deemed representative for a group of farmers, as rural communities often follow similar practices as elders decide after consultation in the family. The collected information through this assessment pertains to the use of various fertilizers, yield of major crops, major soil constraints hampering productivity, and percentage of the farmers availing soil and water testing facility in each district across Punjab. The validation of such trends in each district was based on field surveys, follow-up interviews and discussions with public and private sector stakeholders.

The crop data was disaggregated by districts according to the following crop production regions:

- **Cotton-Wheat**
  Bahawalnagar, Bahawalpur, Dera Ghazi Khan, Khanewal, Lodhran, Multan, Muzaffargarh, Rajanpur, Rahim Yar Khan, and Vehari
- **Rice-Wheat**
  Gujranwala, Gujrat, Hafizabad, Mandi Bahauddin, Narowal, Nankana Sahib, Sheikhupura, and Sialkot
- **Mixed Cropping**
  Chiniot, Faisalabad, Jhang, Kasur, Lahore, Okara, Pakpattan, Sahiwal, Sargodha, and Toba Tek Singh
- **Pulses-Wheat (Thal Area)**
  Bhakkar, Khushab, Layyah, and Mianwali
- **Maize-Wheat-Oilseeds (Rainfed Area)**
  Attock, Chakwal, Jhelum, and Rawalpindi

Regarding the application of different nutrient sources, all progressive, medium- and small-holder farmers were assumed to apply fertilizers/nutrients in eight different combinations: N only; NP; NPK; NP + MN; NP + FYM; NP + MN + FYM; NPK + MN; NPK + MN + FYM, where, N = Nitrogen; P = Phosphorus; K = Potassium; FYM = Farm Yard Manure; MN = Micronutrients. Moreover, keeping the other factors of production constant, addition of each nutrient to individual nutrient use scenario will presumably increase the commodity/crop yield.

NFDC Offtake Data

The crop-wise disaggregation of total offtake data was based on the relative use and area sown for each crop and was assumed to be equal to what farmers are using at the farm-gate level. Despite minor fluctuations in annual fertilizer offtake, the overall trends of total and product-wise offtake of fertilizers remained comparable across past several years. These patterns of such trends also coincided with those derived from the information regarding fertilizer use gathered directly from the farmers. Therefore, the used data-sets suffice for the objective and scope of the Atlas, i.e. development of overall fertilizer/nutrient use scenarios in the perspective of sustainable crop intensification and better soil health. Weights to specific crop(s) sown were assigned to segregate product-wise offtake data (tons per district) in kg/ acre for each crop in a district. Later, for regional scenarios the amounts of fertilizers for each crop were aggregated to represent cumulative use of fertilizers for five crops in each

crop production region.

The fertilizer offtake data acquired from NFDC was incorporated district-wise in tabular form. The agricultural statistics data and addresses of soil and water testing facilities in the province have been documented which would provide a fundamental baseline for future management and planning of nutrient(s) use in the province.

Spatial Data Mapping and Analysis

Preliminary, a base map of the province containing the district boundaries was prepared in ArcGIS software to aid geo-spatial mapping and analysis. The results of the Rapid Fertilizer Use Assessment (RFUA) and the fertilizer offtake data presented in the tabular form were linked with vector data of the districts for spatial-cum-attribute data analysis. Scenarios of fertilizer use were developed to study response with regard to yields of various crops at district level in the province.

Data Visualization

The layout of the Atlas was prepared incorporating all necessary mapping details. The soil fertility status and fertilizer offtake data was mapped under different sections of the atlas for general overview and presentation. The fertilizer use information was illustrated in the atlas in aggregated and cartographic form as well as tabular statistics per crop per district.

Soil Fertility Status

Fauji Fertilizer Company Limited (FFCL) has been providing Advisory Services to the farming community throughout Pakistan since 1981, for increasing the agriculture production and economic returns at the farm-gate level. The Company is providing soil and water testing facilities all over the country through its five mobile Farm Advisory Centers. As of today, these centers are located at Hassan Abdal, Sahiwal, Multan, Bahawalpur and Sukkur. The laboratories are periodically relocated in order to facilitate the farming community of each district. The soil fertility data from January 2001 to February 2014 in terms of soil electrical conductivity (EC), soil reaction (pH), organic matter (OM), available phosphorus (P) and extractable potassium (K) was obtained and disaggregated by districts. It was assumed that EC, pH, OM, P and K values are the indicative of the overall soil fertility status of each district. The farmers of the respective district may plan nutrient management strategy accordingly. However, they should consult the Soil and Water Testing Laboratories and Agriculture Advisory Services before sowing of any crop(s).

SUMMARY AND WAY FORWARD

Agriculture is the backbone of Pakistan's economy. Thus, national development is possible through efficient use and conservation of natural resources, particularly the soil/land which is non-renewable. Unfortunately, unsustainable management practices have led to loss of soil fertility and health, compelling the use of chemical fertilizers which too is not efficient to the desirable level. The resource base of raw materials for fertilizer production is also depleting fast. These scenarios warrant adoption of best management practices to enhance fertilizer use efficiency and improve soil fertility for sustaining agricultural productivity. The Soil Fertility Atlas for the Punjab Province is a comprehensive document that provides detailed information on cropping patterns, management practices, soil fertility status, trends of fertilizer use, advisory services/facilities available to the farmers in the province, and also suggests the strategies to maximize productivity while sustaining the soil health and environmental quality.

This Atlas reveals that the use of nutrients is skewed towards nitrogen, phosphorus and proportional use of potassium is less than 1% as compared to the application of nitrogen and phosphorus. Use of micronutrients and organic sources of nutrients is not common among most of the farmers. Overall, <10% of the farmers use organic sources of nutrients predominantly in wheat-occupied cropping systems whereas <20% farmers across the Punjab apply micronutrients regardless of the product quality (largely in rice-based cropping system) out of five crops under observation. Nevertheless, burning of crop residues and lack of scientific application of both inorganic and organic sources of nutrients still remained a concern. Indeed, the district-wise disaggregation of NFDC offtake data did not reflect the actual usage of the fertilizers at the farm-gate level. This divergence when compared with the Rapid Fertilizer Use Assessment (RFUA) was attributed to the storage of fertilizers at various locations in the Punjab. Overall, except one crop production region, i.e. Mixed Cropping (vs. Cotton-Wheat), the cumulative usage of fertilizers/nutrients in all of the regions for five crops followed the same trend: Rice-Wheat > Pulses-Wheat > Maize-Wheat-Oilseeds. About 70% higher nutrient use was figured out from RFUA for all crop production regions except in the rice-wheat based cropping system than the processed NFDC offtake data. This is to note that, farmers reported nutrient(s) application in eight different combinations across the Punjab (N only; NP; NPK; NP + MN; NP + FYM; NP + MN + FYM; NPK + MN; NPK + MN + FYM). Moreover, the addition of each nutrient to individual nutrient use scenario was not translated into the increased yield for four selected crops. However, the increased use of nutrients presumably enhanced yield in case of wheat. Therefore, further investigations are required in the specific crop production region(s) to determine suitable nutrient use scenarios for improved efficiency and yield.

Soil-related constraints weighted 40% in the problem-matrix that could hamper productivity were reported by the farmers at the provincial scale. However, the degree of soil constrains varied from 43 to 50% in regional scenarios. For example, soil-constraints in cotton-wheat were reported 50% followed by mixed crops (48%) and rice-wheat (43%). While in Thal and rainfed areas, canal water shortage and high inputs prices emerged as the principal components impacting productivity and farmers' satisfaction. The generation of soil maps for regional scenarios to identify the limiting soil constraints in the consistently poor performing areas may be helpful. In addition, development of supporting database/archives would allow moving towards non-destructive approaches for problem assessment and wisdom driven agriculture. The spatial distribution of constraints at similar scale could also be used to obtain the cost of lost production using soil-constraints matrix. Although crop production in good quality soils is the priority, simultaneous focus should be on agricultural-constrained soils under the changing climate scenarios.

In nutshell, first 2Rs of the desirable 4R Nutrient Stewardship (Right fertilizer/nutrient (Source) at the Right rate at the Right time in the Right place) are usually practiced, but the latter 2Rs are rarely followed by the farming communities, which results in low nutrient use efficiency and economic returns. This is the first step forward in the right direction and similar activities should be undertaken in other provinces of the country for achieving the food security and socio-economic uplift. For this purpose, a network of soil (macro- and micro- nutrients), plant, water, and fertilizer Quality Testing Facilities for the benefit of farming community should be established. The existing testing laboratories may not be enough to facilitate about 4 million farmers of the Punjab. Outreach linkages with the farmers may be strengthened for extensive surveys/assessments at farm-gate level and applying best management practices according to 4R soil constraint-based commodity-specific packages. All the partner organizations are welcomed for collaborative efforts to address the adoption of best methodology for nutrient use, and mapping of most responsive crop growth stage(s). Certainly, this effort would contribute towards setting a national framework and policy intervention for Agriculture and Natural Resources Management in SDGs agenda (specifically Crop Production, Environment, and Soil and Water for agriculture related activities). Let us join hands with federal/provincial agencies as well as private sector for collaborative initiatives to achieve sustainable development.

ACRONYMS

ABEI	Agricultural and Biological Engineering Institute
CAEWRI	Climate Change, Alternate Energy and Water Resources Institute
CAN	Calcium Ammonium Nitrate
DAP	Di-Ammonium Phosphate
dSm^{-1}	DeciSiemens per meter
FAO	Food and Agriculture Organization of the United Nations
FAC	Farmer Advisory Center
FFCL	Fauji Fertilizer Company Limited
FYM	Farm Yard Manure
GAUL	Global Administrative Unit Layers
ICARDA	International Center for Agricultural Research in the Dry Areas
K	Potassium
Km	Kilometer
LRRI	Land Resources Research Institute
mm	Millimeter
MN	Micronutrients
N	Nitrogen
NARC	National Agricultural Research Center
NFDC	National Fertilizer Development Center
NIAB	Nuclear Institute for Agriculture and Biology
P	Phosphorus
PARC	Pakistan Agricultural Research Council
RFUA	Rapid Fertilizer Use Assessment
SAWCRI	Soil and Water Conservation Research Institute
SFRI	Rapid Soil Fertility Survey and Soil Testing Institute, Punjab
USDA	U.S. Department of Agriculture
USAID	U.S. Agency for International Development

TABLE OF CONTENTS

Foreword i
Acknowledgements ii
Introduction iii
Methodology iv
Summary and Way Forward vi
Acronyms vii

SECTION 1 - GENERAL MAPS

Districts of Punjab 2
Population of Punjab 3
District-wise Cultivated and Non-Cultivated Area of Punjab 4
Total Area Under Irrigation in Punjab 5
Soil Fertility and Soil Health Management Practices in Punjab 6
Land Cover Map of Punjab 7
Soil and Water Testing Facilities in Punjab 8

SECTION 2 - RAPID FERTILIZER USE ASSESSMENT

Fertilizer Use and Crop Yield 10
Major Crops in Punjab 11

Fertilizer Use Maps

Application of Urea to Wheat in Punjab 12
Application of Urea to Rice/Paddy in Punjab 13
Application of Urea to Maize in Punjab 14
Application of Urea to Cotton in Punjab 15
Application of Urea to Sugarcane in Punjab 16
Total Use of Urea in Punjab 17
Application of DAP to Wheat in Punjab 18
Application of DAP to Rice/Paddy in Punjab 19
Application of DAP to Maize in Punjab 20
Application of DAP to Cotton in Punjab 21
Application of DAP to Sugarcane in Punjab 22
Total Use of DAP in Punjab 23
Total Use of CAN in Punjab 24
District-wise Use of Nitrogen 25
District-wise Use of Phosphorus 26
District-wise Use of Potassium 27
NPK Usage Rates in Punjab 28

Yield Maps

Average Yield of Wheat 29
Average Yield of Rice/Paddy 30
Average Yield of Maize 31
Average Yield of Cotton 32
Average Yield of Sugarcane 33
Yield of Wheat Under Different Scenarios of Fertilizer Use in Punjab 34
Yield of Rice/Paddy Under Different Scenarios of Fertilizer Use in Punjab 35
Yield of Maize Under Different Scenarios of Fertilizer Use in Punjab 36
Yield of Cotton Under Different Scenarios of Fertilizer Use in Punjab 37
Yield of Sugarcane Under Different Scenarios of Fertilizer Use in Punjab 38

Soil Maps

Major Soil Problems 39
Soil and Water Testing Facilities Availed by Farmers 40
Region-wise Comparative Fertilizer Consumption in Punjab 41

SECTION 3 - MAPPING NFDC FERTILIZER OFFTAKE DATA

Fertilizer Offtake Maps

Total Offtake of Urea 43
Total Offtake of DAP 44
Total Offtake of CAN 45
District-wise Use of Nitrogen 46
District-wise Use of Phosphorus 47
District-wise Use of Potassium 48
NPK Usage Rates in Punjab 49
Region-wise Comparative Fertilizer Offtake in Punjab 50

SECTION 4 - SOIL FERTILITY STATUS MAPPING

District-wise Average pH 52
District-wise Average Electrical Conductivity (EC) 53
District-wise Average Organic Matter Content 54
District-wise Average Available Phosphorus 55
District-wise Average Extractable Potassium 56

DISTRICT PROFILES

Attock 58
Bahawalnagar 59
Bahawalpur 60
Bhakkar 61
Chakwal 62
Chiniot 63
Dera Ghazi Khan 64
Faisalabad 65
Gujranwala 66
Gujrat 67
Hafizabad 68
Jhang 69
Jhelum 70
Kasur 71
Khanewal 72
Khushab 73
Lahore 74
Layyah 75
Lodhran 76
Mandi Bahauddin 77
Mianwali 78
Multan 79
Muzaffargarh 80
Nankana Sahib 81
Narowal 82
Okara 83
Pakpattan 84
Rahim Yar Khan 85
Rajanpur 86
Rawalpindi 87
Sahiwal 88
Sargodha 89
Sheikhupura 90
Sialkot 91
Toba Tek Singh 92
Vehari 93

Key Messages 94-99

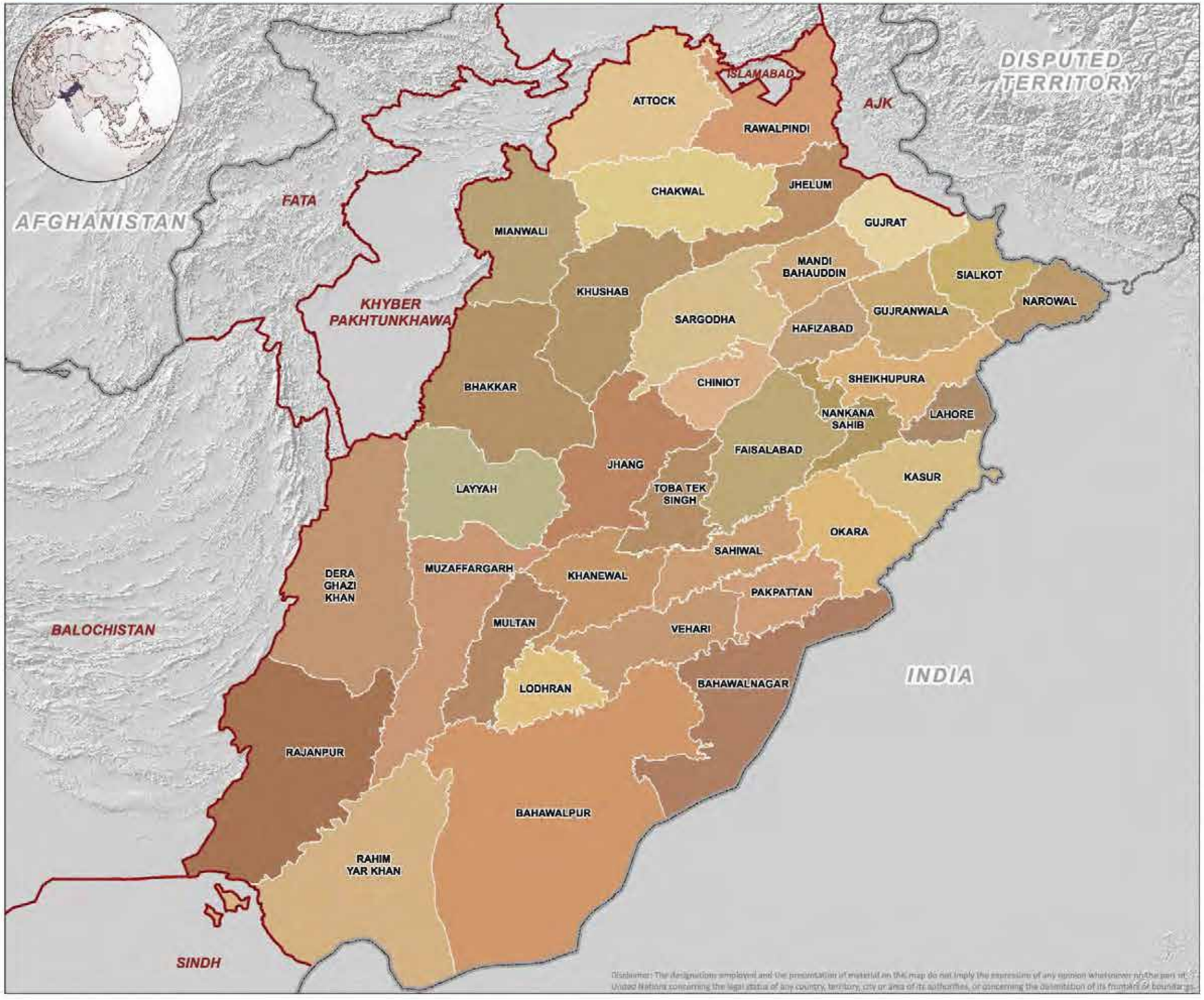
ANNEXURES

Annexure I: Questionnaire for Rapid Fertilizer Use Assessment 102
Annexure II: Number of Soil Samples from Different Districts Analyzed by Fauji Fertilizer Company Limited 103
Annexure III: District-wise Results of the Soil Samples Analyzed by Fauji Fertilizer Company Limited 104-108
Annexure IV: Criteria for Soil Nutrient Analysis 109
Annexure V: Addresses of Soil and Water Testing Facilities in Punjab (English) 110
Annexure V: Addresses of Soil and Water Testing Facilities in Punjab (Urdu) 111
Annexure VI: Dominant Soil Series, Classification and Areas of their Occurrence 112-115

SECTION 1

GENERAL MAPS

DISTRICTS OF PUNJAB



Disclaimer: The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of United Nations concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

Map Legend

Administrative limits

- Country
- Province
- District

About Map

The map shows the districts in Punjab province. There are total 36 districts in the province.

Data Sources

Government of the Punjab, FAO and GAUL

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

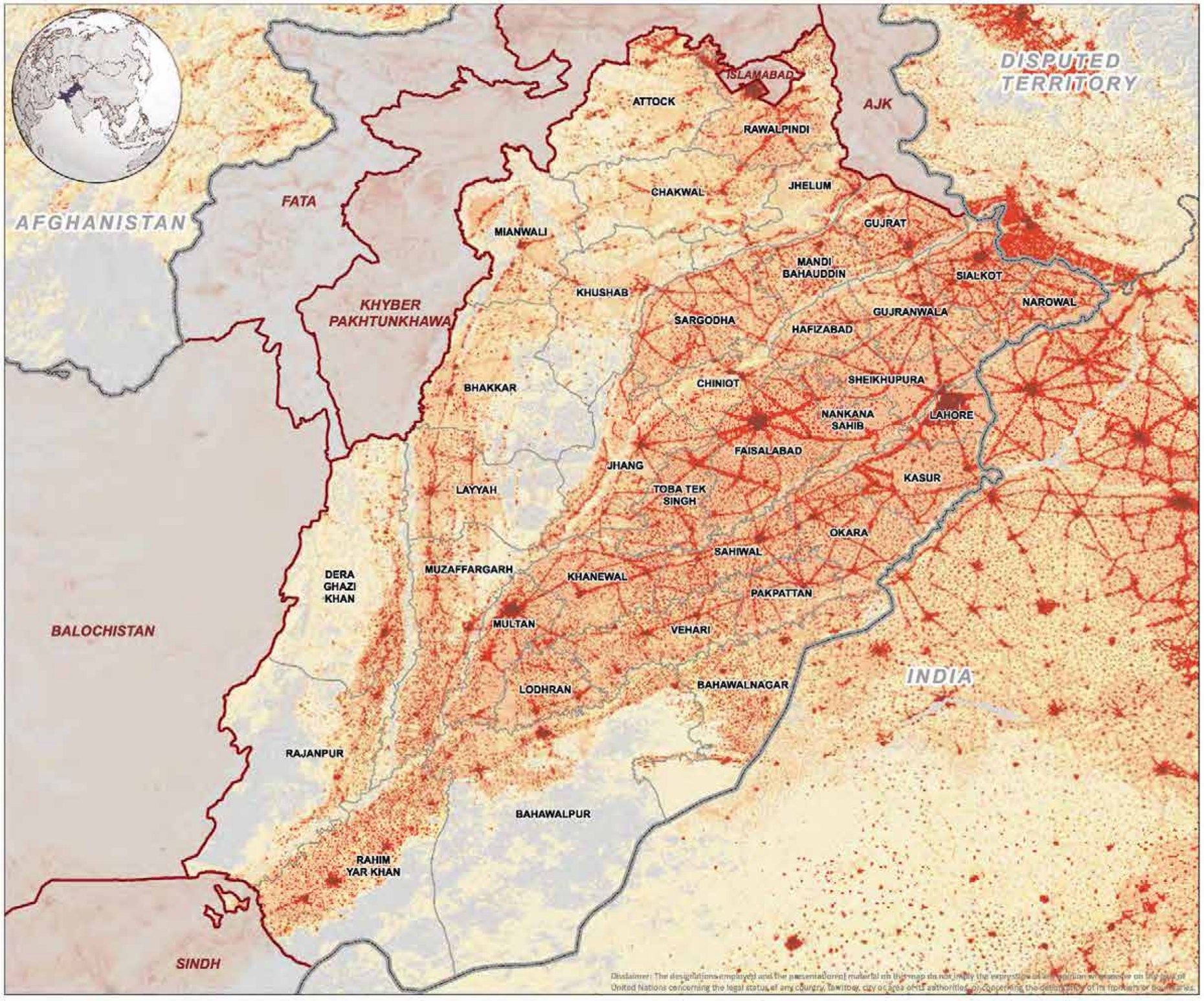
Kilometers

Date: 20 Jan 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_Districts_01_20150910

POPULATION OF PUNJAB
(Per square kilometer)



Map Legend

Administrative limits

- Country
- Province
- District

Population density (per square kilometer)

0	101- 500
1 - 5	501 - 2,500
6 - 25	2501 - 5,000
26 - 50	5001 - 130,000
51 - 100	

About Map

The map shows the population density i.e. number of persons per square kilometer in Punjab province.

Data Sources

FAO, GAUL, LandScan data 2011

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

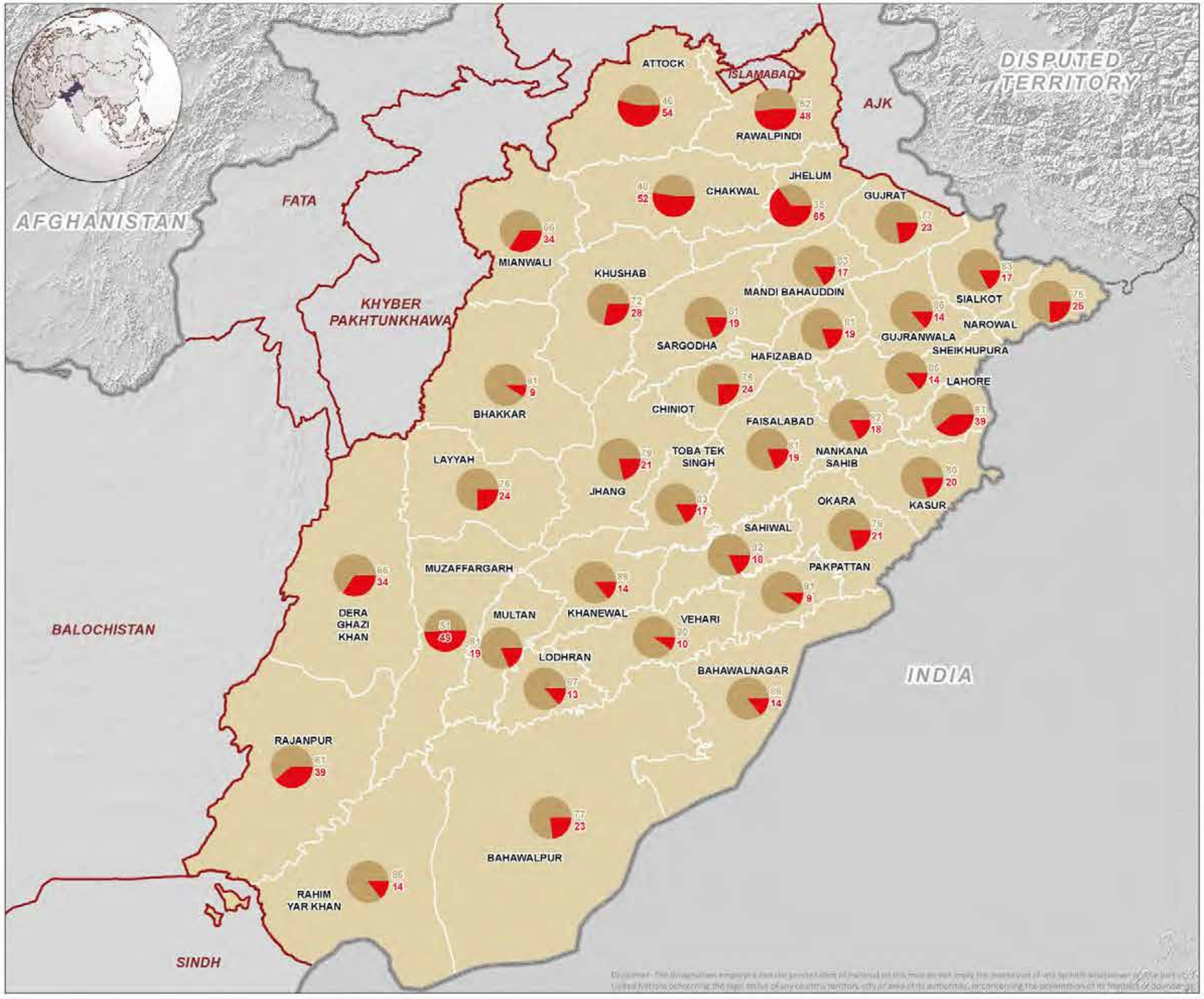
Date: 12 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_Population_02_20160212

DISTRICT-WISE CULTIVATED AND NON-CULTIVATED AREA OF PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Land Use
(in percentage)

- Cultivated Area
- Non cultivated Area

About Map

The map shows extent of cultivated and non-cultivated area as percentage of the total area in each district. The data is derived from Land Use Statistics 2013-2014.

Data Sources

FAO, GAUL, Land Use Statistics 2013-2014,
Pakistan Bureau of Statistics.

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200
Kilometers

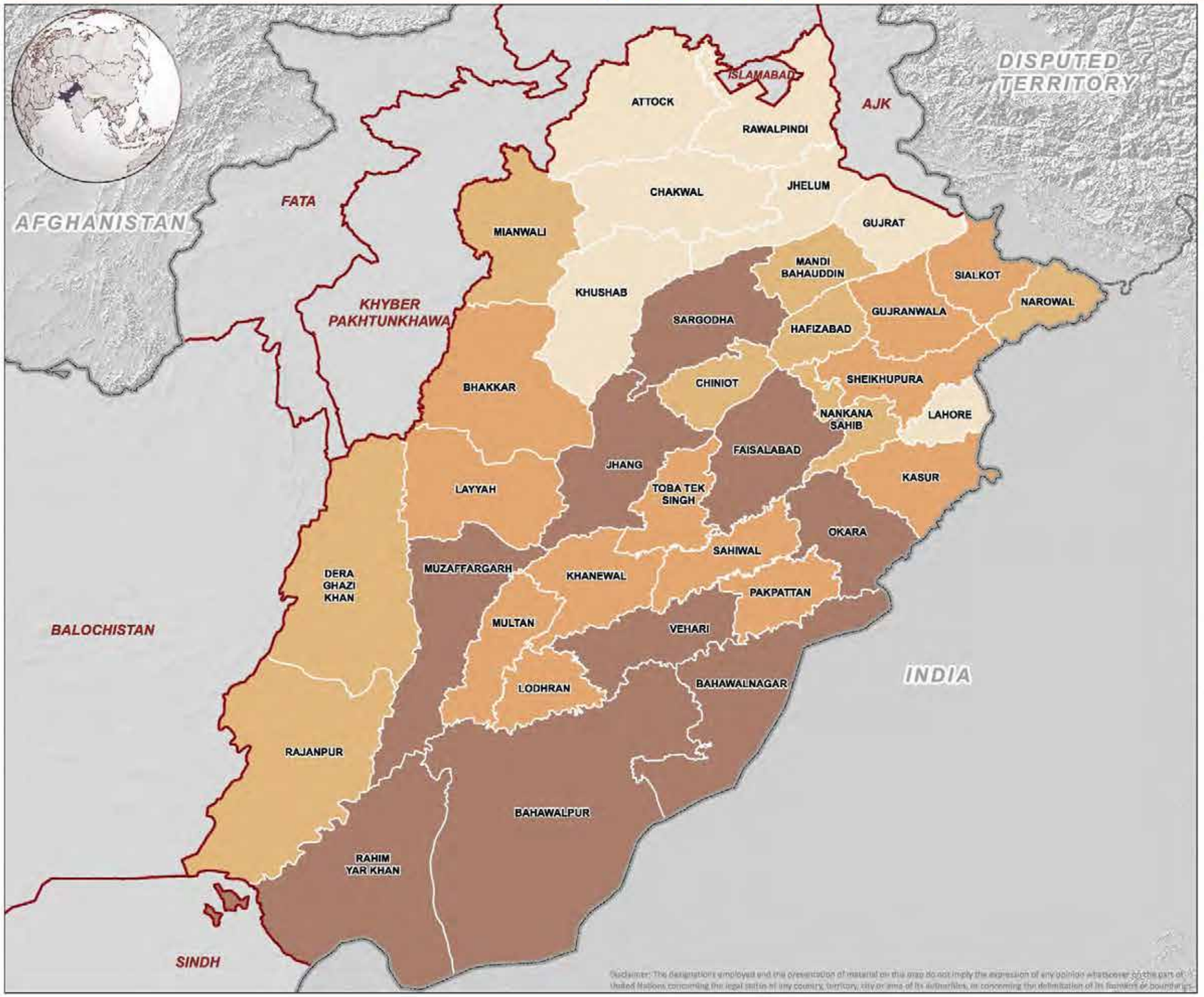
Date: 11 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_cultiv_03_20150910

TOTAL AREA UNDER IRRIGATION IN PUNJAB
(Hectares)

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Area under Irrigation (000 hectares)

- < 200
- 201 - 400
- 401 - 600
- 601 - 800

About Map

The map shows the area under irrigation in each district. The data is sourced from Land Use Statistics 2013-2014, Government of the Punjab. The percentage of irrigated area may be relatively higher in the area-wise smaller districts.

Data Sources

FAO, GAUL, Land Use Statistics 2013-2014, Pakistan Bureau of Statistics.

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

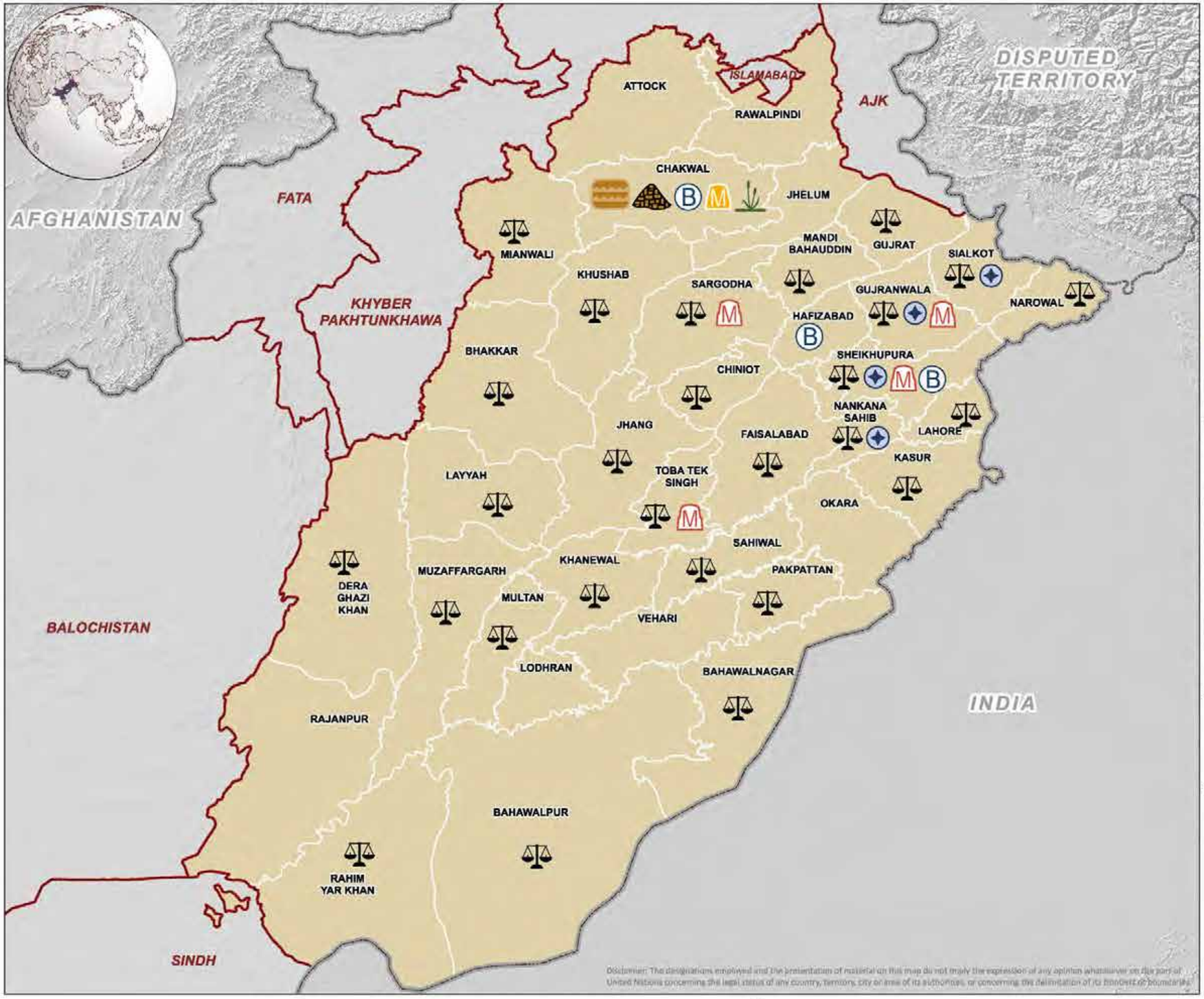
Date: 15 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_Irrigation_04_20150910

SOIL FERTILITY AND SOIL HEALTH MANAGEMENT PRACTICES IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Disclaimer: The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of United Nations concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

Map Legend

Administrative limits

- Country
- Province
- District

Technologies by ICARDA (Collabrators)

- Balanced use of N&P fertilizers using Fertilizer Prediction Model (Universty of Agriculture, Faisalabad)
- Micronutrients (B, Zn and Fe) for citrus and vegetables (SFRI, Lahore)
- Micronutrients for peanut (B) and wheat (Zn) (LRRI, NARC,Islamabad)
- Use of Biozote (biofertilizer) (LRRI, NARC, Islamabad)
- Green Manuring (SAWCRI,CHAKWAL)
- Pak Seeder for rice residue management and zero-till wheat sowing (ABEI,NARC, Islamabad)
- Fertilizer (DAP) Band Placement (LRRI, NARC, Islamabad)
- On-farm composting and use of compost for growing vegetables (SAWCRI,CHAKWAL)

About Map

This map shows soil fertility and soil health management practices/ technologies being promoted in Punjab by ICARDA in a USDA funded project "Improving soil fertility and soil health in Pakistan through demonstration and dissemination of best management practices for farmers".

Data Sources

FAO, GAUL, ICARDA

Map Scale and Datum

Datum: WGS 84 Nominal scale: 1:2,698,500 at A3

0 50 100 150 200

Kilometers

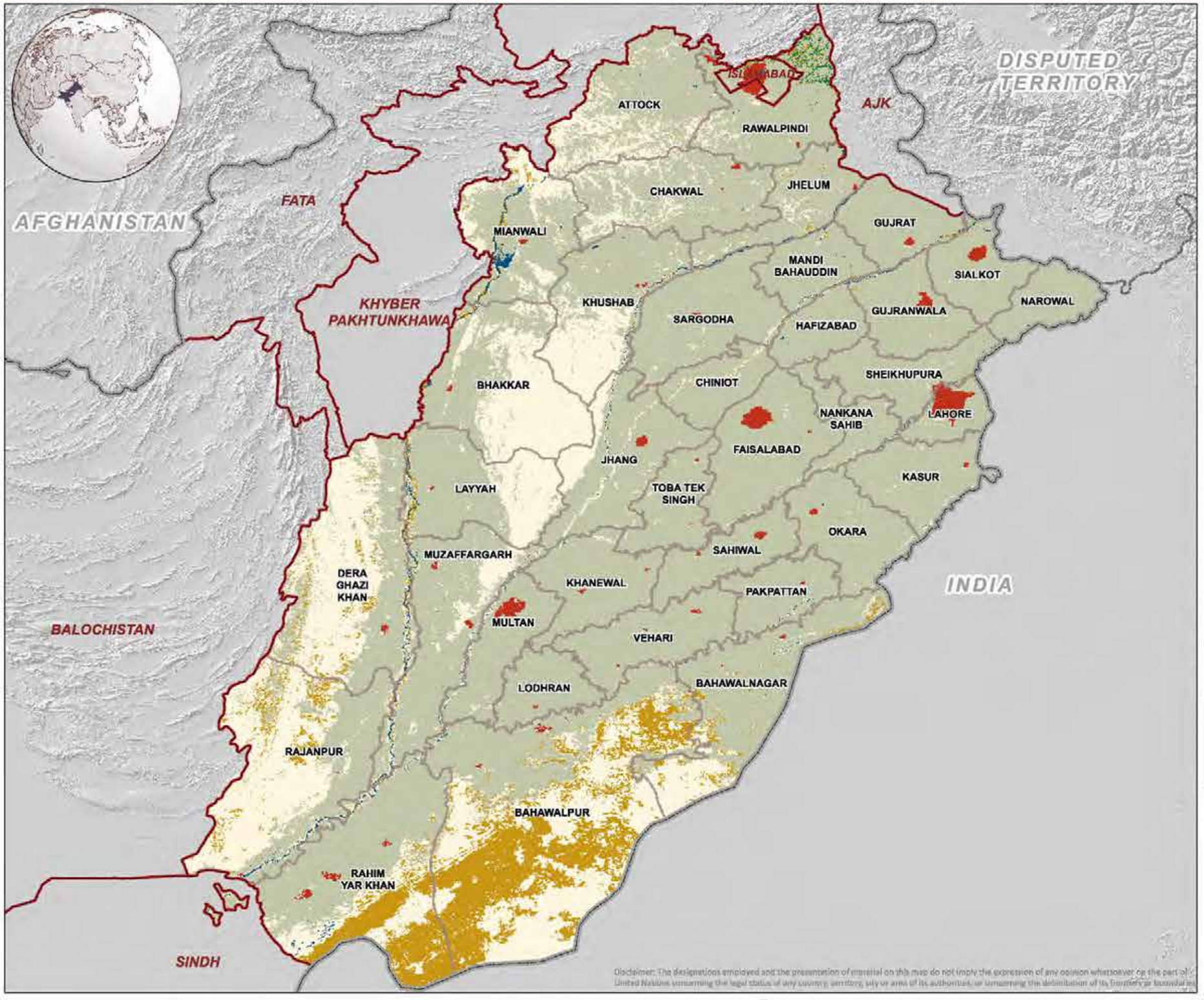
Date: 18 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_ICARDA_07_20150910

N

LAND COVER MAP OF PUNJAB



Disclaimer: The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of United Nations concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

Map Legend

Administrative limits

- Country
- Province
- District

Land Cover types

- Croplands
- Forests
- Grassland/Shrubland
- Sparse vegetation
- Urban/Builtup/Artificial areas
- Bare areas
- Water bodies

About Map

The map shows different types of land covers/natural vegetation in the Punjab province.

Data Sources

FAO, GAUL, GlobeCover data 2009

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

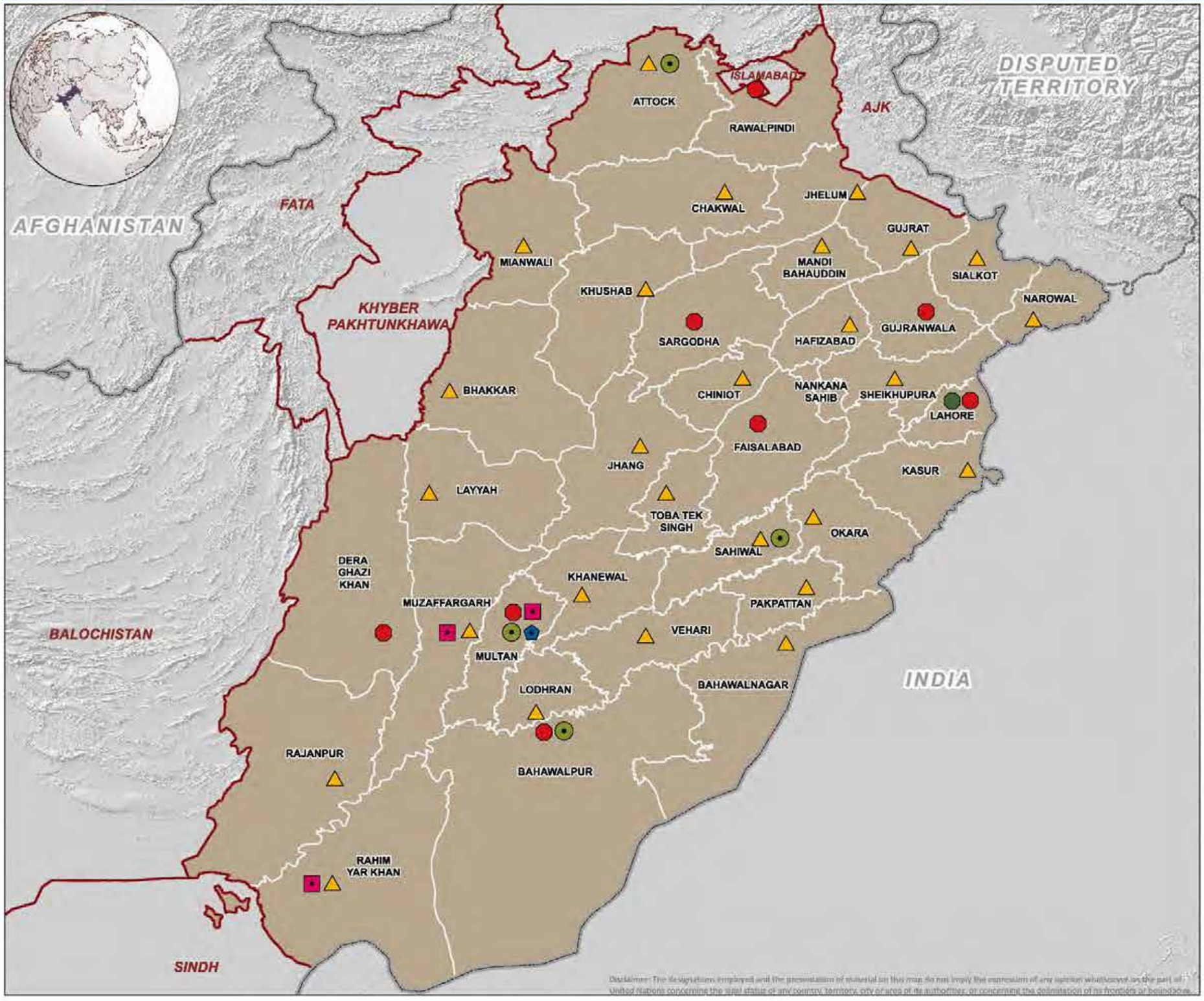
Date: 17 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_Landcover_08_20150910

SOIL AND WATER TESTING FACILITIES IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Disclaimer: The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of United Nations concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

Map Legend

Administrative limits

- Country
- Province
- District

Soil and water testing facilities

Rapid Soil Fertility Survey and Soil Testing Institute, Punjab

Provincial Lab | Divisional Lab | District Lab

Fauji Fertilizer Company Limited

Soil and Water Testing Lab/ Farm Advisory Center

Fatima Fertilizers Company Limited/Pak Arab Fertilizers

Soil Fertility Lab

Engro Fertilizers Limited

Soil Fertility Lab

About Map

The map shows the current locations of various soil and water testing facilities in Punjab. For complete addresses of the facilities, refer to Annex V.

Data Sources

FAO, GAUL, SFRI, FFCL, Fatima Fertilizers Limited/Pak Arab Fertilizers, Engro Fertilizers Limited

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

Date: 23 Apr 2015

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_Soiltesting_9_20150910

SECTION 2

RAPID FERTILIZER USE ASSESSMENT

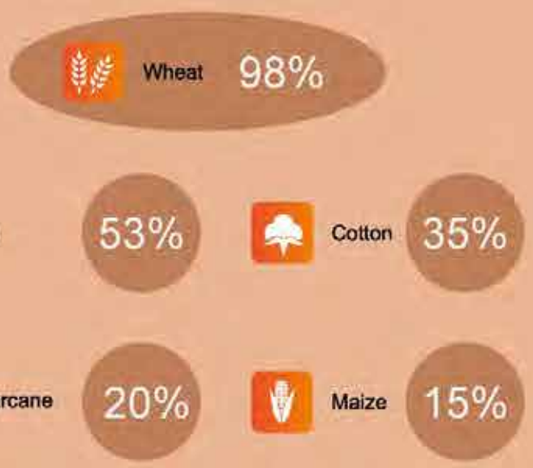
FERTILIZER USE AND CROP YIELD

To assess fertilizer use at farm-gate, a Rapid Fertilizer Use Assessment (RFUA) was carried out during 2015 in collaboration with the Provincial Agriculture Extension Department (Directorate General Agriculture Extension & Adaptive Research, Punjab) in thirty-six districts across Punjab. The data collected through RFUA is used to prepare fertilizer use maps for each of the major crops. The trends of average crop(s) yields under different fertilizer use scenarios obtained by the interviewed farmers are also described. The sample size in each district was 33 and total number of samples collected is 1188. The selection of farmers reveals that the sample size was skewed towards medium level to progressive farmers with whom agriculture extension workers frequently interact. The use of potassium (K) and/or micronutrients (alone or with FYM) in addition to NP improved crop yields. However, FYM alone may not fulfil crop requirement. Use of K, micronutrients and FYM in appropriate combination(s) along with N and P is recommended for achieving optimal crop productivity.

KEY INDICATORS

- Major crops grown by farmers
- Yield of major crops
- Farm size
- Crop-wise use of fertilizers (inorganic/chemical fertilizers)
  - Crop-wise use of Urea
  - Crop-wise use of Di-Ammonium Phosphate (DAP)
  - Crop-wise use of Calcium Ammonium Nitrate (CAN)
  - Crop-wise use of Sulphate of Potash (SOP) and Muriate of Potash (MOP)
- Crop-wise use of organic sources of nutrients/FYM
- Farmers availing soil and water test facilities

KEY FINDINGS

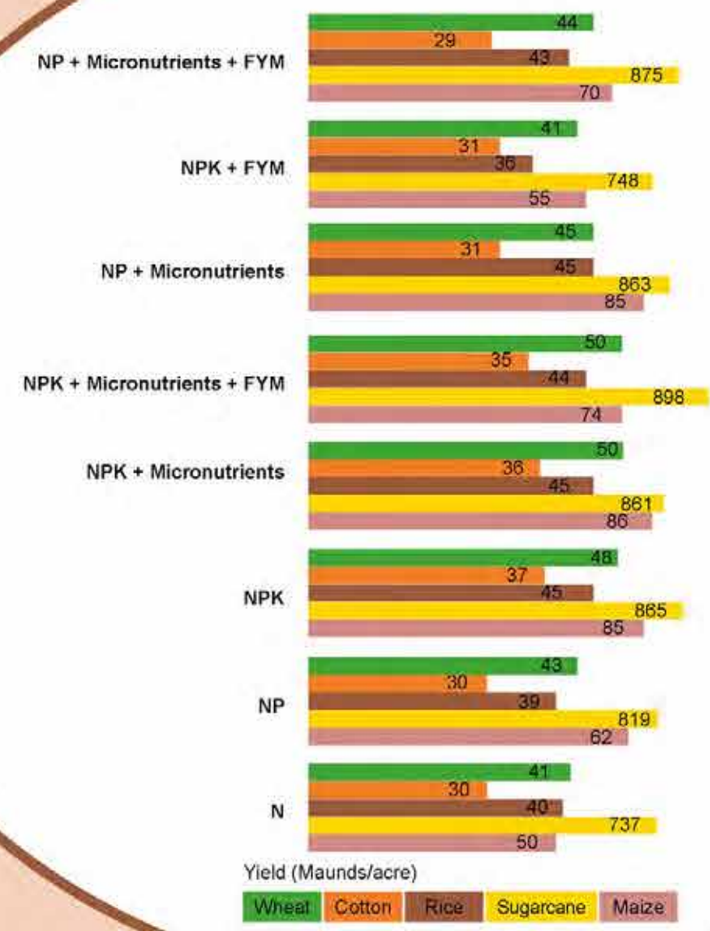


Farm Size (Acres)	Percent Farmers
• < 5	12%
• 6-15	37%
• 16-25	23%
• 26-50	14%
• > 50	14%

Laboratory Analysis	
• Soil Test	28%
• Water Test	20%

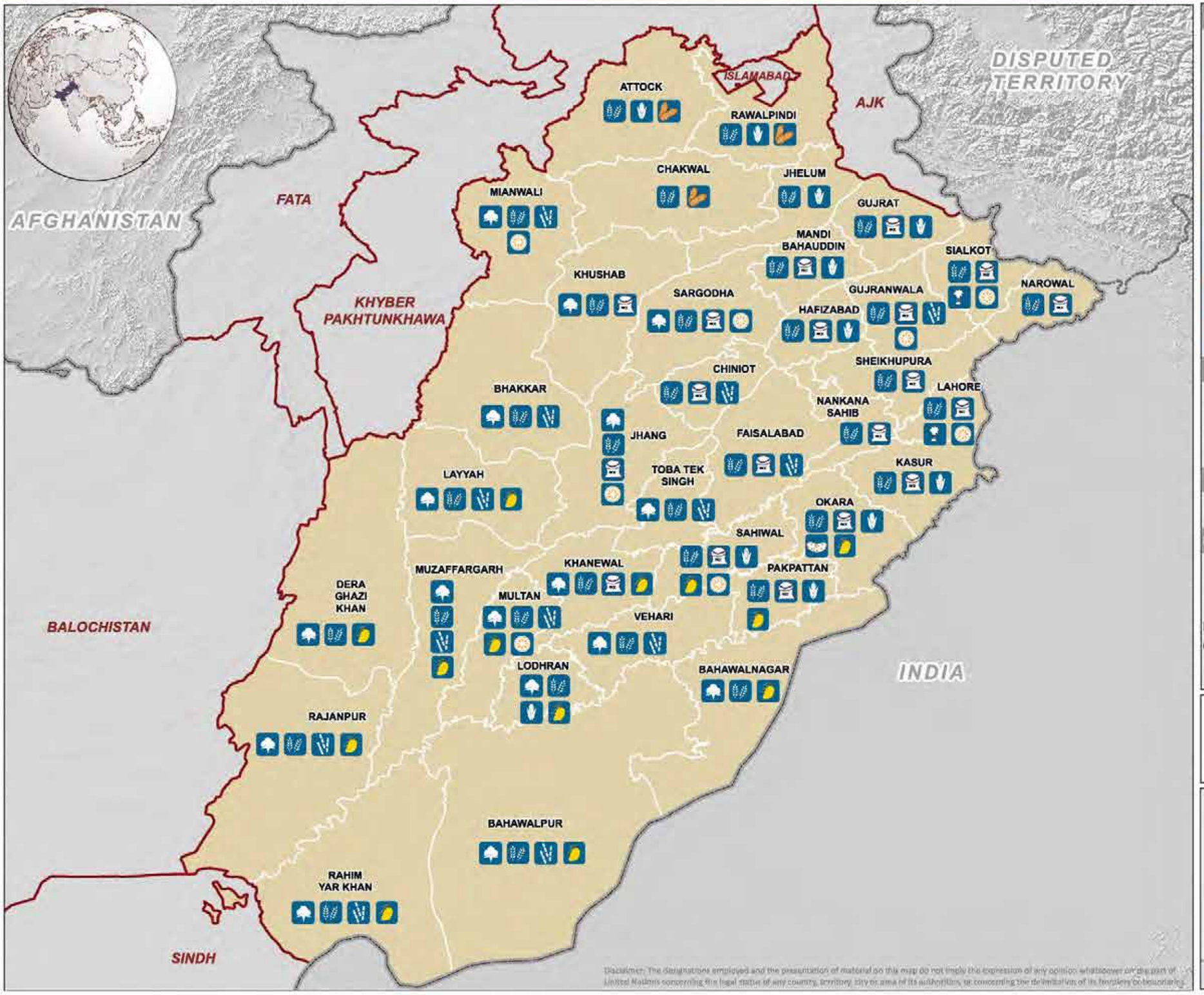
Major Problems	
Soil-related Constraints	>40%
• Salinity	20%
• Water-logging	14%
• Sodicity	7%
Others	<50%
• Canal water shortage	
• Load shedding	
• High prices of fertilizers	
• Low commodity prices	

Use of Organic Sources	
• Wheat	25%
• Rice/Paddy	8%
• Cotton	5%
• Sugarcane	6%
• Maize	3%
• Other Crops	4%



MAJOR CROPS IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Major crops

- Wheat
- Rice
- Maize
- Cotton
- Sugarcane
- Groundnut
- Potato
- Fodder
- Mango
- Citrus

About Map

The map shows major crops grown in each district. The information is derived from Rapid Fertilizer Use Assessment carried out in 2015. The sample size was 33 farmers interviewed per district and total number of respondents in Punjab were 1188.

Data Sources

FAO, GAUL, Rapid Fertilizer Use Assessment (2015)

Map Scale and Datum

Datum: WGS 84 Nominal scale: 1:2,698,500 at A3

0 50 100 150 200

Kilometers

Date: 18 Feb 2016

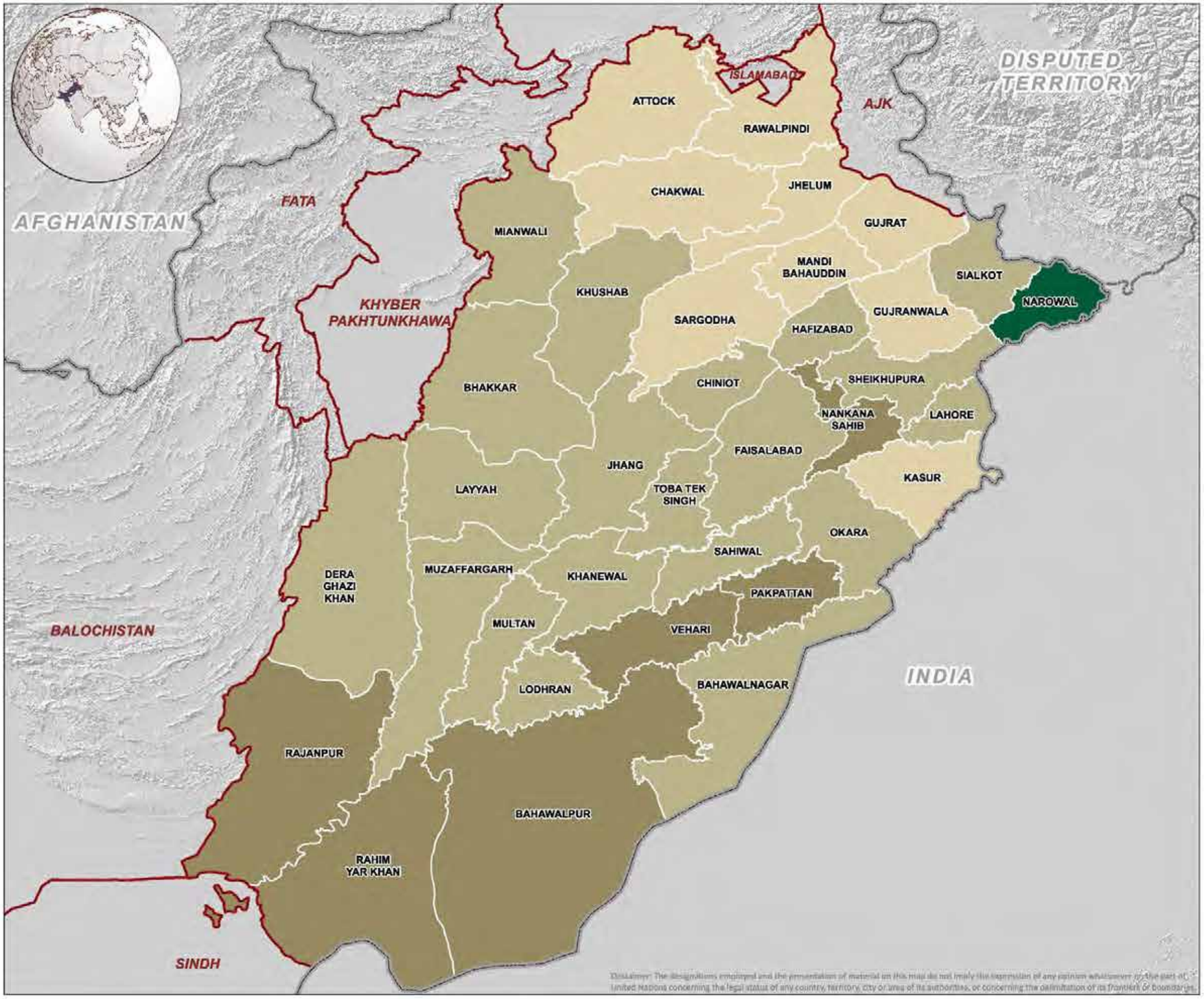
Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_MC_05_20150910

N

APPLICATION OF UREA TO WHEAT IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Application of Urea (kg/acre)

- ≤ 70.0
- 70.1 - 100.0
- 100.1 - 120.0
- 120.1 - 140.0

About Map

The map shows that majority of the farmers use barely equal or less than the recommended (100 kg/acre) Urea, while fewer apply adequate or even higher dose. This trend needs rationalization considering the N contributed from other sources and soil test values.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

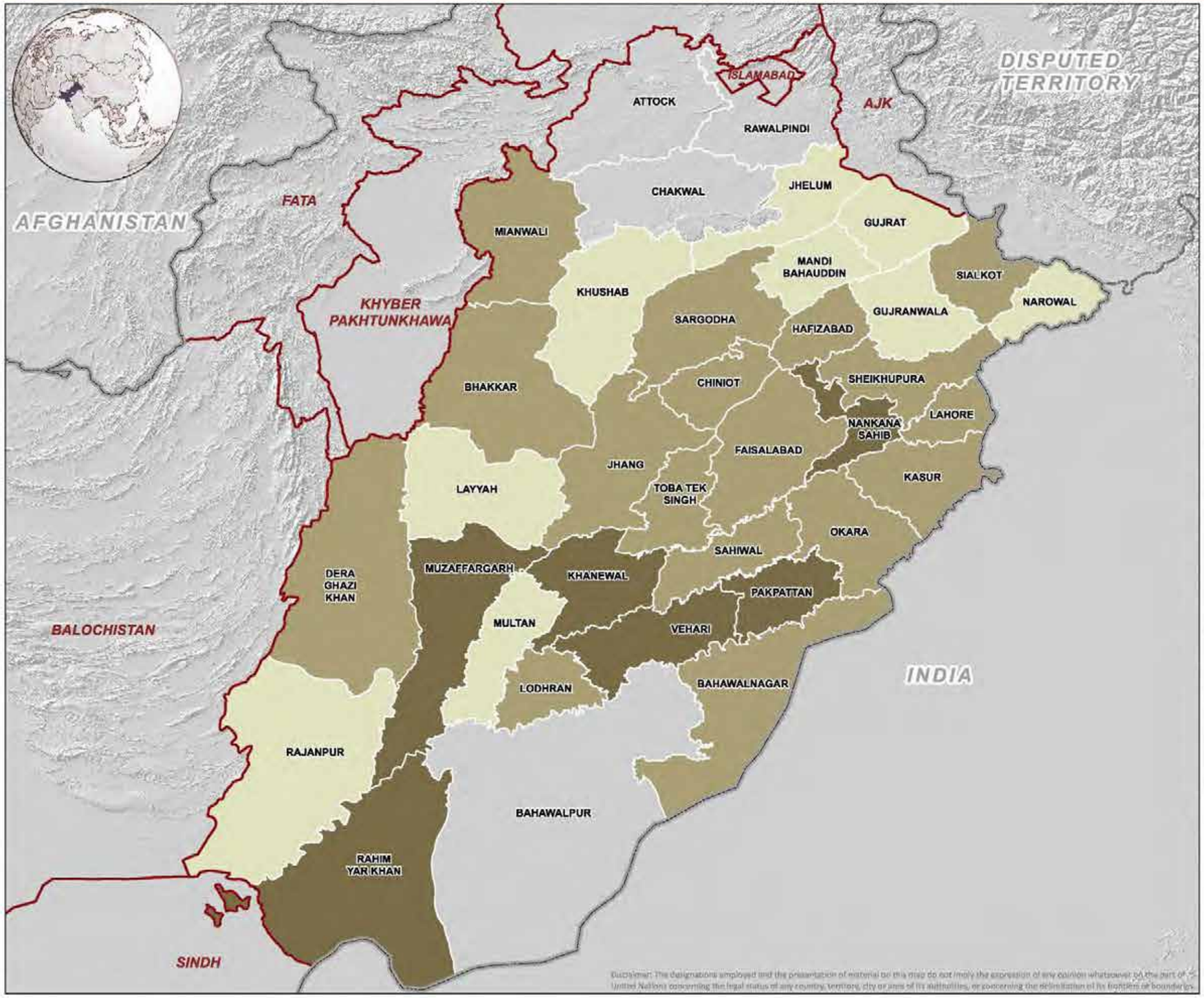
Date: 19 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_UreaWheat_2.1_20150910

APPLICATION OF UREA TO RICE/PADDY IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Application of Urea (kg/acre)

- ≤ 70.0
- 70.1 - 100.0
- 100.1 - 130.0
- No significant data

About Map

Urea use in core rice growing areas is adequate (Sialkot, Sheikhupura, Hafizabad, Nankana Sahib) or lesser (Narowal, Gujranwala, Gujrat, Mandi Bahauddin) even than the generalized recommendation of Agriculture Department of the Punjab. Farmers in the non-core areas (Pakpattan, Vehari, Khanewal, Muzaffargarh, Rahim Yar Khan) apply relatively higher rates.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

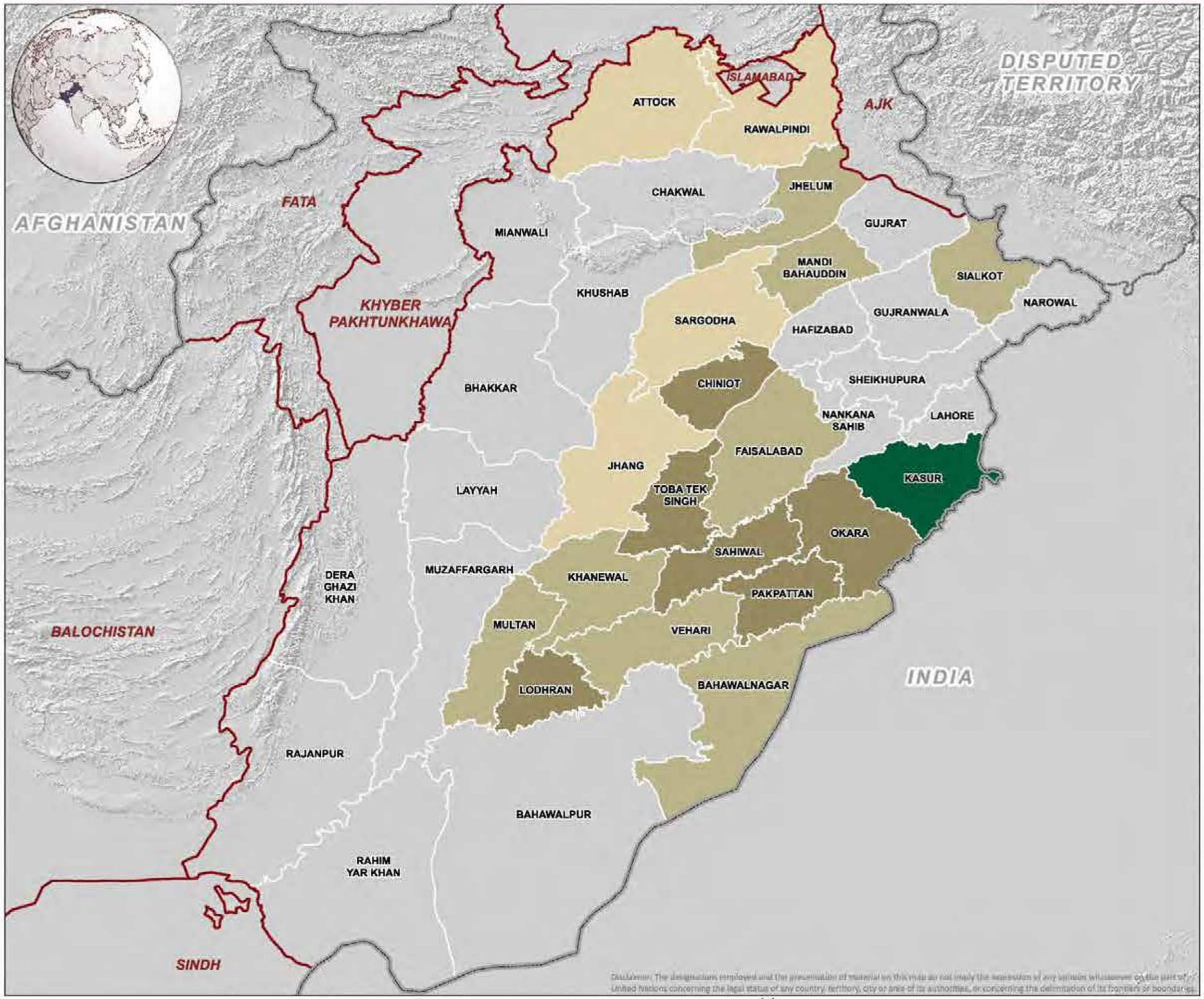
Date: 19 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_UreaRi_2.2_20150508

APPLICATION OF UREA TO MAIZE IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Application of Urea (kg/acre)

- ≤ 100.0
- 100.1 - 150.0
- 150.1 - 200.0
- 200.1 - 250.0
- No significant data

About Map

Farmers in primary maize growing districts (Chiniot, Kasur, Okara, Sahiwal, Toba Tek Singh) apply adequate quantity of urea to maize crop. Moreover, maize growers in Jhang use lesser and In Faisalabad and Lahore districts use intermediate quantity of urea.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

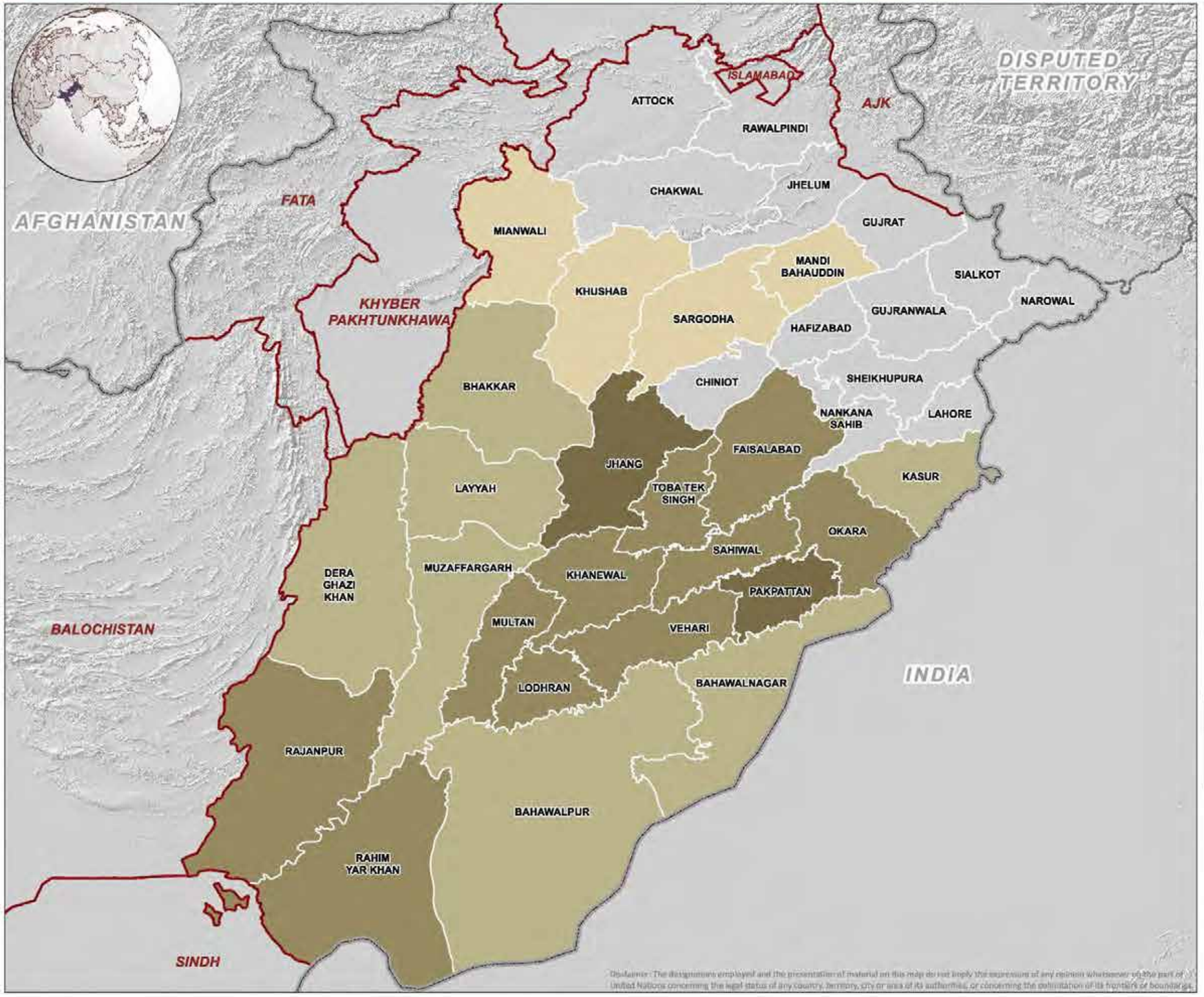
Date: 22 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_UreaMaize_2.3_20150910

APPLICATION OF UREA TO COTTON IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Disclaimer: The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of United Nations concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

Map Legend

Administrative limits

- Country
- Province
- District

Application of Urea (kg/acre)

- ≤ 100.0
- 100.1 - 150.0
- 150.1 - 200.0
- 200.1 - 250.0
- No significant data

About Map

In most of the core cotton growing (Khanewal, Multan, Vehari, Lodhran, Rajanpur and Rahim Yar Khan) as well as in non-core cotton growing (Pakpattan and Jhang) districts, urea application is excessive.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

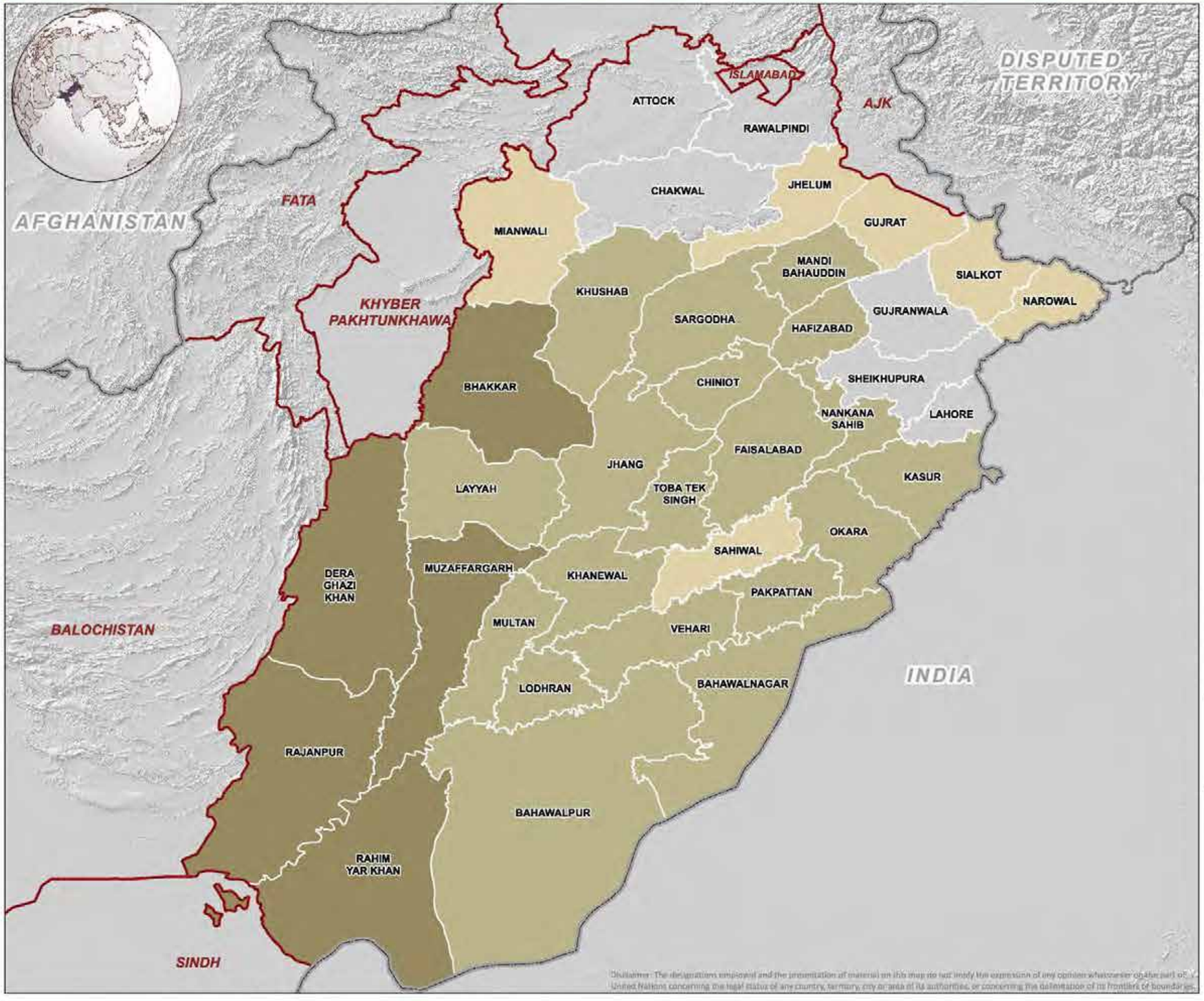
Date: 22 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_UreaCot_2.4_20150910

APPLICATION OF UREA TO SUGARCANE IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Application of Urea (kg/acre)

- ≤ 100.0
- 100.1 - 200.0
- 200.1 - 300.0
- No significant data

About Map

In five districts (Bhakkar, Muzaffargarh, Dera Ghazi Khan, Rahim Yar Khan and Rajanpur), urea use is relatively higher that could meet crop requirements on fertile soils. In most other districts, applied urea appears less than the crop requirements, and thus needs consideration of the soil fertility status and crop type (e.g., ratoon) for optimum production.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

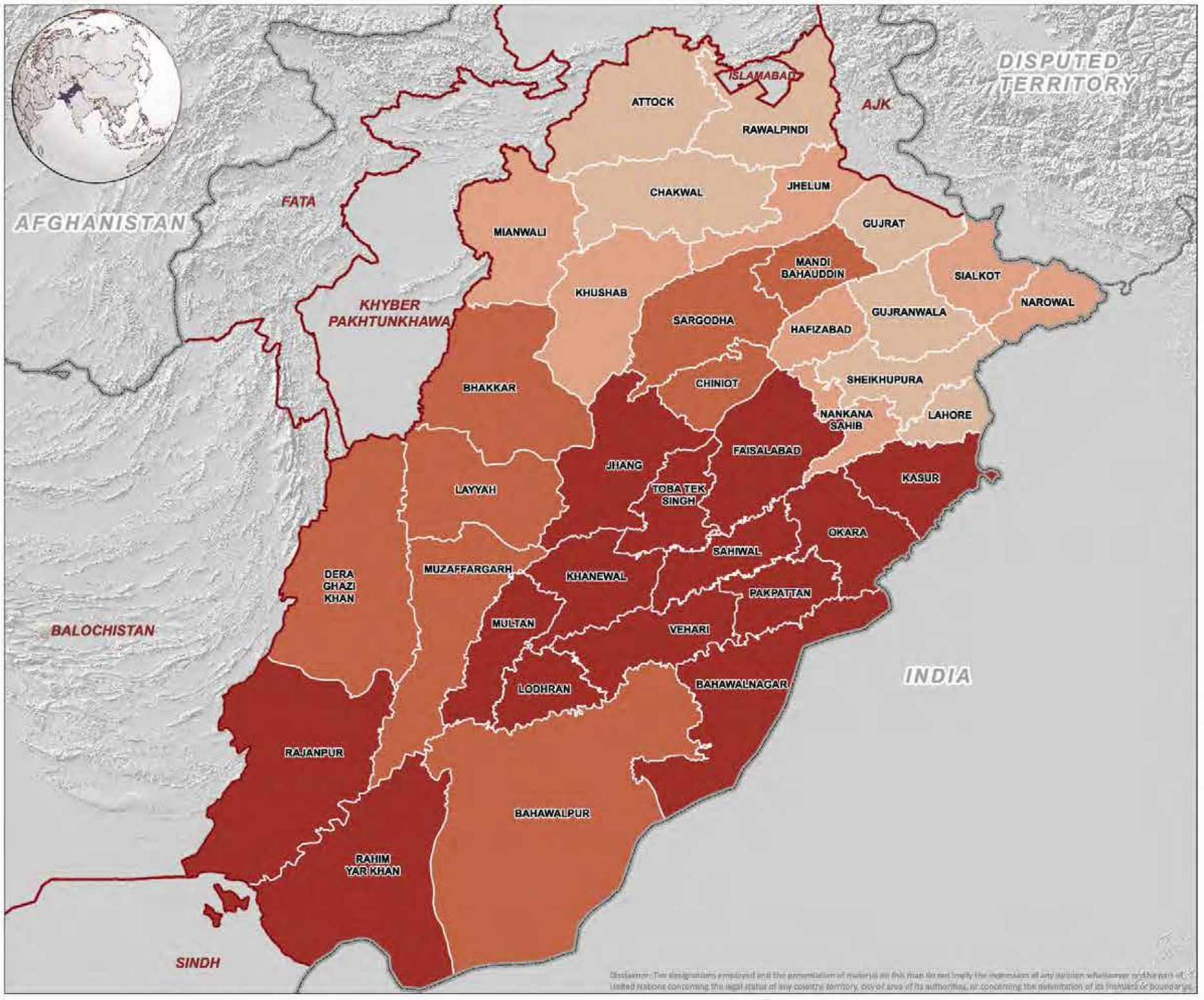
Date: 22 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_UreaSg_2.5_20150910

TOTAL USE OF UREA IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Total use of Urea per district (kg/acre)

- ≤ 200.0
- 200.1 - 400.0
- 400.1 - 600.0
- 600.1 - 800.0

About Map

This map indicates total use of urea for all five major crops if grown on a field in same year. However, actual usage will be variable and lesser depending on the crop(s) grown.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

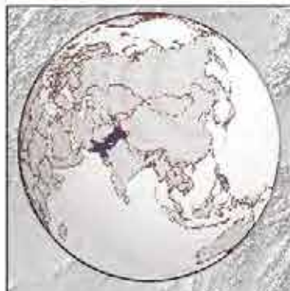
Date: 23 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_Urea_17_20150910

APPLICATION OF DI-AMMONIUM PHOSPHATE (DAP) TO WHEAT IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



AFGHANISTAN
FATA
KHYBER PAKHTUNKHAWA
BALOCHISTAN
SINDH
INDIA
DISPUTED TERRITORY
AJK
ISLAMABAD
ATTOCK
RAWALPINDI
CHAKWAL
JHELUM
MIANWALI
GUJRAT
MANDI BAHAUDDIN
SIALKOT
KHUSHAB
NAROWAL
SARGODHA
GUJRANWALA
HAFIZABAD
BHAKKAR
CHINIOT
SHEIKHUPURA
NANKANA SAHIB
LAHORE
FAISALABAD
JHANG
KASUR
LAYYAH
TOBA TEK SINGH
OKARA
SAHIWAL
DERA GHAZI KHAN
MUZAFFARGARH
KHANEWAL
PAKPATTAN
MULTAN
VEHARI
LODHRAN
BAHAWALNAGAR
RAJANPUR
BAHAWALPUR
RAHIM YAR KHAN

Map Legend

Administrative limits

- Country
- Province
- District

Application of DAP (kg/acre)

- ≤ 50.0
- 50.1 - 65.0
- 65.1 - 80.0
- 80.1 - 100.0

About Map

The map indicates that use of DAP is common throughout the Punjab. However, applied rates are highly variable, with adequate use in only three districts (Gujranwala, Toba Tek Singh and Rahim Yar Khan) and medium P usage in most of the remaining districts.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

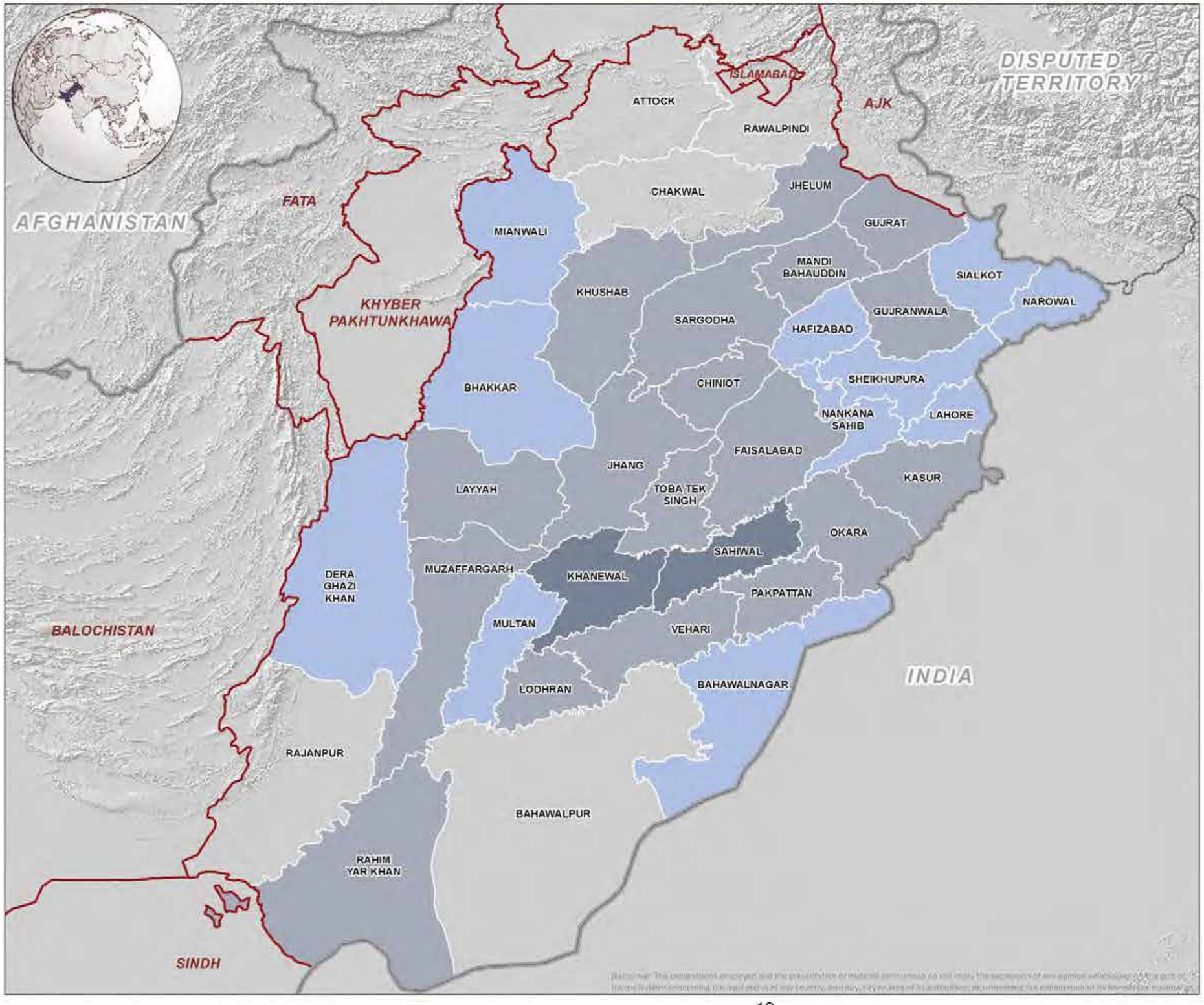
Date: 24 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_DAP _4.1_20150325

APPLICATION OF DI-AMMONIUM PHOSPHATE (DAP) TO RICE/PADDY IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Application of DAP (kg/acre)

- ≤ 50.0
- 50.1 - 70.0
- 70.1 - 90.0
- No significant data

About Map

The map shows relatively low DAP use in core rice growing areas. In most remaining districts in other cropping zones DAP application rates are relatively higher.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

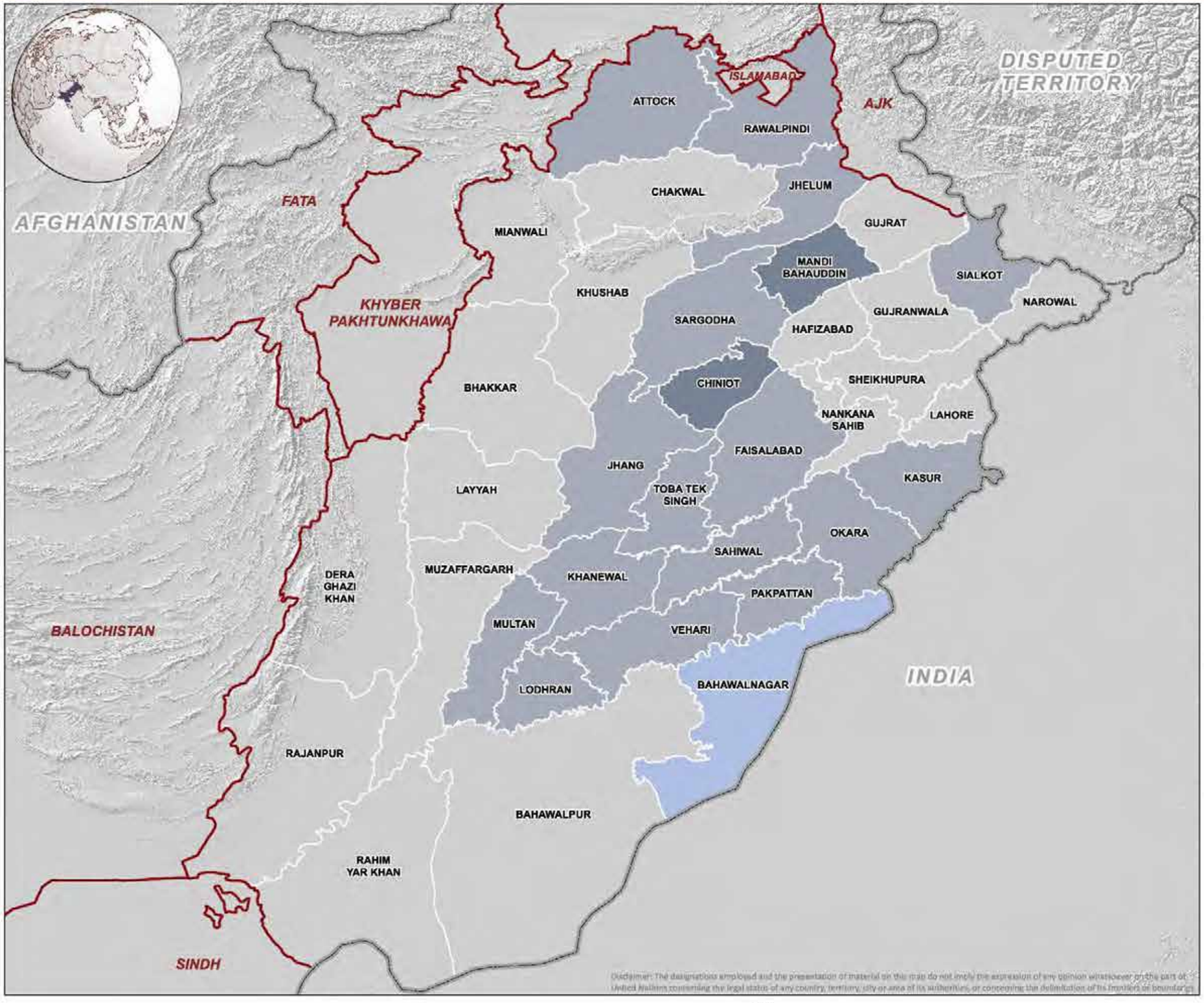
Date: 24 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_DAPRi_4.2_20150325

APPLICATION OF DI-AMMONIUM PHOSPHATE (DAP) TO MAIZE IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Disclaimer: The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of United Nations concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

Map Legend

Administrative limits

- Country
- Province
- District

Application of DAP (kg/acre)

- ≤ 50.0
- 50.1 - 100.0
- 100.1 - 150.0
- No significant data

About Map

The map shows that except for Bahawal Nagar district, medium rates of DAP are applied to maize crop. Further, the adequate information is lacking for about 50% of the districts across Punjab.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

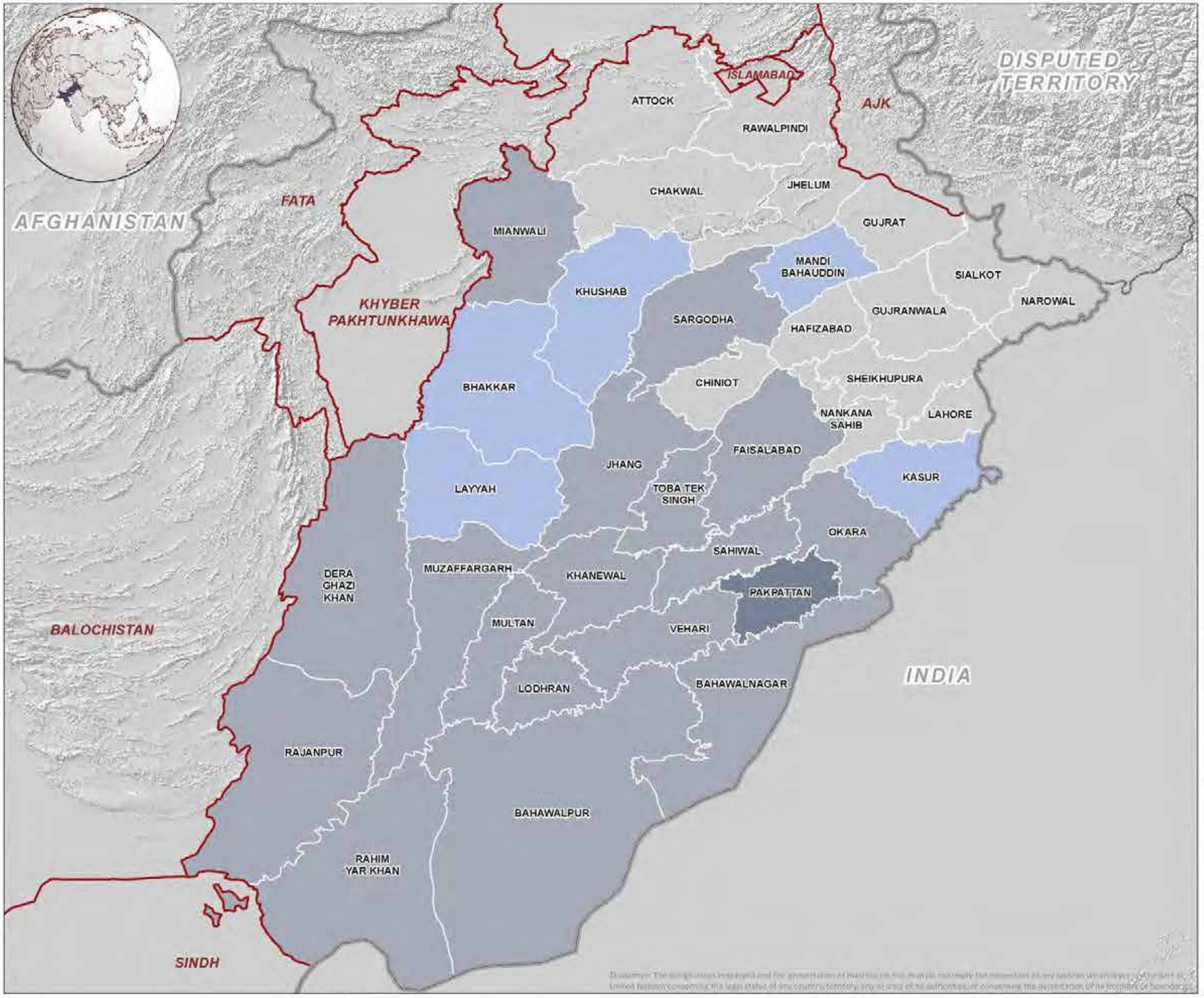
Date: 24 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_DAPMaize_4.3_20150325

APPLICATION OF DI-AMMONIUM PHOSPHATE (DAP) TO COTTON IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Application of DAP (kg/acre)

- ≤ 50.0
- 50.1 - 75.0
- 75.1 - 100.0
- No significant data

About Map

The map shows that adequate DAP is used in core cotton growing areas.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

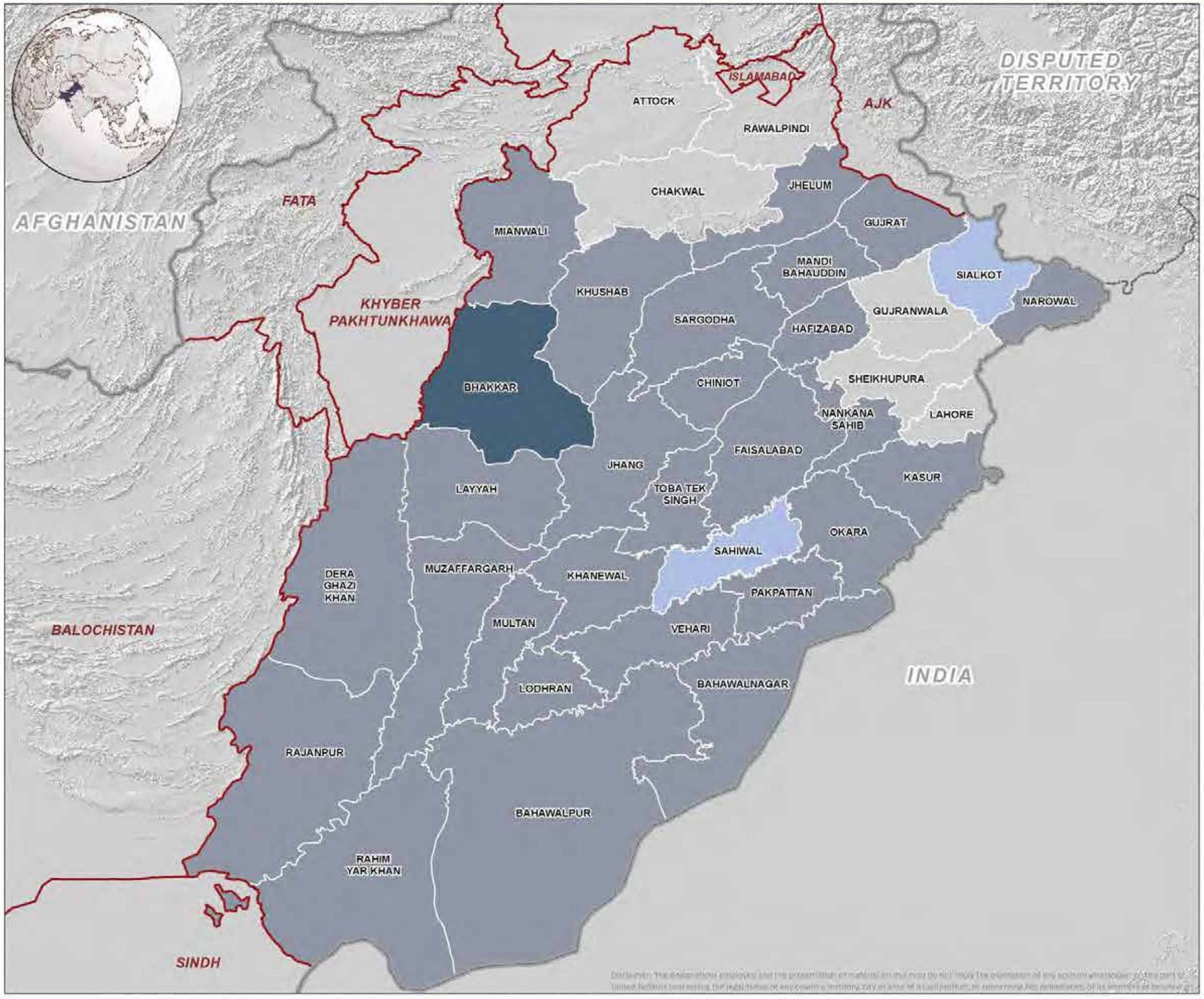
Date: 24 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_DAPCot_4.4_20150910

APPLICATION OF DI-AMMONIUM PHOSPHATE (DAP) TO SUGARCANE IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Application of DAP (kg/acre)

- ≤ 50.0
- 50.1 - 100.0
- 100.1 - 150.0
- No significant data

About Map

The map shows that adequate or even higher than the DAP rates recommended for fertile soils are applied to sugarcane in most of the Punjab. The DAP use being highest in Bhakkar and lowest in Sahiwal and Sialkot districts.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

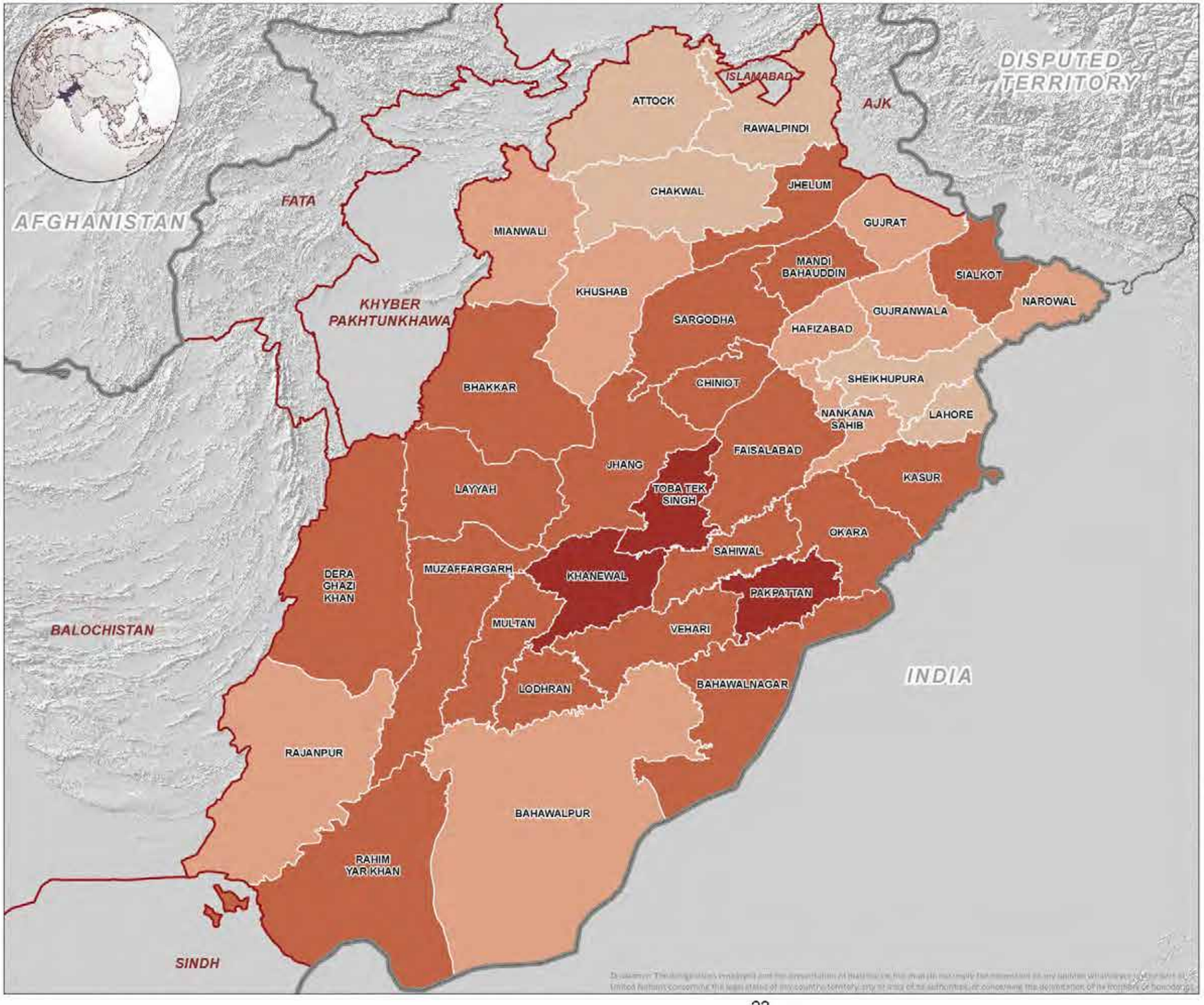
Date: 24 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_DAPSug_4.5_20150910

TOTAL USE OF DI-AMMONIUM PHOSPHATE (DAP) IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Total use of DAP per district (kg/acre)

- ≤ 125
- 126 - 250
- 251 - 375
- 376 - 500

About Map

This map indicates total use of DAP for all five major crops if grown on a field in same year. However, actual usage will be variable and lesser depending on the crop(s) grown.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

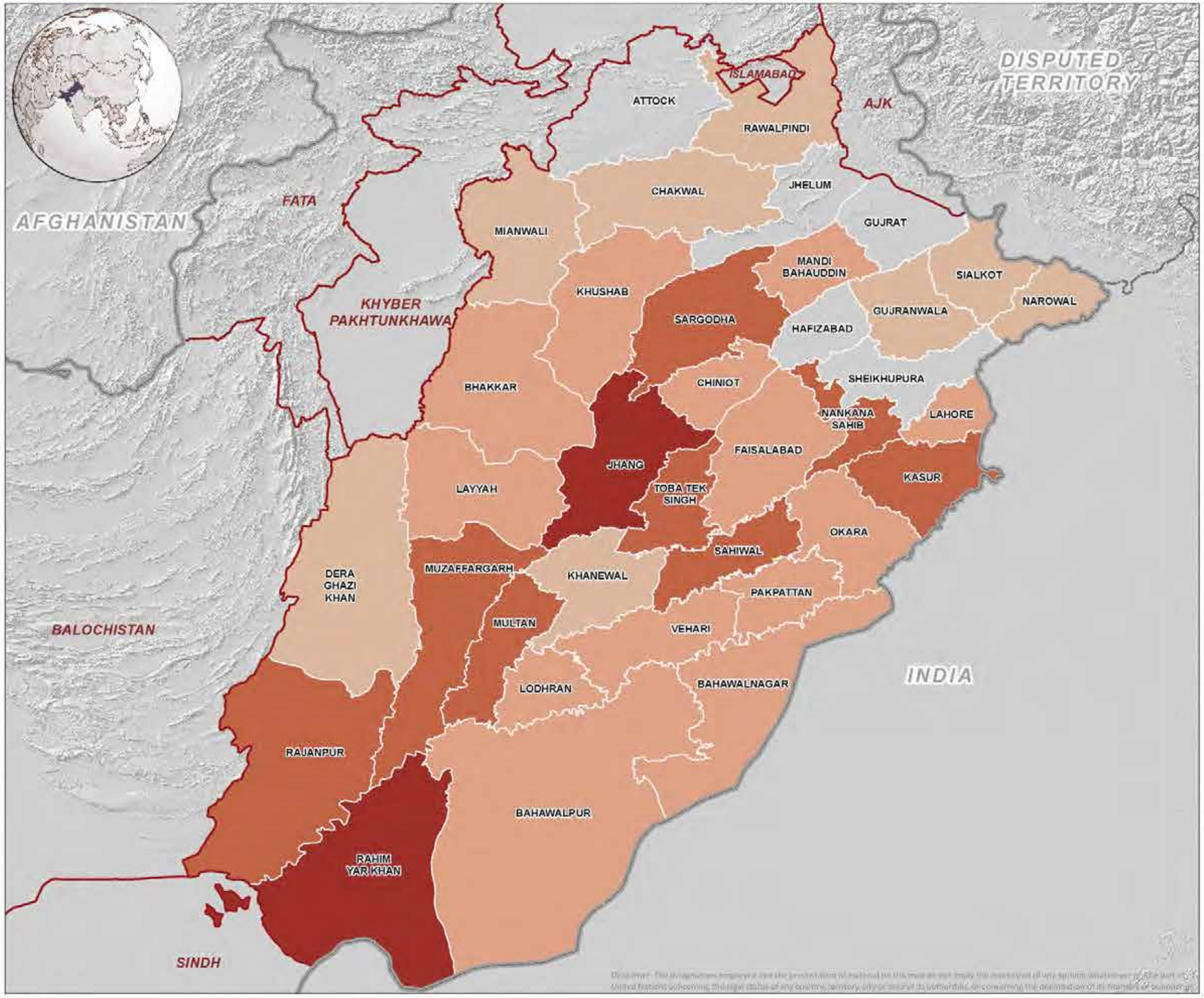
Date: 24 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_DAP_4.6_20150327

TOTAL USE OF CALCIUM AMMONIUM NITRATE (CAN) IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Total use of CAN per district (kg/acre)

- ≤ 100.0
- 100.1 - 200.0
- 200.1 - 300.0
- 300.1 - 400.0
- No significant data

About Map

This map indicates total use of CAN for all five major crops if grown on a field in same year. However, actual usage will be variable and lesser depending on the crop(s) grown.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

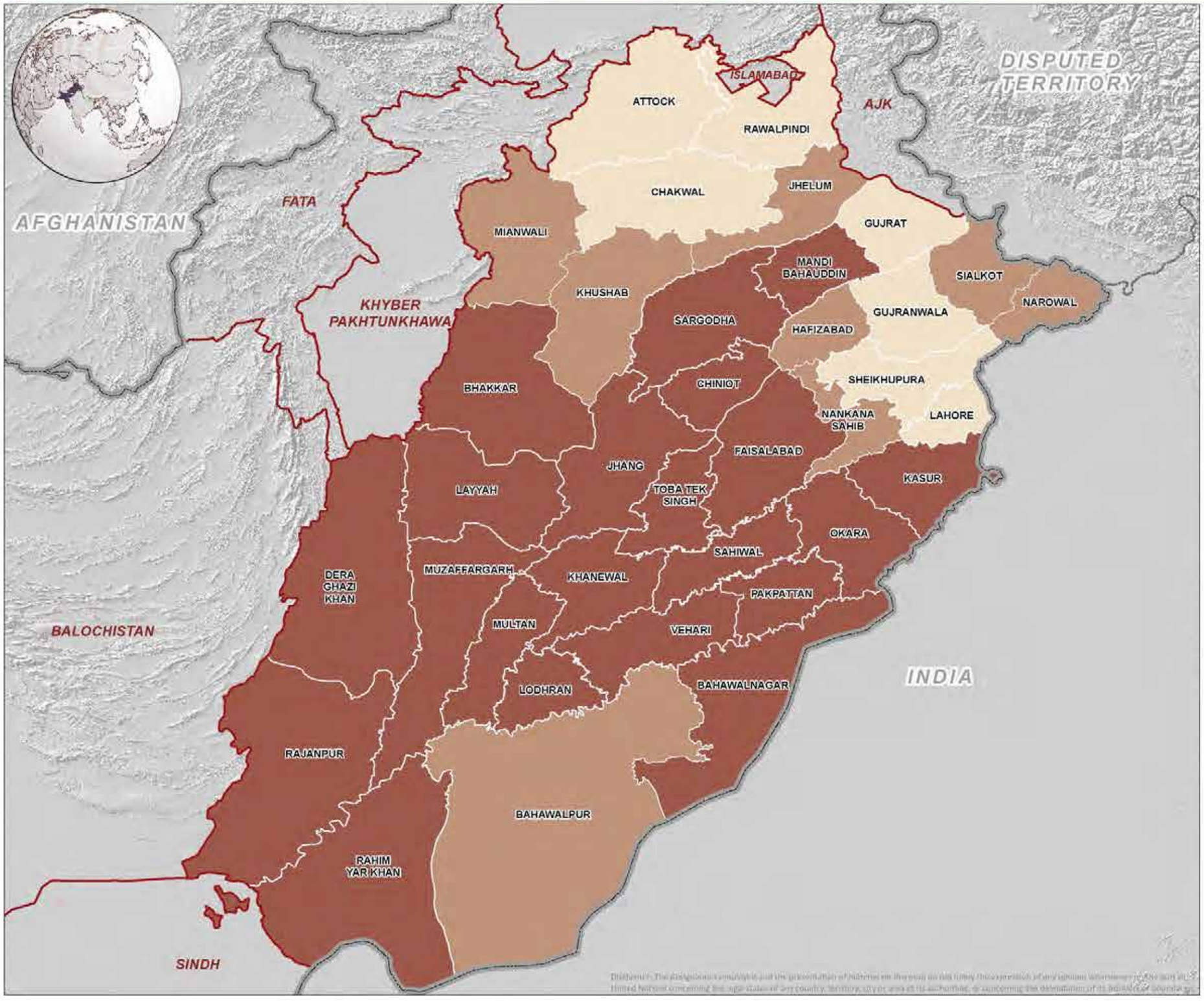
Kilometers

Date: 23 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_CANt _3.6_20150327

DISTRICT-WISE USE OF NITROGEN



Map Legend

Administrative limits

- Country
- Province
- District

Amount of Nitrogen [N] (Kg/acre)

- ≤ 150.0
- 150.1 - 300.0
- 300.1 - 500.0

About Map

The maps shows use of Nitrogen derived from Urea, DAP and CAN applied in each district. Irrespective of the source, relatively lower N usage is obvious in core rice growing andrainfed areas compared to all other districts of the Punjab.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

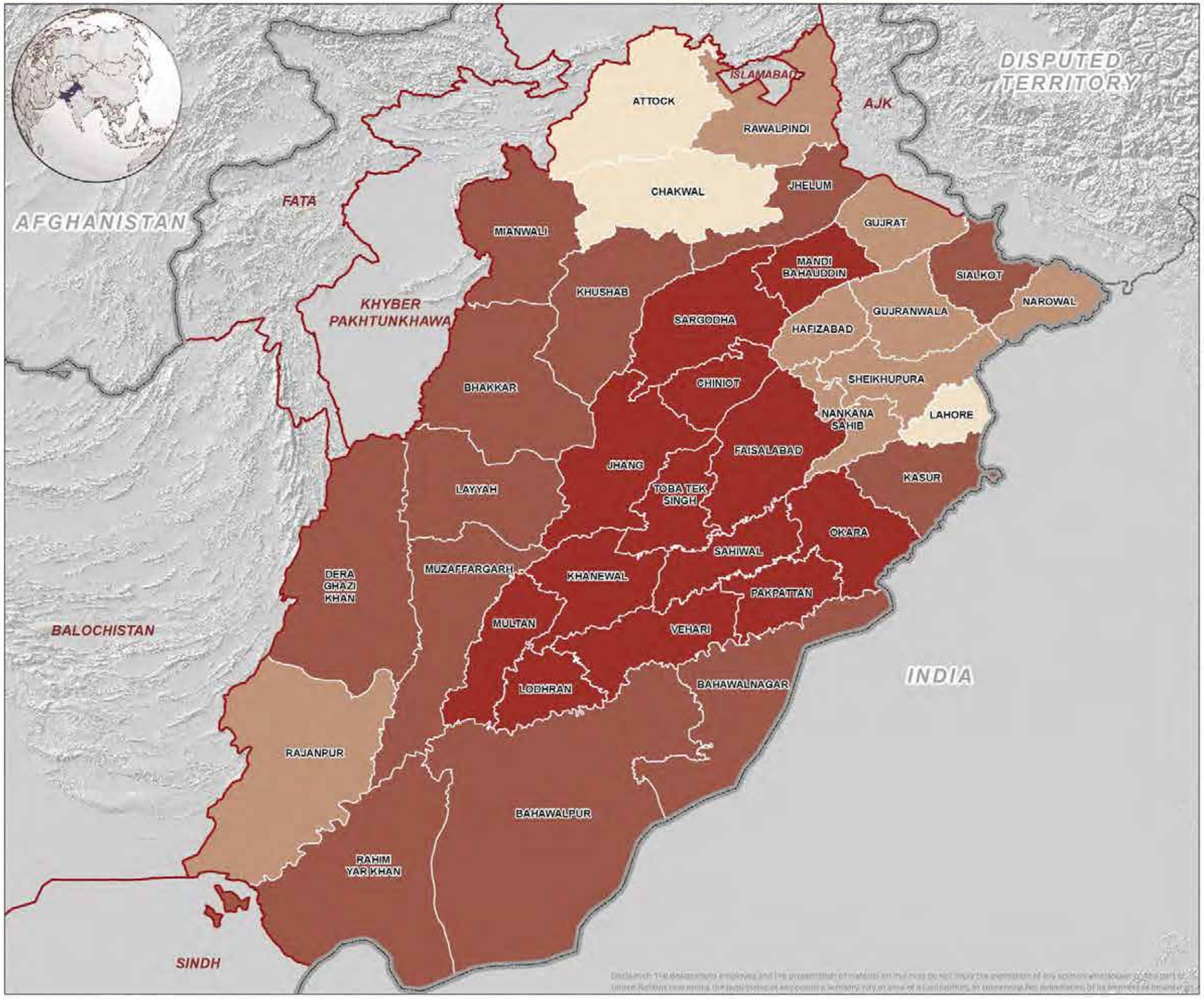
Date: 02 March 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_N_5.1_20150423

DISTRICT-WISE USE OF PHOSPHORUS

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits
- Country
- Province
- District

Amount of Phosphorus P_2O_5 (Kg/acre)
- ≤ 50.0
- 50.1 - 100.0
- 100.1 - 150.0
- 150.1 - 200.0

About Map

The maps shows use of Phosphorus derived from DAP applied in each district. The overall P application is variable with high usage in the entire mixed cropping zone and adjoining districts of cotton growing areas. Lower P use is indicated in most rice growing districts followed by minimum in rainfed districts Attock and Chakwal.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

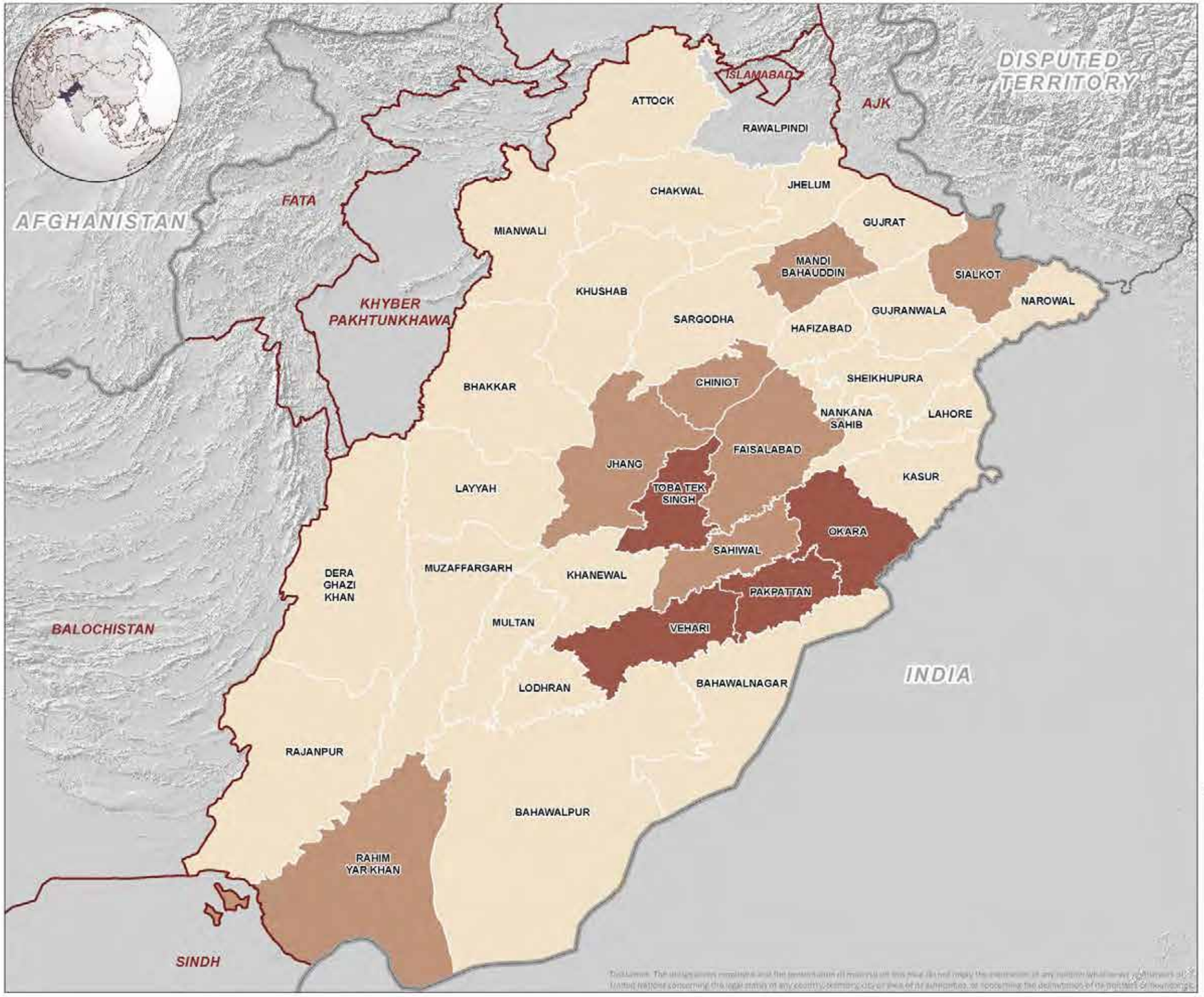
Date: 02 March 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_P_5.2_20150910

DISTRICT-WISE USE OF POTASSIUM

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Amount of Potassium K_2O (Kg/acre)

- ≤ 0.23
- 0.24 - 0.45
- 0.46 - 0.68

About Map

The map shows use of Potassium derived from Sulfate of Potash (SOP) and Muriate of Postsh (MOP) applied in each district. Overall, minimal K use is obvious in most districts. Highest K use is in Okara, Pakpattan, Vehari and Toba Tek Singh followed by four districts of mixed cropping zone and two districts in rice area.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

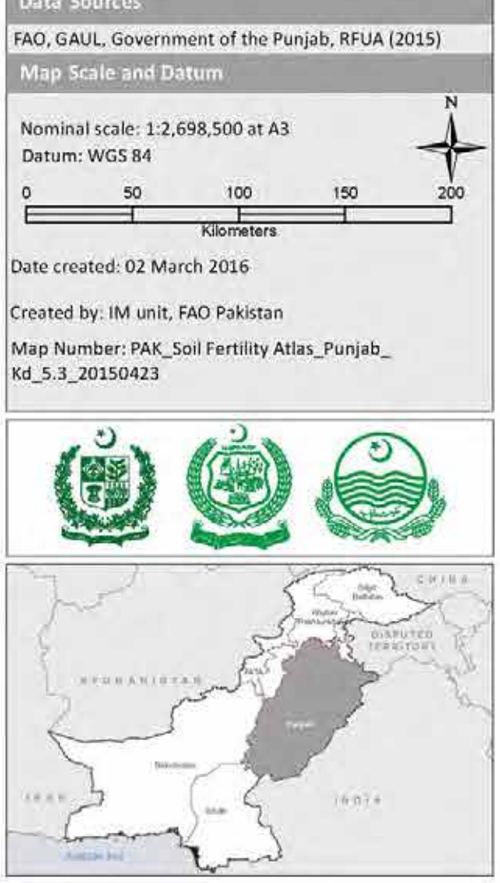
0 50 100 150 200

Kilometers

Date created: 02 March 2016

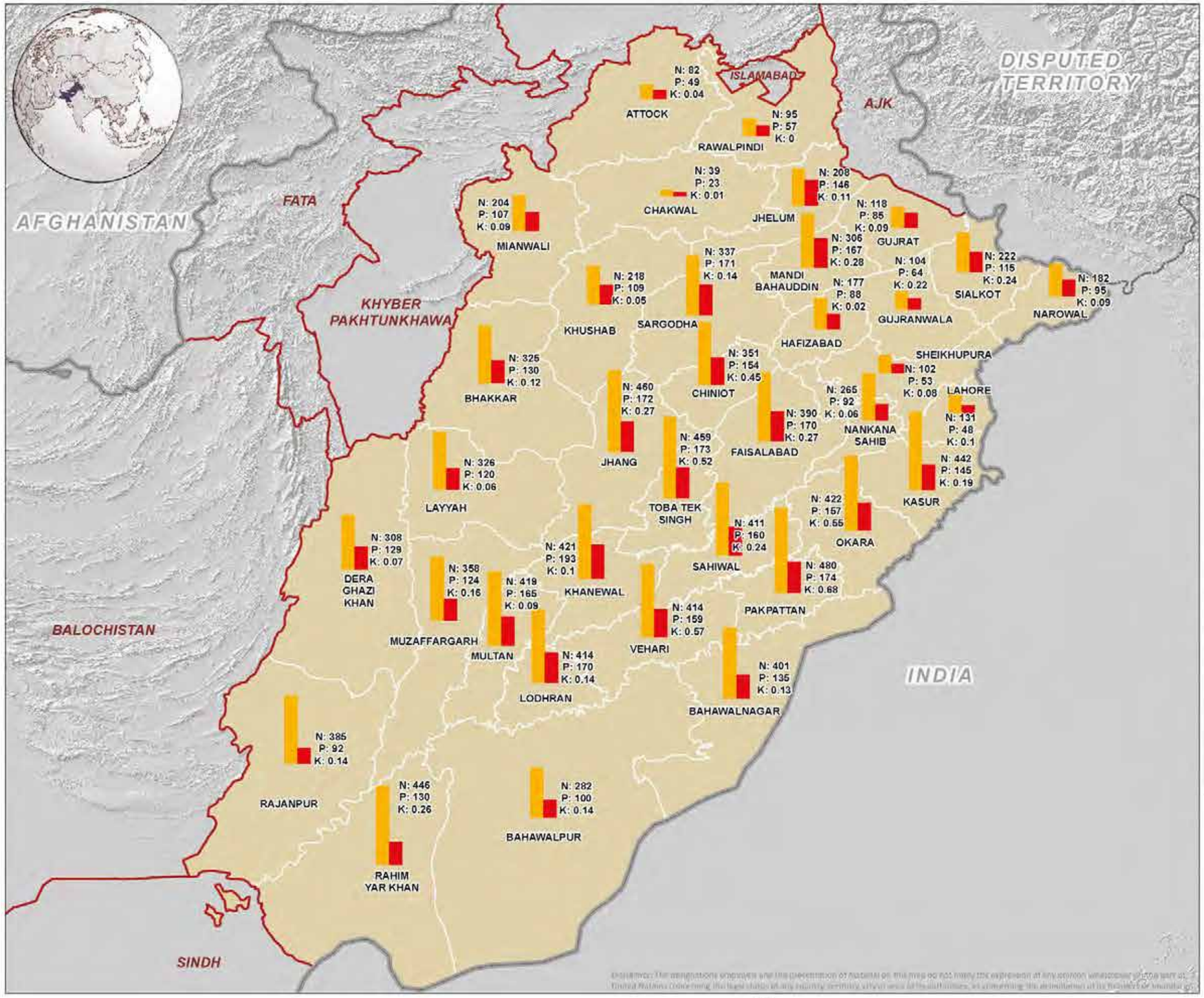
Created by: IM unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_Kd_5.3_20150423



NPK USAGE RATES IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

NP rates (kg/acre)

Nitrogen | Phosphorus

About Map

The map shows relative usage of NPK, indicating that invariably all farmers use N and P but with a highly variable N:P ratio. Further, use of K is not common and needs attention. Similar trends regarding K use are evident from NFDC offtake data. Since K use rate is non-significant, so it has not been shown in the map legend.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

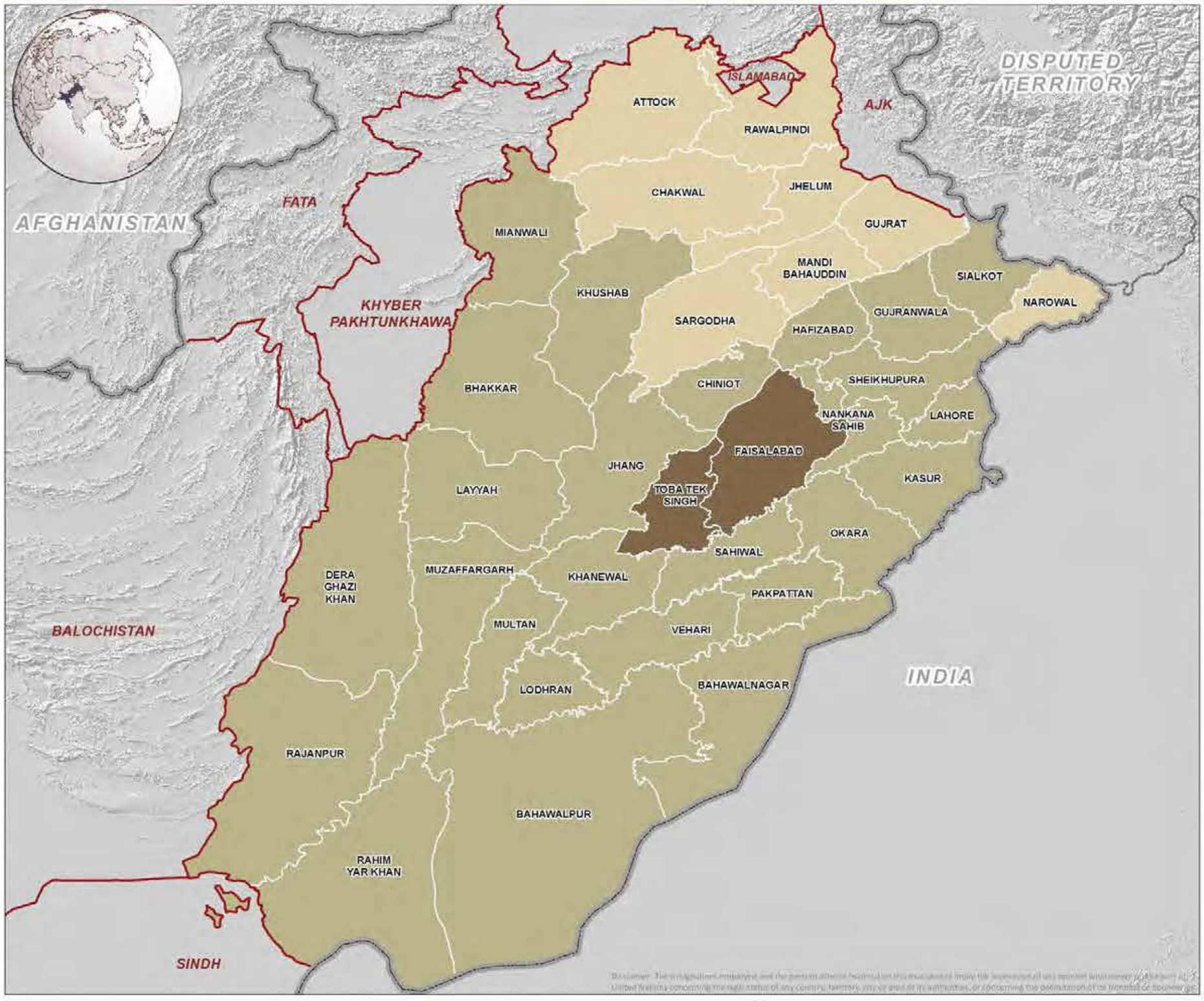
Kilometers

Date: 02 March 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_NPKr_5.4_20150423

AVERAGE YIELD OF WHEAT



Map Legend

Administrative limits

- Country
- Province
- District

Average Yield (Maunds/acre)

- ≤ 40.0
- 40.1 - 50.0
- 50.1 - 60.0

About Map

The map shows relatively higher wheat yield (>50 maunds/acre) in Toba Tek Singh and Faisalabad districts with comparable NP fertilizer inputs. It indicates the role of other factors like cropping intensity which may be of significance to achieve better yield in other districts. 1 maund = 40 kg

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

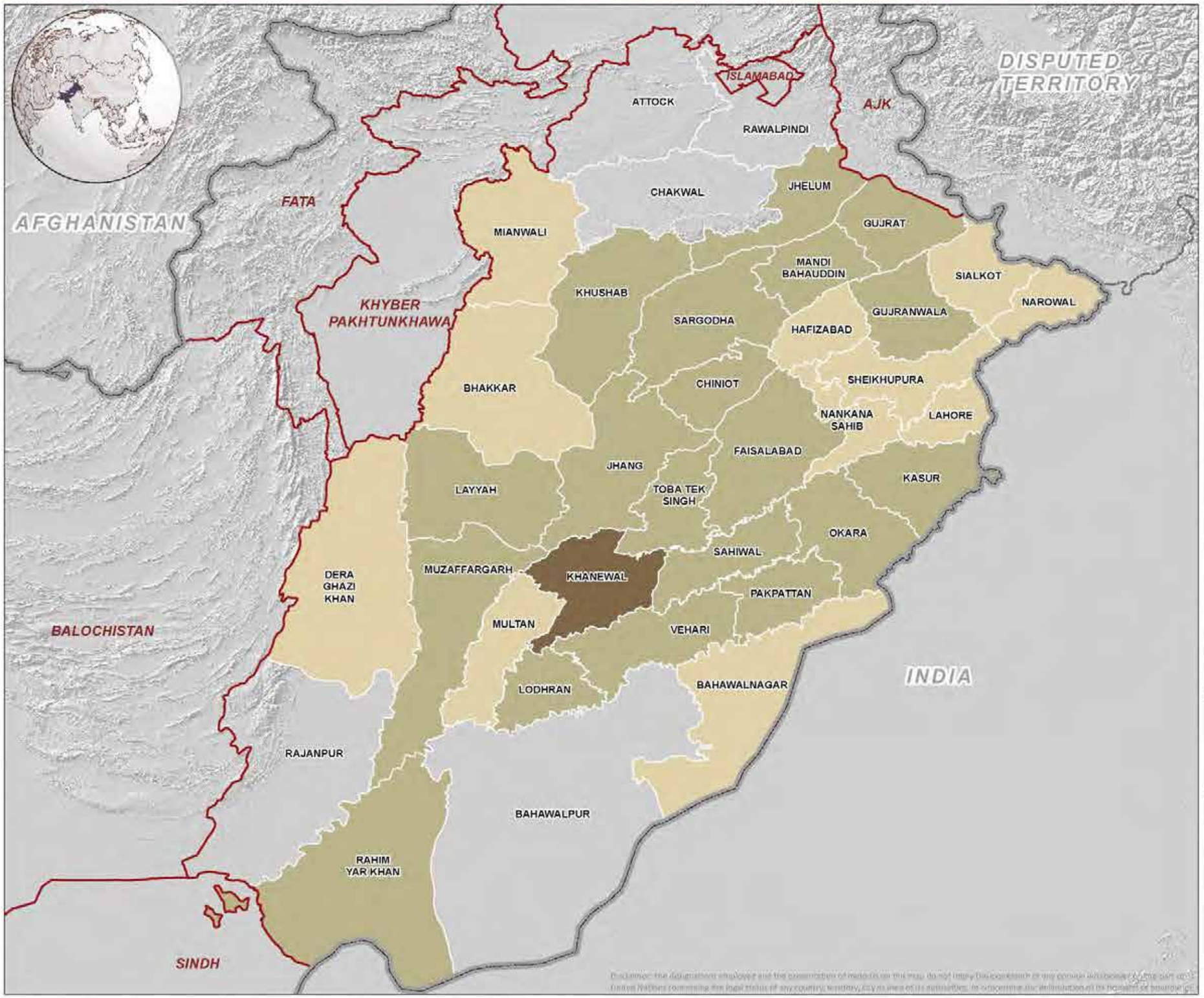
Kilometers

Date: 07 March 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_YieldWheatr_6.1_20150120

AVERAGE YIELD OF RICE/PADDY



Map Legend

Administrative limits

- Country
- Province
- District

Average Yield (Maunds/acre)

- ≤ 50.0
- 50.1 - 75.0
- 75.1 - 100.0
- No significant data

About Map

The map shows relatively lower paddy yield in few districts of the core rice growing areas than in non-core areas. The reason for low yield in core rice growing areas may the sowing of conventional basmati varieties.

1 maund = 40 kg

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

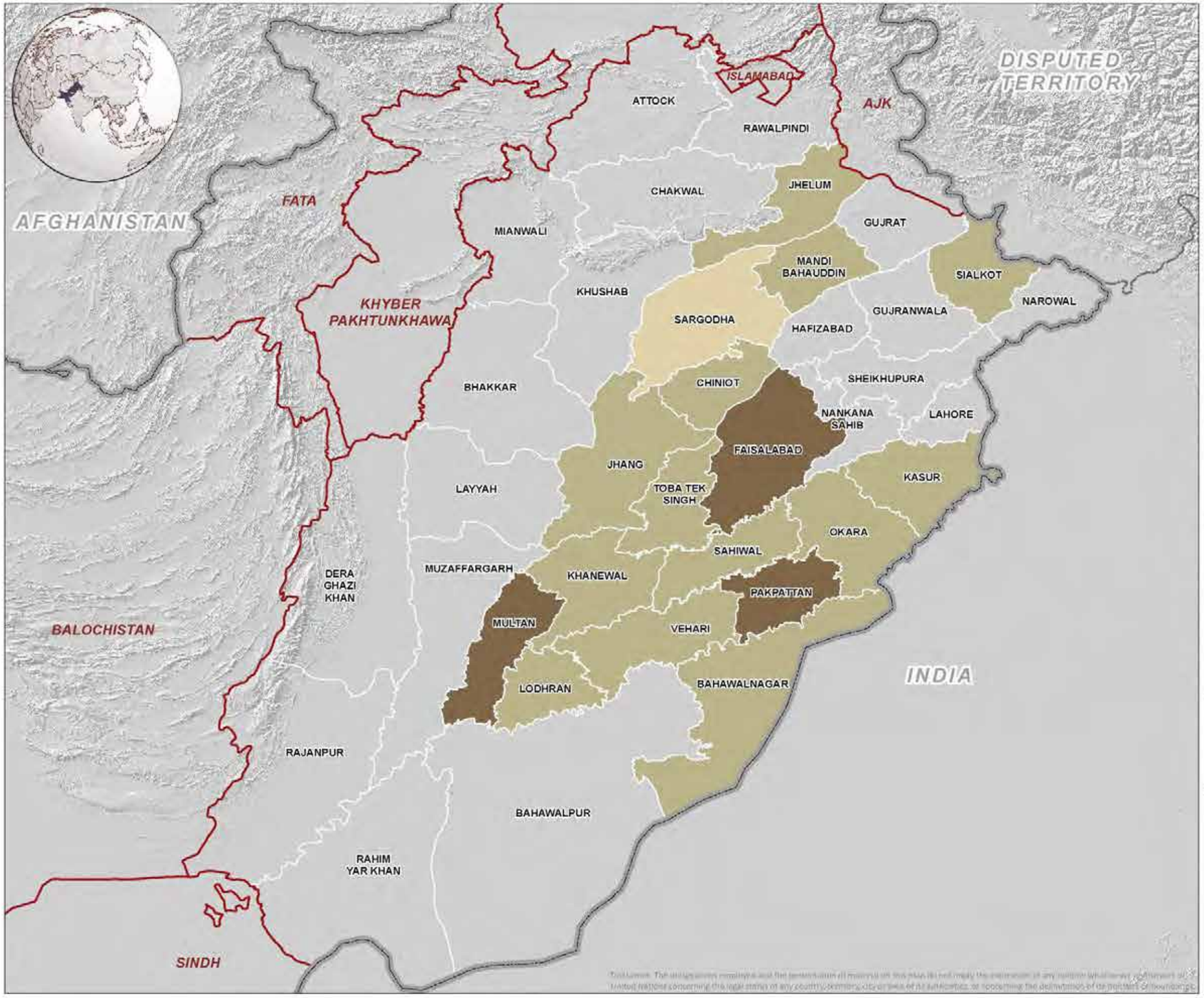
Kilometers

Date: 07 March 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_YieldRir_6.2_20150120

AVERAGE YIELD OF MAIZE



Map Legend

Administrative limits

- Country
- Province
- District

Average Yield (Maunds/acre)

- ≤ 50
- 51 - 100
- 101 - 150
- No significant data

About Map

The map shows overall medium range of average yields in the mixed cropping zone. Outstandingly high yields of maize recorded in three districts, Faisalabad, Pakpattan and Multan indicates some factors other than the use of fertilizer.

1 maund = 40 kg

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

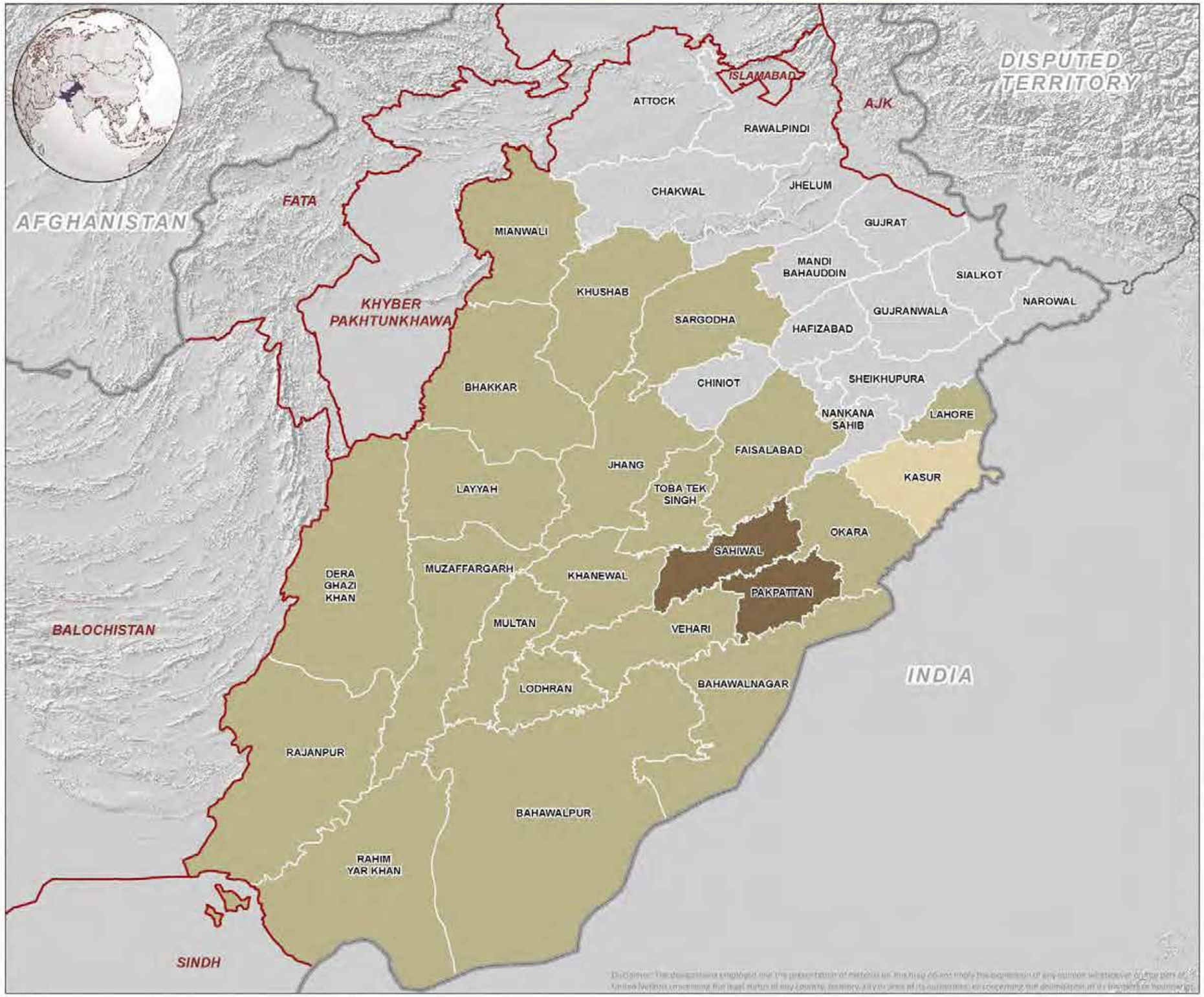
Kilometers

Date: 07 March 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_YieldMa_6.3_20150120

AVERAGE YIELD OF COTTON



Map Legend

Administrative limits

- Country
- Province
- District

Average Yield (Maunds/acre)

- ≤ 20.0
- 20.1 - 40.0
- 40.1 - 60.0
- No significant data

About Map

The map shows remarkably higher yield in two districts (Sahiwal and Pakpattan), while the yield is in the medium range in core and non-core cotton growing districts of the Punjab.
1 maund/acre = 40 kg

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

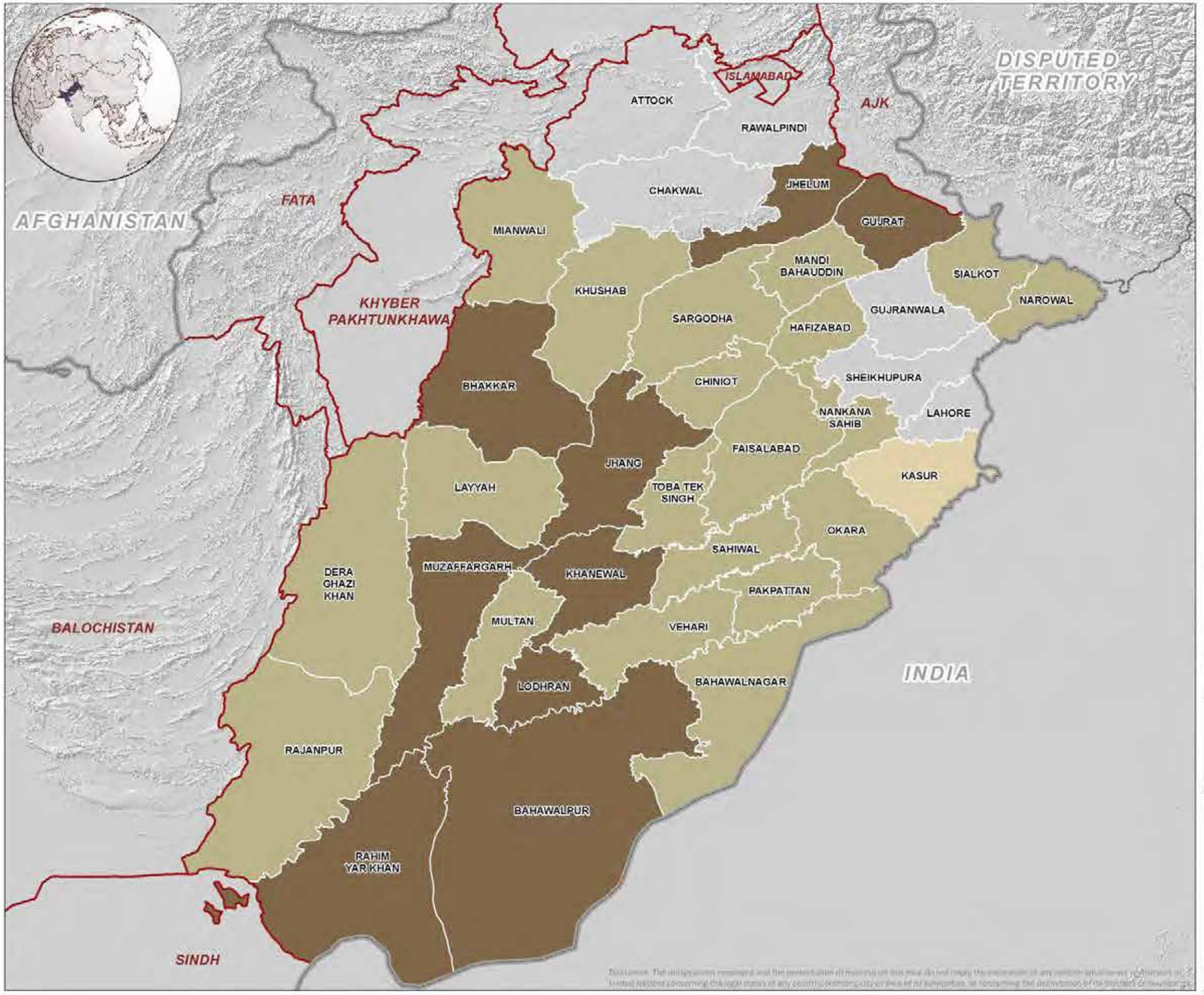
Kilometers

Date: 07 March 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_ YieldCott_6.4_20150327

AVERAGE YIELD OF SUGARCANE



Map Legend

Administrative limits

- Country
- Province
- District

Average Yield (Maunds/acre)

- ≤ 606
- 607 - 900
- 901 - 1200
- No significant data

About Map

The map shows relatively higher sugarcane yield (900-1200 maunds/acre) in the districts of Southern Punjab, whereas medium cane yield in the districts of Central Punjab, irrespective of the district-wise crop acreage.
1 maund = 40 kg

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

Date: 07 March 2016

Created by: IM Unit, FAO Pakistan

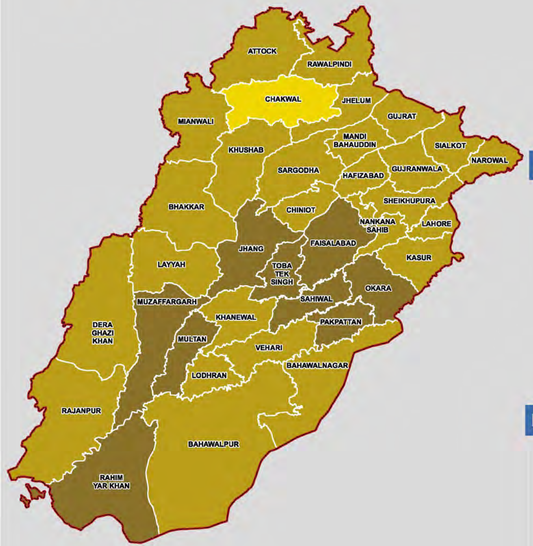
Map Number: PAK_Soil Fertility Atlas_Punjab_YieldSugr_6.5_20150327

YIELD OF WHEAT UNDER DIFFERENT SCENARIOS OF FERTILIZER USE IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA

NP

54%



NP + FYM

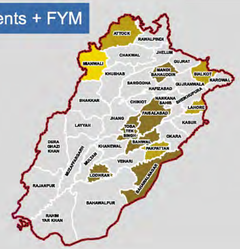
18%

NPK

12%

NPK + Micronutrients + FYM

4%



NP + Micronutrients

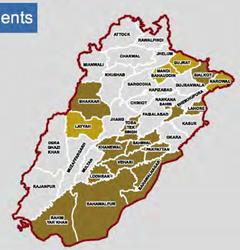
3%

N

3%

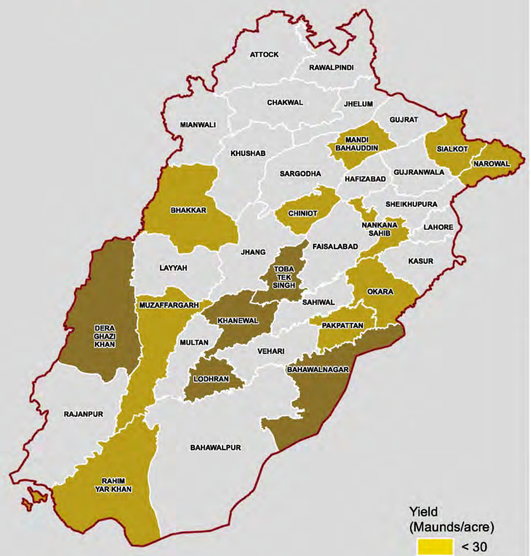
NPK + Micronutrients

3%



NP + Micronutrients + FYM

3%



Map Legend

Administrative limits

- Country
- Province
- District

About Map

The map shows yield of Wheat under different scenarios of fertilizer use adopted by farmers in Punjab. These eight scenarios inluclude N only; NP; NPK; NP + MN; NP + FYM; NP + MN + FYM; NPK + MN ; NPK + MN + FYM.

where:
N = Nitrogen
P = Phosphorus
K = Potassium
FYM = Farm Yard Manure
MN = Micronutrients

The maps shows that average wheat yield with NP application by majority of the farmers (54%) is in the medium range. Use of K and micronutrients has a definite role in enhancing wheat yield. However, the addition of a nutrient to a given scenario of nutrient/fertilizer use may not necessarily have impact on yield.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA 2015

Map Scale and Datum

Datum: WGS 84

0 150 300 450 600
Kilometers

Date: 09 May 2016
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_ Punjab_wheatscen_17.1_20150831

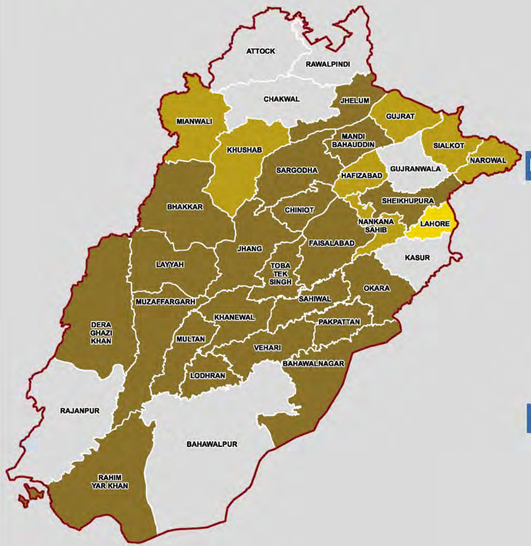
N

YIELD OF RICE/PADDY UNDER DIFFERENT SCENARIOS OF FERTILIZER USE IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA

NP + Micronutrients

41%

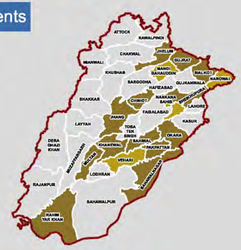


NP

23%

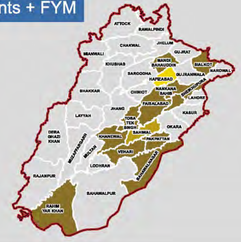
NPK + Micronutrients

12%



NP + Micronutrients + FYM

8%



N

6%

NPK

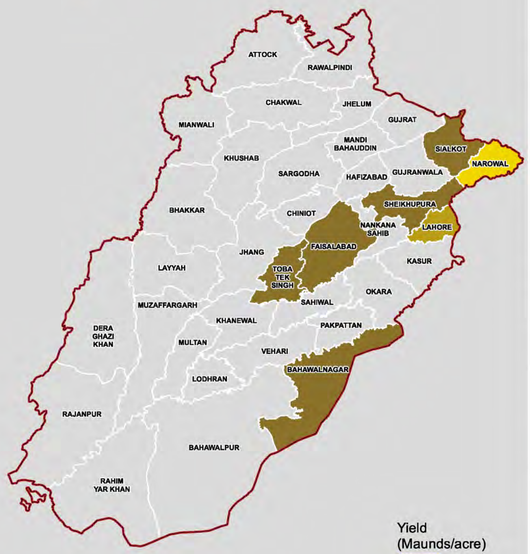
6%

NP + FYM

2%

NPK + Micronutrients + FYM

2%



Map Legend

Administrative limits

- Country
- Province
- District

About Map

The map shows yield of Rice under different scenarios of fertilizer use adopted by farmers in Punjab. These eight scenarios inlucude N only; NP; NPK; NP + MN; NP + FYM; NP + MN + FYM; NPK + MN ; NPK + MN + FYM.

where:

N = Nitrogen
P = Phosphorus
K = Potassium
FYM = Farm Yard Manure
MN = Micronutrients

The map shows that majority of the farmers (41%) use micronutrients in combination with NP in Punjab. This scenario showd average paddy yield in the maximum range. However, the addition of a nutrient to a given scenario of nutrient/fertilizer use may not necessarily have impact on yield.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA 2015

Map Scale and Datum

Datum: WGS 84

0 160 320 480 640
Kilometers

Date: 09 May 2016
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_ Punjab_ricescen_17.2_20150831

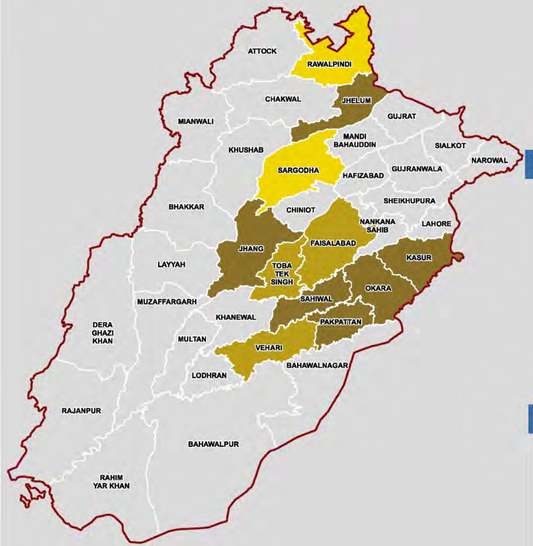
N

YIELD OF MAIZE UNDER DIFFERENT SCENARIOS OF FERTILIZER USE IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA

NP

20%

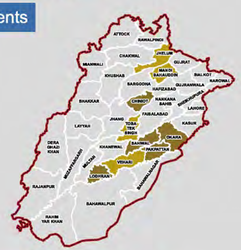


NPK

20%

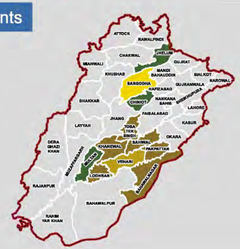
NPK + Micronutrients

20%



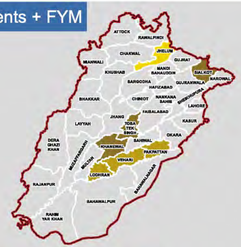
NP + Micronutrients

20%



NPK + Micronutrients + FYM

6%



N

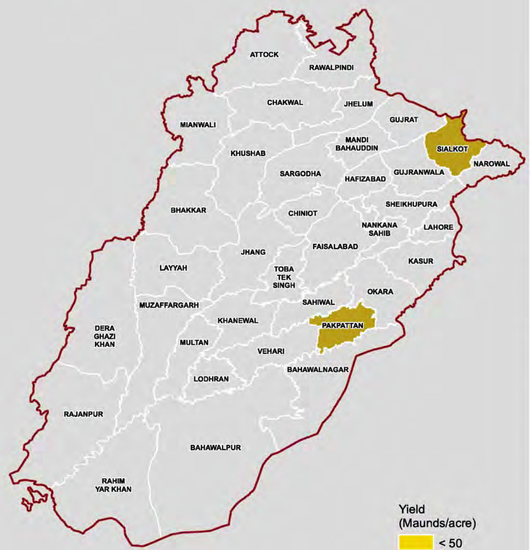
6%

NP + FYM

6%

NP + Micronutrients + FYM

2%



Map Legend

Administrative limits

- Country
- Province
- District

About Map

The map shows yield of Maize under different scenarios of fertilizer use adopted by farmers in Punjab. These eight scenarios inlucude N only; NP; NPK; NP + MN; NP + FYM; NP + MN + FYM; NPK + MN ; NPK + MN + FYM.

where:
N = Nitrogen
P = Phosphorus
K = Potassium
FYM = Farm Yard Manure
MN = Micronutrients

The map shows a variable trend of usage of different nutrient combination by farmers in Punjab. In addition to NP, application of K or micronutrients alone or in combination improved maize yield. However, the addition of a nutrient to a given scenario of nutrient/fertilizer use may not necessarily have impact on yield.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA 2015

Map Scale and Datum

Datum: WGS 84

0 150 300 450 600
Kilometers

Date: 09 May 2016
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_ Punjab_maizescen_17.3_20150831

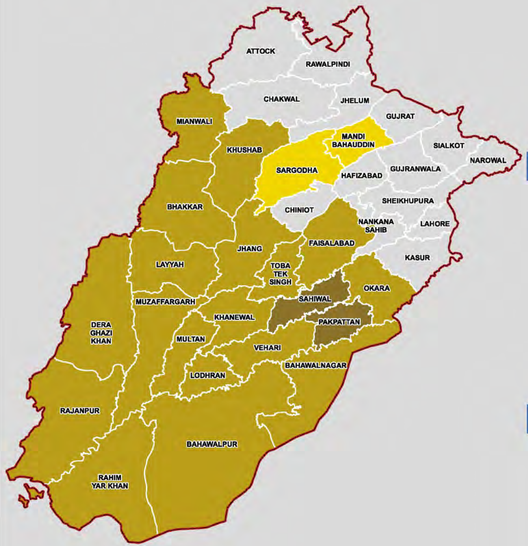
N

YIELD OF COTTON UNDER DIFFERENT SCENARIOS OF FERTILIZER USE IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA

NP

31%

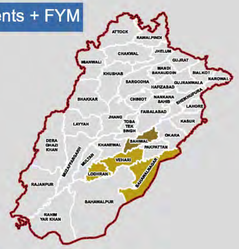


NP + Micronutrients

21%

NPK + Micronutrients + FYM

20%



N

10%

NP + FYM

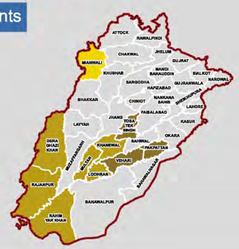
5%

NPK

5%

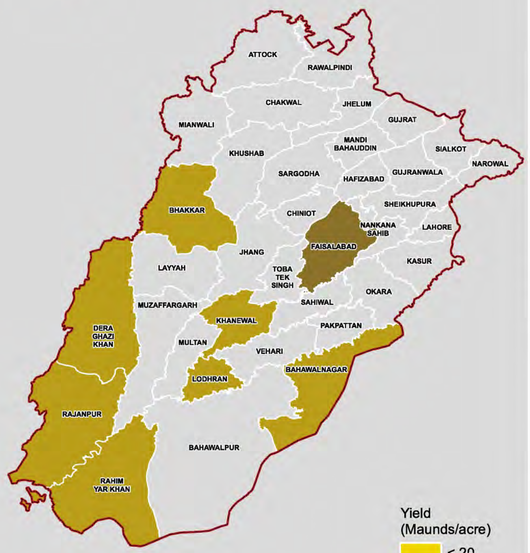
NPK + Micronutrients

5%



NP + Micronutrients + FYM

3%



Map Legend

Administrative limits

- Country
- Province
- District

About Map

The map shows yield of Cotton under different scenarios of fertilizer use adopted by farmers in Punjab. These eight scenarios iniuclude N only; NP; NPK; NP + MN; NP + FYM; NP + MN + FYM; NPK + MN ; NPK + MN + FYM.

where:
N = Nitrogen
P = Phosphorus
K = Potassium
FYM = Farm Yard Manure
MN = Micronutrients

The map shows a variable trend of usage of different nutrient combination by farmers in the Punjab, as NP (31%) followed by NP + Micronutrients and NPK + Micronutrients + FYM each by 20% of the farmers. However, the addition of a nutrient to a given scenario of nutrient/fertilizer use did not have a clear impact on seed cotton yield.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA 2015

Map Scale and Datum

Datum: WGS 84

0 160 320 480 640
Kilometers

Date: 09 May 2016
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_ Punjab_cottscen_17.4_20150831

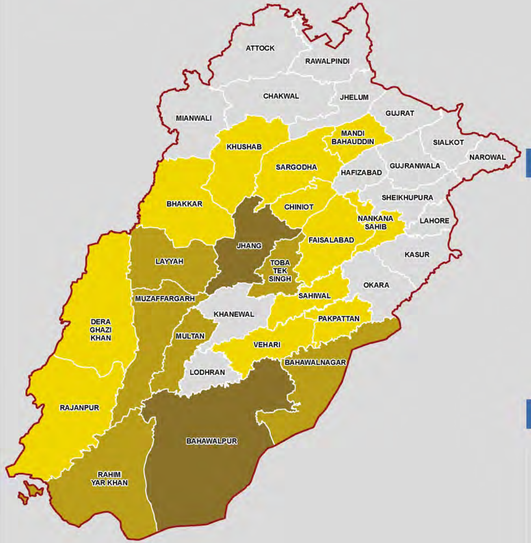
N

YIELD OF SUGARCANE UNDER DIFFERENT SCENARIOS OF FERTILIZER USE IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA

NP

36%

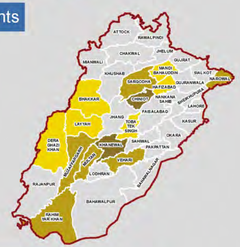


NPK

24%

NP + Micronutrients

12%

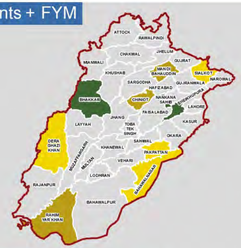


NP + FYM

12%

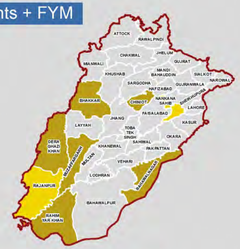
NPK + Micronutrients + FYM

5%



NP + Micronutrients + FYM

5%

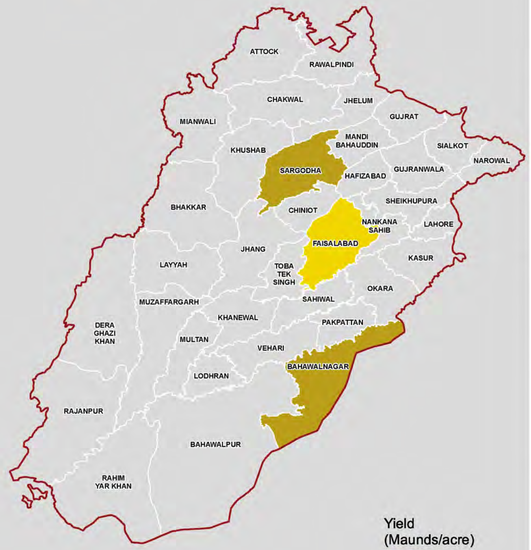


NPK + Micronutrients

4%

N

2%



Map Legend

Administrative limits

- Country
- Province
- District

About Map

The map shows yield of Sugarcane under different scenarios of fertilizer use adopted by farmers in Punjab. These eight scenarios inlucude N only; NP; NPK; NP + MN; NP + FYM; NP + MN + FYM; NPK + MN ; NPK + MN + FYM.

where:
N = Nitrogen
P = Phosphorus
K = Potassium
FYM = Farm Yard Manure
MN = Micronutrients

The map shows that majority of the farmers (36%) use NP followed by NPK (24%). Use of K, micronutrients and FYM alone or in combination has a definite role in enhancing Sugarcane yield. However, the addition of a nutrient to a given scenario of nutrient/fertilizer use may not necessarily have impact on yield.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA 2015

Map Scale and Datum

Datum: WGS 84

0 160 320 480 640

Kilometers

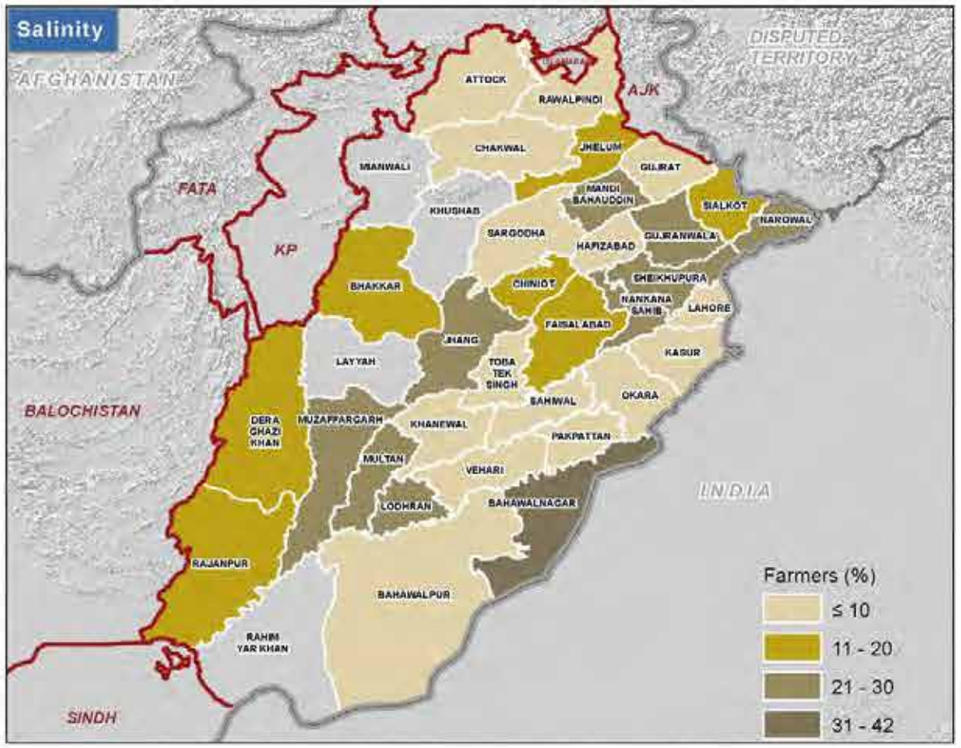
Date: 09 May 2016

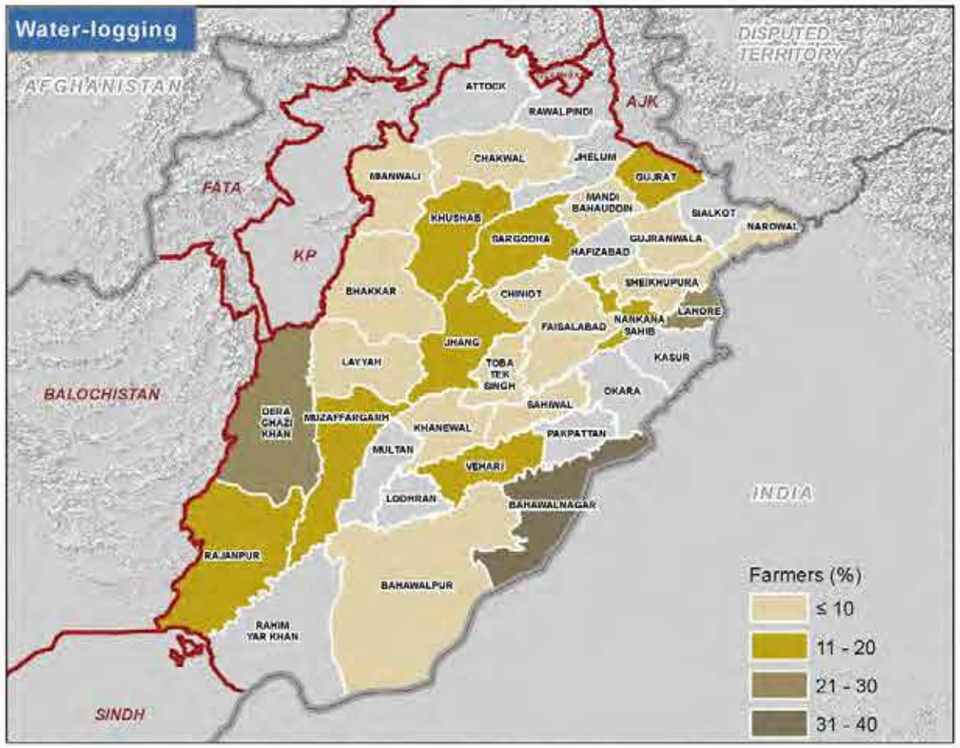
Created by: IM Unit, FAO Pakistan

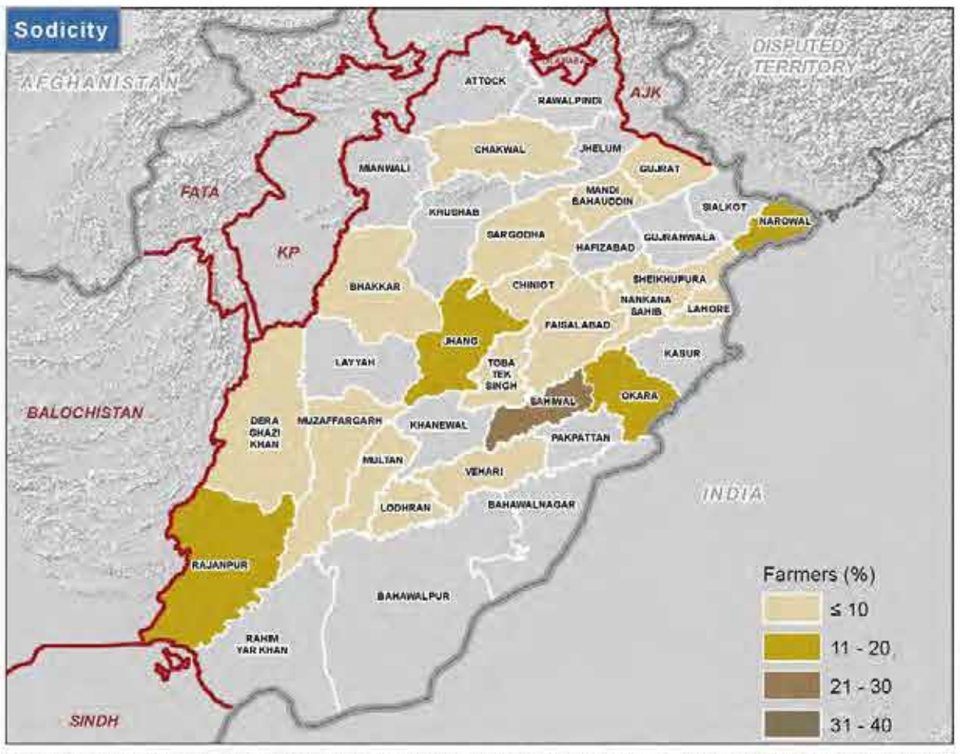
Map Number: PAK_Soil Fertility Atlas_ Punjab_Sugscen_17.5_20150831

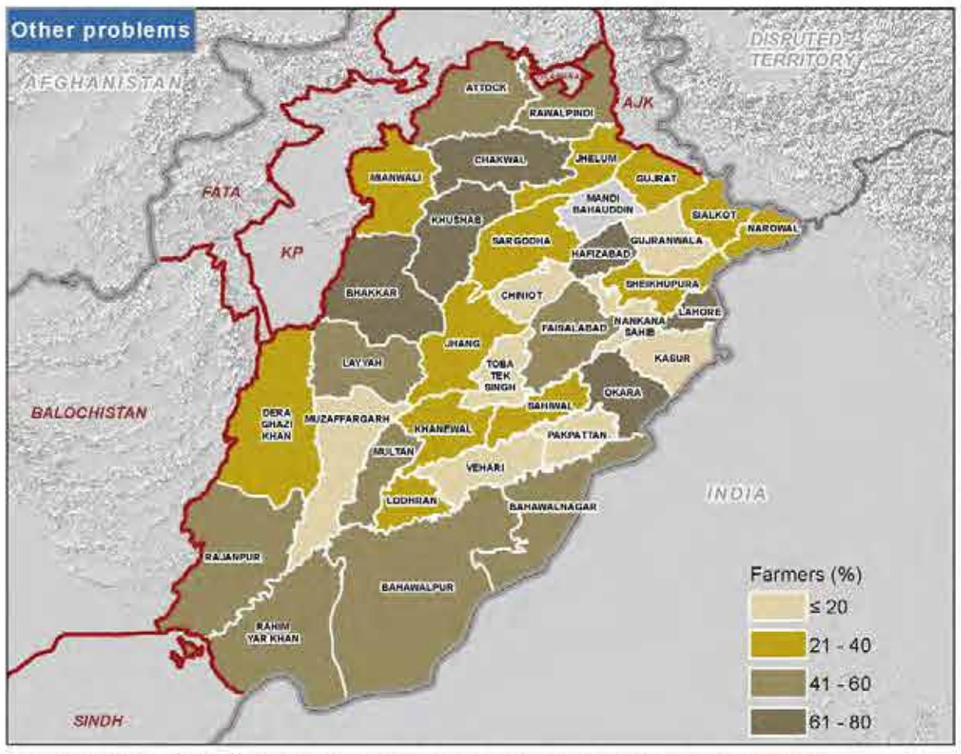
N

MAJOR SOIL PROBLEMS









Map Legend

Administrative limits

- Country
- Province
- District

About Map

This map shows the information about various soil related problems based on the findings of Rapid Fertilizer Use Assessment (2015). The occurrence of soil salinity problem even in the irrigated farms is matter of concern. Other problems canal water shortage, high prices of fertilizers, low commodity prices, load shedding etc. also add to the constraints affecting crop productivity.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA 2015

Map Scale and Datum

Nominal scale: 1:5,946,833 at A3

Datum: WGS 84

N

0 75 150 225 300

Kilometers

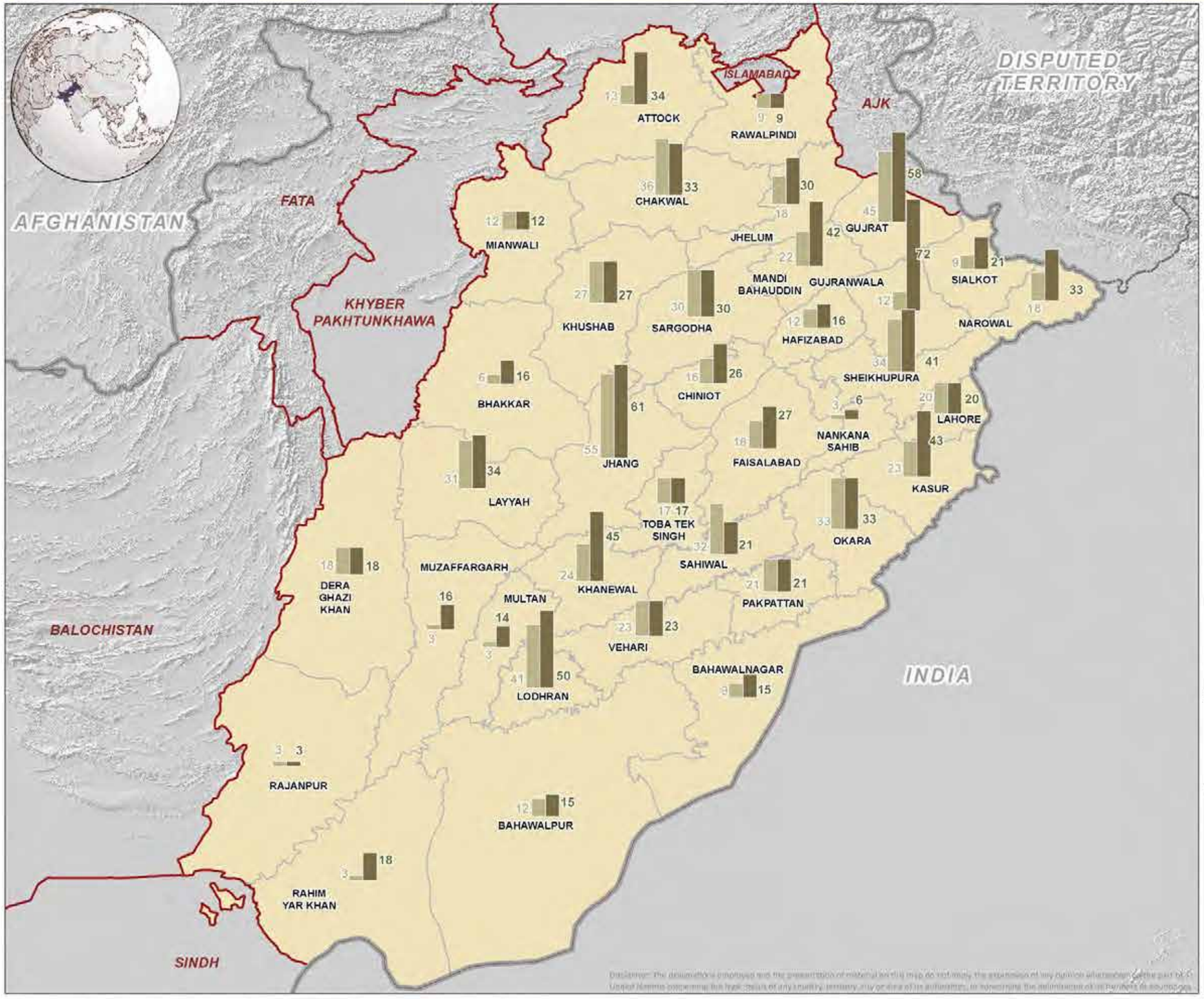
Date: 27 Jan 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_SoilProbl_16.1_20150629

SOIL AND WATER TESTING FACILITIES AVAILED BY FARMERS

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Farmers who availed water tests (%)

Farmers who availed soil tests (%)

About Map

The map shows percentage of farmers who availed soil and water testing facility. There is a dire need to enhance farmers' awareness regarding significance of soil/water/plant/fertilizer testing w.r.t. resource use, and also to strengthen the Quality Testing Labs.

Data Sources

FAO, GAUL, Government of the Punjab, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

Date : 27 Jan 2016

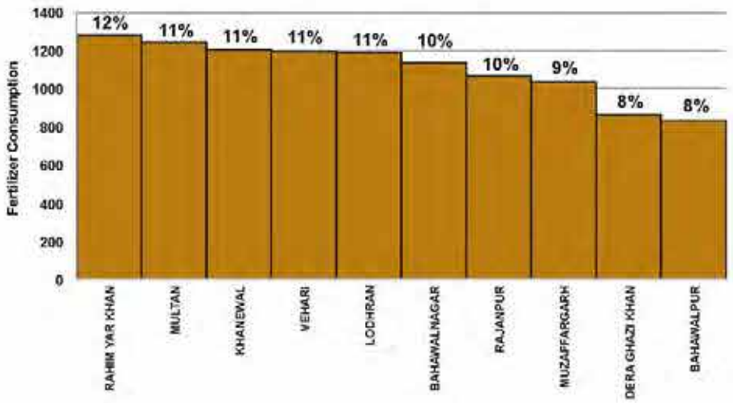
Created by: IM unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_Soiltest_16.2_20150529

REGION-WISE COMPARATIVE FERTILIZER CONSUMPTION IN PUNJAB

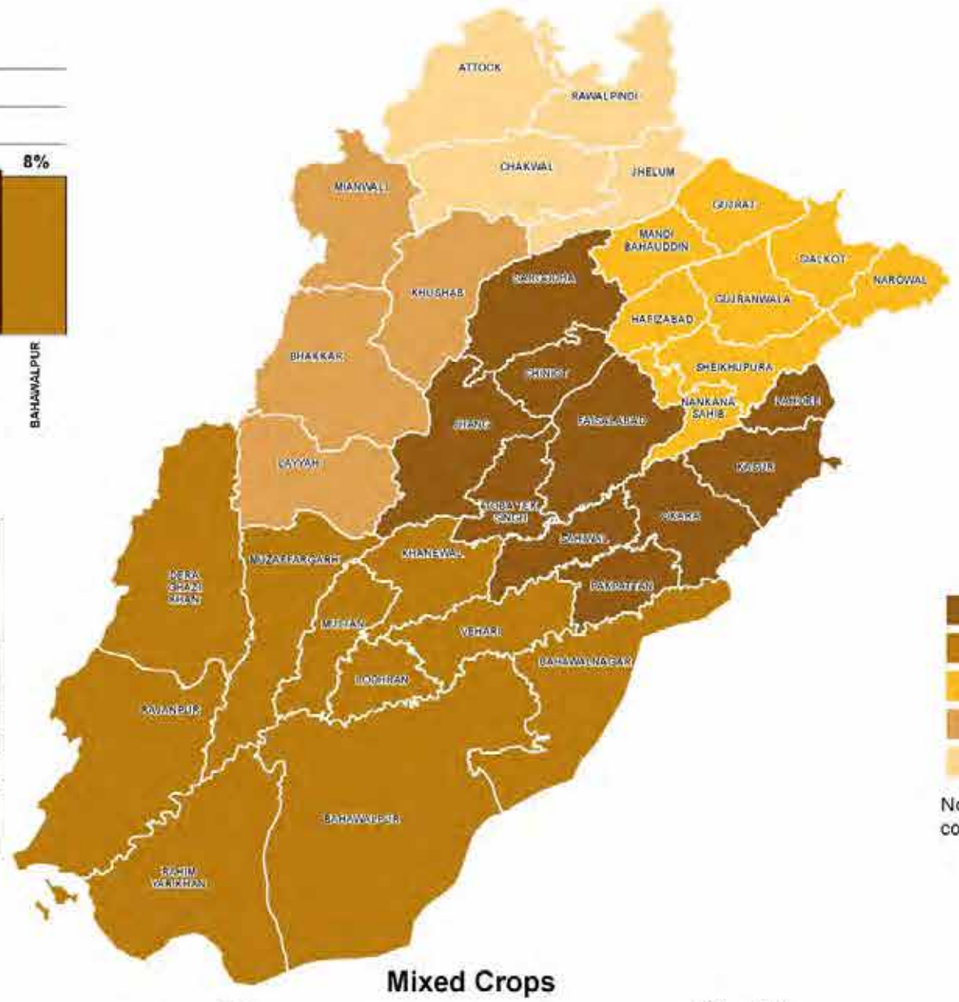
USAID FROM THE AMERICAN PEOPLE | USDA

Cotton-Wheat

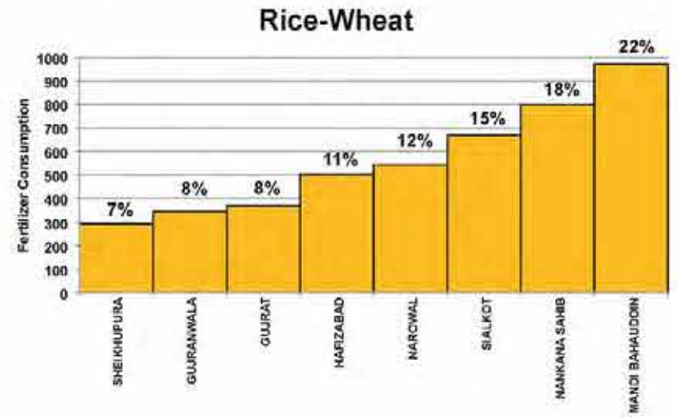


Region	Total consumption of fertilizer* (kg/acre)	Respondents
Mixed Crops	11,414	330
Cotton-Wheat	11,049	330
Rice-Wheat	4,491	264
Pulses-Wheat	3,188	132
Maize-Wheat- Oilseeds	1,331	132

*The accumulated consumption was calculated for Wheat, Rice, Maize, Cotton and Sugarcane, if grown in the same field in a year. How, actual usage will vary depending on the crop(s) sown.



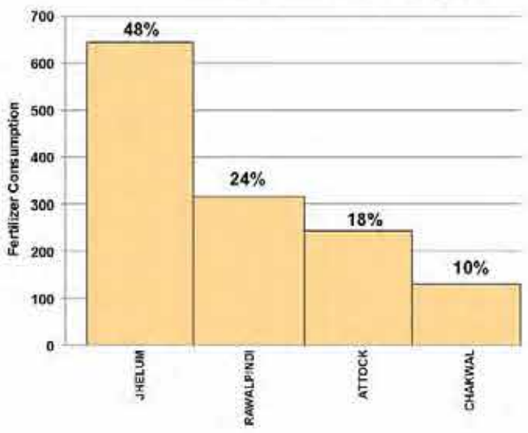
Rice-Wheat



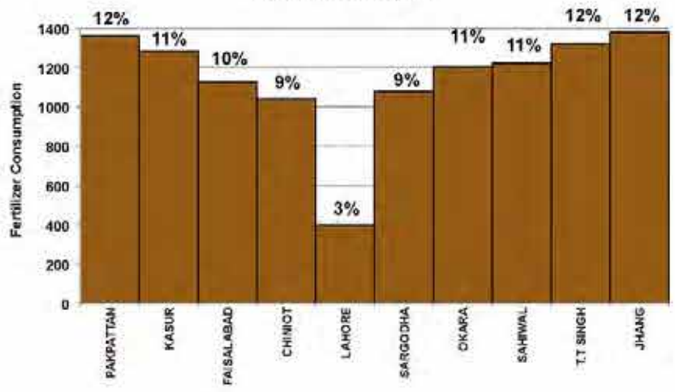
- Mixed Crops
- Cotton-Wheat
- Rice-Wheat
- Pulses-Wheat (Thal Area)
- Maize-Wheat-Oilseeds (Rainfed Area)

Note: The numbers in % above each bar represent each district's share in total consumption of fertilizer in the particular region.

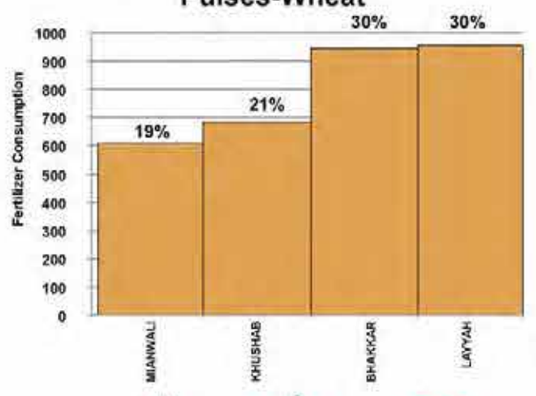
Maize-Wheat-Oilseeds



Mixed Crops



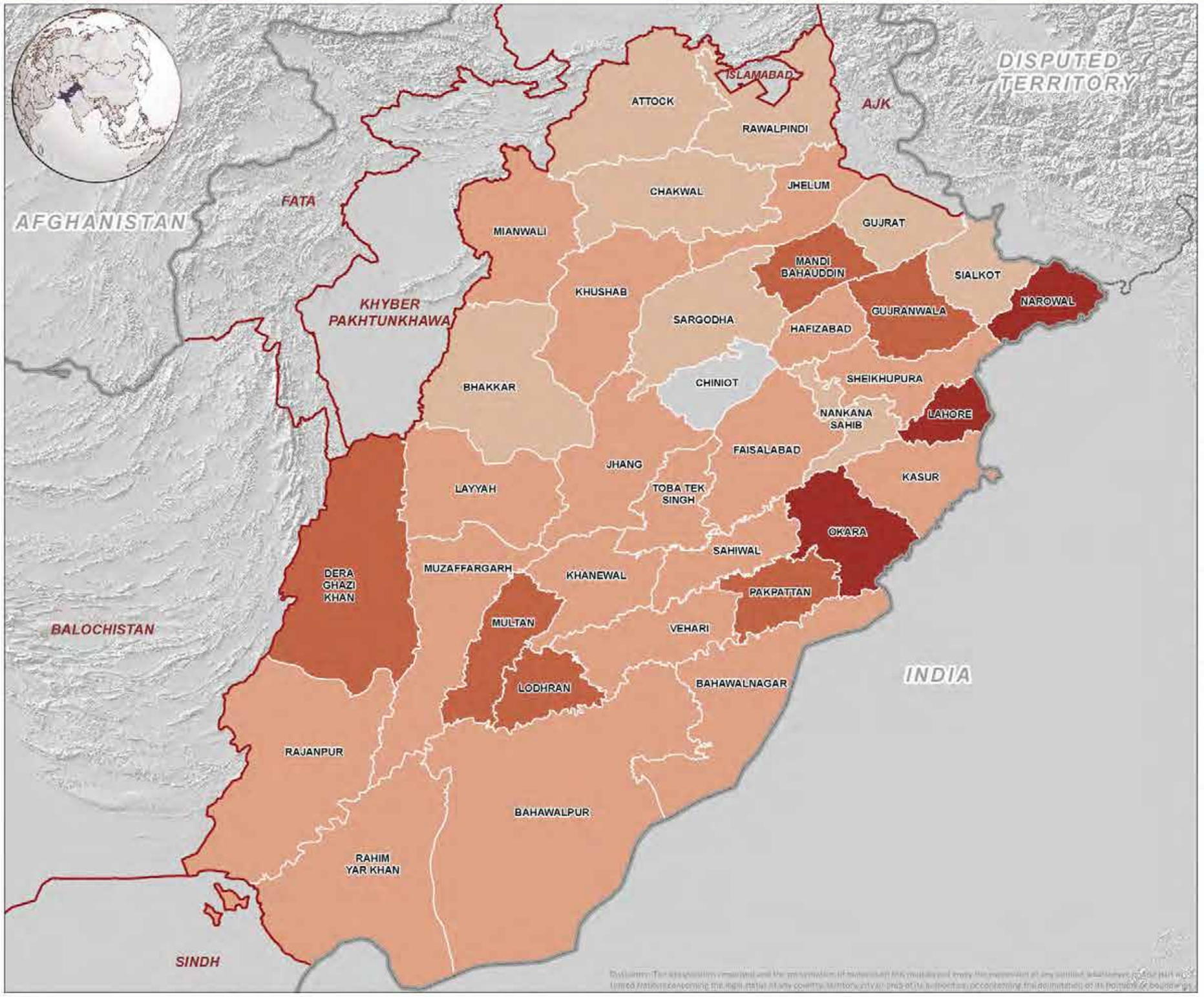
Pulses-Wheat



SECTION 3

MAPPING FERTILIZER OFFTAKE DATA

TOTAL OFFTAKE OF UREA



Map Legend

Administrative limits

- Country
- Province
- District

District-wise total offtake of Urea (kg/acre)

- ≤ 300
- 301 - 600
- 601 - 900
- 901 - 1200

About Map

This map shows overall total urea offtake for all five major crops if grown on a field in same year. However, actual usage will be variable and lesser depending on the crop(s) grown. The data indicates similar trends as the total use of urea inferred from RFUA. The higher offtake of urea in three districts (Narowal, Lahore and Okara) does not necessarily reflect its usage in these districts. The urea available in these districts is presumably consumed in the adjoining districts, and explains the comparable trends of NFDC offtake with the RFUA patterns.

Data Sources

FAO, GAUL, NFDC fertilizer offtake data (2012-2013)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

N

Datum: WGS 84

0 50 100 150 200

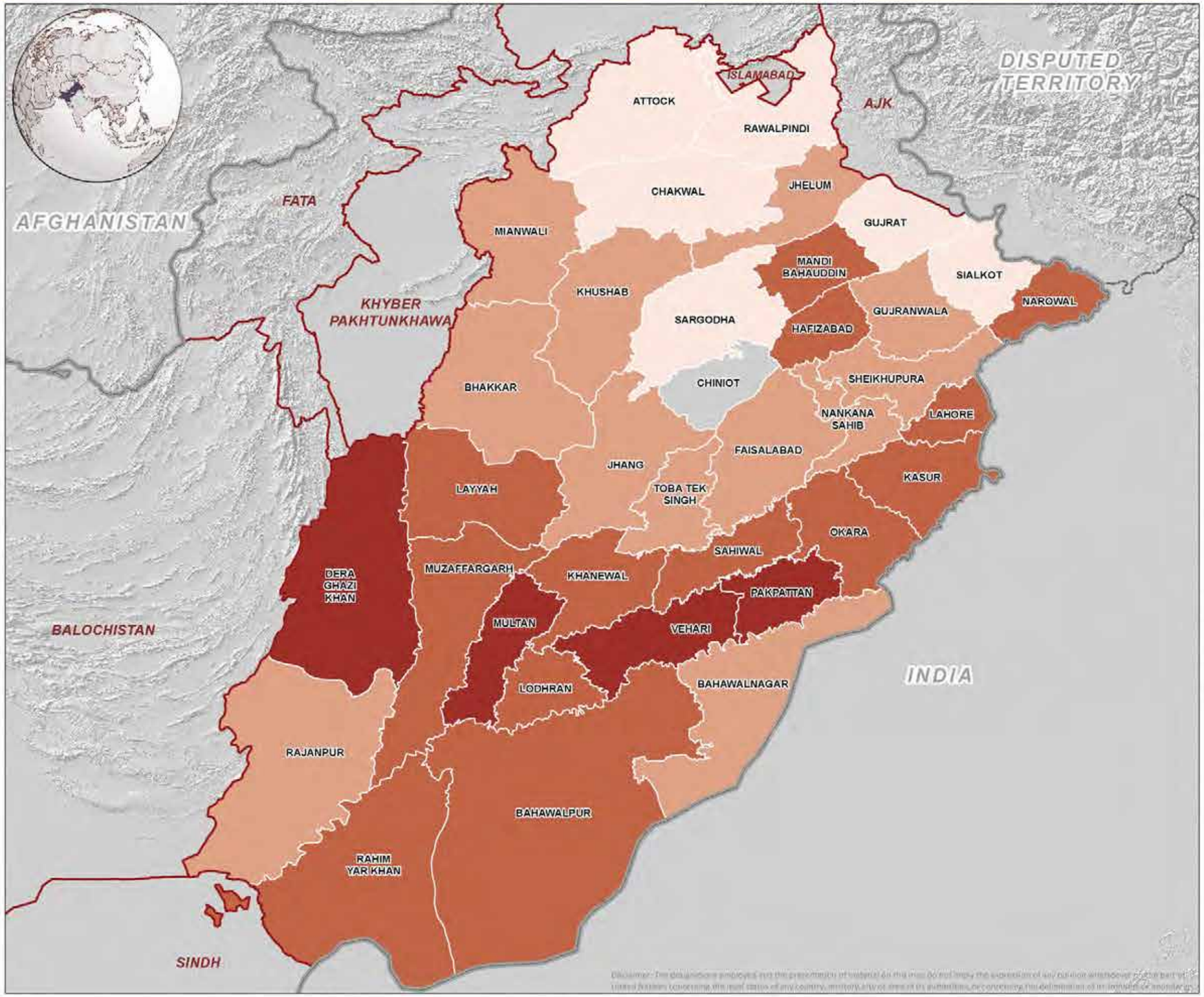
Kilometers

Date: 08 June 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_Urea _8.6_20150910

TOTAL OFFTAKE OF DI-AMMONIUM PHOSPHATE (DAP)



Map Legend

Administrative limits

- Country
- Province
- District

District-wise total offtake of DAP (kg/acre)

- ≤ 50
- 51 - 100
- 101 - 150
- 151 - 200

About Map

This map shows overall total DAP offtake for all five major crops if grown on a field in same year. However, actual usage will be variable and lesser depending on the crop(s) grown. The data indicates relatively higher DAP usage in cotton growing areas of Southern Punjab. The overall trends are similar as the total use of DAP inferred from RFUA.

Data Sources

FAO, GAUL, NFDC fertilizer offtake data (2012-2013)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

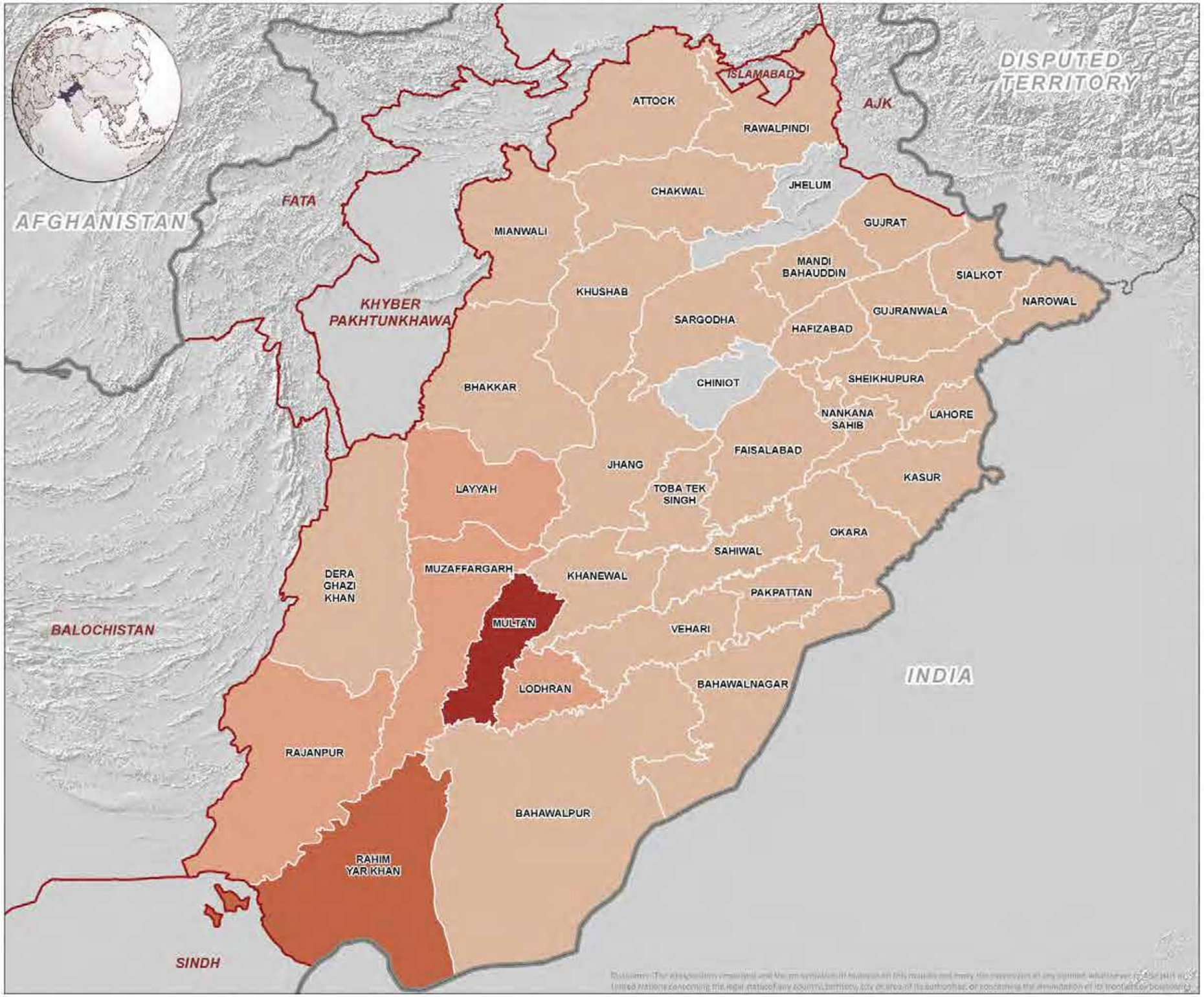
Date: 08 June 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_DAP _10.6_20150910

TOTAL OFFTAKE OF CALCIUM AMMONIUM NITRATE (CAN)

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

District-wise total Offtake of CAN (kg/acre)

- ≤ 50
- 51 - 100
- 101 - 150
- 151 - 200
- No significant data

About Map

This map shows overall total CAN offtake for all five major crops if grown on a field in same year. However, actual usage will be variable and lesser depending on the crop(s) grown. The overall CAN use is low in most of the districts except for a few cotton growing districts in Southern Punjab. Further, higher use of CAN observed in four districts in mixed cropping zone inferred from RFUA is not in accordance with the total CAN offtake.

Data Sources

FAO, GAUL, NFDC fertilizer offtake data (2012-2013)

Map Scale and Datum

N

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

0 50 100 150 200

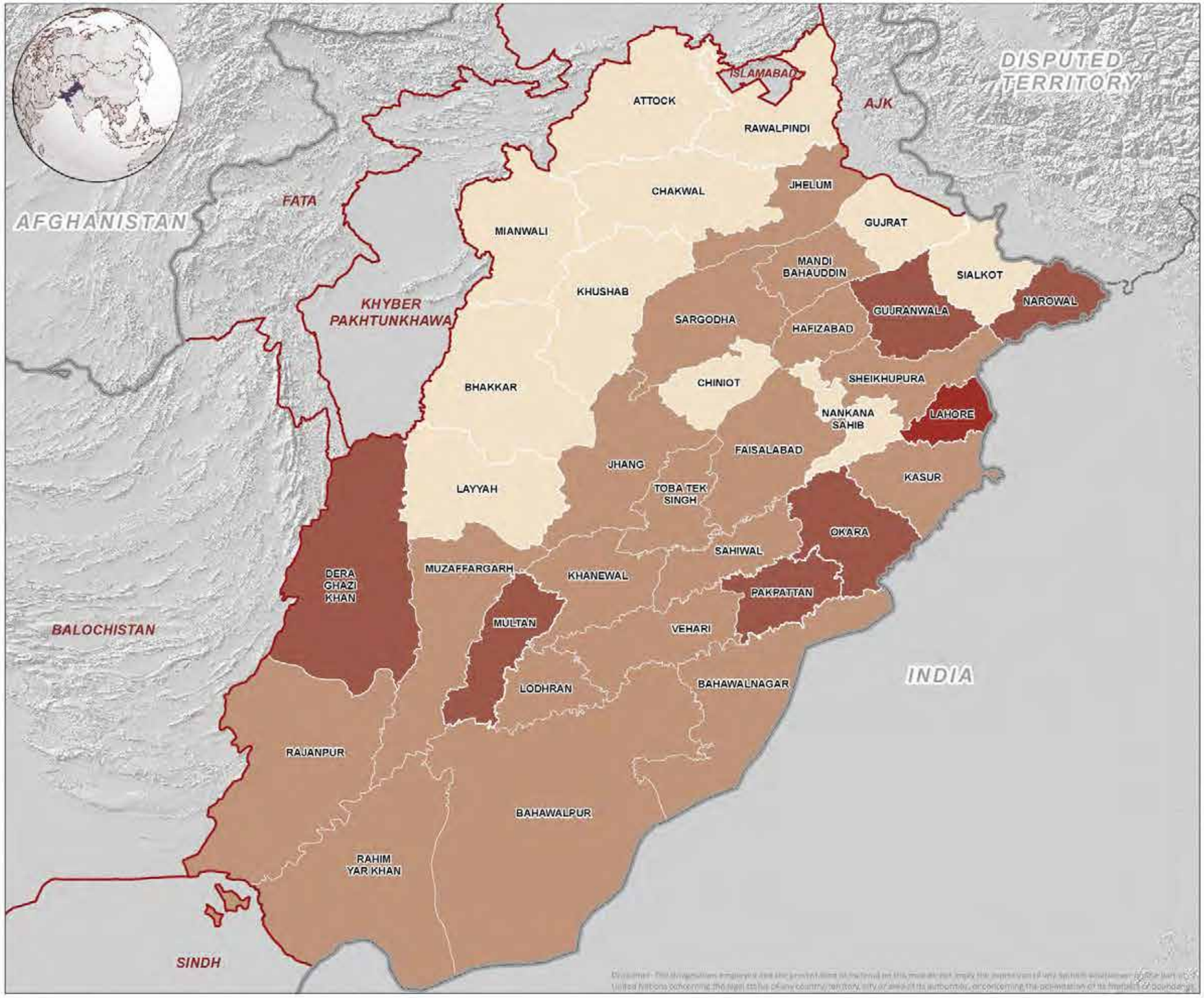
Kilometers

Date: 08 June 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_CAN _9.6_20150910

DISTRICT-WISE USE OF NITROGEN



Map Legend

Administrative limits

- Country
- Province
- District

Offtake of Nitrogen (Kg/acre)

- ≤ 35.0
- 35.1 - 70.0
- 70.1 - 105.0
- 105.1 - 135.0

About Map

The map shows total offtake of Nitrogen irrespective of the fertilizer source in each district. Relatively lower N offtake is obvious in Thal and rainfed areas. Overall, medium offtake is seen in most districts of the Punjab; while high offtake in districts like Lahore, may not necessarily reflect its usage in the same district.

Data Sources

FAO, GAUL, NFDC Annual Fertilizer Review (2012-2013)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

N

Datum: WGS 84

0 50 100 150 200

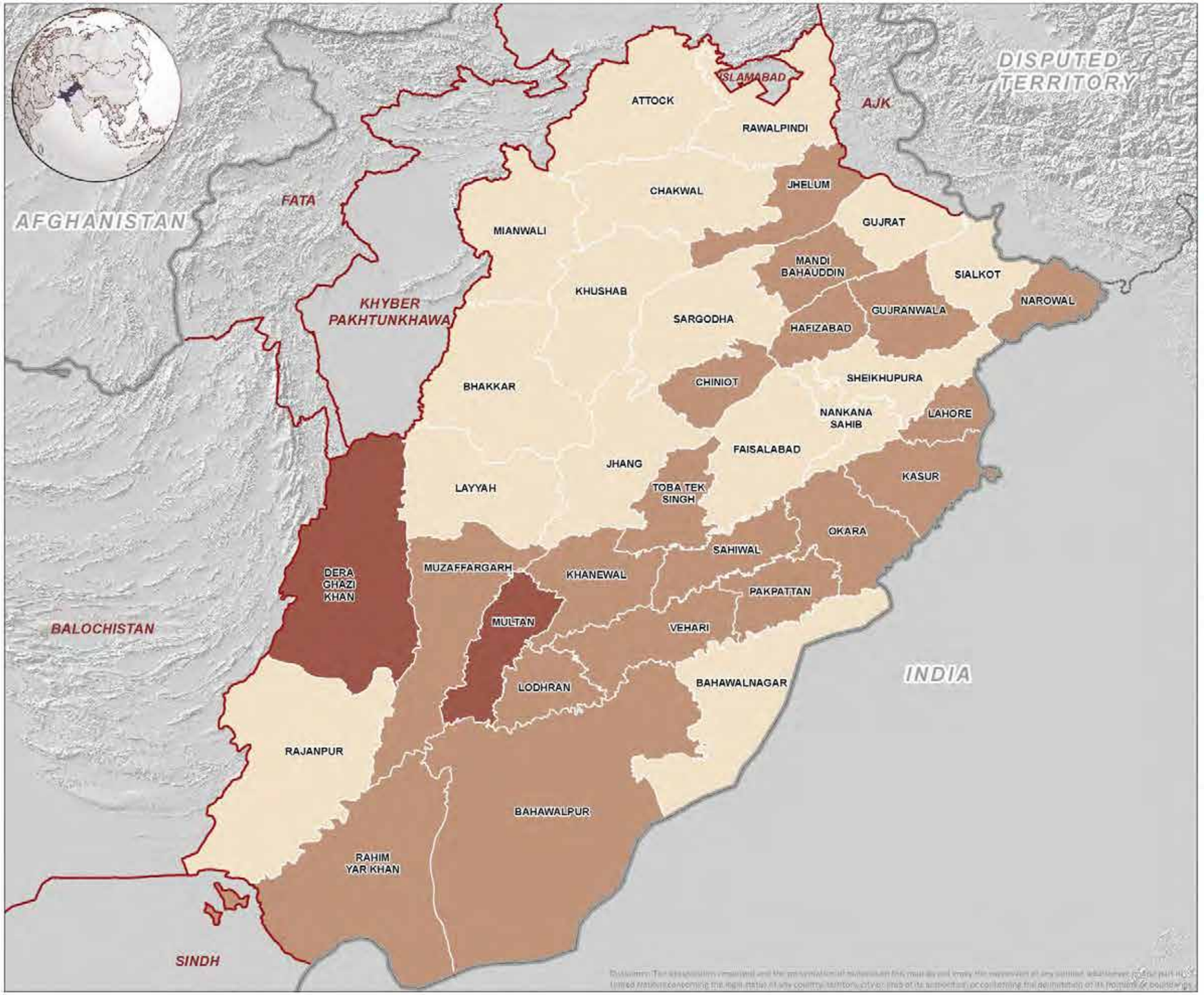
Kilometers

Date: 08 June 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_N_11.1_20150910

DISTRICT-WISE USE OF PHOSPHORUS



Map Legend

Administrative limits

- Country
- Province
- District

Offtake of Phosphorus (Kg/acre)

- ≤ 10.0
- 10.1 - 20.0
- 20.1 - 30.0

About Map

The map shows offtake of Phosphorus in each district. Higher P offtake is clearly shown in most cotton growing districts followed by some districts each in mixed cropping and rice zones.

Data Sources

FAO, GAUL, NFDC Annual Fertilizer Review (2012-2013)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

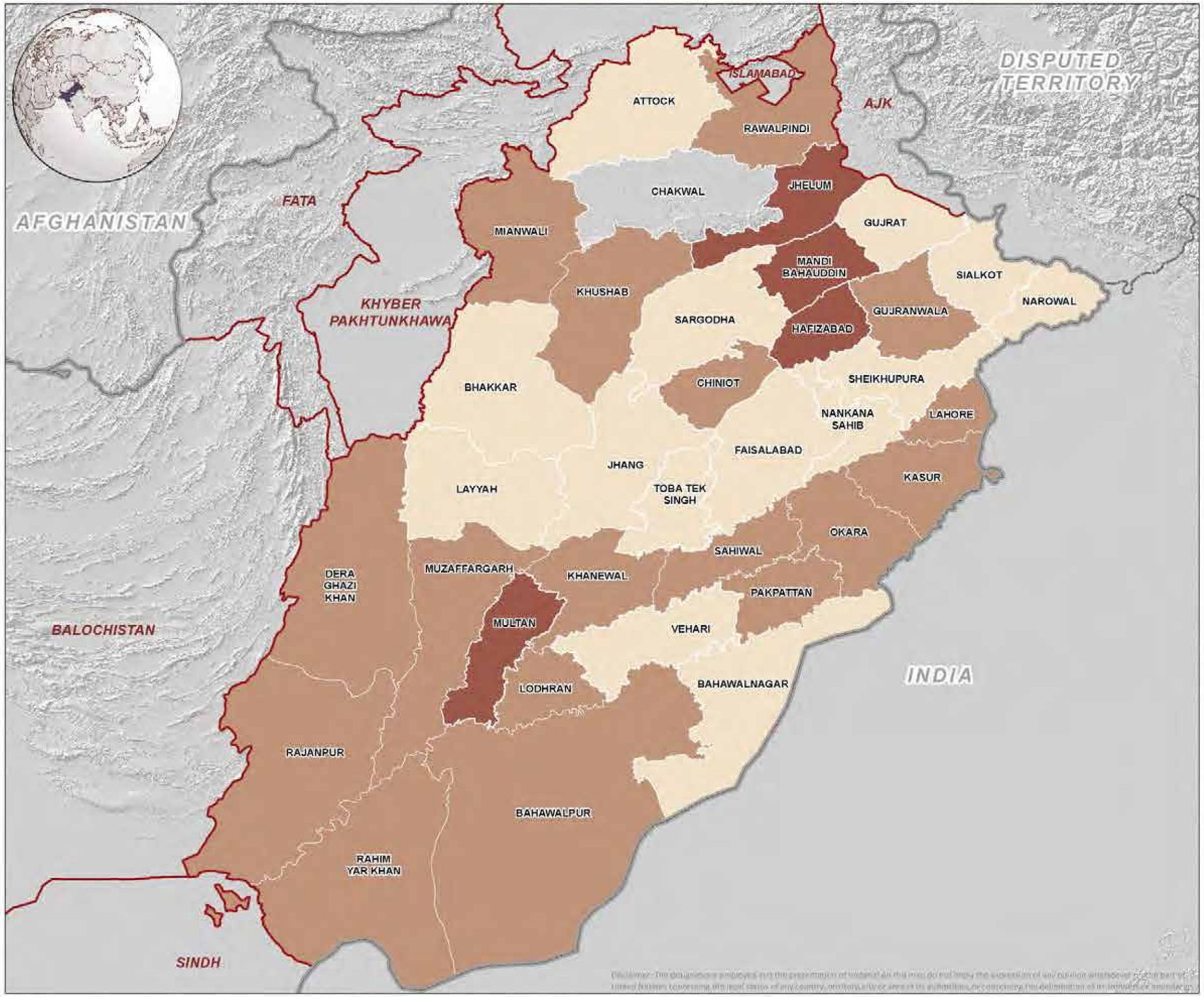
Date: 13 June 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_P_11.2_20150910

DISTRICT-WISE USE OF POTASSIUM

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Offtake of Potassium (Kg/acre)

- < 0.20
- 0.21 - 0.40
- 0.41 - 0.62
- No significant data

About Map

The map shows offtake of Potassium in each district. Relatively higher offtake is indicated in Jhelum, Mandi-Bahauddin, and Hafizabad districts followed by core cotton growing areas. In most rice and mixed cropping districts K offtake is on the lower side.

Data Sources

FAO, GAUL, NFDC Annual Fertilizer Review (2012-2013)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

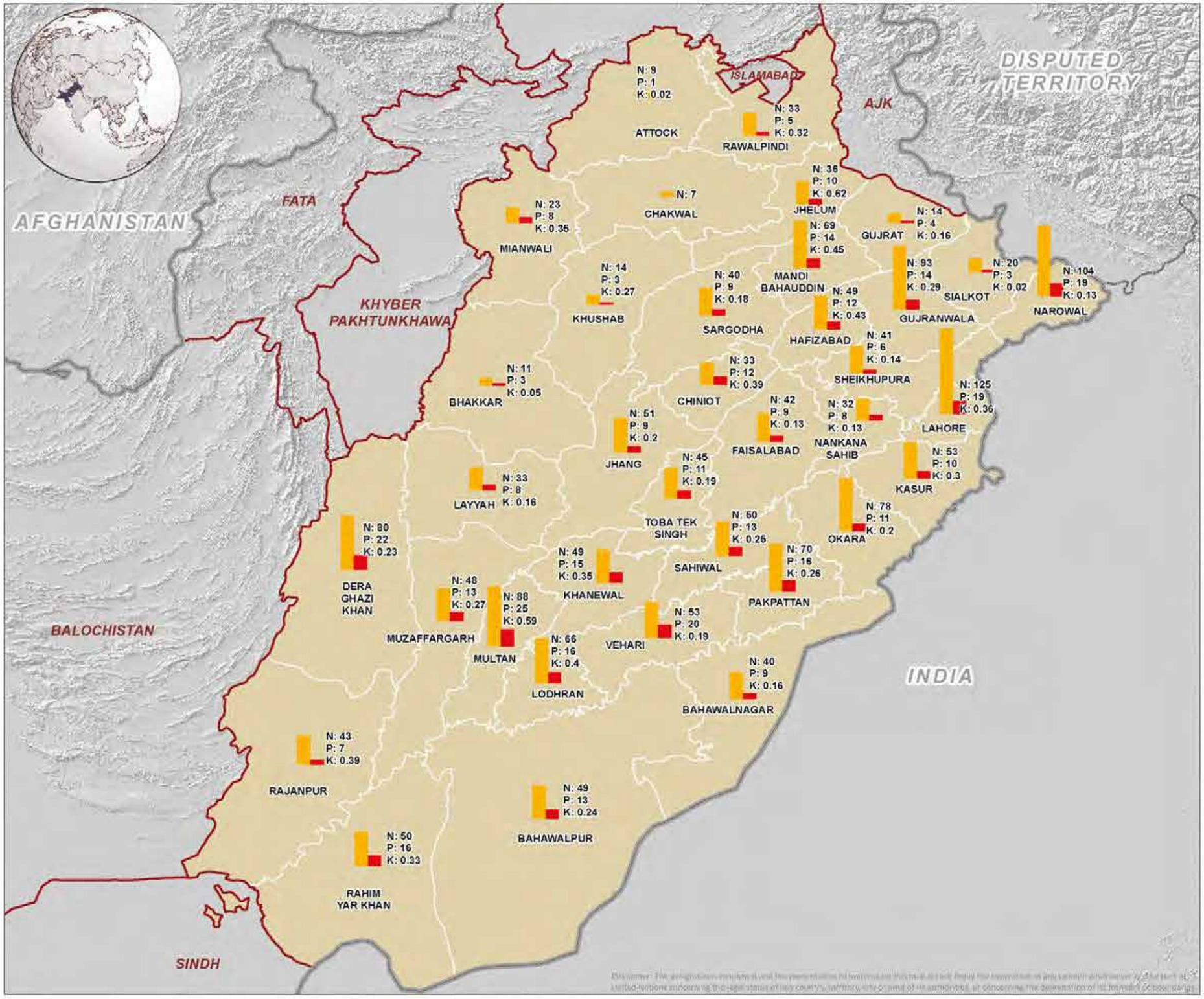
Date: 13 June 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_K _66_20150910

NPK USAGE RATES IN PUNJAB

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

NP rates (kg/acre)

- Nitrogen
- Phosphorus

About Map

The map shows relative usage of NPK, indicating that invariably all farmers use N and P but with a highly variable N:P ratio. Further, use of K is not common and needs attention. Similar trends regarding K use are evident from RFUA data. Since K use rate is non-significant, so it has been shown in the map legend.

Data Sources

FAO, GAUL, NFDC Annual Fertilizer Review (2012-2013)

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

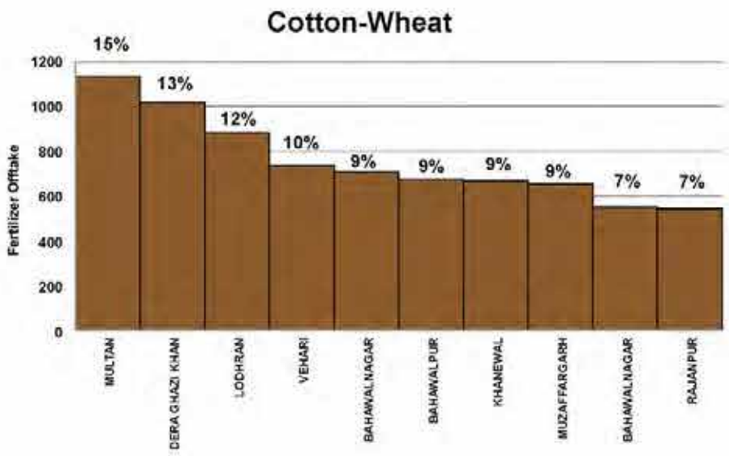
Kilometers

Date: 13 June 2016

Created by: IM Unit, FAO Pakistan

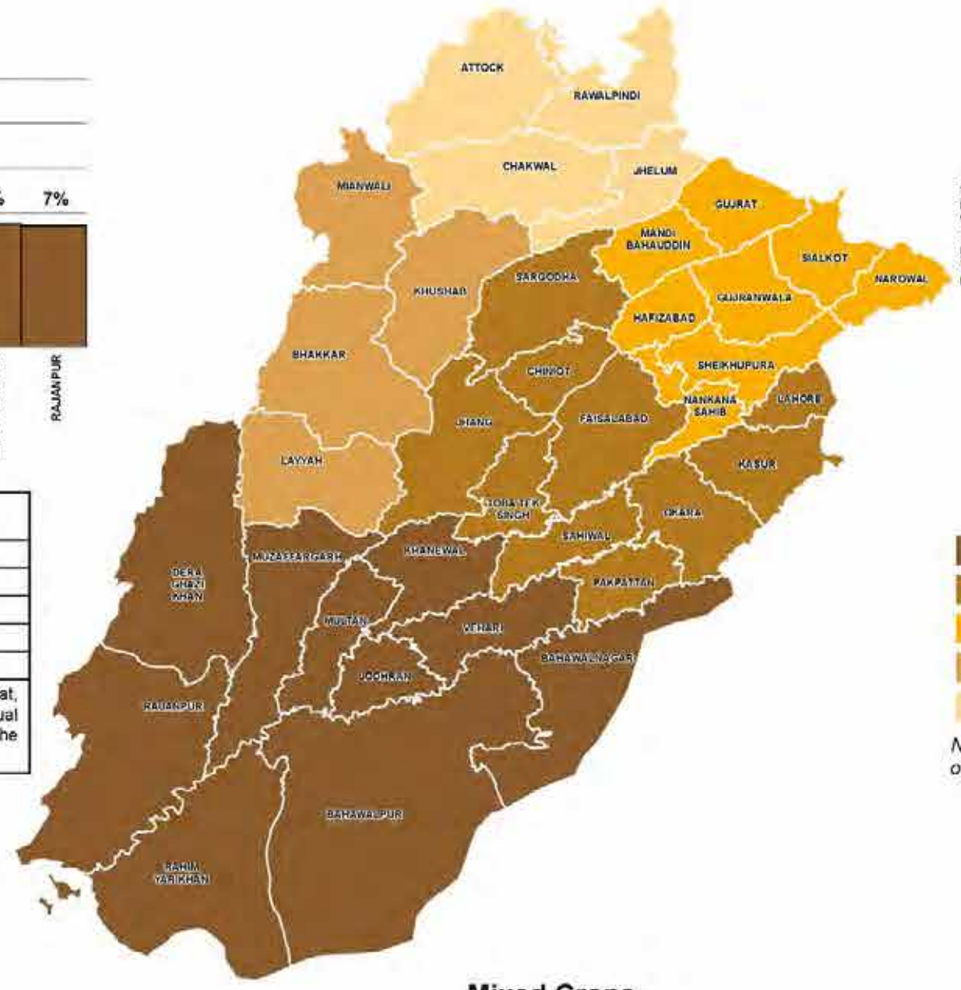
Map Number: PAK_Soil Fertility Atlas_Punjab_NPK _11.4_20150910

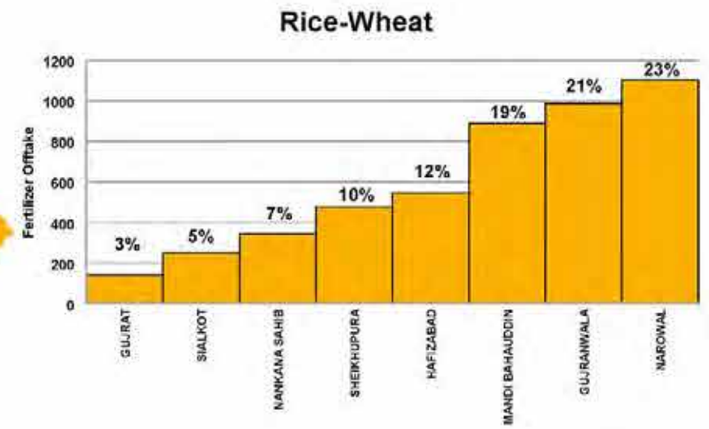
REGION-WISE COMPARATIVE FERTILIZER OFFTAKE IN PUNJAB



Region	Total fertilizer offtake*
Cotton-Wheat	7,563
Mixed Crops	6,818
Rice-Wheat	4,730
Pulses-Wheat	1,655
Maize-Wheat-Oilseeds	749

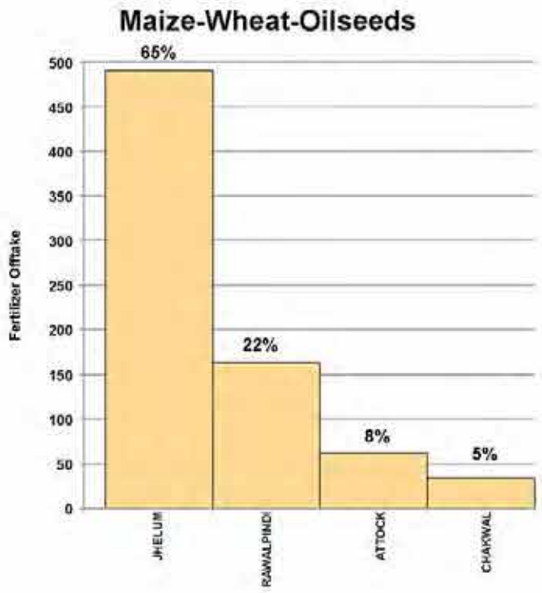
*The total offtake was disaggregated from NFDC offtake data on area basis for Wheat, Rice, Maize, Cotton and Sugarcane, if grown in the same field in a year. However, actual usage will vary depending on the crops(s) sown. This is to note that no area for the selected commodities in Mixed Crops was reported in Chiniot district.

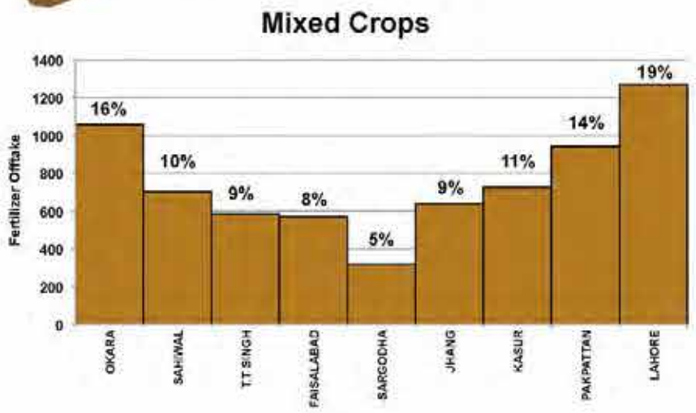


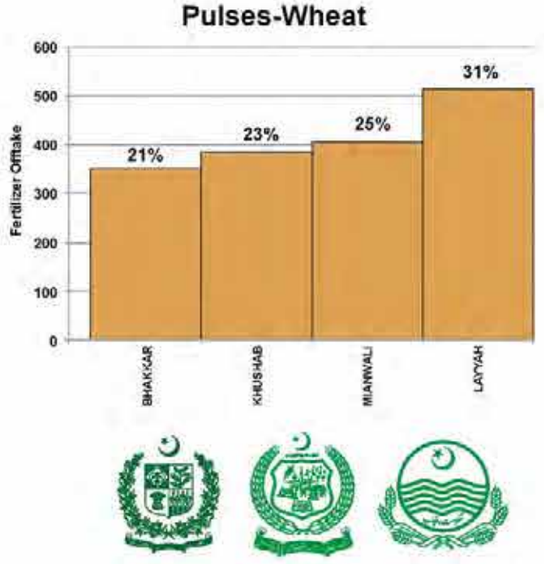


- Cotton-Wheat
- Mixed Crops
- Rice-Wheat
- Pulses-Wheat (Thal Area)
- Maize-Wheat-Oilseeds (Rainfed Area)

Note: The numbers in % above each bar represent each district's share in total offtake of fertilizer in the particular region.



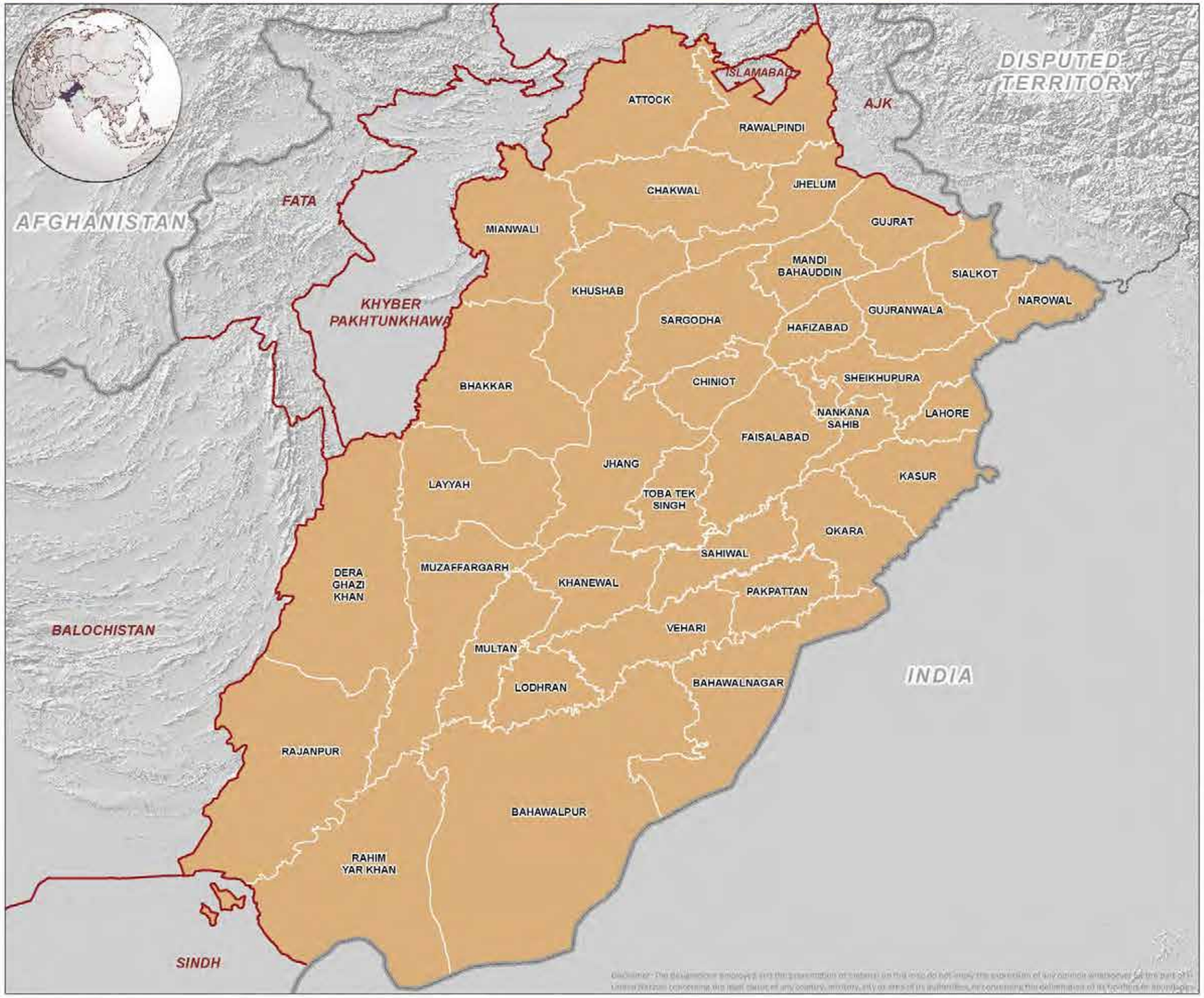




SECTION 4

SOIL FERTILITY STATUS MAPPING

DISTRICT-WISE AVERAGE pH



Map Legend

Administrative limits

- Country
- Province
- District

pH value

- > 7.5

About Map

This map shows average pH of the soils in each district. Overall, invariably the soils are alkaline; the pH values may be in the high (> 9) range in areas where salinity problem exists. For details, please see Annexure – IV.

Data Sources

FAO, GAUL, Fauji Fertilizer Company Limited (FFCL), Rawalpindi

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

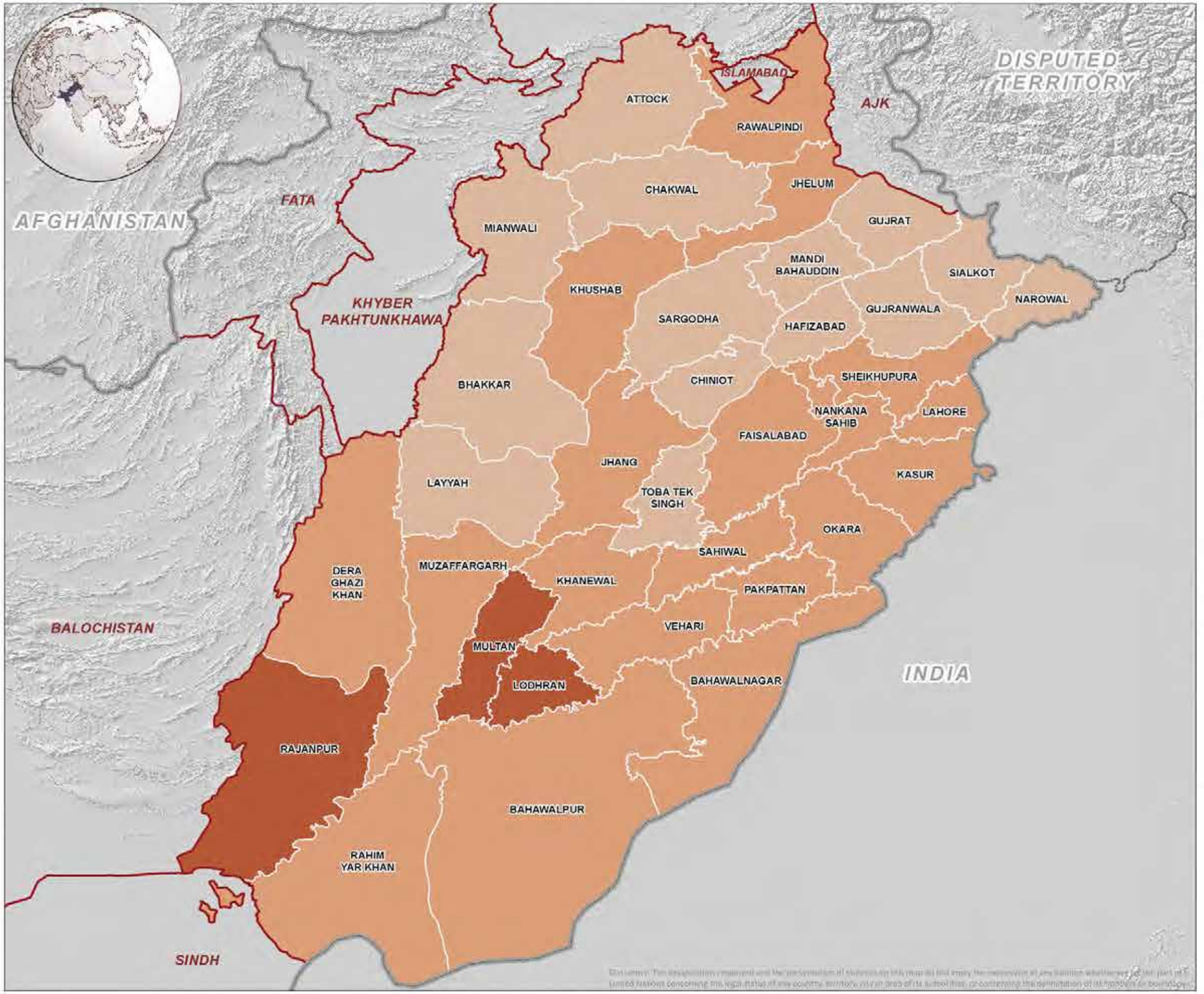
Date: 11 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_pH _15.1_20150910

DISTRICT-WISE AVERAGE ELECTRICAL CONDUCTIVITY (EC)

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

EC value (dSm^{-1})

- ≤ 0.51
- 0.52 - 1.00
- 1.01 - 1.50

About Map

This map shows soil salinity status (EC 1:2.5, dSm^{-1}) of each district. Southern Punjab appears to be more affected. The trend of salt buildup in the soils of irrigated lands is evident. For details, please see Annexure – IV.

Data Sources

FAO, GAUL, Fauji Fertilizer Company Limited (FFCL), Rawalpindi

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

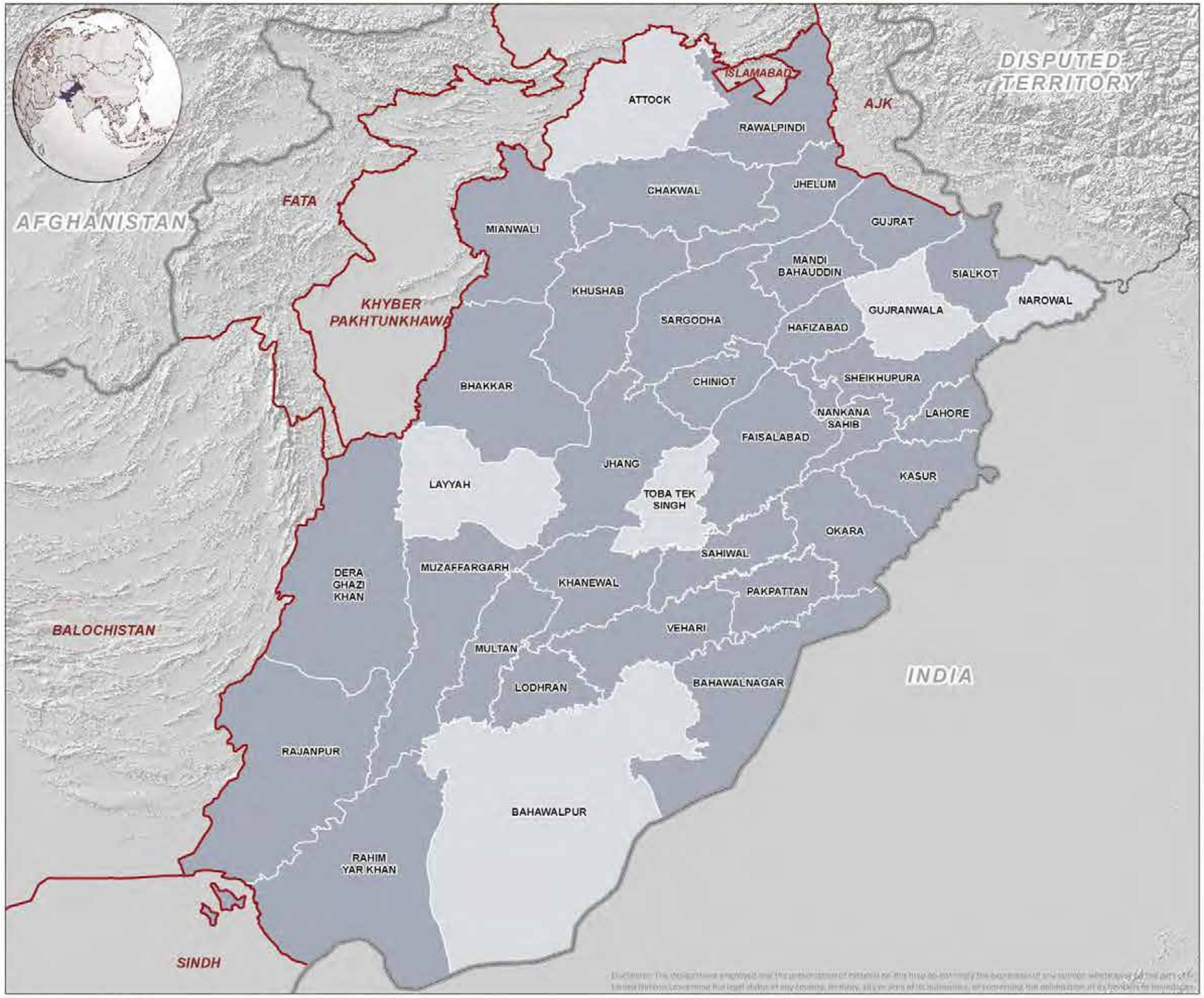
Kilometers

Date: 11 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_ECr _15.2_20150910

DISTRICT-WISE AVERAGE ORGANIC MATTER CONTENT



Map Legend

Administrative limits

- Country
- Province
- District

Organic Matter (%)

- ≤ 0.5
- 0.5-1.0

About Map

This map shows average organic matter content of soils in each district. Invariably the soils are low in organic matter that reflects low fertility status.
For details, please see Annexure – IV.

Data Sources

FAO, GAUL, Fauji Fertilizer Company Limited (FFCL), Rawalpindi

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

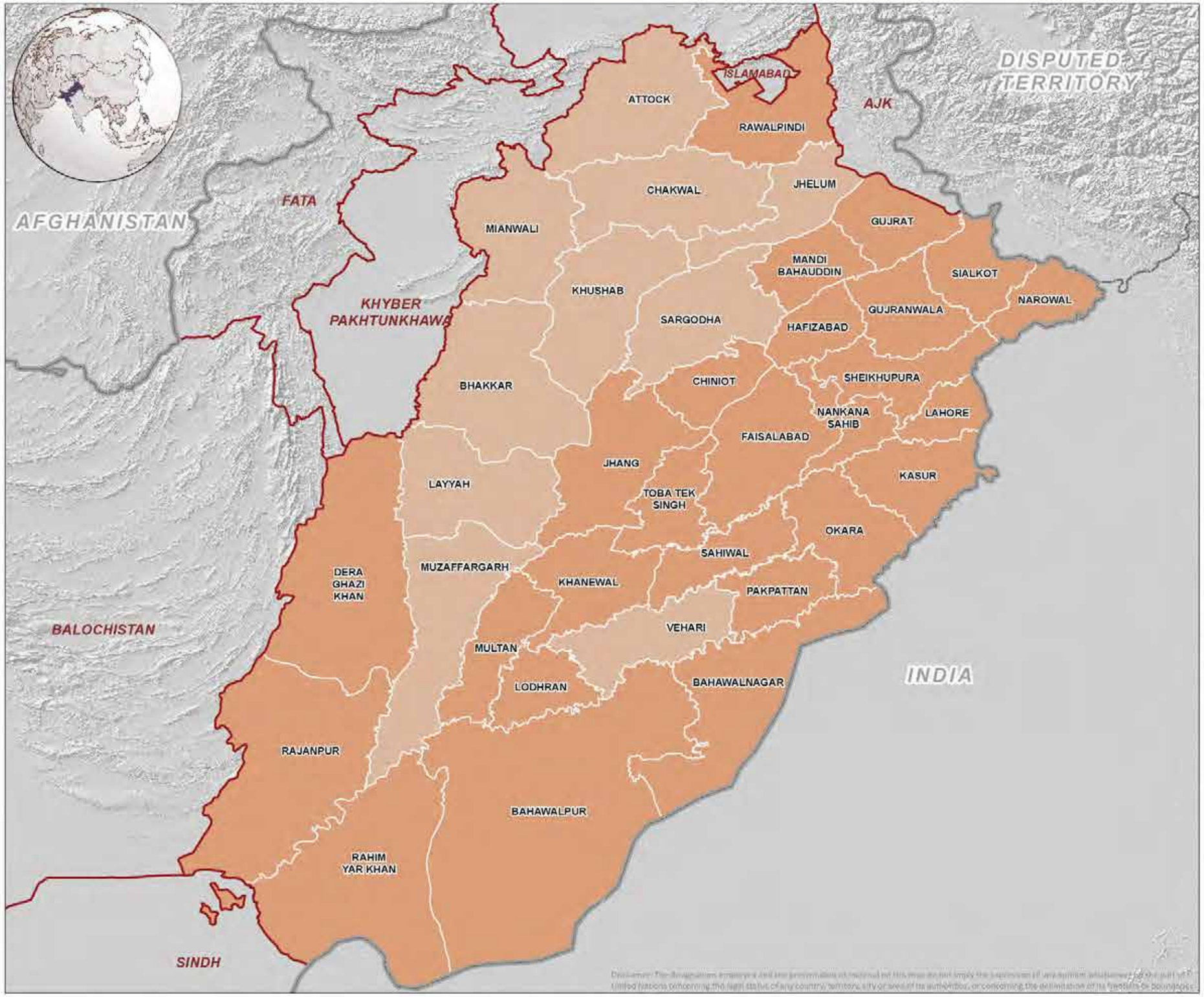
Date: 11 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_OMc _15.4_20150910

DISTRICT-WISE AVERAGE AVAILABLE PHOSPHORUS

USAID FROM THE AMERICAN PEOPLE | USDA



Map Legend

Administrative limits

- Country
- Province
- District

Available Phosphorus (ppm)

- ≤5.0
- 5.1 - 10.0
- 10.1 - 15.0

About Map

This map shows the fertility status of the soils based on the available phosphorus. Most of the soils are deficient or have low medium levels of available P. -For details, please see Annexure IV.

Data Sources

FAO, GAUL, Fauji Fertilizer Company Limited (FFCL), Rawalpindi.

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

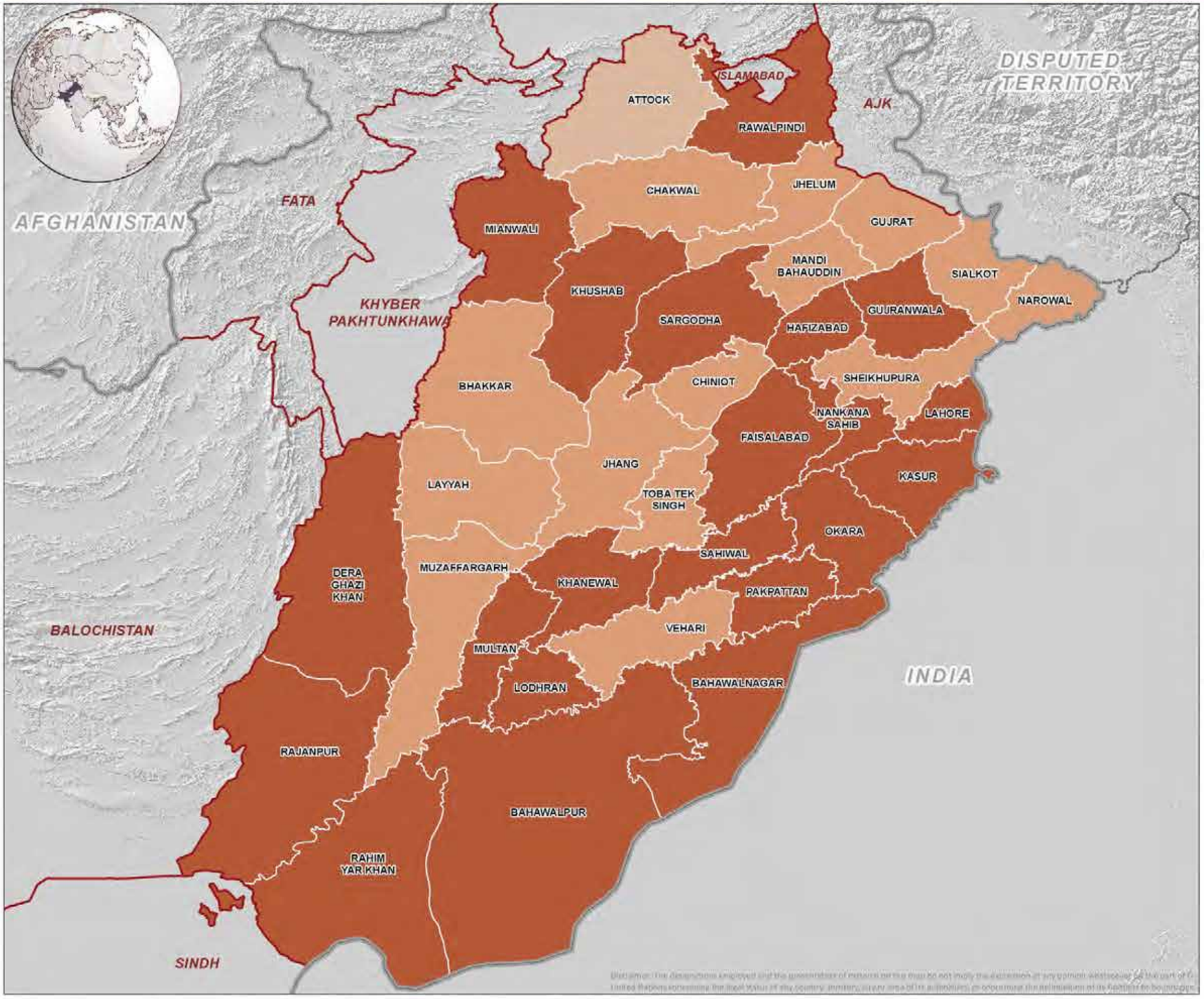
Kilometers

Date: 11 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_AvP _15.5_20150910

DISTRICT-WISE AVERAGE EXTRACTABLE POTASSIUM



Map Legend

Administrative limits

- Country
- Province
- District

Extractable Potassium (ppm)

- ≤ 100
- 101 - 150
- > 150

About Map

This map shows the fertility status of the soils based on the extractable potassium. The deficiency of K is evident in the soils of many districts of Punjab. The use of potassic fertilizers cannot be ignored any further.
For details, please see Annexure IV.

Data Sources

FAO, GAUL, Fauji Fertilizer Company Limited (FFCL), Rawalpindi

Map Scale and Datum

Nominal scale: 1:2,698,500 at A3

Datum: WGS 84

N

0 50 100 150 200

Kilometers

Date: 11 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_ExK _15.6_20150910

DISTRICT PROFILES

ATTOCK

Attock district lies on the eastern bank of Indus River, north-east of Punjab province. The topography varies from hills to plateaus and dissected plains. Climate of the district comprises of hot summers and cold winters. The main crops include wheat, groundnut, maize and vegetables. The major landmark of the district is famous Attock Fort. There are six tehsils in the district: Attock, Fateh Jang, Pindi Gheb, Jand, Hazro and Hasan Abdal. The district headquarter is located at Attock.

SOIL ATTRIBUTES

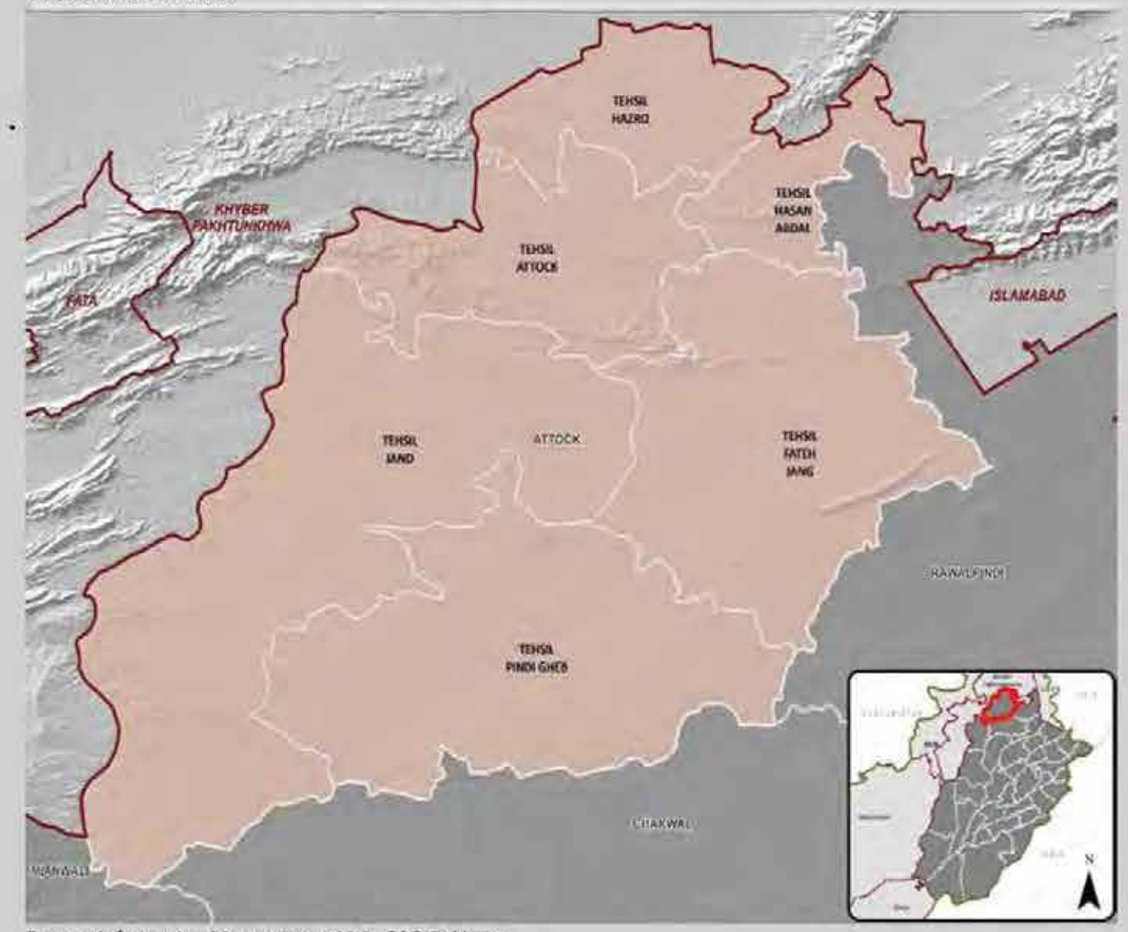
Parent Material	Limestone and sandstone bedrock, shallow and deep loamy soils in highlands and valleys
Dominant Soil Series	Missa, Guliana, Rajar, Balkassar, Ghazi
pH	7.4 – 8.1 (Average 7.79)
Electrical Conductivity (dSm^{-1})	0.12 – 0.75 (Average 0.28)
Organic Matter (%)	0.17 – 0.91 (Average 0.54)
Available Phosphorus (ppm)	2 – 14 (Average 4.69)
Extractable Potassium (ppm)	52 – 210 (Average 98)
Farmers availing soil test facility (%)	34
Farmers availing water test facility (%)	13

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and the Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	235,357
Total Uncultivated Area (hectares)	373,196
Total Area under Irrigation (hectares)	29,495
Major Rabi Crop(s)	Wheat, Mustard
Major Kharif Crop(s)	Sorghum/Millets, Groundnut, Maize
Total Livestock Population	2,327,494

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

BAHAWALNAGAR

Bahawalnagar district is situated in the south-east of Punjab. Most of the land is agricultural along with some desert region, i.e. Cholistan. The climate of the district is that of a hot desert with hot summers and mild winters. Precipitation mostly occurs in the monsoon season from June to August. However, some of the precipitation also occurs from February to April. There are five tehsils in the district: Bahawalnagar, Haroonabad, Chishtian, Fort Abbas and Minchinabad. The district headquarter is located at Bahawalnagar.

SOIL ATTRIBUTES

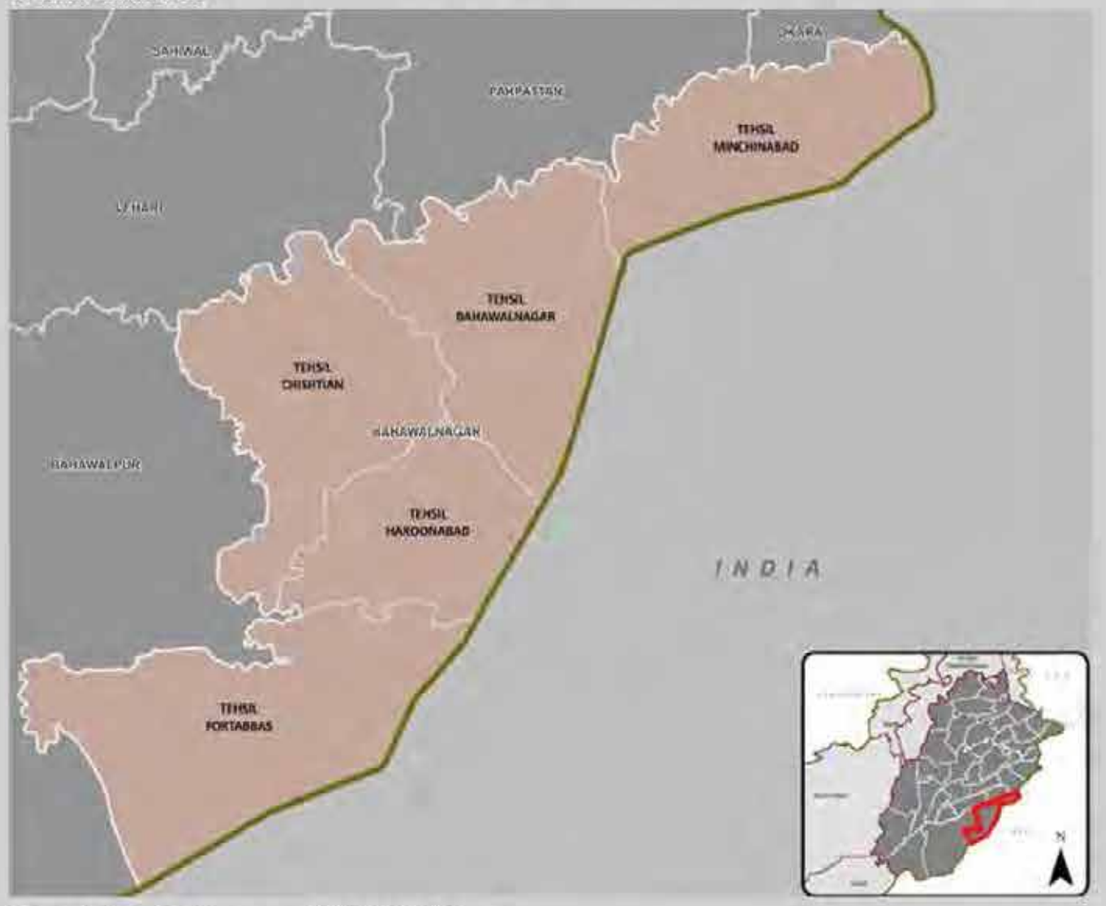
Parent Material	Mixed calcareous alluvium/ sand dunes
Dominant Soil Series	Yazman, Dheranwala, Lyallpur, Sultanpur, Awagat
pH	7.2 – 10.8 (Average 8.34)
Electrical Conductivity (dSm^{-1})	0.1 – 24 (Average 0.84)
Organic Matter (%)	0.1 – 2.31 (Average 0.61)
Available Phosphorus (ppm)	1 – 43 (Average 5.89)
Extractable Potassium (ppm)	32 – 400 (Average 157)
Farmers availing soil test facility (%)	15
Farmers availing water test facility (%)	9

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	817,909
Total Uncultivated Area (hectares)	102,065
Total Area under Irrigation (hectares)	802,772
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Cotton, Rice
Total Livestock Population	3,524,544

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

BAHAWALPUR

The landscape of the Bahawalpur district is diverse from irrigated to vast areas of deserts. Climate is with hot summers and mild winters. The main crops of the district are cotton, sugarcane, wheat, sunflower, rape/ mustard seeds and rice. Mango, dates and guava are some of the exports from this district. There are five tehsils in the district: Bahawalpur, Ahmedpur East, Hasilpur, Khairpur Tamewali and Yazman. Yazman is the largest tehsil that consists of the Cholistan desert area. The district headquarter is located at Bahawalpur.

SOIL ATTRIBUTES

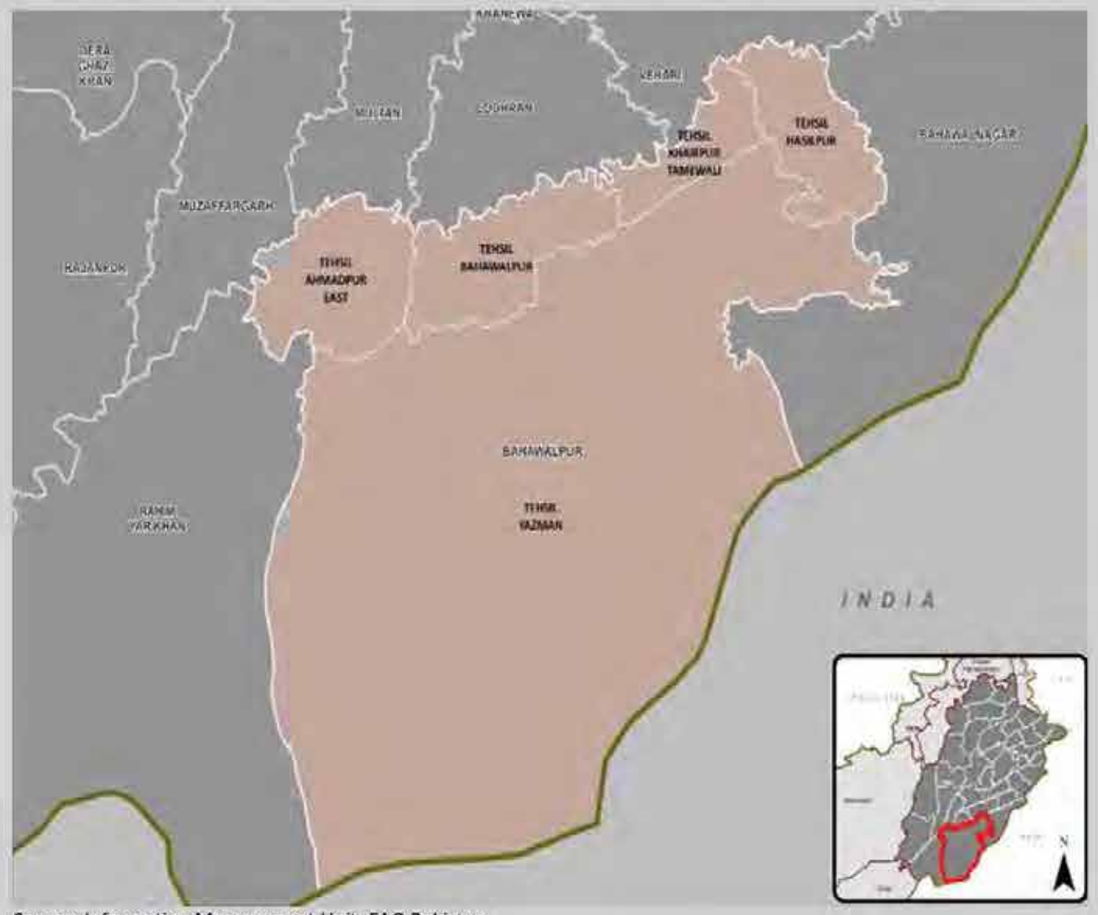
Parent Material	Mixed calcareous alluvium/sandy plains
Dominant Soil Series	Bahawalnagar, Cholistan, Dheranwala, Gambat, Harunabad
pH	7.4 – 11.2 (Average 8.30)
Electrical Conductivity (dSm^{-1})	0.08 – 26.6 (Average 0.74)
Organic Matter (%)	0.1 – 2.3 (Average 0.50)
Available Phosphorus (ppm)	1 – 40 (Average 5.24)
Extractable Potassium (ppm)	26 – 400 (Average 159)
Farmers availing soil test facility (%)	15
Farmers availing water test facility (%)	12

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown	636,572
Total Uncultivated Area (hectares)	119, 507
Total Area under Irrigation (hectares)	632,848
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Cotton, Millets, Sunflower
Total Livestock Population	3,409,596

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

BHAKKAR

Bhakkar was declared as a district in 1981. The climate is hot and dry during the summer and moderately cold in the winter. Uninhabited plains of the Thal desert cover a vast area of the district. The riverine land along the Indus River is a **fertile** strip. There are four tehsils in the district: Bhakkar, Darya Khan, Kalurkot and Mankera. Bhakkar is also the district headquarter.

SOIL ATTRIBUTES

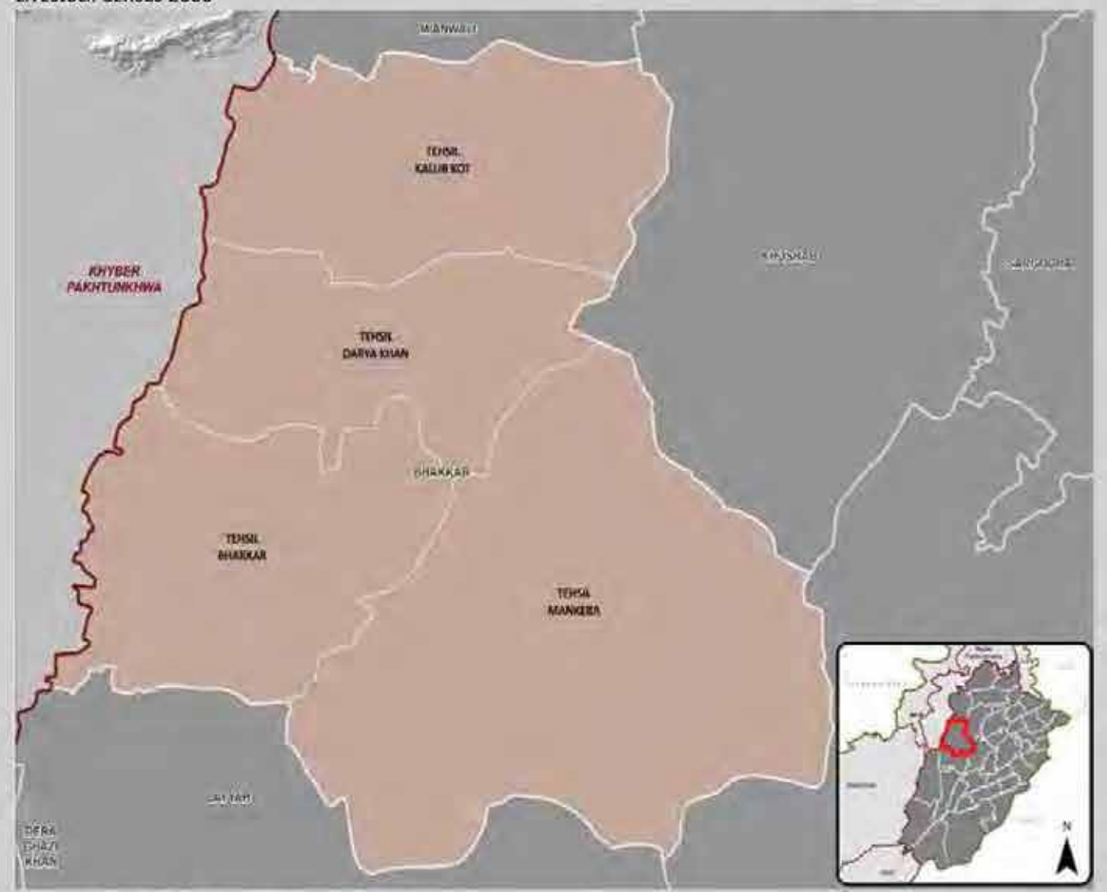
Parent Material	Rolling sand plains and fresh alluvium
Dominant Soil Series	Bhakkar, Banda, Bhutesar, Fazilpur, Saggu
pH	7.53 – 8.76 (Average 8.01)
Electrical Conductivity (dSm^{-1})	0.1 – 0.83 (Average 0.24)
Organic Matter (%)	0.22 – 1.35 (Average 0.75)
Available Phosphorus (ppm)	2 – 10 (Average 4.15)
Extractable Potassium (ppm)	30 – 350 (Average 107)
Farmers availing soil test facility (%)	16
Farmers availing water test facility (%)	6

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	793,714
Total Uncultivated Area (hectares)	72,468
Total Area under Irrigation (hectares)	408,177
Major Rabi Crop(s)	Wheat, Gram
Major Kharif Crop(s)	Cotton, Millet
Total Livestock Population	3,028,861

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

CHAKWAL

Chakwal district is situated in Pothwar plateau and Salt Range. Climate comprises of hot summers and cold winters. There is a large agriculture area that relies on rainfall. The topography is predominantly hilly, but also covered with forests in the southwest. In the north and northeast, there are leveled plains with some unfertile rocky patches. The southern portion extends to the Salt Range. There are five tehsils in the district: Chakwal, Kallar Kahar, Choa Saidan Shah, Talagang and Lawa. The district headquarter is located at Chakwal.

SOIL ATTRIBUTES

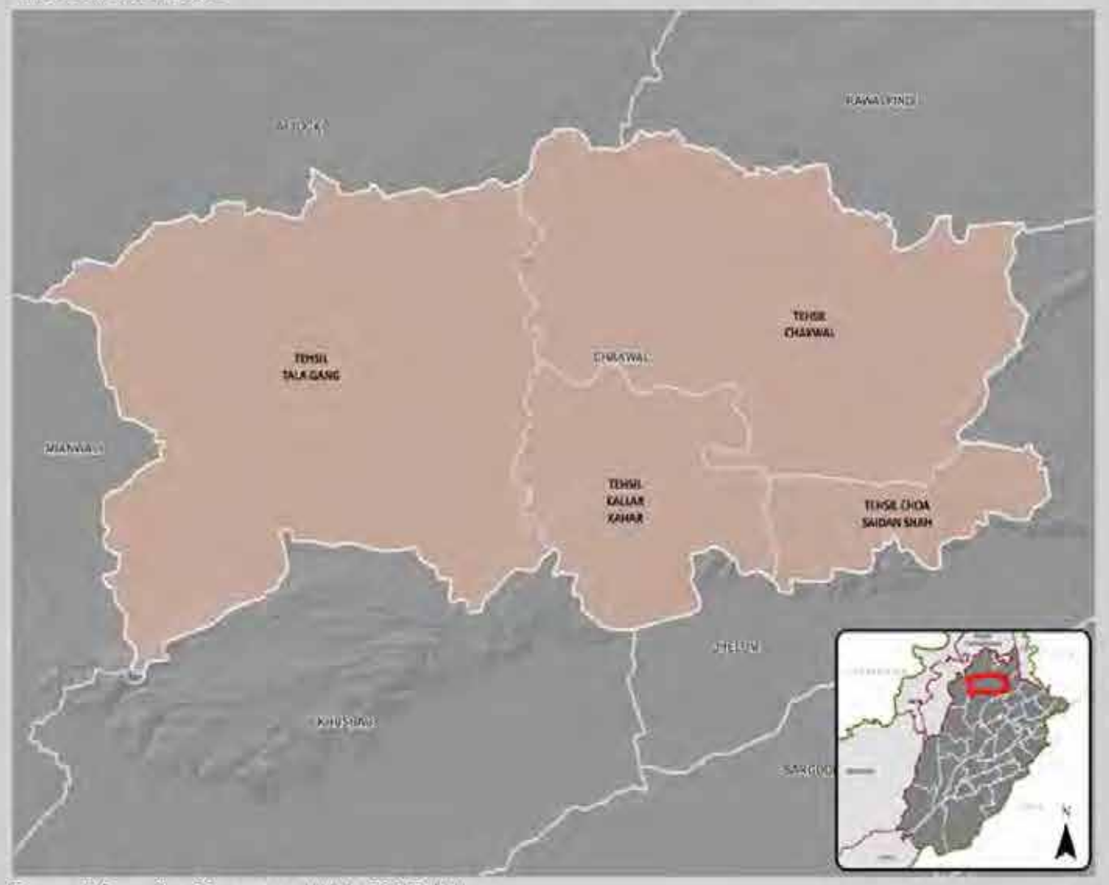
Parent Material	Moderately fine to fine textured, calcareous soils developed in late Pleistocene loess
Dominant Soil Series	Mial, Balkassar, Rajar, Namal
pH	7.6 – 8.6 (Average 8.01)
Electrical Conductivity (dSm^{-1})	0.1 – 1.35 (Average 0.21)
Organic Matter (%)	0.16 – 1.18 (Average 0.75)
Available Phosphorus (ppm)	3 – 9 (Average 4.40)
Extractable Potassium (ppm)	60 – 210 (Average 117)
Farmers availing soil test facility (%)	33
Farmers availing water test facility (%)	36

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	262,583
Total Uncultivated Area (hectares)	349,986
Total Area under Irrigation (hectares)	15,441
Major Rabi Crop(s)	Wheat, Mustard
Major Kharif Crop(s)	Groundnut, Sorghum
Total Livestock Population	2,221,410

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

CHINIOT

Chiniot district is positioned between the heart of river Chenab and the heads of small rocky hills. Climate of the district comprises of hot summers and cold winters. The land is mostly fertile suitable for producing crops like wheat, rice, sugarcane, vegetables and fruits. Traditional wooden furniture from Chiniot is widely famous and exported worldwide. There are three tehsils in the district: Chiniot, Bhawana and Lalian. The district headquarter is located at Chiniot.

SOIL ATTRIBUTES

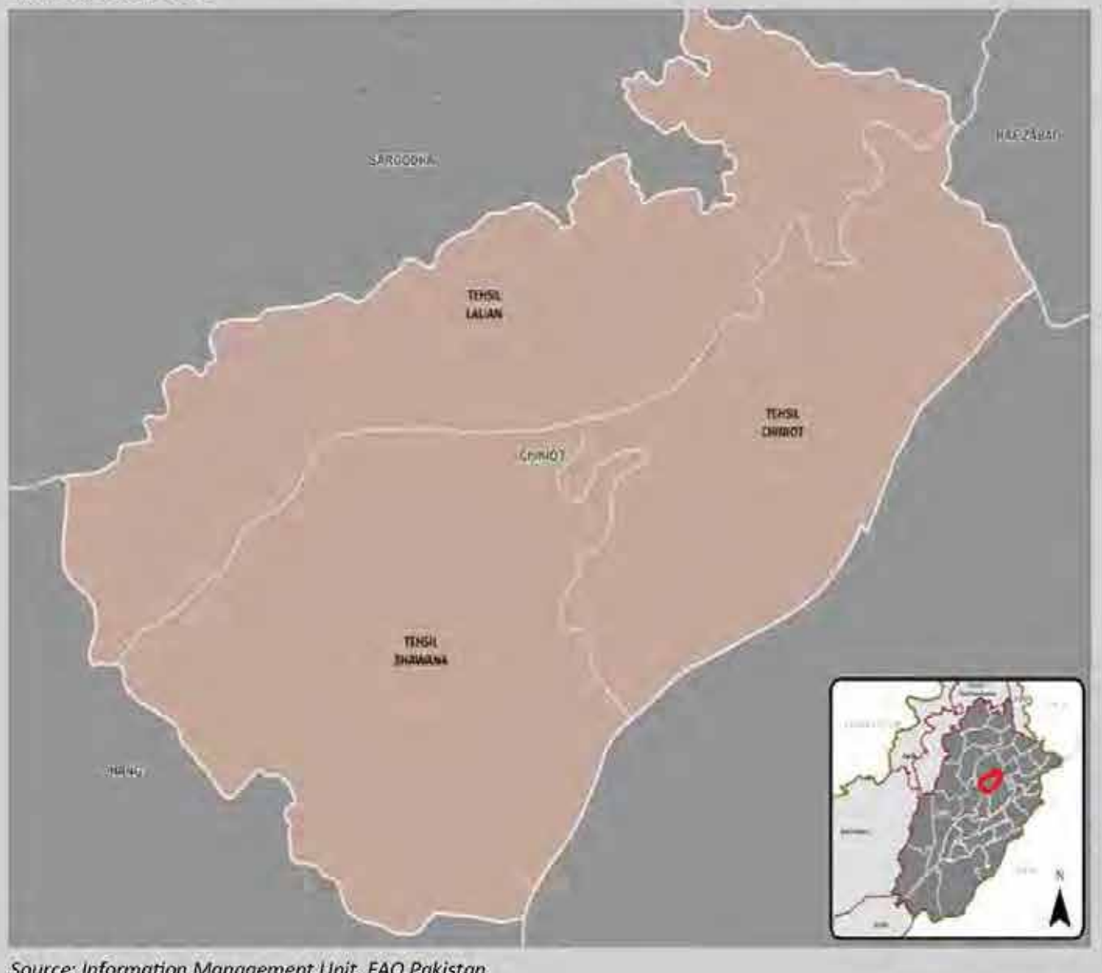
Parent Material	Mainly loamy and clayey soils of sub-recent river plains
Dominant Soil Series	Kasur, Lalian, Miani, Sultanpur, Shahpur
pH	7.41 – 9.53 (Average 8.06)
Electrical Conductivity (dSm^{-1})	0.14 – 1.8 (Average 0.43)
Organic Matter (%)	0.1 – 1.05 (Average 0.61)
Available Phosphorus (ppm)	1.5 – 16 (Average 6.40)
Extractable Potassium (ppm)	56 – 400 (Average 141)
Farmers availing soil test facility (%)	26
Farmers availing water test facility (%)	16

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	305,895
Total Uncultivated Area (hectares)	64,041
Total Area under Irrigation (hectares)	305,736
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Rice, Maize, Sugarcane

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

DERA GHAZI KHAN

Dera Ghazi Khan district is located at the foot hills of Suleiman Mountain Range. The climate is hot and dry during the summer and moderately cold in the winter. Occasional heavy rainfall causes flooding in the region. Hill-torrent irrigation is practiced in the western part of the district. It also includes a hill station, Fort Munro located at a height of 1,972 meters above sea level. The district headquarter is located at Dera Ghazi Khan.

SOIL ATTRIBUTES

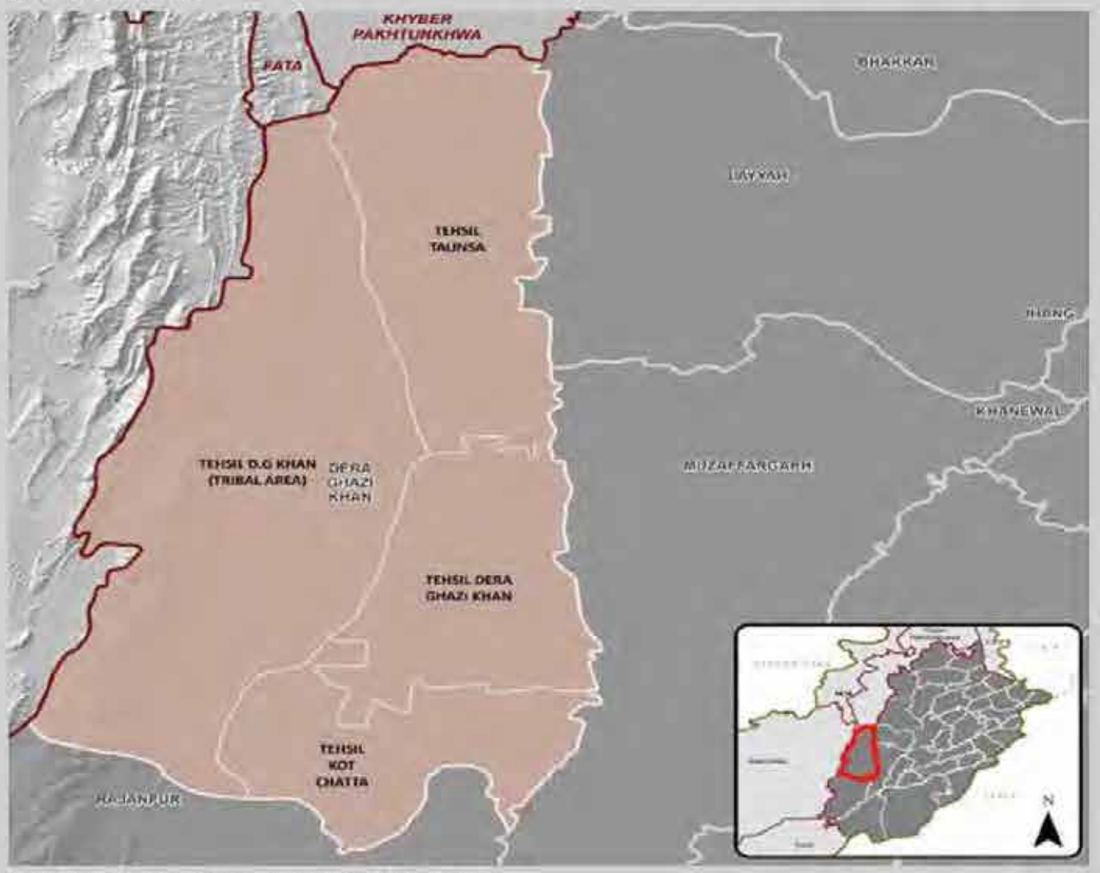
Parent Material	Mixed calcareous alluvium of piedmont plain
Dominant Soil Series	Shahdara, Jhatpat, Kandhkot, Kahror, Kashmore
pH	7.3 – 10.8 (Average 8.31)
Electrical Conductivity (dSm^{-1})	0.026 – 36 (Average 0.92)
Organic Matter (%)	0.1 – 2.19 (Average 0.54)
Available Phosphorus (ppm)	1 – 52 (Average 5.20)
Extractable Potassium (ppm)	26 – 400 (Average 174)
Farmers availing soil test facility (%)	18
Farmers availing water test facility (%)	18

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	356,036
Total Uncultivated Area (hectares)	225,316
Total Area under Irrigation (hectares)	323,731
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Cotton, Rice, Sugarcane
Total Livestock Population	3,313,927

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security &Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

FAISALABAD

Faisalabad, the third largest city of Pakistan, is situated in the central Punjab. Climate of the district comprises of hot summers and cold winters. This district is the hub of agricultural research and has the biggest cotton market in Asia. The district is home to numerous textile, sugar and flour mills. There are six tehsils in the district: Faisalabad City, Faisalabad Saddar, Jaranwala, Chak Jhumra, Samundri and Tandlianwala. The district headquarter is situated at Faisalabad.

SOIL ATTRIBUTES

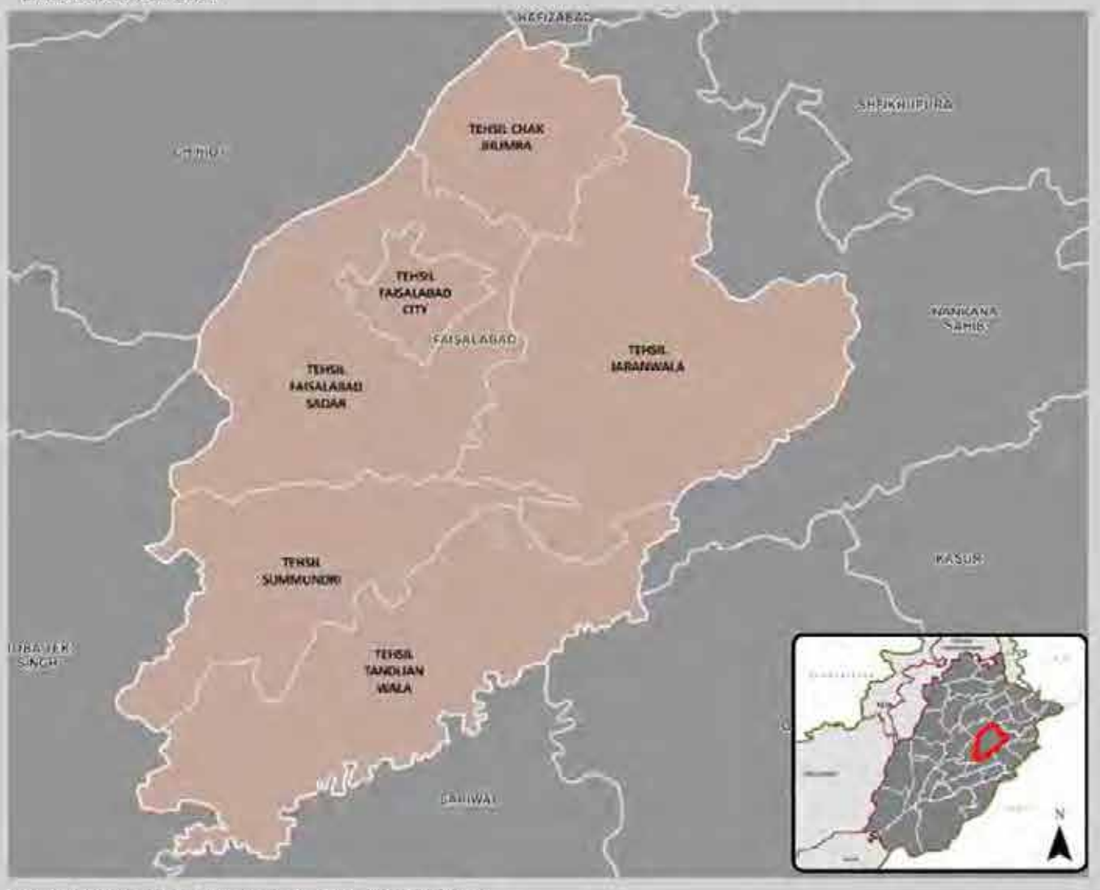
Parent Material	The soils formed in a river terrace; the alluvial deposits of Chenab and Ravi rivers
Dominant Soil Series	Hafizabad, Lyallpur, Sultanpur, Sindhelianwali, Khurianwala
pH	6.67 – 10.2 (Average 8.26)
Electrical Conductivity (dSm^{-1})	0.1 – 10 (Average 0.55)
Organic Matter (%)	0.12 – 2.1 (Average 0.57)
Available Phosphorus (ppm)	1 – 19 (Average 5.82)
Extractable Potassium (ppm)	38 – 400 (Average 153)
Farmers availing soil test facility (%)	27
Farmers availing water test facility (%)	18

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	698,489
Total Uncultivated Area (hectares)	111,261
Total Area under Irrigation (hectares)	698,362
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Sugarcane, Rice, Maize
Total Livestock Population	3,604,315

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

GUJRANWALA

Gujranwala district lies on the Grand Trunk (GT) road built by Emperor Sher Shah Suri in the 16th century. Climate of the district comprises of hot summers and cold winters. The main crops include wheat, rice, sugarcane, vegetables and fodder. The district has several commercial and industrial centers for the manufacturing of ceramics, metal tools, leather, utensils, fans, textiles etc. There are four tehsils in the district: Gujranwala, Kamoke, Nowshera Virkan and Wazirabad. The district headquarter is located at Gujranwala.

SOIL ATTRIBUTES

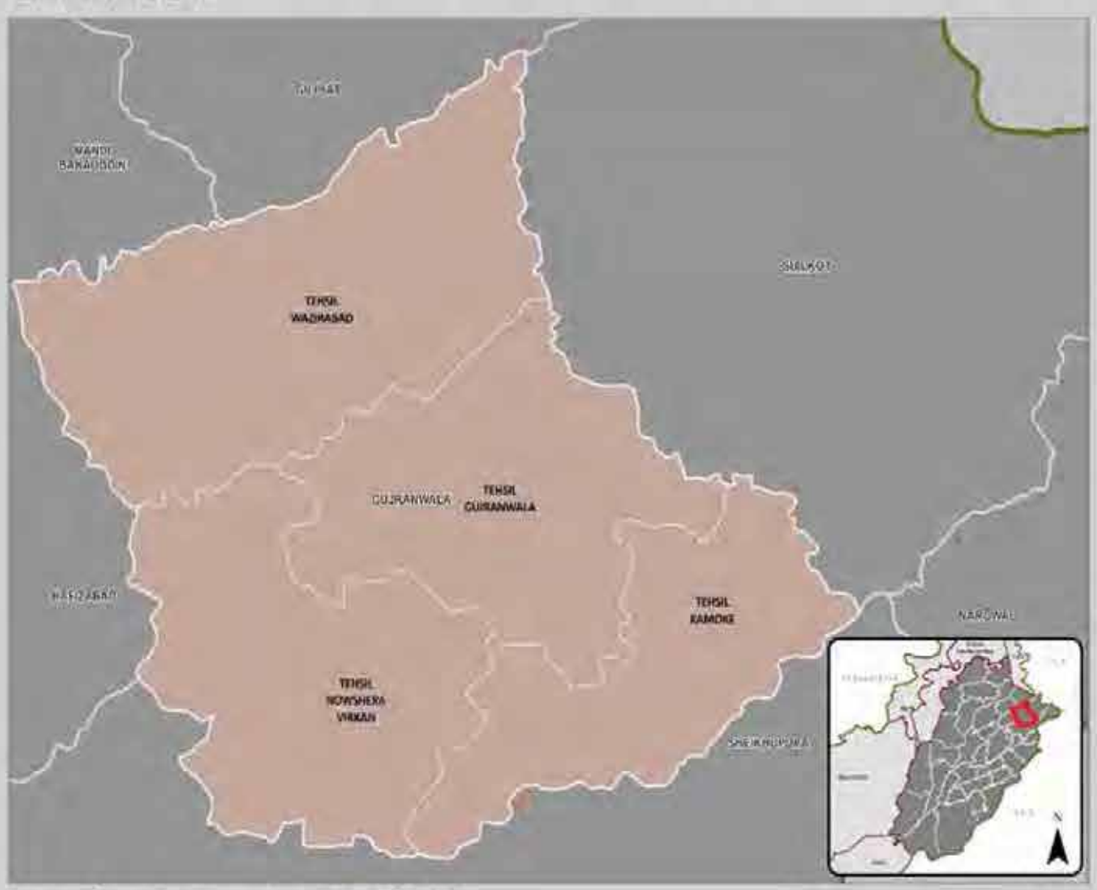
Parent Material	Mainly mixed calcareous alluvium
Dominant Soil Series	Bhalwal, Hafizabad, Lyallpur, Eminabad, Gujranwala
pH	7 – 10.7 (Average 8.12)
Electrical Conductivity (dSm^{-1})	0.1 – 8.19 (Average 0.28)
Organic Matter (%)	0.1 – 1.69 (Average 0.55)
Available Phosphorus (ppm)	1 – 27 (Average 5.85)
Extractable Potassium (ppm)	34 – 400 (Average 156)
Farmers availing soil test facility (%)	72
Farmers availing water test facility (%)	12

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	550,700
Total Uncultivated Area (hectares)	52,375
Total Area under Irrigation (hectares)	548,455
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Rice, Sugarcane
Total Livestock Population	1,893,449

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

GUJRAT

Gujrat is an old district located between the two famous rivers, Jhelum and Chenab. However, shortage of irrigation water is a big problem; only 56% of the cultivated area is irrigated and crops on the remaining area depend on rainfall. The climate of the district is hot and dry during the summer and moderately cold in the winter. The land is suitable for cultivation of rice and sugarcane. In addition to agriculture, Gujrat is known for farm industry, traditional pottery and wooden furniture. There are three tehsils in the district: Gujrat, Kharian and Sarai Alamgir. The district headquarter is situated at Gujrat.

SOIL ATTRIBUTES

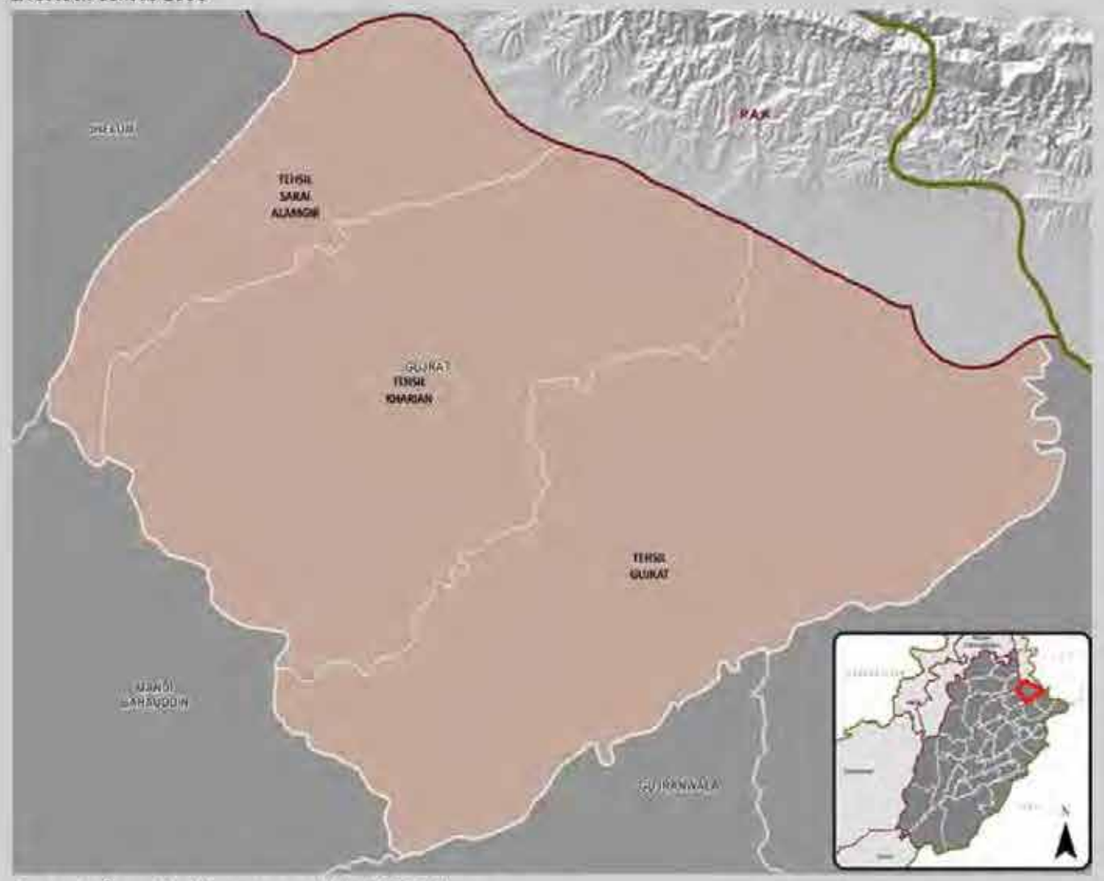
Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Gujranwala, Pindorian, Lyallpur, Bhalwal, Shahdara
pH	7.0 – 9.9 (Average 7.99)
Electrical Conductivity (dSm^{-1})	0.1 – 2.2 (Average 0.31)
Organic Matter (%)	0.27 – 1.59 (Average 0.72)
Available Phosphorus (ppm)	3 – 30 (Average 6.24)
Extractable Potassium (ppm)	40 – 350 (Average 147)
Farmers availing soil test facility (%)	57
Farmers availing water test facility (%)	45

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	299,120
Total Uncultivated Area (hectares)	72,305
Total Area under Irrigation (hectares)	168,572
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Rice, Sugarcane
Total Livestock Population	1,165,111

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

HAFIZABAD

Hafizabad is situated in central Punjab and known for its rice production. The climate of the district is hot and dry during the summer and moderately cold in the winter. Due to the proximity of the hills, there is more rainfall in the east than the western part. There are two tehsils in the Hafizabad district: Hafizabad and Pindi Bhattian. The district headquarter is situated at Hafizabad.

SOIL ATTRIBUTES

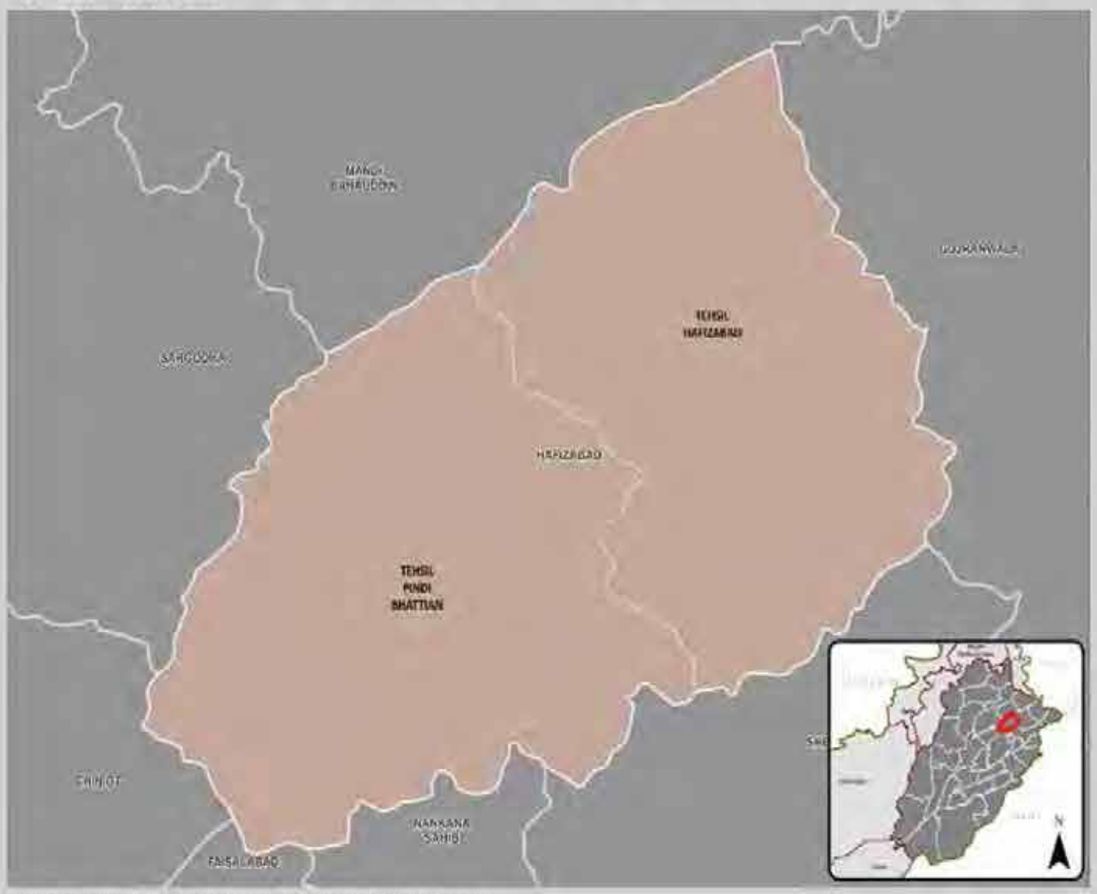
Parent Material	Mainly loamy and clayey alluvium
Dominant Soil Series	Eminabad, Hafizabad, Pindorian, Wazirabad, Kamunki
pH	7.2 – 11.0 (Average 8.32)
Electrical Conductivity (dSm^{-1})	0.1 – 6.3 (Average 0.43)
Organic Matter (%)	0.1 – 1.78 (Average 0.57)
Available Phosphorus (ppm)	1 – 17 (Average 6.07)
Extractable Potassium (ppm)	42 – 400 (Average 148)
Farmers availing soil test facility (%)	16
Farmers availing water test facility (%)	12

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	347,610
Total Uncultivated Area (hectares)	45,835
Total Area under Irrigation (hectares)	347,463
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Rice, Sugarcane
Total Livestock Population	1,324,420

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security &Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

JHANG

Jhang is one of the oldest districts of Punjab. The district is mainly bordered by Chiniot, Sargodha, Khushab, Layyah, Toba Tek Singh and Khanewal districts. The climate is hot and dry during the summer and moderately cold in the winter. Most of the land is suitable for cultivation except areas having salinity/sodicity problem. There are three tehsils in the district: Jhang, Shorkot and Ahmedpur Sial. The district headquarter is situated at Jhang.

SOIL ATTRIBUTES

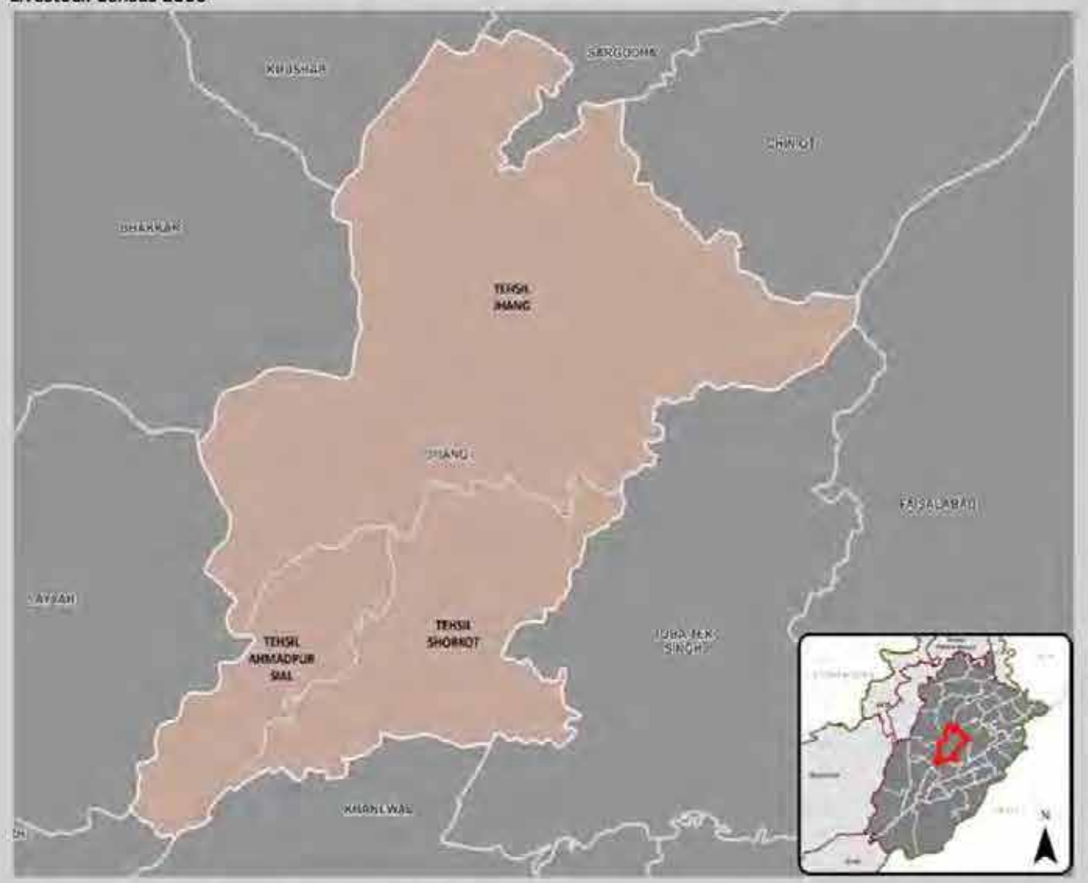
Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Hafizabad, Jhakkar, Khurrianwala, Shahpur, Sultanpur
pH	7.6 – 9.9 (Average 8.35)
Electrical Conductivity (dSm^{-1})	0.1 – 4.4 (Average 0.54)
Organic Matter (%)	0.1 – 1.4 (Average 0.62)
Available Phosphorus (ppm)	1 – 16 (Average 5.85)
Extractable Potassium (ppm)	28 – 400 (Average 138)
Farmers availing soil test facility (%)	61
Farmers availing water test facility (%)	54

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	685,371
Total Uncultivated Area (hectares)	131,888
Total Area under Irrigation (hectares)	606,541
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Rice, Sugarcane, Maize
Total Livestock Population	5,062,387

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

JHELUM

Jhelum district lies in the north east of Punjab. The Jhelum River crosses the district through the eastern and southern parts. The climate comprises of hot summers and cold winters. The riverine soil is mostly plain, alluvial and quite fertile. Khewra salt mines, one of the largest salt mines in the world, and the famous historical Rohtas Fort are located in this district. There are four tehsils in the district: Jhelum, Sohawa, Pind Dadan Khan and Dina. The district headquarter is situated at Jhelum.

SOIL ATTRIBUTES

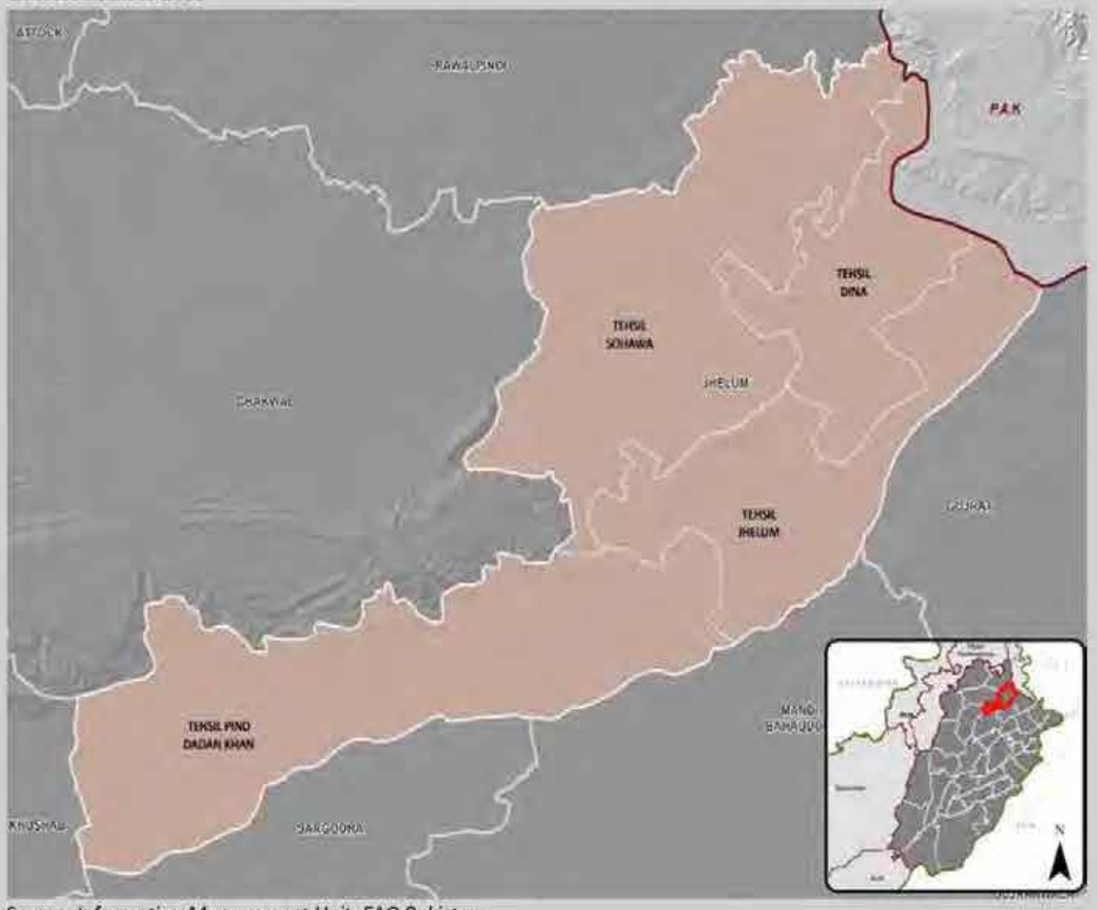
Parent Material	Diverse in nature consisting of loess and alluvium
Dominant Soil Series	Balkassar, Chakwal, Dhumman, Kahuta, Missa
pH	7.3 – 10.1 (Average 8.52)
Electrical Conductivity (dSm^{-1})	0.1 – 15 (Average 0.88)
Organic Matter (%)	0.1 – 1.8 (Average 0.61)
Available Phosphorus (ppm)	1 – 25 (Average 4.33)
Extractable Potassium (ppm)	30 – 340 (Average 118)
Farmers availing soil test facility (%)	30
Farmers availing water test facility (%)	18

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	105,689
Total Uncultivated Area (hectares)	232,329
Total Area under Irrigation (hectares)	35,338
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Maize, Millet, Rice
Total Livestock Population	1,043,115

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

KASUR

Kasur district represents mixed cropping zone of Punjab. It is surrounded by Lahore in the north, Okara in the south and Nankana Sahib in the northwest. Climate of the district comprises of hot summers and cold winters. The main crops are wheat, rice, cotton, maize, sugarcane and vegetables. Famous Sufi poet Baba Bulleh Shah was born in the Kasur city. There are four tehsils: Kasur, Chunian, Kot Radha Kishen and Pattoki. The district headquarter is situated at Kasur.

SOIL ATTRIBUTES

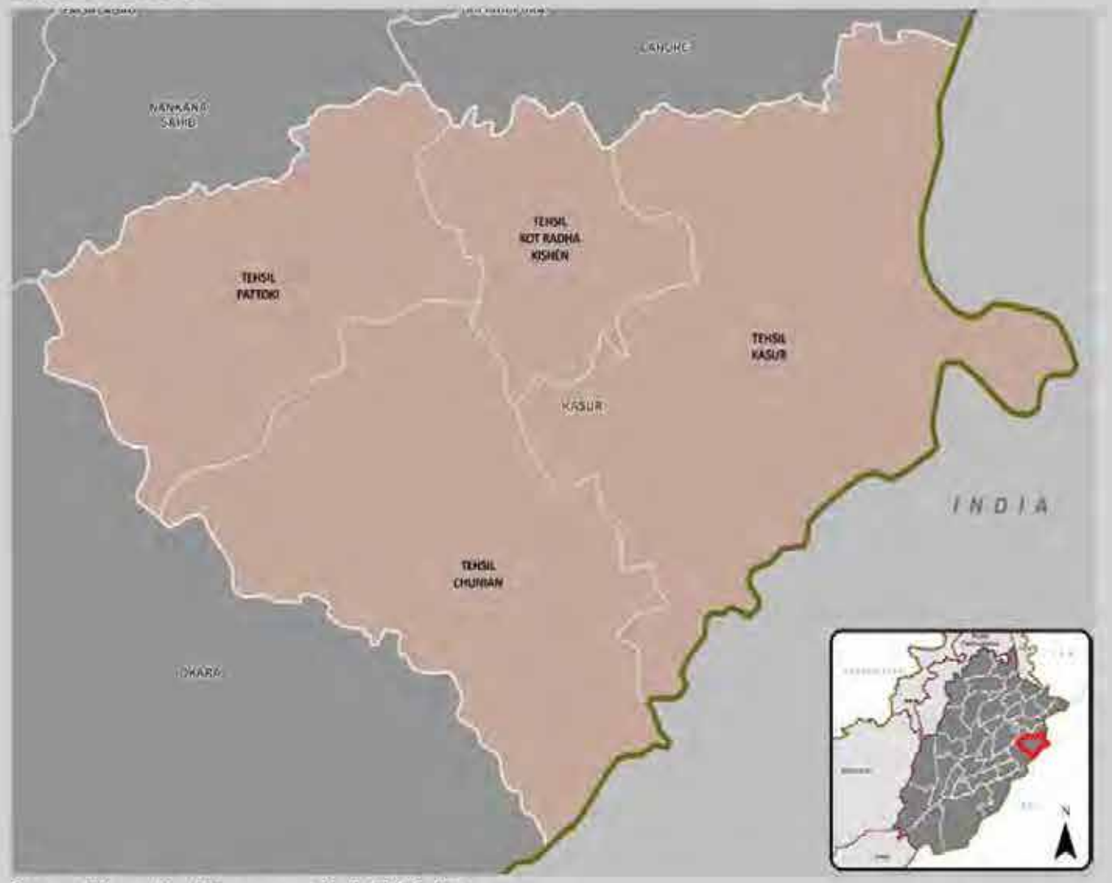
Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Bhalwal, Sultanpur, Khurrianwala, Gujranwala, Pindorian
pH	7.1 – 11 (Average 8.14)
Electrical Conductivity (dSm^{-1})	0.1 – 20.5 (Average 0.76)
Organic Matter (%)	0.1 – 2.9 (Average 0.79)
Available Phosphorus (ppm)	1 – 52 (Average 8.02)
Extractable Potassium (ppm)	25 – 400 (Average 150)
Farmers availing soil test facility (%)	43
Farmers availing water test facility (%)	23

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	520,711
Total Uncultivated Area (hectares)	79,213
Total Area under Irrigation (hectares)	520,383
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Rice, Maize, Sugarcane
Total Livestock Population	2,701,658

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

KHANEWAL

Khanewal was given the status of district in 1985 by combining two tehsils of Multan district. Climate of the district comprises of hot summers and cold winters. The main crops include wheat, cotton, sugarcane, vegetables and fruits. The district has the second largest railway station in the country, known as the Khanewal Junction. There are four tehsils in the district: Khanewal, Jahanian, Kabirwala and Mian Channu. The district headquarter is situated at Khanewal city.

SOIL ATTRIBUTES

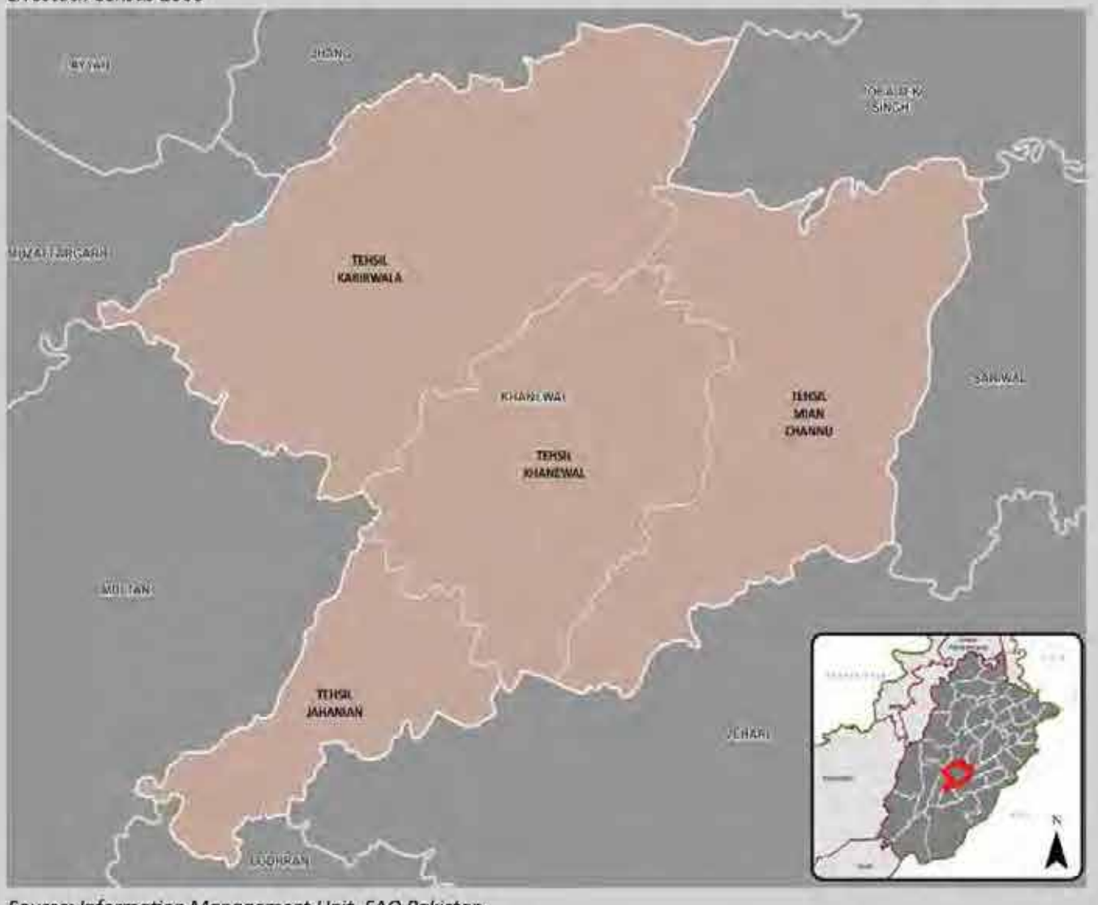
Parent Material	Mixed loamy and clayey material
Dominant Soil Series	Shahdara, Bhalike, Pacca, Gajiana, Rustam
pH	7.4 – 10.7 (Average 8.41)
Electrical Conductivity (dSm^{-1})	0.1 – 19.5 (Average 0.62)
Organic Matter (%)	0.1 – 2.8 (Average 0.75)
Available Phosphorus (ppm)	1 – 44 (Average 5.92)
Extractable Potassium (ppm)	28 – 400 (Average 155)
Farmers availing soil test facility (%)	45%
Farmers availing water test facility (%)	24%

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Services Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	572,853
Total Uncultivated Area (hectares)	60,439
Total Area under Irrigation (hectares)	570,545
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Cotton, Sugarcane
Total Livestock Population	2,714,703

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

KHUSHAB

Khushab district is bounded in the north by salt range and in the east by Jhelum River. The climate is extreme with long hot summers and cold dry winters. The district has diverse landscape features that vary from mountains, deserts to lush green lands. Soon Sakasir valley, one of the beautiful hill stations of Pakistan, lies in Khushab. The district is abundant in natural resources like salt and coal. There are four tehsils in the district: Khushab, Quaidabad, Noorpur Thal and Naushera. The district headquarter is situated at Jauharabad.

SOIL ATTRIBUTES

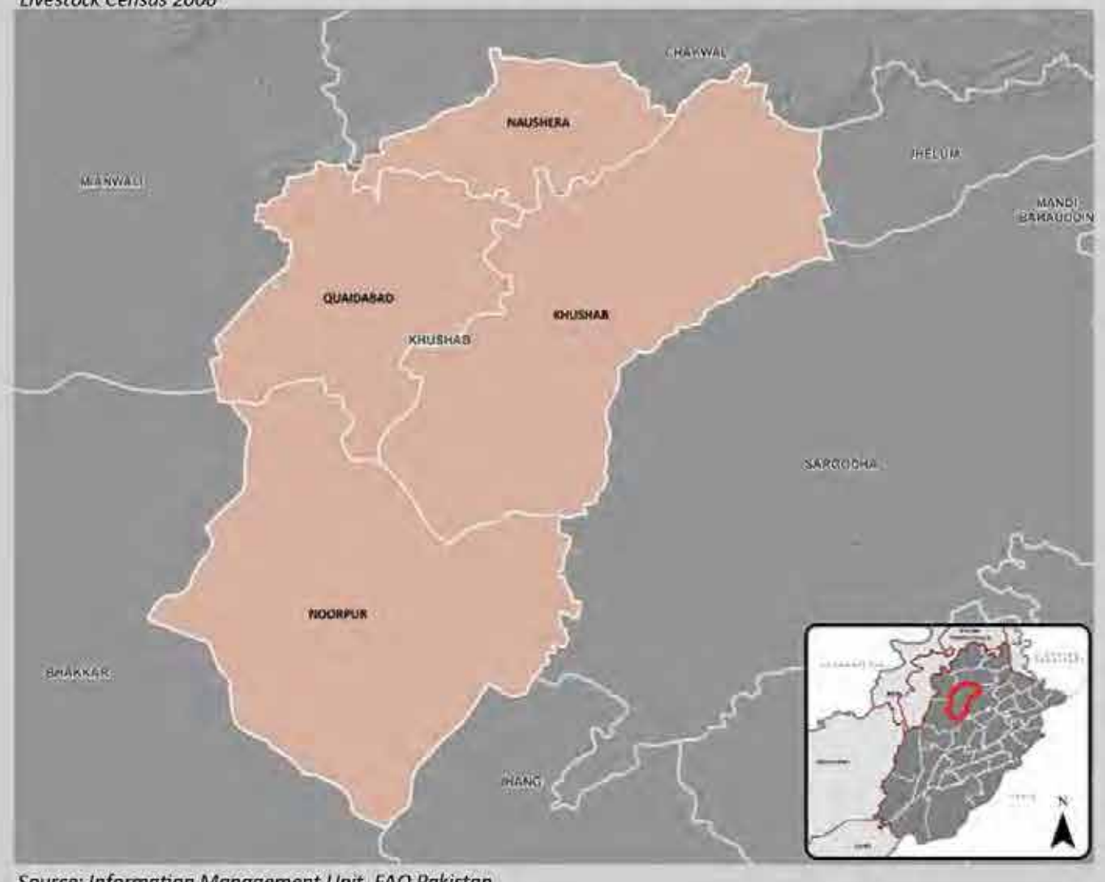
Parent Material	Rolling sand plains, mixed alluvium of river and piedmont plain
Dominant Soil Series	Bhakkar, Bhareri, Firoz, Gandhra, Missa
pH	7.4 – 8.7 (Average 8.06)
Electrical conductivity (dSm^{-1})	0.1 – 3.1 (Average 0.54)
Organic Matter (%)	0.2 – 1.7 (Average 0.85)
Available Phosphorus (ppm)	1 – 15 (Average 4.86)
Extractable Potassium (ppm)	40 – 360 (Average 154)
Farmers availing soil test facility (%)	27
Farmers availing water test facility (%)	27

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	430,159
Total Uncultivated Area (hectares)	185,840
Total Area under Irrigation (hectares)	143,966
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Coarse grains, Rice
Total Livestock Population	1,864,563

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

LAHORE

Lahore is the most densely populated district of Punjab. Climate of the district comprises of hot summers and cold winters. Lahore, the 2nd largest city of Pakistan, is the provincial capital that has historical landmarks like Badshahi Mosque, Lahore Fort and Shalimar Garden. The city is referred to as the cultural heart of Pakistan and hosts most of the arts, cuisine, festivals, music, gardening and intelligentsia of the country.

SOIL ATTRIBUTES

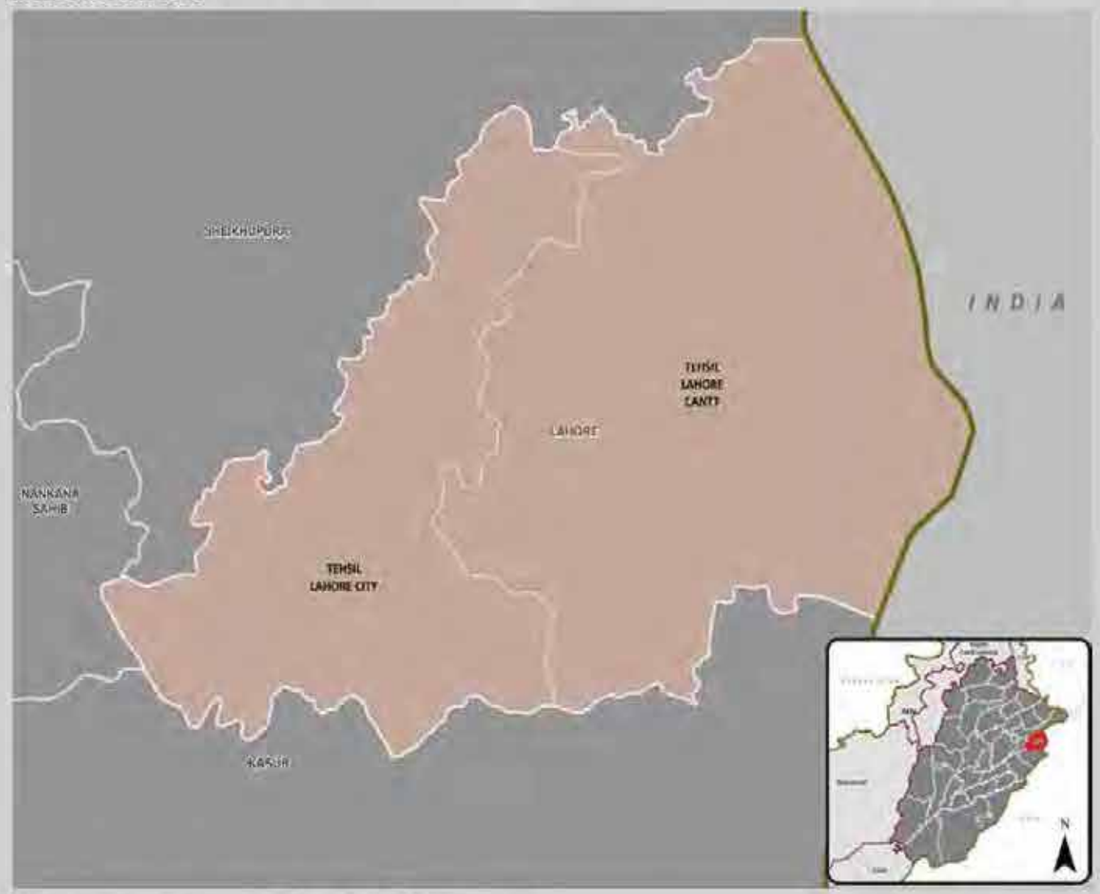
Parent Material	Mixed calcareous alluvium
Soil Series	Bhalwal, Hafizabad, Lyallpur, Khurrianwala, Gujranwala
pH	7.0 – 10.3 (Average 8.33)
Electrical Conductivity (dSm^{-1})	0.1 – 22.7 (Average 0.69)
Organic Matter (%)	0.1-2.89 (Average 0.80)
Available Phosphorus (ppm)	1-50 (Average 6.66)
Extractable Potassium (ppm)	25 – 400 (Average 152)
Farmers availing soil test facility (%)	20
Farmers availing water test facility (%)	20

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	171,741
Total Uncultivated Area (hectares)	51,160
Total Area under Irrigation (hectares)	168,623
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Maize, Potato, Rice
Total Livestock Population	1,028,780

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

LAYYAH

Layyah district located in the western part of Punjab consists of a semi-rectangular block of sandy land between the Indus River and the Chenab River in the Thal Doab. The climate is extreme with long hot summers and cold dry winters. The main crops are sugarcane, wheat, cotton, gram and guar seed. There are three tehsils in the district: Layyah, Choubara and Karor Lal Esan. The district headquarter is at Layyah.

SOIL ATTRIBUTES

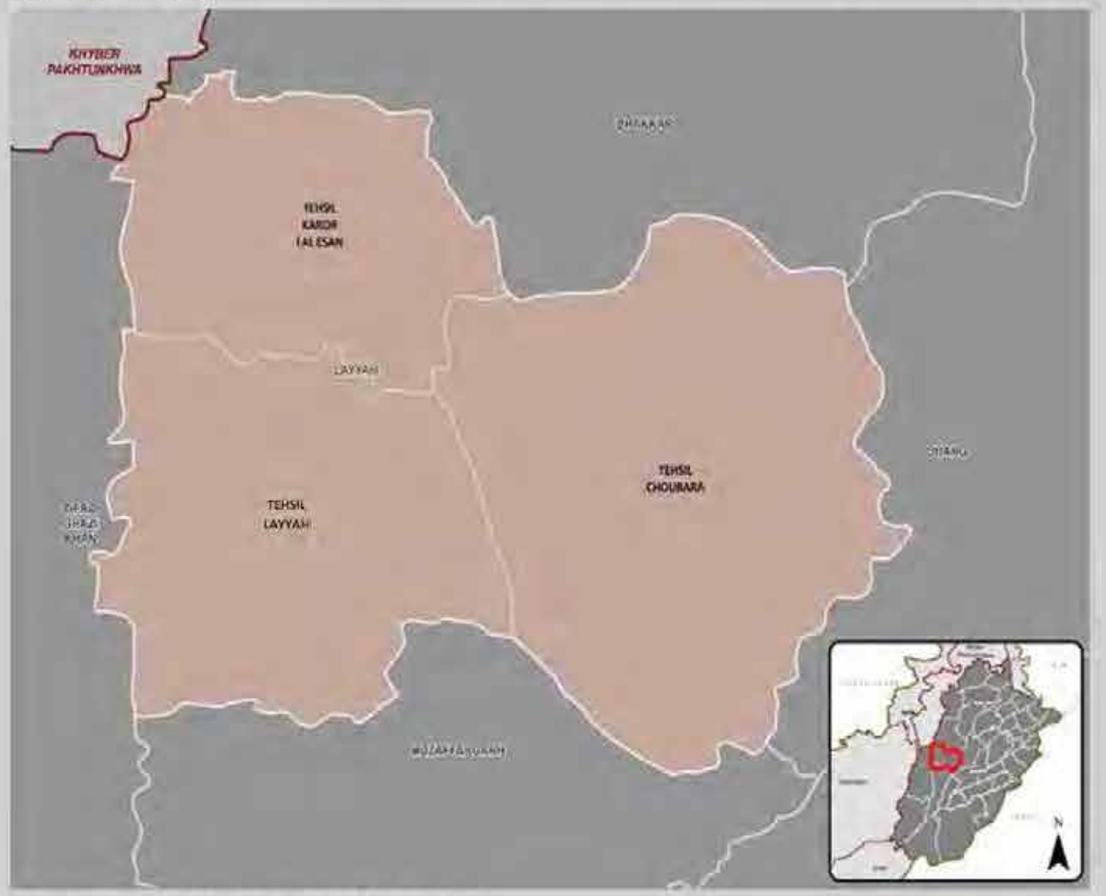
Parent Material	Rolling sand plains and fresh alluvium
Dominant Soil Series	Bhakkar, Banda, Bhutesar, Fazilpur, Shahdara
pH	7.6 – 10.3 (Average 8.23)
Electrical Conductivity (dSm^{-1})	0.1 – 7.9 (Average 0.43)
Organic Matter (%)	0.1 – 1.6 (Average 0.48)
Available Phosphorus (ppm)	1 – 25 (Average 4.44)
Extractable Potassium (ppm)	26 – 380 (Average 110)
Farmers availing soil test facility (%)	34
Farmers availing water test facility (%)	31

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	513,790
Total Uncultivated Area (hectares)	153,922
Total Area under Irrigation (hectares)	437,159
Major Rabi Crop(s)	Wheat, Gram
Major Kharif Crops(s)	Cotton, Sugarcane
Total Livestock Population	2,948,752

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

LODHRAN

Lodhran district is situated on the northern side of river Sutlej. The entire district is a smooth plain. Hot and dry weather prevails during summer and cold during the winter. Major crops of the district include wheat and cotton while minor crops include rice, sunflower, sugarcane and tobacco. The groundwater in Dunyapur area is predominantly brackish, while that in Kahror Pacca and Lodhran is sweet. There are three tehsils in the district: Lodhran, Kahror Pacca and Dunyapur. The district headquarter is located at Lodhran city.

SOIL ATTRIBUTES

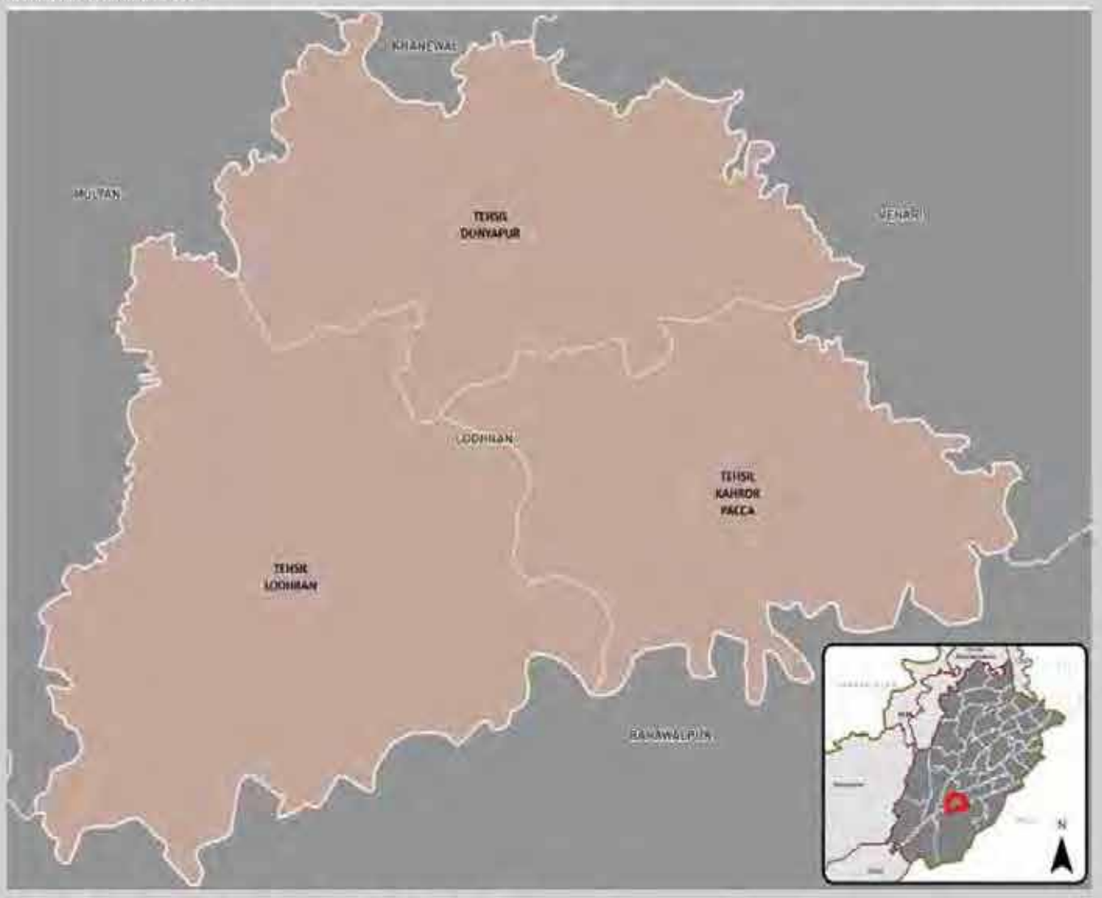
Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Shahdara, Bhalike, Pacca, Gajiana, Nabipur
pH	7.6 – 10.3 (Average 8.27)
Electrical Conductivity (dSm^{-1})	0.1 – 7.9 (Average 1.18)
Organic Matter (%)	0.1 – 1.6 (Average 0.71)
Available Phosphorus (ppm)	1 – 25 (Average 6.26)
Extractable Potassium (ppm)	26 – 380 (Average 153)
Farmers availing soil test facility (%)	50
Farmers availing water test facility (%)	4

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	446,689
Total Uncultivated Area (hectares)	36,695
Total Area under Irrigation (hectares)	446,689
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Cotton, Rice
Total Livestock Population	1,573,118

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

MANDI BAHAUDDIN

Mandi Bahauddin district is bordered on the northwest by the Jhelum river, on the southeast by the Chenab River, and on the southwest by the Sargodha district. Hot and dry weather prevails during summer and cold during the winter. The main crops are wheat, rice, sugarcane, vegetables and fodder. There are three tehsils in the district: Mandi Bahauddin, Malakwal and Phalia. The district headquarter is located at Mandi Bahauddin.

SOIL ATTRIBUTES

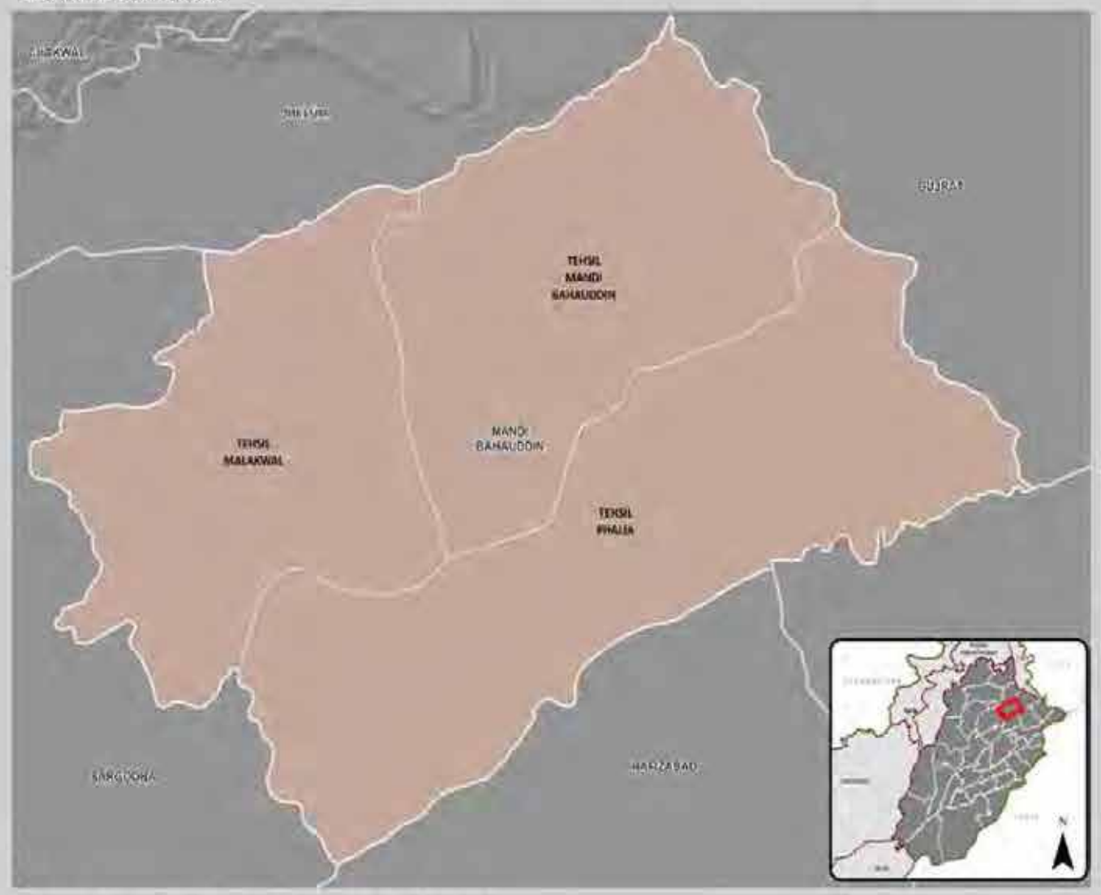
Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Hafizabad, Miani, Shahdara, Lyallpur, Gujranwala
pH	7.2 – 10.3 (Average 8.27)
Electrical Conductivity (dSm^{-1})	0.1 – 9.2 (Average 1.18)
Organic Matter (%)	0.2 – 1.7 (Average 0.71)
Available Phosphorus (ppm)	1 – 20 (Average 6.26)
Exctractable Potassium (ppm)	30 – 400 (Average 153)
Farmers availing soil test facility (%)	42
Farmers availing water test facility (%)	22

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	354,927
Total Uncultivated Area (hectares)	45,998
Total Area under Irrigation (hectares)	351,770
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Rice, Sugarcane
Total Livestock Population	1,647,069

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

MIANWALI

Mianwali district is situated in the northwest of Punjab province. The climate is extreme with long hot summers and cold dry winters. The landscape is diverse varying from mountains, deserts, to lush green fields. The two well-known migrant clans of the district are the Niazi Pashtuns and the Awan tribe. The district comprises of three tehsils: Mianwali, Piplan and Isakhel. The district headquarter is at Mianwali.

SOIL ATTRIBUTES

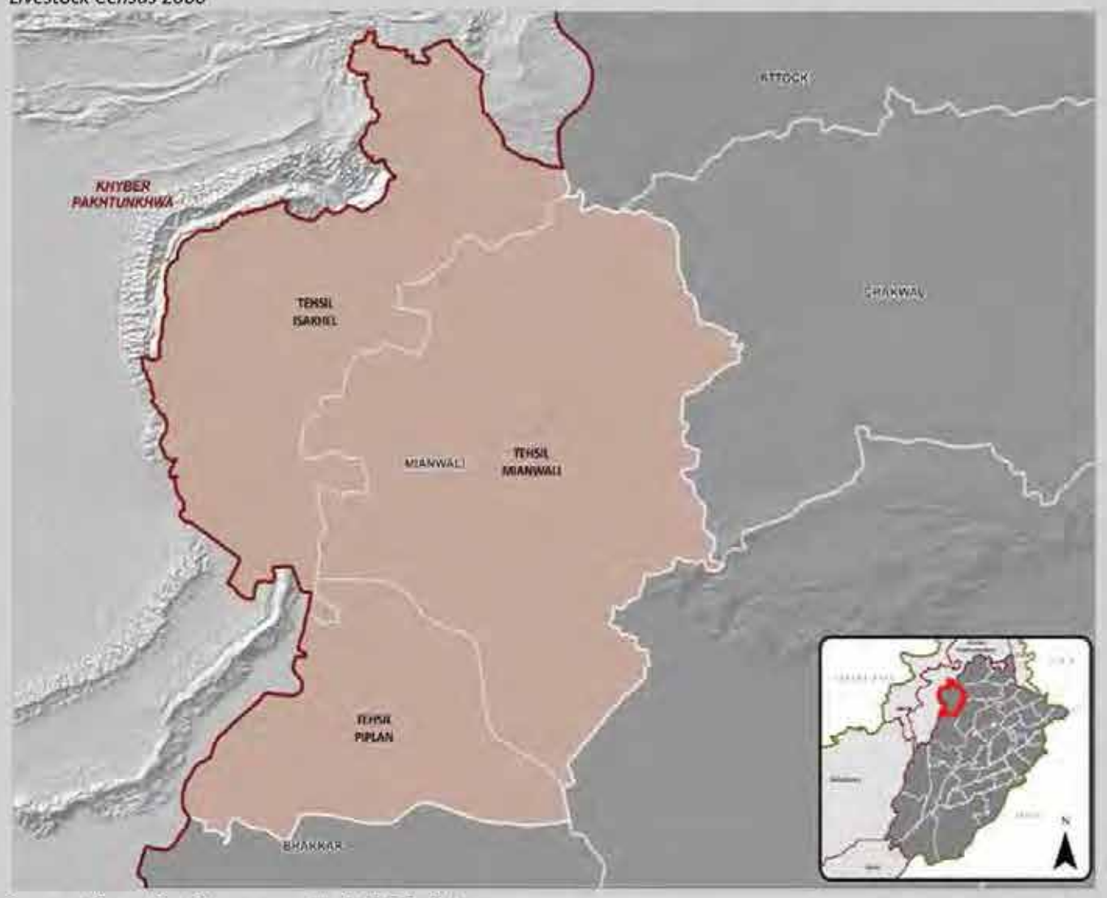
Parent Material	Mixed alluvium of river and piedmont plains
Dominant Soil Series	Shahdara, Bhakkar, Bhareri, Fazilpur, Banda
pH	7.2 – 8.6 (Average 7.91)
Electrical Conductivity (dSm^{-1})	0.1 – 1.1 (Average 0.37)
Organic Matter (%)	0.2 – 1.4 (Average 0.76)
Available Phosphorus (ppm)	2 – 14 (Average 4.89)
Extractable Potassium (ppm)	50 – 300 (Average 148)
Farmers availing soil test facility (%)	12
Farmers availing water test facility (%)	12

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	341,562
Total Uncultivated Area (hectares)	194,540
Total Area under Irrigation (hectares)	262,965
Major Rabi Crop(s)	Wheat, Gram
Major Kharif Crop(s)	Sugarcane, Millet
Total Livestock Population	2,194,855

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

MULTAN

The land of Multan district is plain and very fertile with Chenab river passing on its western side. Hot and dry weather prevails during summer and cold during the winter. The main crops include wheat, cotton, sugarcane, vegetables and fruits (e.g. mango). There are four tehsils in the district: Multan City, Multan Saddar, Shujabad and Jalalpur Pirwala. The district headquarter is located at Multan which is known to be one of the oldest cities in the Southeast Asia.

SOIL ATTRIBUTES

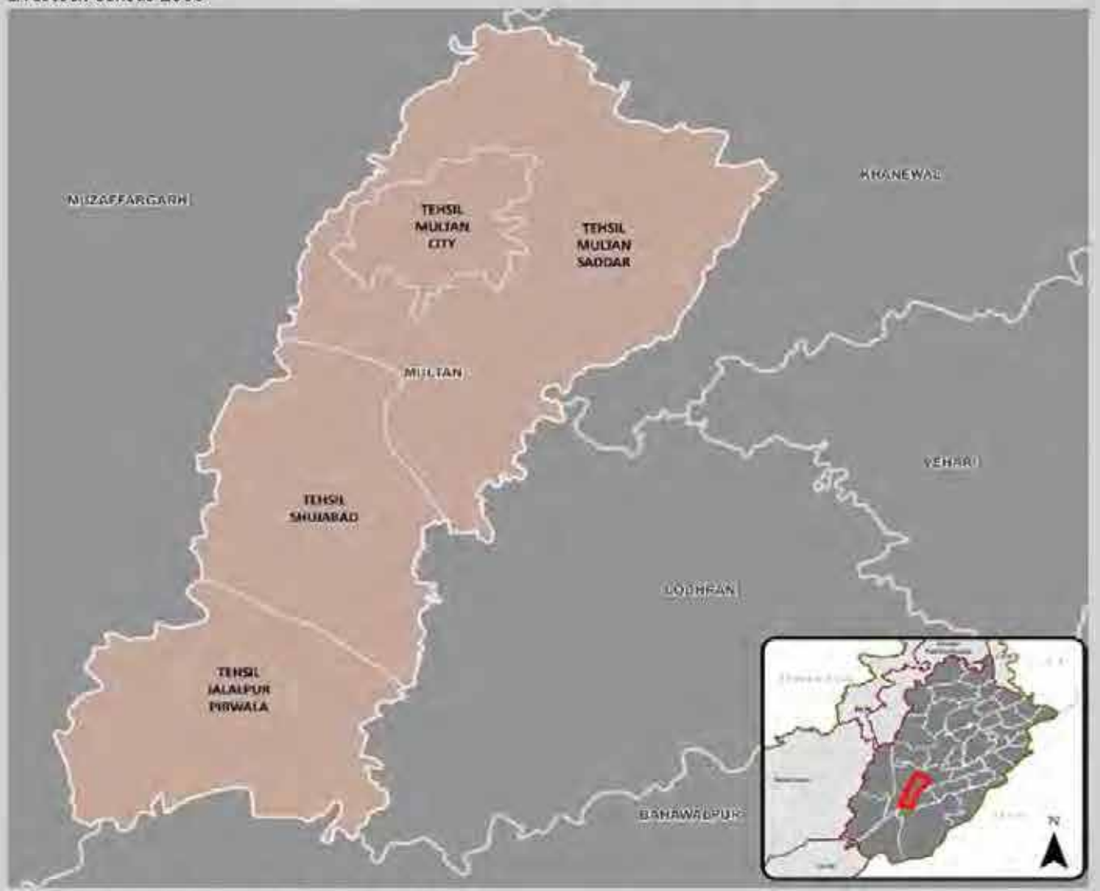
Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Rustam, Shahdara, Bhalike, Pacca, Gajiana
pH	7.3 – 10 (Average 7.91)
Electrical Conductivity (dSm^{-1})	0.04 – 37 (Average 0.37)
Organic Matter (%)	0.1 – 3.0 (Average 0.76)
Available Phosphorus (ppm)	1 – 50 (Average 4.89)
Extractable Potassium (ppm)	26 – 400 (Average 148)
Farmers availing soil test facility (%)	14
Farmers availing water test facility (%)	3

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	477,797
Total Uncultivated Area (hectares)	70,638
Total Area under Irrigation (hectares)	471,308
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Cotton, Sugarcane
Total Livestock Population	2,342,891

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

MUZAFFARGARH

Muzaffargarh was founded by the Mughal governor of Multan, Nawab Muzaffar Khan in 1794. The district lies between Indus river in the west and Chenab river in the east. Hot and dry weather prevails during summer and cold during the winter. The main crops are cotton, wheat, sugarcane and fruit orchards (mainly citrus and mango). The land of this district close to the Chenab river is usually flooded in the monsoon season. There are four tehsils in the district: Muzaffargarh, Alipur, Jatoi and Kot Addu. The district headquarter is at Muzaffargarh.

SOIL ATTRIBUTES

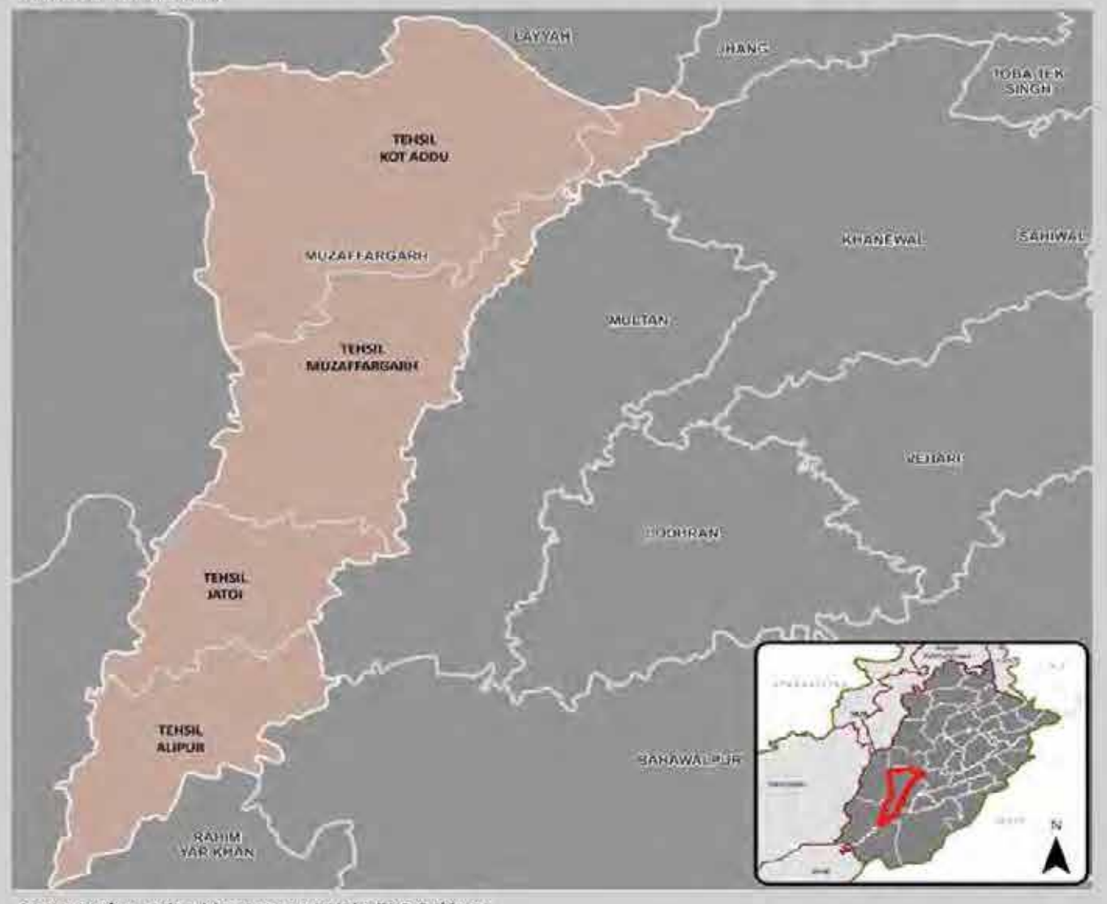
Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Shahdara, Thal Rangpur, Matli, Sultanpur, Jhakkar
pH	7.3 – 10 (Average 7.91)
Electrical Conductivity (dSm^{-1})	0.1 – 9.9 (Average 0.37)
Organic Matter (%)	0.1 – 1.5 (Average 0.76)
Available Phosphorus (ppm)	1 – 16 (Average 4.89)
Extractable Potassium (ppm)	25 – 392 (Average 148)
Farmers availing soil test facility (%)	16
Farmers availing water test facility (%)	3

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	679,637
Total Uncultivated Area (hectares)	403,752
Total Area under Irrigation (hectares)	658,818
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Cotton, Sugarcane
Total Livestock Population	4,829,961

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

NANKANA SAHIB

Nankana Sahib was previously a tehsil of Sheikhupura district that raised to the status of district in May 2005. Climate of the district comprises of hot summers and cold winters. The main crops include wheat, rice, sugarcane, maize and vegetables. Nankana Sahib is famous for being the birth place of Baba Guru Nanak, the founder and first guru of Sikhism. There are three tehsils in this district: Nankana Sahib, Sangla Hill and Shahkot. The district headquarter lies at Nankana Sahib.

SOIL ATTRIBUTES

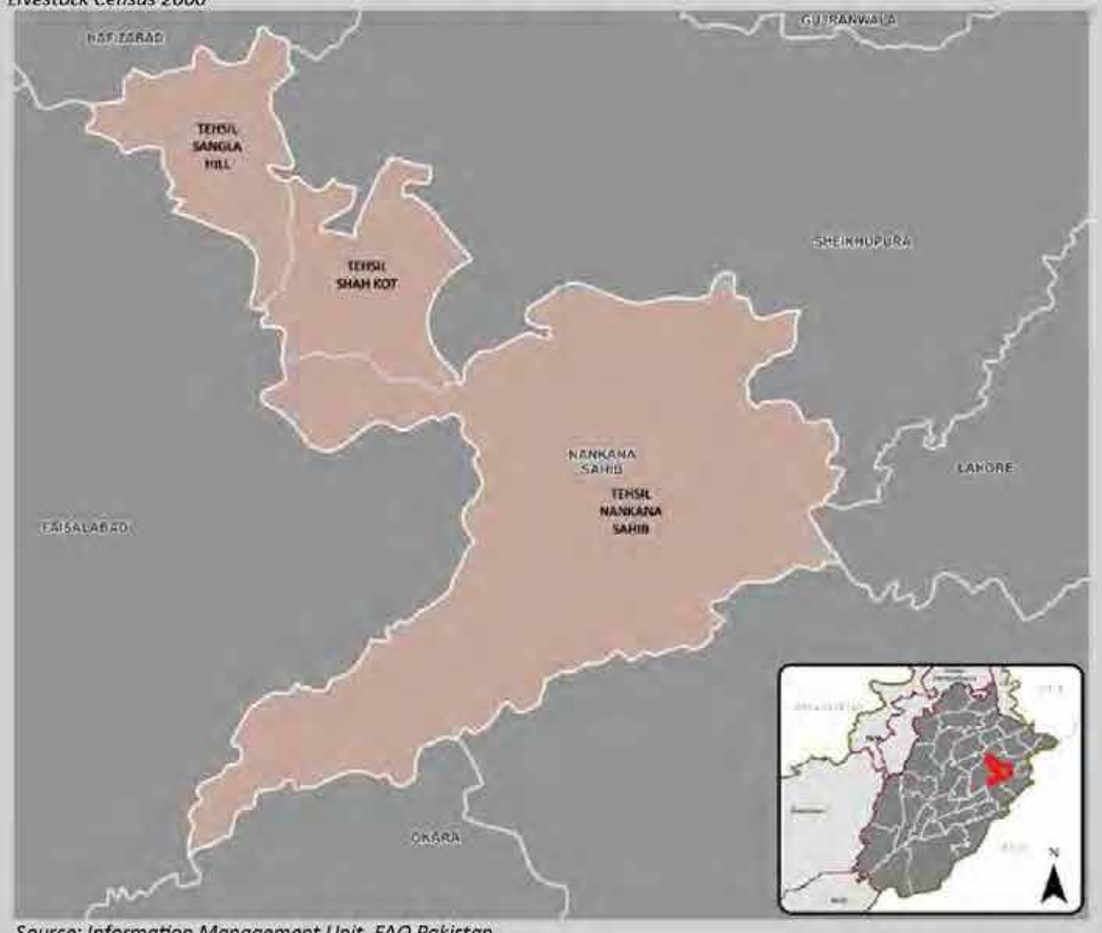
Parent Material	Mainly loamy and clayey soils of sub-recent river plains
Dominant Soil Series	Miranpur, Paccaa, Satghara, Pindorian, Rasulpur
pH	7.5 – 10.3 (Average 8.31)
Electrical Conductivity (dSm^{-1})	0.1 – 5.0 (Average 0.54)
Organic Matter (%)	0.1 – 1.02 (Average 0.58)
Available Phosphorus (ppm)	1 – 24 (Average 7.23)
Extractable Potassium (ppm)	62 – 400 (Average 149)
Farmers availing soil test facility (%)	6
Farmers availing water test facility (%)	3

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	313,206
Total Uncultivated Area (hectares)	39,281
Total Area under Irrigation (hectares)	313,182
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Rice, Sugarcane, Maize
Total Livestock Population	1,322,948

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

NAROWAL

Narowal district lies in the northeast of the Punjab and represents rice belt of the province. The district is bounded on two sides by alluvial soils. The climate is hot and dry during the summer and moderately cold in the winter. The main crops include rice, wheat, maize, vegetables and fruits. There are three tehsils in this district: Narowal, Shakargarh and Zafarwal. The district headquarter is situated at Narowal.

SOIL ATTRIBUTES

Parent Material	Loamy and clayey non-calcareous alluvium
Dominant Soil Series	Miani, Sindhlianwali, Kamunki, Shahdara, Sialkot
pH	7.4 – 7.7 (Average 7.58)
Electrical Conductivity (dSm^{-1})	0.31 – 0.48 (Average 0.40)
Organic Matter (%)	0.5 – 0.7 (Average 0.63)
Available Phosphorus (ppm)	4 – 9 (Average 6.57)
Extractable Potassium (ppm)	104 – 132 (Average 117)
Farmers availing soil test facility (%)	33
Farmers availing water test facility (%)	18

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	299,559
Total Uncultivated Area (hectares)	58,270
Total Area under Irrigation (hectares)	220,108
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Rice, Maize, Potato
Total Livestock Population	983,573

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006

Source: Information Management Unit, FAO Pakistan

OKARA

Okara district is famous for its fertile land, livestock and peaceful natural environment. It is bounded in the northwest by river Ravi and in the southeast by river Sutlej. The climate is hot and dry during the summer and moderately cold in the winter. The district represents well-defined mixed cropping belt of Punjab. The main crops are maize , potato, sugarcane, wheat and rice. There are three tehsils in the district: Okara, Depalpur and Renala Khurd. The district headquarter is Okara city.

SOIL ATTRIBUTES

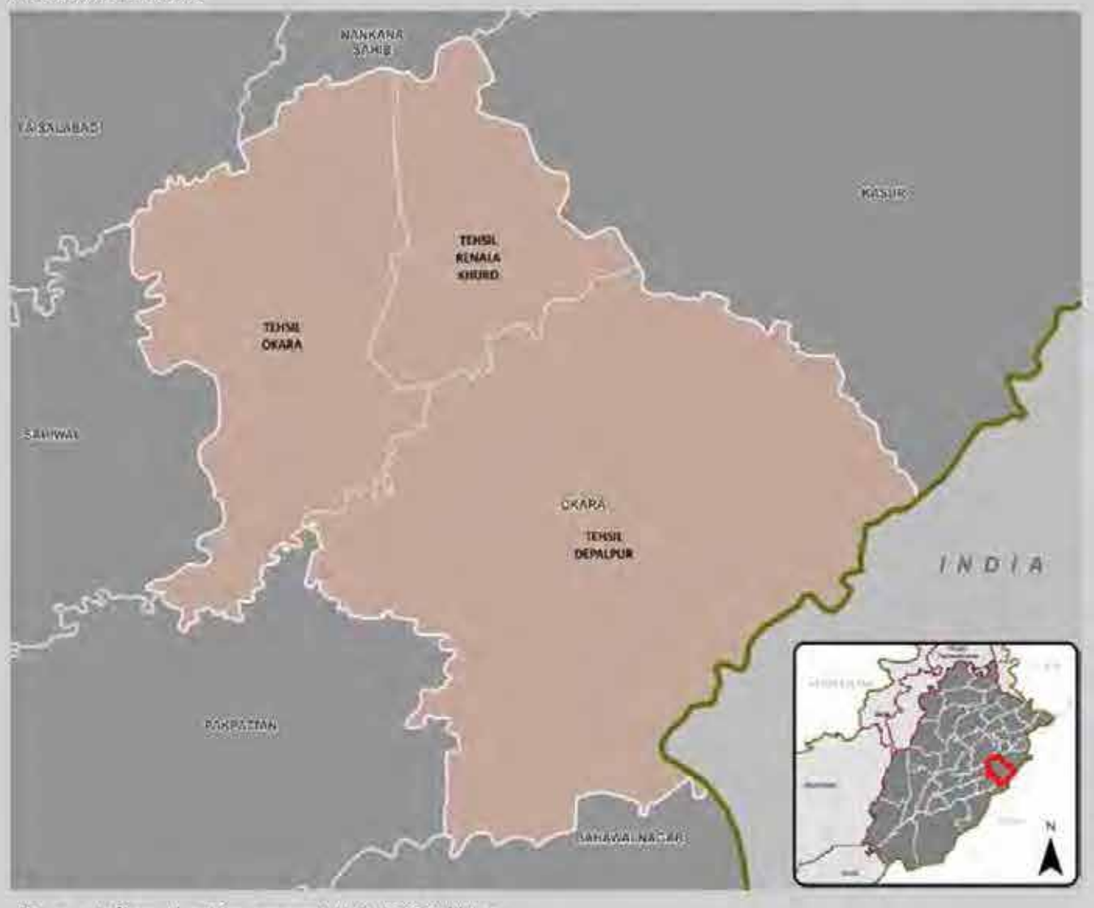
Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Jhakkar, Shahdara, Qadirabad, Lyallpur, Sindhlianwali
pH	7.1 – 9.2 (Average 8.15)
Electrical Conductivity (dSm^{-1})	0.1 – 4.8 (Average 0.42)
Organic Matter (%)	0.17 – 1.84 (Average 0.92)
Available Phosphorus (ppm)	3 – 20 (Average 5.33)
Extractable Potassium (ppm)	40 – 400 (Average 137)
Farmers availing soil test facility (%)	33
Farmers availing water test facility (%)	33

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	632,679
Total Uncultivated Area (hectares)	90,430
Total Area under Irrigation (hectares)	632,616
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Maize, Potato, Sugarcane
Total Livestock Population	2,309,614

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

PAKPATTAN

Pakpattan district is known for the fertility of its soil; therefore, most of the population of the district relies on agriculture. The climate is hot and dry during the summer and moderately cold in the winter. The main crops are wheat, rice, cotton, maize and sugarcane. The fruits and vegetables grown here include mango, guava, oranges, carrots and potatoes. Pakpattan is the city of great Saint Hazrat Baba Fariduddin Ganj Shakar. There are two tehsils in the district: Pakpattan and Arifwala. The district headquarter is located at Pakpattan.

SOIL ATTRIBUTES

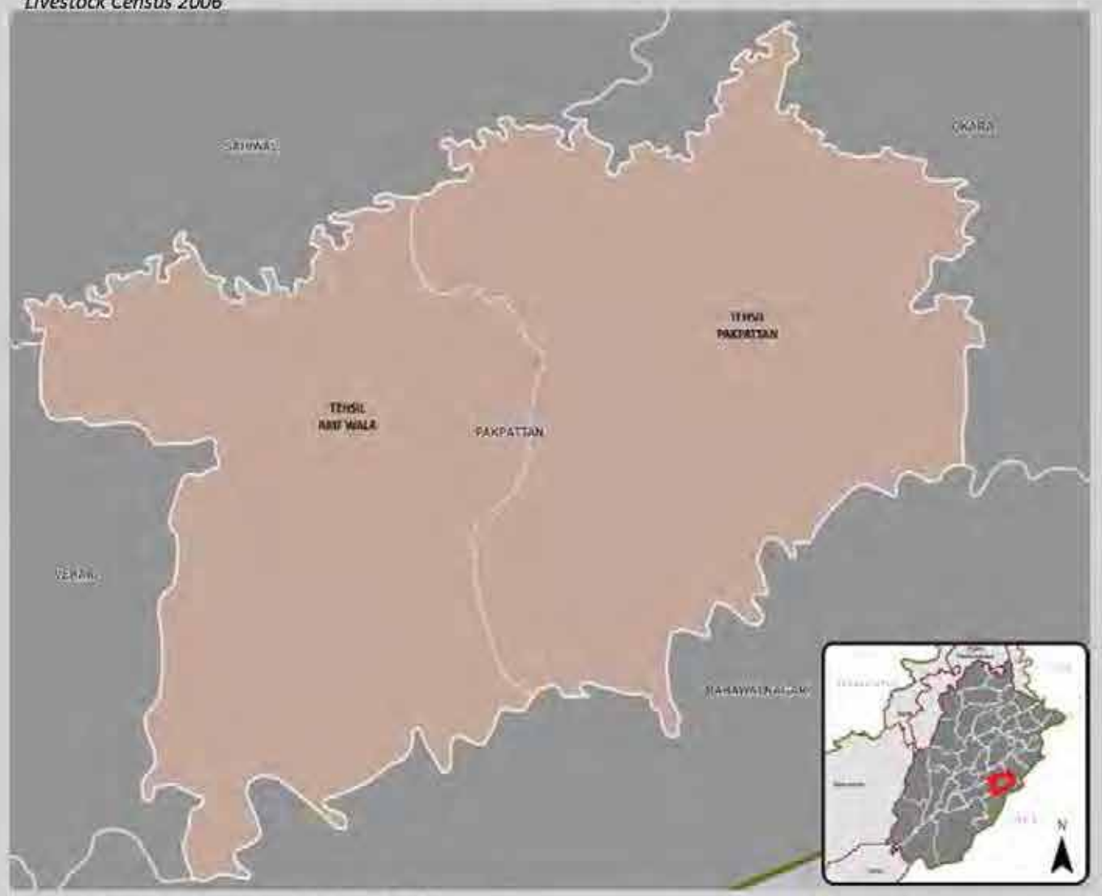
Parent Material	Mainly loamy and clayey sub-recent alluvium
Dominant Soil Series	Bagh, Jhakkar, Dungi, Pacca, Shahdara
pH	7.2 – 9.3 (Average 8.20)
Electrical Conductivity (dSm^{-1})	0.1 – 8.2 (Average 0.35)
Organic Matter (%)	0.2 – 1.7 (Average 0.89)
Available Phosphorus (ppm)	3 – 15 (Average 5.42)
Extractable Potassium (ppm)	50 – 370 (Average 152)
Farmers availing soil test facility (%)	21
Farmers availing water test facility (%)	21

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	403,009
Total Uncultivated Area (hectares)	25,780
Total Area under Irrigation (hectares)	403,006
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Maize, Cotton, Rice, Sugarcane
Total Livestock Population	1,615,203

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan.

RAHIM YAR KHAN

Rahim Yar Khan district lies in the south of Punjab province. The climate is that of a desert with hot summers and mild winters. Major crops include cotton, sugarcane, wheat and the orchards of mango and citrus. Based on physical features, this district is divided into three main parts which are riverside area, canal irrigated area and desert area called Cholistan. There are four tehsils in Rahim Yar Khan: Khanpur, Liaquatpur, Rahim Yar Khan and Sadiqabad. The district headquarter is located at Rahim Yar Khan.

SOIL ATTRIBUTES

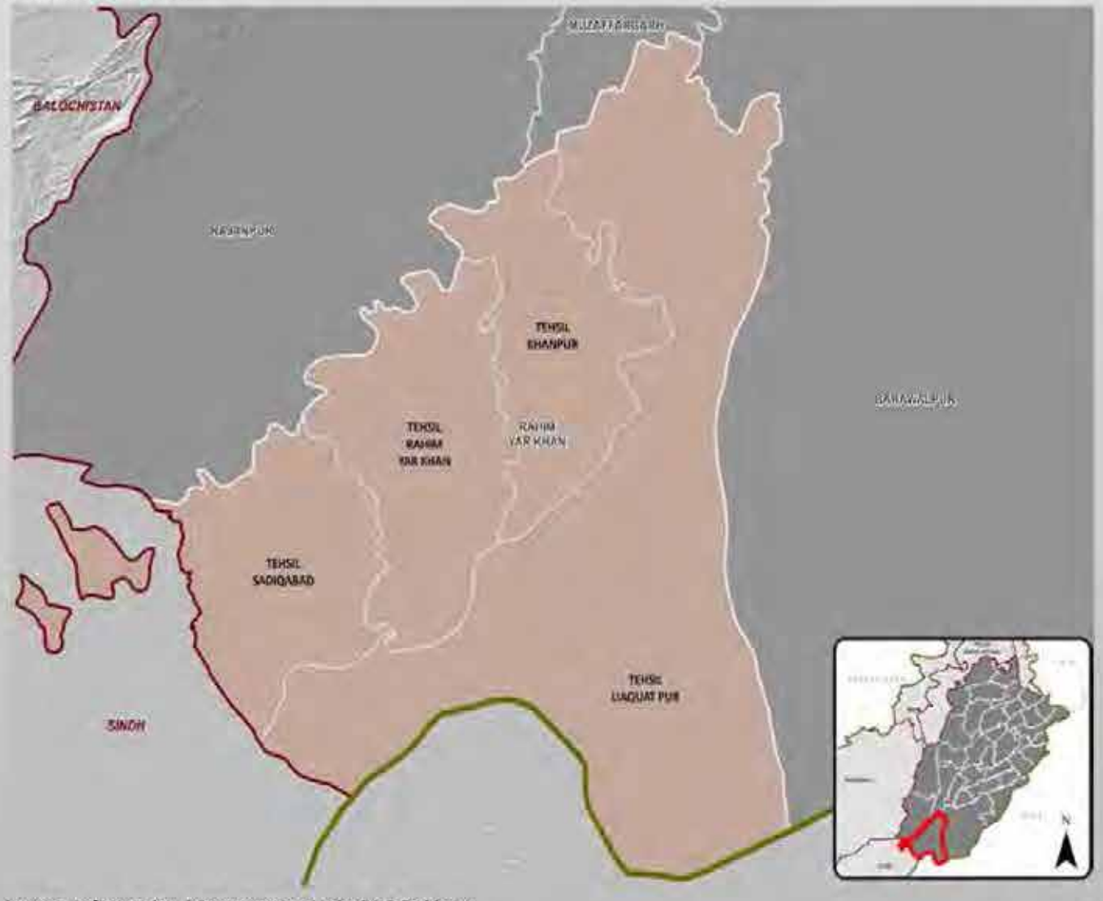
Parent Material	Mixed calcareous alluvium and sand plain
Dominant Soil Series	Bagh, Harunabad, Pacca, Shujabad, Sindhlianwali
pH	7.7 – 9.9 (Average 8.21)
Electrical Conductivity (dSm^{-1})	0.1 – 12.5 (Average 0.85)
Organic Matter (%)	0.1 – 1.2 (Average 0.36)
Available Phosphorus (ppm)	2 – 12 (Average 5.23)
Extractable Potassium (ppm)	60 – 380 (Average 161)
Farmers availing soil test facility (%)	18
Farmers availing water test facility (%)	3

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	750,543
Total Uncultivated Area (hectares)	99,960
Total Area under Irrigation (hectares)	744,651
Major Rabi Crops	Wheat
Major Kharif Crops	Cotton, Sugarcane
	4,159,656

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

RAJANPUR

Rajanpur district lies on the west bank of the Indus river in the south-west of Punjab province. The climate is hot and dry during the summer and moderately cold in the winter. The district is famous for cotton and sugarcane. Wheat and rice are also cultivated. Canal irrigation is the major source of water as the rainfall is negligible in the region. Occasional heavy rainfall causes flooding in the district. Hill-torrent irrigation is also practiced in the western parts of the district. The district headquarter is at Rajanpur.

SOIL ATTRIBUTES

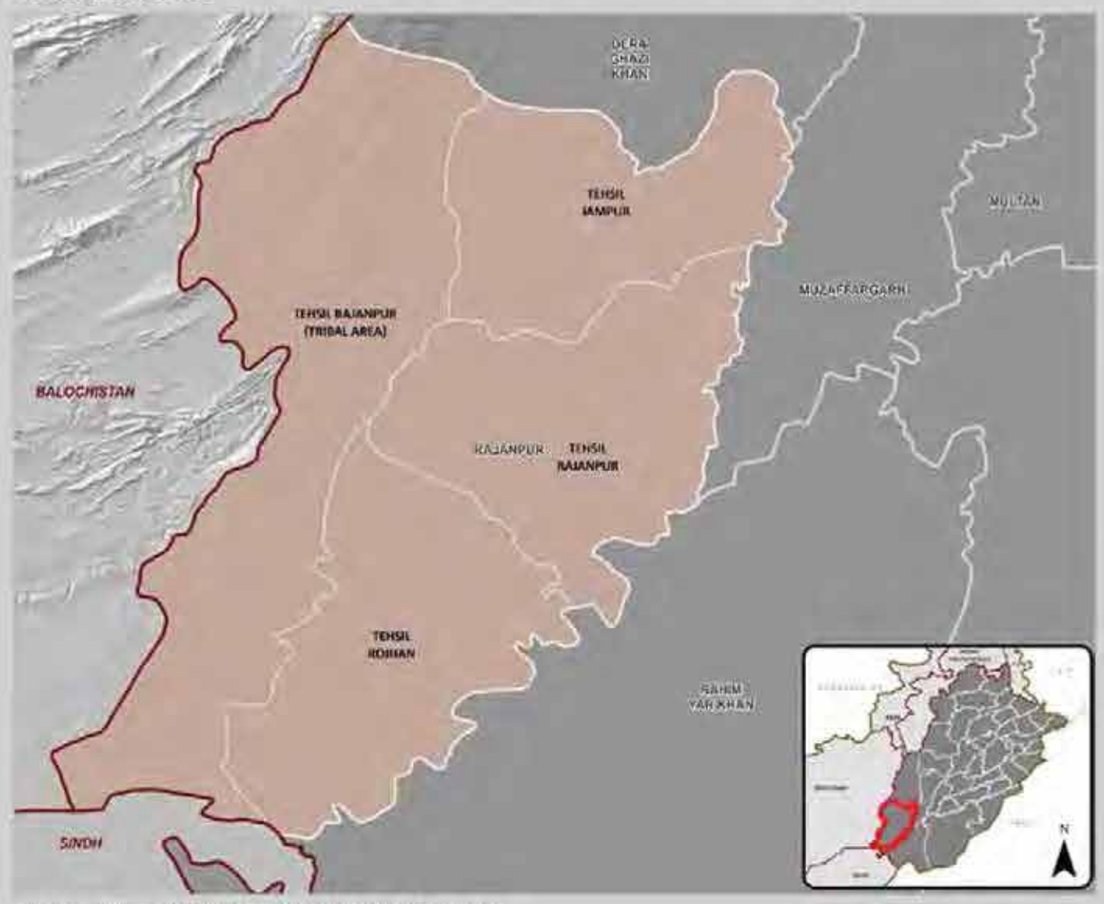
Parent Material	Loamy and clayey river alluvium and that of saline piedmont plains
Dominant Soil Series	Shahdara, Jhatpat, Kandhkot, Kahror, Kashmore
pH	8.0 – 9.3 (Average 8.44)
Electrical Conductivity (dSm^{-1})	0.1 – 9.9 (Average 1.57)
Organic Matter (%)	0.1 – 1.4 (Average 0.57)
Available Phosphorus (ppm)	1 – 14 (Average 3.90)
Extractable Potassium (ppm)	30 – 362 (Average 155)
Farmers availing soil test facility (%)	3
Farmers availing water test facility (%)	3

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	398,789
Total Uncultivated Area (hectares)	296,625
Total Area under Irrigation (hectares)	342,073
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Cotton, Sugarcane
Total Livestock Population	2,324,116

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

RAWALPINDI

Rawalpindi is situated near Islamabad in the Pothwar Plateau, north of Punjab. Climate of the district comprises of hot summers and cold winters. The main crops grown in the district are wheat, barley, maize, millet, groundnut and pulses. Rawalpindi is the fourth largest city in Pakistan by population. There are seven tehsils in the district: Gujar Khan, Kahuta, Kallar Syaddan, Kotli Sattian, Murree, Taxila and Rawalpindi. The district headquarter is located at Rawalpindi.

SOIL ATTRIBUTES

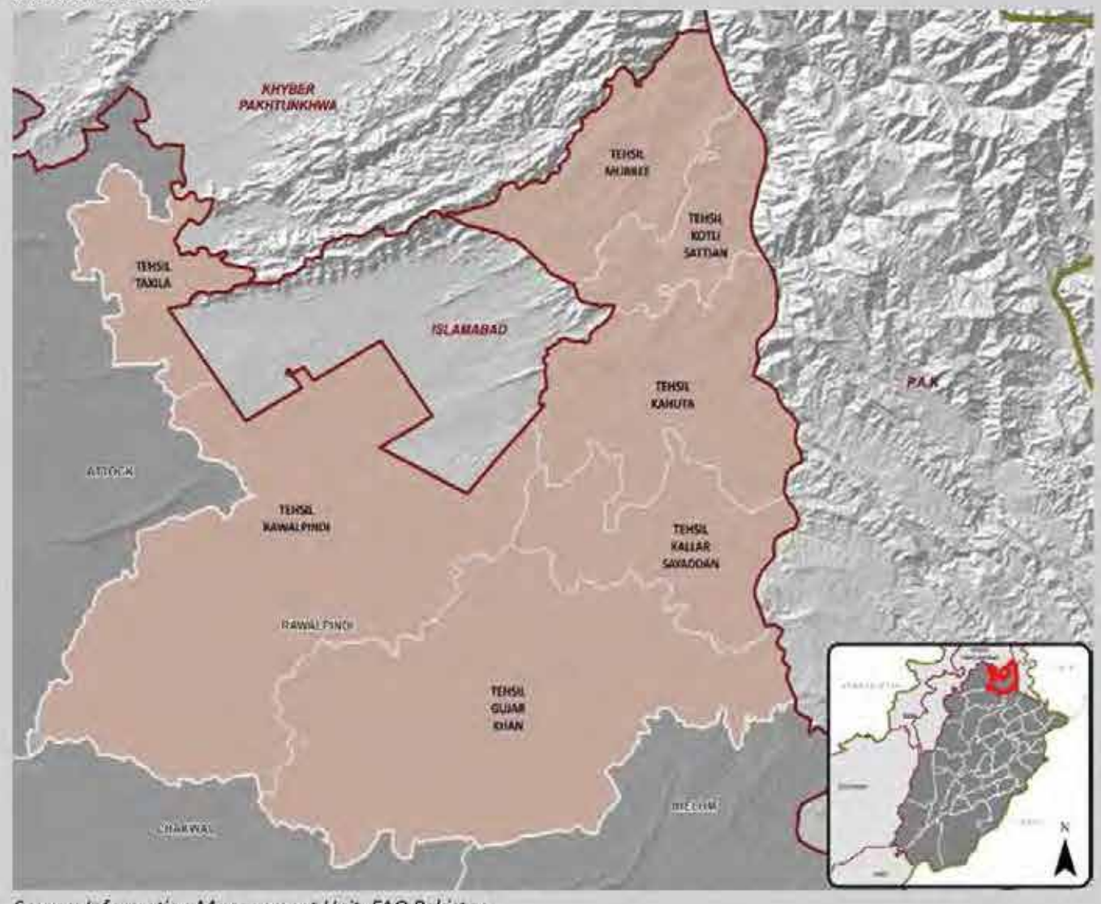
Parent Material	Mainly calcareous loess material
Dominant Soil Series	Rajar, Soan, Rawalpindi, Missa, Guliana
pH	7.2 – 8.5 (Average 7.81)
Electrical Conductivity (dSm^{-1})	0.1 – 0.85 (Average 0.26)
Organic Matter (%)	0.3 – 1.2 (Average 0.55)
Available Phosphorus (ppm)	2 – 14 (Average 5.04)
Extractable Potassium (ppm)	40 – 380 (Average 118)
Farmers availing soil test facility (%)	9
Farmers availing water test facility (%)	9

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	233,393
Total Uncultivated Area (hectares)	251,931
Total Area under Irrigation (hectares)	10,700
Major Rabi Crop(s)	Wheat, Mustard
Major Kharif Crop(s)	Sorghum, Groundnut, Maize
Total Livestock Population	2,203,917

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

SAHIWAL

Sahiwal district represents the mixed cropping belt of Punjab province. The climate of the district is extreme, i.e. very hot in summer and cold in winter. The soil of the district is very fertile. The main crops are maize, potato, wheat, cotton, sugarcane and rice while the fruits include citrus, mango and guava. The district is famous for its cattle and breed of buffaloes. There are two tehsils in the district: Sahiwal and Chichawatni. The district headquarter is at Sahiwal.

SOIL ATTRIBUTES

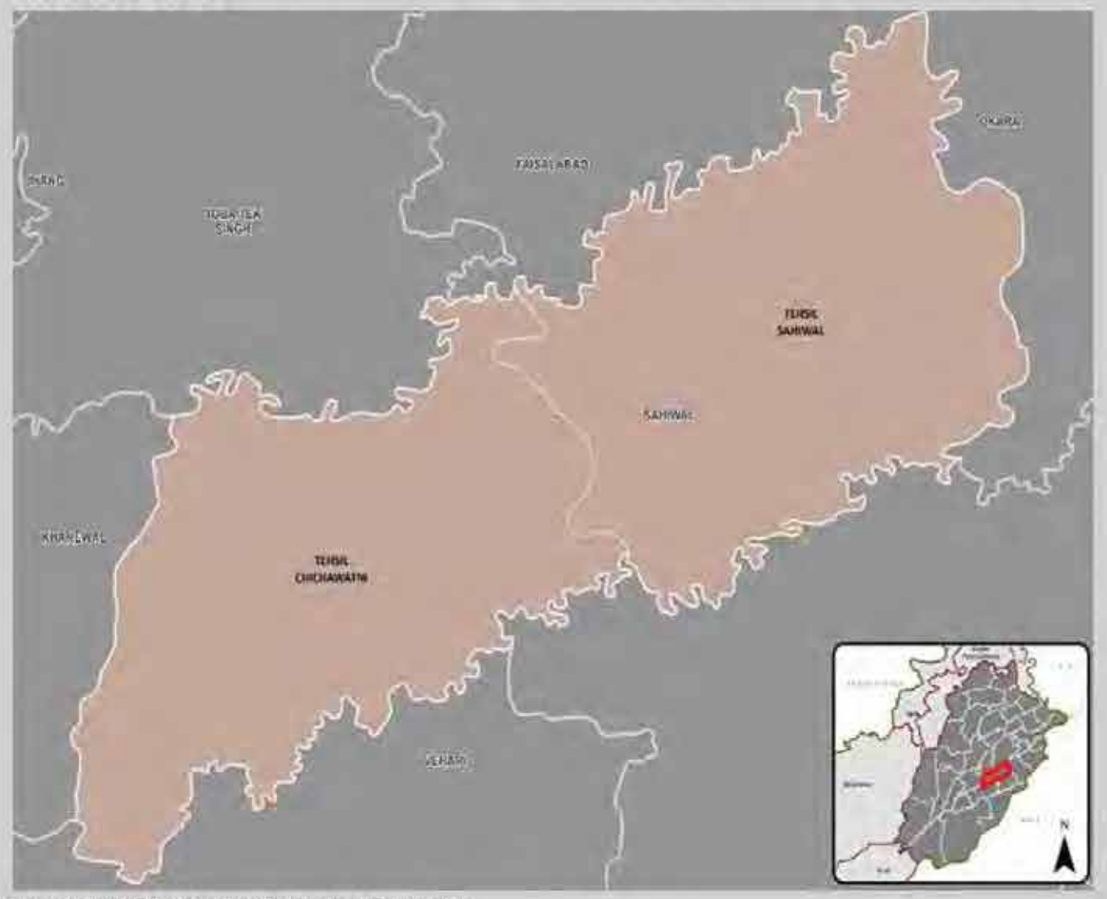
Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Sultanpur, Bhalwal, Gamber, Lyallpur, Firoz
pH	7.5 – 10.4 (Average 8.22)
Electrical Conductivity (dSm^{-1})	0.1 – 7.35 (Average 0.49)
Organic Matter (%)	0.1 – 2.6 (Average 0.78)
Available Phosphorus (ppm)	3 – 18 (Average 5.12)
Extractable Potassium (ppm)	30 – 400 (Average 138)
Farmers availing soil test facility (%)	20
Farmers availing water test facility (%)	32

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	447,182
Total Uncultivated Area (hectares)	58,411
Total Area under Irrigation (hectares)	447,101
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Maize, Potato, Sugarcane
Total Livestock Population	2,086,175

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

SARGODHA

Sargodha mainly comprises of flat and fertile plains between the River Jhelum on the west and north, and the River Chenab on the east. Climate of the district comprises of hot summers and cold winters. The district represents mixed cropping zone of Punjab and is mainly famous for citrus export. Main crops sown are wheat, maize, rice and sugarcane. There are seven tehsils in the district: Bhera, Bhalwal, Kot Momin, Sahiwal, Sargodha, Shahpur and Sillanwali. The district headquarter is at Sargodha.

SOIL ATTRIBUTES

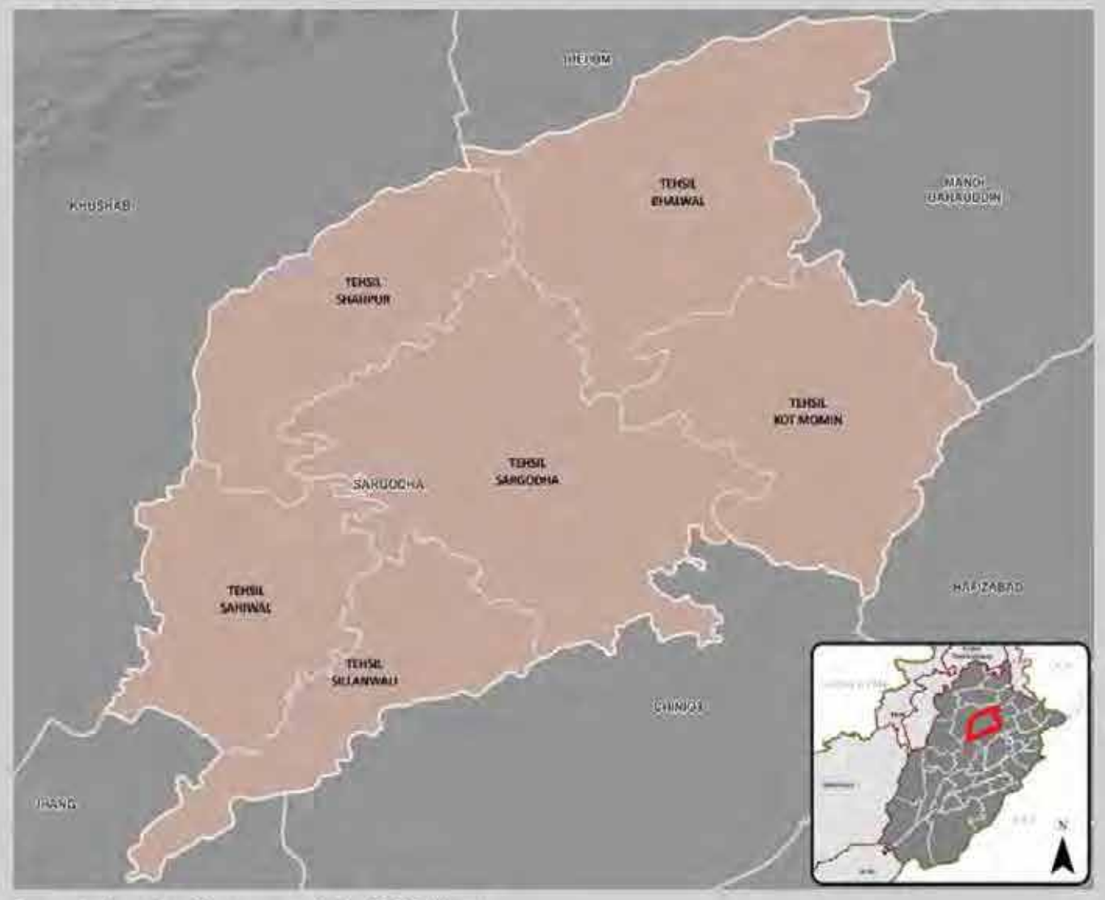
Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Bhalwal, Lyallpur, Firoz, Gujranwala, Shahpur
pH	7.4 – 9.4 (Average 8.02)
Electrical Conductivity (dSm^{-1})	0.1 – 5.0 (Average 0.46)
Organic Matter (%)	0.2 – 1.8 (Average 0.77)
Available Phosphorus (ppm)	2 – 18 (Average 5.11)
Extractable Potassium (ppm)	40 – 400 (Average 167)
Farmers availing soil test facility (%)	30
Farmers availing water test facility (%)	30

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	706,302
Total Uncultivated Area (hectares)	118,676
Total Area under Irrigation (hectares)	705,636
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Maize, Rice, Sugarcane
Total Livestock Population	3,028,870

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

SHEIKHUPURA

Sheikhupura is commonly known for its industrial and agriculture surroundings and the best export-quality rice. The climate is hot and dry during the summer and moderately cold in the winter. Main crops in the district include rice, wheat and sugarcane, besides a variety of vegetables. There are five tehsils in the district: Sheikhupura, Ferozewala, Muridke, Sharakpur and Safdarabad. The district headquarter is located at Sheikhupura.

SOIL ATTRIBUTES

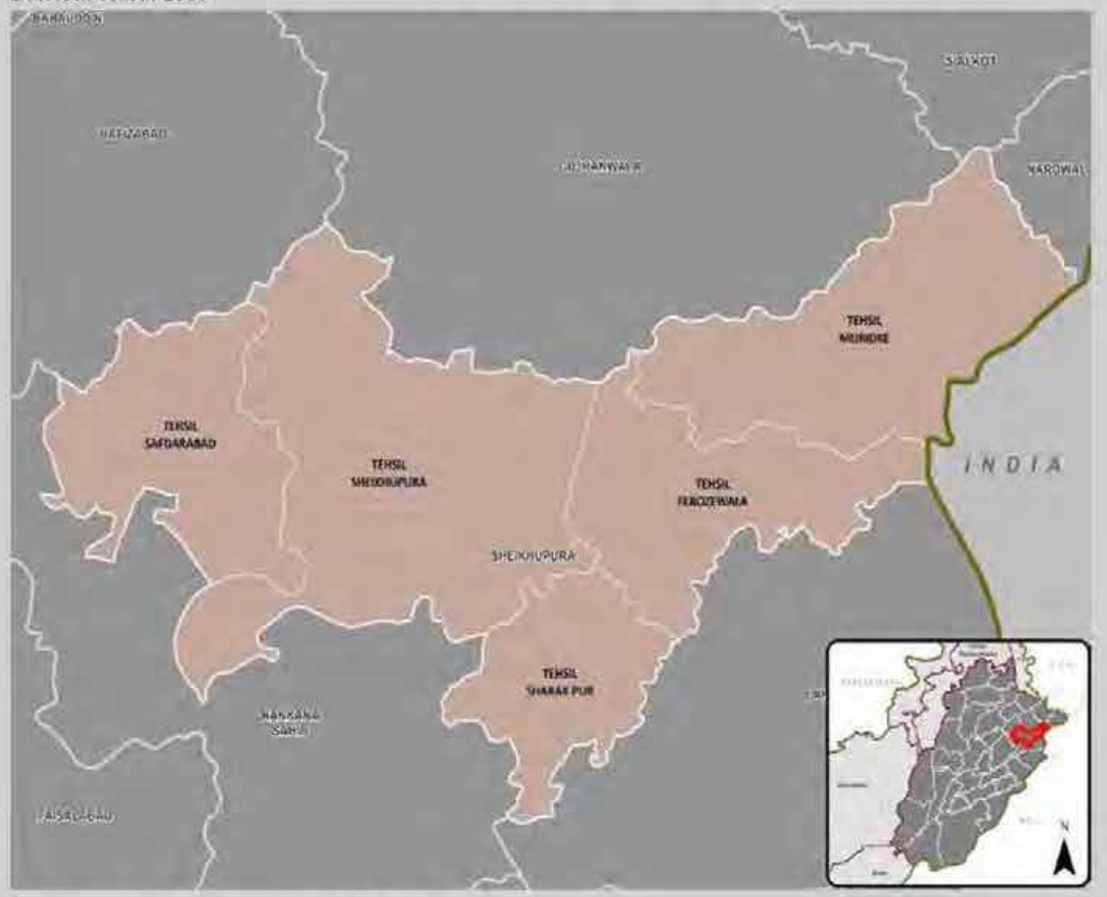
Parent Material	Mixed calcareous alluvium
Soil Series	Pacca, Lyallpur, Hafizabad, Bhalwal, Firoz
pH	7.4 – 9.8 (Average 8.28)
Electrical Conductivity (dSm^{-1})	0.2 – 2.0 (Average 0.53)
Organic Matter (%)	0.2 – 1.4 (Average 0.72)
Available Phosphorus (ppm)	3 – 18 (Average 6.34)
Extractable Potassium (ppm)	90 – 400 (Average 163)
Farmers availing soil test facility (%)	41
Farmers availing water test facility (%)	34

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	516,801
Total Uncultivated Area (hectares)	52,698
Total Area under Irrigation (hectares)	516,801
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Rice, Sugarcane
Total Livestock Population	1,705,741

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

SIALKOT

Sialkot district is located in the northeast of the Punjab province. The climate is hot and dry during the summer and moderately cold in the winter. Main crops include rice, wheat, vegetables and fruits (e.g., guava and citrus). Sialkot is renowned for industrial production of sports goods, surgical instruments, leather goods/garments, cutlery and musical instruments. There are four tehsils of Sialkot: Daska, Pasrur, Sambrial and Sialkot. The district headquarter is located at Sialkot.

SOIL ATTRIBUTES

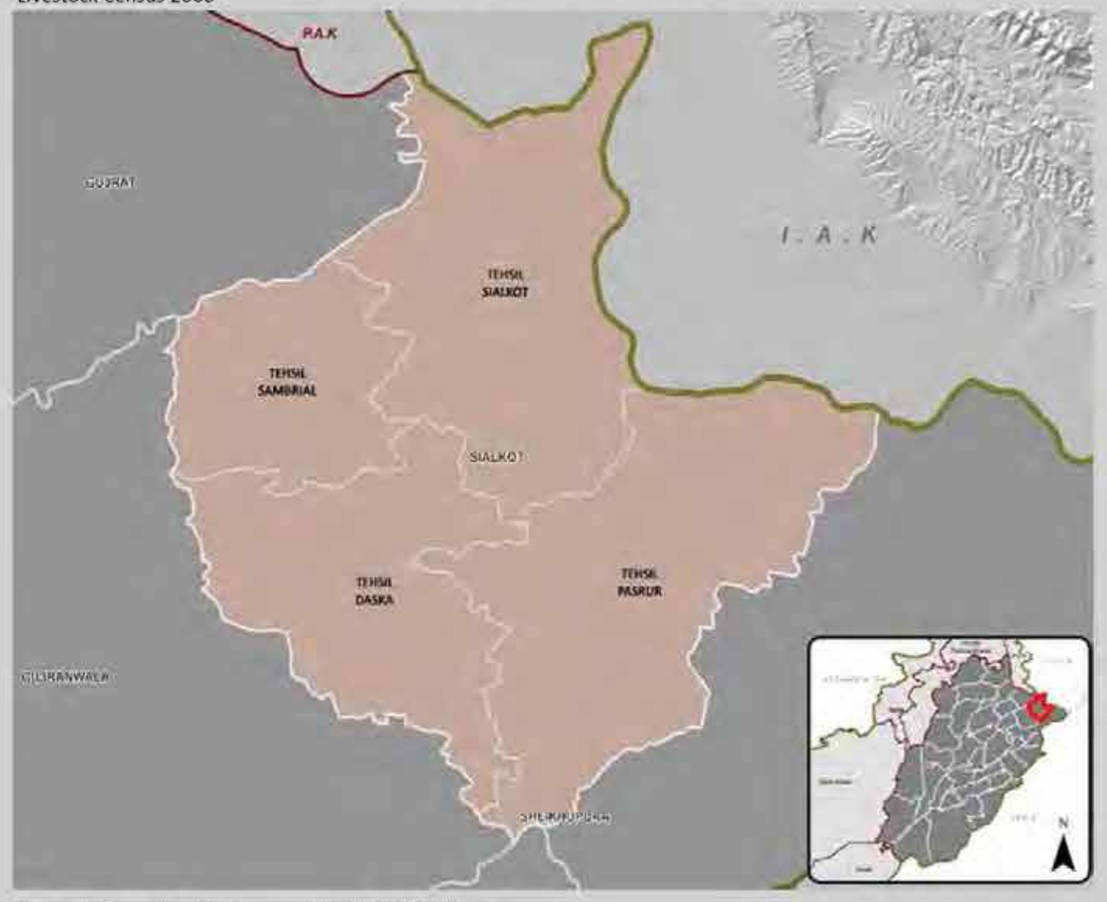
Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Sialkot, Pasrur, Gujranwala, Shakargarh, Miani
pH	7.2 – 8.5 (Average 7.70)
Electrical Conductivity (dSm^{-1})	0.2 – 0.8 (Average 0.46)
Organic Matter (%)	0.3 – 1.2 (Average 0.69)
Available Phosphorus (ppm)	3 – 28 (Average 7.84)
Extractable Potassium (ppm)	70 – 370 (Average 130)
Farmers availing soil test facility (%)	21
Farmers availing water test facility (%)	9

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	412,983
Total Uncultivated Area (hectares)	52,974
Total Area under Irrigation (hectares)	403,974
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Rice
Total Livestock Population	1,586,315

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan.

TOBA TEK SINGH

Toba Tek Singh is located in central Punjab. The district is one of the best producers of oranges in Pakistan. The climate is hot and dry during the summer and moderately cold in the winter. The district represents mixed cropping zone of Punjab. Majority of inhabitants are employed in the agriculture industry that produces several kinds of agricultural and dairy products. There are three tehsils in the district: Gojra, Toba Tek Singh and Kamalia. The district headquarter is at Toba Tek Singh.

SOIL ATTRIBUTES

Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Lyallpur, Bhalike, Pacca, Gajiana, Rustam
pH	7.5 – 9.0 (Average 7.96)
Electrical Conductivity (dSm^{-1})	0.2 – 1.0 (Average 0.41)
Organic Matter (%)	0.2 – 1.1 (Average 0.59)
Available Phosphorus (ppm)	2 – 20 (Average 5.95)
Extractable Potassium (ppm)	74 – 336 (Average 140)
Farmers availing soil test facility (%)	17
Farmers availing water test facility (%)	17

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	419,208
Total Uncultivated Area (hectares)	42,124
Total Area under Irrigation (hectares)	419,208
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Cotton, Rice, Sugarcane
Total Livestock Population	1,710,668

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006

Source: Information Management Unit, FAO Pakistan.

VEHARI

Vehari is known for cotton production and was declared as district on 1 July 1976. The climate is hot and dry during the summer and moderately cold in the winter. The district consists of plains and fertile land suitable for growing cotton, wheat and other crops. The main fruit crops include mango, guava and citrus. Major land is irrigated by the Chenab and Ravi rivers. Vehari has numerous cotton processing factories, cotton-seed oil extraction plants; sugarcane processing is also common. The district has three tehsils; Mailsi, Vehari & Burewala and the district headquarter is located at Vehari city.

SOIL ATTRIBUTES

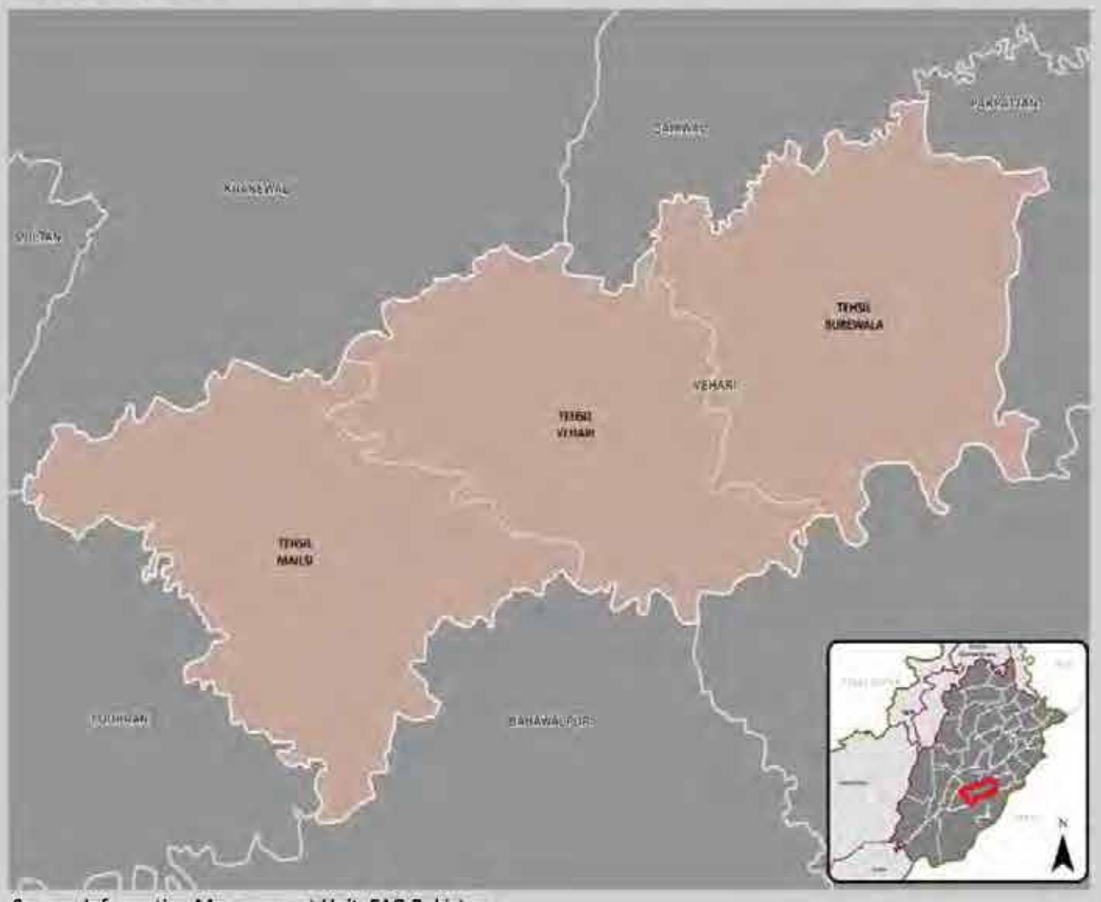
Parent Material	Sub-recent river alluvium
Dominant Soil Series	Bagh, Jhakkar, Pacca, Dungi, Shahdara
pH	7.6 – 9.0 (Average 8.28)
Electrical Conductivity (dSm^{-1})	0.1 – 5.3 (Average 0.71)
Organic Matter (%)	0.1 – 1.4 (Average 0.64)
Available Phosphorus (ppm)	1 – 37 (Average 4.85)
Extractable Potassium (ppm)	34 – 282 (Average 127)
Farmers availing soil test facility (%)	23
Farmers availing water test facility (%)	23

Source:
District Soil Survey Reports, Soil Survey of Pakistan
Farm Advisory Service Centers, Fauji Fertilizer Company Limited (FFCL)
Rapid Fertilizer Use Assessment, FAO (2015)
Land Cover Atlas of Punjab (FAO, SUPARCO and Government of the Punjab)

AGRICULTURAL INFORMATION

Total Area Sown (hectares)	656,364
Total Uncultivated Area (hectares)	43,414
Total Area under Irrigation (hectares)	655,777
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Cotton, Rice, Sugarcane
Total Livestock Population	2,401,073

Source: Crop Reporting Services, Punjab; Economic Wing, Ministry of National Food Security & Research (2014-15); Livestock Census 2006



Source: Information Management Unit, FAO Pakistan

KEY MESSAGES
SOIL HEALTH MANAGEMENT AND CROP PRODUCTIVITY

As a result of intensive cropping and high yields over the years, most of agricultural soils in Pakistan have become deficient in various macro- and micro-nutrient elements, because the nutrients were not adequately replenished into the soils in proportion to the nutrients removed through crop harvests. Consequently, adoption of Fertilizer Best Management Practices (FBMP) according to specific farming system(s) is essential for sustainable crop production and maintenance of soil health. Therefore, following recommendations are formulated for the benefit of farming communities.

As the Management Practices differ according to the site conditions and farm systems, the fertilizers (nutrients) should be applied following the guiding principles of 4R Stewardship, as described below:

- Right source (Suitable source of nutrients)
- Right rate (Quantity applied according to crop requirement and soil test)
- Right time (Fertilizer applied at the time when crop can best utilize it)
- Right placement (Suitable method of nutrient/fertilizer application)

Soil and Water Testing Facilities: Such facilities are available at the district level both by government and private sectors (especially the fertilizer companies) free of cost or with nominal charges. Farmers should get soil and water samples analyzed before crop planting, and use optimum and balanced fertilizer based on soil test values for achieving maximum profitability

KEY MESSAGES
SOIL HEALTH MANAGEMENT AND CROP PRODUCTIVITY

Ensure Use of Quality Fertilizers: Unless fertilizers are of good quality, the money and effort to correct soil-plant problems cannot be remunerative. Therefore, farmers are advised to buy good quality fertilizers from trusted/authorized dealers and reputed companies.

Integrated Plant Nutrient Management System: Balanced and integrated nutrient management is the key to soil health, high productivity, profitability and environmental protection. Biological sources of nutrients (organic fertilizers: green manure, farm yard manure, compost, poultry waste, etc.) including bio-fertilizers should be combined with inorganic fertilizers for enhancing nutrient use efficiency and improving soil health.

Crop Residue Management: Crop residues are good source of nutrients, and residue burning leads to different problems. Burning of crop residues should be discouraged; instead these should be incorporated into the soil for enhancing organic matter contents.

Conservation of Soil Moisture: Soil moisture is important for nutrient uptake and plant growth processes. Therefore, i) apply fertilizer at soil field capacity at sowing, ii) immediately irrigate in case the fertilizer is broadcast in standing crop, iii) apply fertilizer after rainfall in rainfed areas, and iv) use 1/2 N, P and K fertilizers at the time of sowing in arid zone/Barani areas.

KEY MESSAGES
SOIL HEALTH MANAGEMENT AND CROP PRODUCTIVITY

Use of Gypsum: It is an efficient way to preserve soil moisture and meet calcium requirements of groundnut in arid areas. Apply gypsum after every 3 years in wheat-groundnut cropping system. Multiple ploughing and use of mould board plough/deep plough in monsoon season is very effective to preserve soil moisture in arid areas.

Urea Losses: In sandy soils, apply Urea in 2 or more splits, but do not use more than the recommended rates. Excessive use of Urea may damage the crop through insect pest attack and depress fruiting through excessive vegetative growth/lodging. Apply Urea in the late afternoon when temperature is low to avoid volatilization losses.

Phosphorus Management: Farmers can reduce P use in the soils where soil P contents are adequate. For example, in areas where poultry manure is added, P rate can be reduced accordingly based on soil P test result. P application can also be reduced in Kharif crops (cotton and rice), if previous crop wheat was adequately fertilized with P.

Improving Produce Quality: Potassium is the quality nutrient element. Use of potash fertilizers where soils are K deficient, and the application of K fertilizers on high value fruit and vegetable crops is recommended.

KEY MESSAGES
SOIL HEALTH MANAGEMENT AND CROP PRODUCTIVITY

Salt-affected Areas: In such areas, special attention may be given to the right source of nutrients; the fertilizers containing both nitrogen and phosphorus, and possibly calcium as well may be preferred. Integrated use of soil amendments and organic fertilizers (farm yard manure, compost) improves efficiency of inorganic fertilizers. Bed-and-furrow sowing and more split applications of fertilizers will further enhance nutrient use efficiency of salt-tolerant crop cultivars.

Irrigation Management: Irrigation management is very important factor wrt the water quality for optimal crop production, particularly under salinity stress conditions. Therefore, poor quality/marginal saline water should be used in cyclic manner, i.e. one or two irrigations with brackish water should be followed by canal water. Brackish water may be used to grow the crops which require more water; for example, grow rice or sorghum with brackish water followed by canal irrigated wheat.

Appropriate Amendments/Manures: Appropriate amendments should be applied to maintain soil health under irrigation with poor quality water. When water is sodic, apply gypsum after the harvest of two crops, i.e., rice-wheat according to soil gypsum requirement; addition of farm yard manure/green manure may be included if water is saline.

KEY MESSAGES
SOIL HEALTH MANAGEMENT AND CROP PRODUCTIVITY

- **Use of Micronutrients:** Few well-known micronutrient deficiencies in Pakistan are: zinc (Zn) deficiency in rice, boron (B) deficiency in cotton, and iron (Fe) chlorosis in deciduous fruits and citrus. Deficiency of micronutrient(s) may be catered through soil application or foliar spray, for example:

  Wheat grains in Pakistan contain around 25 mg Zn kg^{-1}, which is much lesser than 40–60 mg Zn kg^{-1} required for good human health. The Zn concentration in wheat grains can be increased effectively by applying two foliar sprays of Zn – the first one week prior to heading and the second one week after heading.

  Boron deficiency in cotton crop promotes premature flower abortion and in rice crop results in empty panicles on lower end of the ears. Application of boron in cotton may stop dropping of bolls/flowers and reduce sterility in rice.

  Most fruit orchards (Apple, Peach, Plum, Citrus) suffer with the deficiencies of Zn and Fe, which may be corrected by applying 2 to 3 foliar sprays of Zn and Fe source as well as by soil application of micronutrient fertilizers. Further, application of macro- and micro-nutrients in orchards is necessary for quality and optimum yield.

  Soil-applied micronutrient fertilizers leave beneficial residual effects on soil that can last for 3–6 subsequent crops, in certain cases. Therefore, it is not necessary to apply micronutrient fertilizer to each and every crop. However, periodic soil testing is recommended to ascertain the need for micronutrient application to subsequent crops in the same field.

  Micronutrient fertilizers mixed with foliar solutions of pesticide sprays are equally effective in correcting micronutrient deficiencies. For example, zinc sulfate mixed with Confidor insecticide remains effective in ameliorating deficiency of Zn in wheat as well as in increasing Zn density in wheat grains. For cotton as well, B fertilizer can be mixed safely with foliar sprays of pesticides.

KEY MESSAGES
SOIL HEALTH MANAGEMENT AND CROP PRODUCTIVITY

- Use of Agricultural Helplines: Advisory services are available to help the farmers and resolve their problems of emergent nature on priority. The farmers are welcome and encouraged to benefit from the toll-free Helplines listed below.

  Punjab Agriculture Helplines 0800-15000 and 0800-29000 remain active 12 hours daily from 08:00 a.m. to 08:00 p.m. The computerized recording of calls, along with display of callers' ID with date and time, helps in locating the callers for prompt feedback by technical experts on the same day.

  Punjab Agriculture SMS Helpline Service is also available to extend technical guidance to the farmers using mobile phones. Farmers may send SMS at 0304-4000172 from any cellular network for seeking information and guidance to resolve their field problems.

  Private Sector, for example, Fauji Fertilizer Company Limited also offers toll- free Helpline 0800-00332 for farmers to contact for farm advisory services and agriculture associated issues. Moreover, the agriculture related services can also be obtained from other fertilizer companies by visiting their offices (see Annexure-V (page 110) for soil and water testing facilities available in Punjab).

ANNEXURES

ANNEXURE I: QUESTIONNAIRE FOR RAPID FERTILIZER USE ASSESSMENT

Farmer Name ---------- Village Name ----------
Tehsil Name ---------- District ---------- Land size (acre) ----------
Contact Number ---------- Major crop(s) ----------

Fertilizer Use (bags/acre)

Crop	Nitrogen		Phosphate				Potash		Micronutrients		Other
	Urea	CAN	DAP	MAP	SSP	NP	MoP	SoP	Zinc Sulfate	Boron	*Organic sources
Wheat											
Rice											
Cotton											
Sugarcane											
Maize											
Other											

*Farmyard Manure/Green Manure/Crop Residue incorporation (if any)

Irrigation Sources

Irrigated		
Canal ☐	Tube well ☐	Rainfed ☐

Laboratory Analysis (prior to sowing)

Soil Test ☐	Water Test ☐

Yield (Maunds/acre)

Wheat	Rice	Cotton	Sugarcane	Maize	Other

Satisfied with commodities price

YES ☐	NO ☐

Major Problems

Water-logging ☐	Salinity ☐	Sodicity ☐	Others ☐

ANNEXURE II: NUMBER OF SOIL SAMPLES FROM DIFFERENT DISTRICTS ANALYZED BY FAUJI FERTILIZER COMPANY LIMITED

Farm Advisory Center	Districts	Number of Samples
BAHAWALPUR	Bahawalnagar	9,078
	Bahawalpur	4,335
	Chakwal	30
	DG Khan	70
	Faisalabad	1
	Gujranwala	131
	Hafizabad	262
	Jhelum	160
	Kasur	4,434
	Khanewal	44
	Lahore	485
	Lodhran	24
	Mandi Bahauddin	83
	Multan	71
	Nankana Sahib	641
	Okara	693
	Pakpattan	356
	Rahim Yar Khan	2,312
	Rajanpur	20
	Rawalpindi	97
	Sahiwal	672
	Sargodha	2
	Sheikhupura	1,374
	Sialkot	93
HALA	Sargodha	22
MANDI BAHAUDDIN	Attock	111
	Bahawalnagar	2
	Bhakkar	182
	Chakwal	40
	Gujranwala	15
	Gujrat	326
	Jhang	16
	Jhelum	535
	Khushab	36
	Mandi Bahauddin	4,991
	Mianwali	118
	Rawalpindi	360
	Sahiwal	26
	Sargodha	1,457
MULTAN	Bahawalnagar	451
	Bahawalpur	3,828
	Bhakkar	38

Farm Advisory Center	Districts	Number of Samples
MULTAN	DG Khan	9,201
	Faisalabad	1,226
	Gujranwala	4,873
	Gujrat	106
	Hafizabad	526
	Jhang	224
	Kasur	380
	Khanewal	5,166
	Khushab	11
	Lahore	893
	Layyah	1,125
	Lodhran	1,148
	Mandi Bahauddin	16
	Mianwali	8
	Multan	15,229
	Muzaffargarh	59,437
	Nankana Sahib	11,494
	Narowal	169
	Okara	395
	Pakpattan	154
	Rahim Yar Khan	1,375
	Rajanpur	1,412
	Rawalpindi	18
	Sahiwal	520
	Sargodha	237
	Sheikhupura	341
	Sialkot	1,102
	Toba Tek Singh	89
	Vehari	297
SHAHKOT	Attock	34
	Bahawalnagar	13
	Bahawalpur	61
	Bhakkar	29
	Chakwal	1
	Chiniot	523
	DG Khan	46
	Faisalabad	1,394
	Gujranwala	34
	Gujrat	2
	Hafizabad	32
	Jhang	54
	Kasur	91

Farm Advisory Center	Districts	Number of Samples
SHAHKOT	Khanewal	14
	Khushab	2
	Lahore	68
	Layyah	12
	Lodhran	10
	Mandi Bahauddin	18
	Mianwali	114
	Multan	26
	Muzaffargarh	45
	Nankana Sahib	894
	Narowal	7
	Okara	71
	Pakpattan	56
	Rahim Yar Khan	30
	Rajanpur	26
	Rawalpindi	75
	Sahiwal	136
	Sargodha	203
	Sheikhupura	110
	Sialkot	83
	Toba Tek Singh	162
	Vehari	10
SAHIWAL	Attock	9
	Bhakkar	113
	Chakwal	25
	Gujranwala	6
	Gujrat	172
	Hafizabad	10
	Jhelum	33
	Kasur	102
	Khushab	108
	Lahore	298
	Mandi Bahauddin	1,325
	Mianwali	175
	Okara	429
	Pakpattan	4
	Rahim Yar Khan	3
	Rawalpindi	26
	Sahiwal	763
	Sargodha	258
	Sheikhupura	35
	Sialkot	15

ANNEXURE III: DISTRICT-WISE RESULTS OF THE SOIL SAMPLES ANALYZED BY FAUJI FERTILIZER COMPANY LIMITED

District	Soil Parameter	Range (Minimum-Maximum)	Average Value	Fertility Status/Class	Standard Error of Mean (SEM)	Number of Samples
ATTOCK	pH	7.41-8.1	7.79	Neutral	0.03	42
	Electrical Conductivity (dSm^{-1})	0.12-0.75	0.28	Normal	0.02	42
	Organic Matter (%)	0.17-0.91	0.54	Low	0.03	42
	Available Phosphorus (ppm)	2-14	4.69	Low	0.31	42
	Extractable Potassium (ppm)	52-210	98	Low	6.52	42
BAHAWALNAGAR	pH	7.2-10.8	8.34	Neutral	0.00	9,527
	Electrical Conductivity (dSm^{-1})	0.1-24	0.84	Slightly saline	0.01	9,527
	Organic Matter (%)	0.1-2.31	0.61	Low	0.00	9,512
	Available Phosphorus (ppm)	1-43	5.89	Low	0.03	9,527
	Extractable Potassium (ppm)	32-400	157	Adequate	0.63	9,416
BAHAWALPUR	pH	7.4-11.2	8.30	Neutral	0.00	8,175
	Electrical Conductivity (dSm^{-1})	0.08-26.6	0.74	Slightly saline	0.01	8,174
	Organic Matter (%)	0.1-2.35	0.50	Low	0.00	8,143
	Available Phosphorus (ppm)	1-40	5.24	Low	0.03	8,169
	Extractable Potassium (ppm)	26-400	159	Adequate	0.68	8,004
BHAKKAR	pH	7.53-8.76	8.01	Neutral	0.02	179
	Electrical Conductivity (dSm^{-1})	0.1-0.83	0.24	Normal	0.01	179
	Organic Matter (%)	0.22-1.35	0.75	Low	0.02	179
	Available Phosphorus (ppm)	2-10	4.15	Low	0.10	179
	Extractable Potassium (ppm)	30-350	107	Marginal	2.63	179
CHAKWAL	pH	7.62-8.6	8.01	Neutral	0.02	55
	Electrical Conductivity (dSm^{-1})	0.1-1.35	0.21	Normal	0.02	55
	Organic Matter (%)	0.16-1.18	0.75	Low	0.03	55
	Available Phosphorus (ppm)	3-9	4.40	Low	0.16	55
	Extractable Potassium (ppm)	60-210	117	Marginal	3.93	55
CHINIOT	pH	7.41-9.53	8.06	Neutral	0.01	519
	Electrical Conductivity (dSm^{-1})	0.14-1.8	0.43	Normal	0.01	519
	Organic Matter (%)	0.1-1.05	0.61	Low	0.01	519
	Available Phosphorus (ppm)	1.5-16	6.40	Low	0.11	518
	Extractable Potassium (ppm)	56-400	141	Marginal	2.37	516
DERA GHAZI KHAN	pH	7.3-10.8	8.31	Neutral	0.00	9,269
	Electrical Conductivity (dSm^{-1})	0.026-36	0.92	Slightly saline	0.01	9,271
	Organic Matter (%)	0.1-2.19	0.54	Low	0.00	9,220
	Available Phosphorus (ppm)	1-52	5.20	Low	0.05	9,260
	Extractable Potassium (ppm)	26-400	174	Adequate	0.96	8,583

Reference Methods:

Olsen SR, Cole CV, Watanabe SN, Dean LA (1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate. US Department of Agriculture Circular 939, 19 p. Government Printing Office, Washington DC, USA.
Berg MG, Gardner EH (1978). Methods of soil analysis used in the soil testing laboratory at Oregon State University. Special Report 321 (Revised Sep 1978), Agricultural Experimental Station, Oregon State University, Corvallis, USA, 44 p.
Walkley A (1947). A critical examination of a rapid method for determining organic carbon in soils: Effect of variations in digestion conditions and of organic soil constituents. Soil Science, 63, 251-263.

ANNEXURE III: DISTRICT-WISE RESULTS OF THE SOIL SAMPLES ANALYZED BY FAUJI FERTILIZER COMPANY LIMITED

District	Soil Parameter	Range (Minimum-Maximum)	Average Value	Fertility Status/Class	Standard Error of Mean (SEM)	Number of Samples
FAISALABAD	pH	6.67-10.2	8.26	Neutral	0.01	2617
	Electrical Conductivity (dSm^{-1})	0.1-10	0.55	Slightly saline	0.01	2,616
	Organic Matter (%)	0.12-2.1	0.57	Low	0.00	2,614
	Available Phosphorus (ppm)	1-19	5.82	Low	0.05	2,617
	Extractable Potassium (ppm)	38-400	153	Adequate	1.35	2,511
GUJRANWALA	pH	7-10.75	8.12	Neutral	0.01	5,040
	Electrical Conductivity (dSm^{-1})	0.1-8.19	0.28	Normal	0.00	5,040
	Organic Matter (%)	0.1-1.69	0.55	Low	0.00	5,037
	Available Phosphorus (ppm)	1-27	5.85	Low	0.03	5,040
	Extractable Potassium (ppm)	34-400	156	Adequate	1.00	4,933
GUJRAT	pH	7-9.9	7.99	Neutral	0.03	278
	Electrical Conductivity (dSm^{-1})	0.1-2.19	0.31	Normal	0.01	278
	Organic Matter (%)	0.27-1.59	0.72	Low	0.02	278
	Available Phosphorus (ppm)	3-30	6.24	Low	0.20	278
	Extractable Potassium (ppm)	40-350	147	Marginal	3.96	277
HAFIZABAD	pH	7.2-11	8.32	Neutral	0.03	827
	Electrical Conductivity (dSm^{-1})	0.1-6.27	0.43	Normal	0.02	827
	Organic Matter (%)	0.1-1.78	0.57	Low	0.01	826
	Available Phosphorus (ppm)	1-17	6.07	Low	0.09	827
	Extractable Potassium (ppm)	42-400	148	Adequate	2.60	804
JHANG	pH	7.56-9.9	8.35	Alkaline	0.02	278
	Electrical Conductivity (dSm^{-1})	0.1-4.41	0.54	Slightly saline	0.03	278
	Organic Matter (%)	0.1-1.4	0.62	Low	0.01	277
	Available Phosphorus (ppm)	1-16	5.85	Low	0.19	271
	Extractable Potassium (ppm)	28-400	138	Marginal	4.87	271
JHELUM	pH	7.3-10.1	8.52	Alkaline	0.05	193
	Electrical Conductivity (dSm^{-1})	0.12-15	0.88	Slightly saline	0.11	193
	Organic Matter (%)	0.12-1.82	0.61	Low	0.02	193
	Available Phosphorus (ppm)	1-25	4.33	Low	0.25	193
	Extractable Potassium (ppm)	30-340	118	Marginal	4.05	191
KASUR	pH	7.1-10.99	8.14	Neutral	0.01	5,000
	Electrical Conductivity (dSm^{-1})	0.11-20.5	0.76	Slightly saline	0.02	5,000
	Organic Matter (%)	0.1-2.92	0.79	Low	0.01	4,983
	Available Phosphorus (ppm)	1-52	8.02	Marginal	0.09	4,990
	Extractable Potassium (ppm)	25-400	150	Adequate	1.00	4,831
KHANEWAL	pH	7.4-10.7	8.41	Alkaline	0.01	5,220
	Electrical Conductivity (dSm^{-1})	0.1-19.5	0.62	Slightly saline	0.01	5,220
	Organic Matter (%)	0.1-2.84	0.75	Low	0.00	5,217
	Available Phosphorus (ppm)	1-44	5.92	Low	0.06	5,211
	Extractable Potassium (ppm)	28-400	155	Adequate	1.04	5,067

ANNEXURE III: DISTRICT-WISE RESULTS OF THE SOIL SAMPLES ANALYZED BY FAUJI FERTILIZER COMPANY LIMITED

District	Soil Parameter	Range (Minimum-Maximum)	Average Value	Fertility Status/Class	Standard Error of Mean (SEM)	Number of Samples
Khushab	pH	7.4-8.7	8.06	Neutral	0.02	119
	Electrical Conductivity (dSm^{-1})	0.13-3.14	0.54	Slightly saline	0.05	119
	Organic Matter (%)	0.2-1.7	0.85	Low	0.03	119
	Available Phosphorus (ppm)	1-15	4.86	Low	0.24	119
	Extractable Potassium (ppm)	40-360	154	Adequate	7.20	109
LAHORE	pH	7-10.3	8.33	Neutral	0.02	1,743
	Electrical Conductivity (dSm^{-1})	0.1-22.7	0.69	Slightly saline	0.03	1,743
	Organic Matter (%)	0.1-2.89	0.80	Low	0.01	1,717
	Available Phosphorus (ppm)	1-50	6.66	Low	0.14	1,738
	Extractable Potassium (ppm)	25-400	152	Adequate	1.74	1,662
LAYYAH	pH	7.6-10.3	8.23	Neutral	0.01	1,124
	Electrical Conductivity (dSm^{-1})	0.1-7.9	0.43	Normal	0.01	1,124
	Organic Matter (%)	0.1-1.6	0.48	Low	0.01	1,116
	Available Phosphorus (ppm)	1-25	4.44	Low	0.09	1,124
	Extractable Potassium (ppm)	26-380	110	Marginal	1.65	1,117
LODHRAN	pH	7.6-10.2	8.27	Neutral	0.01	1,172
	Electrical Conductivity (dSm^{-1})	0.1-8.53	1.18	Saline	0.04	1,172
	Organic Matter (%)	0.1-1.72	0.71	Low	0.01	1,172
	Available Phosphorus (ppm)	1-24	6.26	Low	0.11	1,172
	Extractable Potassium (ppm)	30-400	153	Adequate	2.17	1,136
MANDI BAHAUDDIN	pH	7.2-10.33	8.27	Neutral	0.01	1,424
	Electrical Conductivity (dSm^{-1})	0.1-9.2	1.18	Saline	0.01	1,424
	Organic Matter (%)	0.16-1.66	0.71	Low	0.01	1,424
	Available Phosphorus (ppm)	1-20	6.26	Low	0.07	1,424
	Extractable Potassium (ppm)	30-400	153	Adequate	1.75	1,413
MIANWALI	pH	7.21-8.58	7.91	Neutral	0.01	296
	Electrical Conductivity (dSm^{-1})	0.14-1.06	0.37	Normal	0.01	296
	Organic Matter (%)	0.18-1.4	0.76	Low	0.02	296
	Available Phosphorus (ppm)	2-14	4.89	Low	0.11	296
	Extractable Potassium (ppm)	50-300	148	Marginal	3.17	292
MULTAN	pH	7.3-10	7.91	Neutral	0.01	5,508
	Electrical Conductivity (dSm^{-1})	0.04-37	0.37	Normal	0.02	5,509
	Organic Matter (%)	0.1-2.97	0.76	Low	0.00	5,479
	Available Phosphorus (ppm)	1-50	4.89	Low	0.07	5,494
	Extractable Potassium (ppm)	26-400	148	Marginal	1.13	5,225
MUZAFFARGARH	pH	7.3-10	7.91	Nuetral	0.01	1,726
	Electrical Conductivity (dSm^{-1})	0.1-9.9	0.37	Normal	0.02	1,726
	Organic Matter (%)	0.1-1.5	0.76	Low	0.01	1,726
	Available Phosphorus (ppm)	1-16	4.89	Low	0.06	1,726
	Extractable Potassium (ppm)	25-392	148	Marginal	1.56	1,715

ANNEXURE III: DISTRICT-WISE RESULTS OF THE SOIL SAMPLES ANALYZED BY FAUJI FERTILIZER COMPANY LIMITED

District	Soil Parameter	Range (Minimum-Maximum)	Average Value	Fertility Status/Class	Standard Error of Mean (SEM)	Number of Samples
NANKANA SAHIB	pH	7.46-10.34	8.31	Neutral	0.02	897
	Electrical Conductivity (dSm^{-1})	0.1-5	0.54	Slightly saline	0.02	897
	Organic Matter (%)	0.1-1.02	0.58	Low	0.01	897
	Available Phosphorus (ppm)	1-24	7.23	Low	0.10	897
	Extractable Potassium (ppm)	62-400	149	Marginal	2.47	856
NAROWAL	pH	7.45-7.75	7.58	Neutral	0.05	7
	Electrical Conductivity (dSm^{-1})	0.31-0.48	0.40	Normal	0.02	7
	Organic Matter (%)	0.5-0.71	0.63	Low	0.03	7
	Available Phosphorus (ppm)	4-9	6.57	Low	0.65	7
	Extractable Potassium (ppm)	104-132	117	Marginal	3.95	7
OKARA	pH	7.14-9.18	8.15	Neutral	0.01	488
	Electrical Conductivity (dSm^{-1})	0.11-4.86	0.42	Normal	0.02	488
	Organic Matter (%)	0.17-1.84	0.92	Marginal	0.01	488
	Available Phosphorus (ppm)	3-20	5.33	Low	0.11	488
	Extractable Potassium (ppm)	40-400	137	Marginal	2.72	484
PAKPATTAN	pH	7.2-9.34	8.20	Neutral	0.01	291
	Electrical Conductivity (dSm^{-1})	0.12-8.2	0.35	Normal	0.03	291
	Organic Matter (%)	0.26-1.78	0.89	Marginal	0.02	291
	Available Phosphorus (ppm)	3-15	5.42	Low	0.14	291
	Extractable Potassium (ppm)	50-370	152	Adequate	3.64	285
RAHIM YAR KHAN	pH	7.7-9.9	8.21	Neutral	0.01	783
	Electrical Conductivity (dSm^{-1})	0.11-12.57	0.85	Slightly saline	0.05	782
	Organic Matter (%)	0.1-1.23	0.36	Low	0.01	779
	Available Phosphorus (ppm)	2-12	5.23	Low	0.06	783
	Extractable Potassium (ppm)	60-380	161	Adequate	0.97	783
RAJANPUR	pH	8-9.3	8.44	Alkaline	0.02	211
	Electrical Conductivity (dSm^{-1})	0.1-9.9	1.57	Saline	0.15	211
	Organic Matter (%)	0.1-1.4	0.57	Low	0.02	211
	Available Phosphorus (ppm)	1-14	3.90	Low	0.15	211
	Extractable Potassium (ppm)	30-362	155	Adequate	5.14	202
RAWALPINDI	pH	7.22-8.5	7.81	Neutral	0.03	101
	Electrical Conductivity (dSm^{-1})	0.13-0.85	0.26	Normal	0.01	101
	Organic Matter (%)	0.27-1.18	0.55	Low	0.02	101
	Available Phosphorus (ppm)	2-14	5.04	Low	0.19	101
	Extractable Potassium (ppm)	40-380	118	Marginal	5.09	101
SAHIWAL	pH	7.49-10.4	8.22	Neutral	0.01	874
	Electrical Conductivity (dSm^{-1})	0.1-7.35	0.49	Normal	0.02	874
	Organic Matter (%)	0.13-2.57	0.78	Marginal	0.01	874
	Available Phosphorus (ppm)	3-18	5.12	Low	0.07	874
	Extractable Potassium (ppm)	30-400	138	Marginal	2.26	862

ANNEXURE III: DISTRICT-WISE RESULTS OF THE SOIL SAMPLES ANALYZED BY FAUJI FERTILIZER COMPANY LIMITED

District	Soil Parameter	Range (Minimum-Maximum)	Average Value	Fertility Status/Class	Standard Error of Mean (SEM)	Number of Samples
SARGODHA	pH	7.35-9.35	8.02	Neutral	0.01	456
	Electrical Conductivity (dSm^{-1})	0.11-5.04	0.46	Normal	0.02	456
	Organic Matter (%)	0.22-1.79	0.77	Low	0.01	456
	Available Phosphorus (ppm)	2-18	5.11	low	0.09	456
	Extractable Potassium (ppm)	40-400	167	Adequate	3.50	446
SHEIKHUPURA	[1]pH	7.37-9.79	8.28	Neutral	0.05	143
	[1]Electrical Conductivity (dSm^{-1})	0.19-1.9	0.53	Slightly saline	0.02	143
	[2]Organic Matter (%)	0.23-1.43	0.72	Low	0.02	143
	[3]Available Phosphorus (ppm)	3-18	6.34	Low	0.24	143
	[4]Extractable Potassium (ppm)	90-400	163	Adequate	6.32	142
SIALKOT	pH	7.24-8.45	7.70	Neutral	0.03	85
	Electrical Conductivity (dSm^{-1})	0.21-0.84	0.46	Normal	0.02	85
	Organic Matter (%)	0.34-1.22	0.69	Low	0.02	85
	Available Phosphorus (ppm)	3-28	7.84	Low	0.44	85
	Extractable Potassium (ppm)	70-370	130	Marginal	4.44	85
TOBA TEK SINGH	pH	7.53-8.64	7.96	Neutral	0.02	161
	Electrical Conductivity (dSm^{-1})	0.17-0.99	0.41	Normal	0.01	161
	Organic Matter (%)	0.18-1.18	0.59	Low	0.01	161
	Available Phosphorus (ppm)	2-20	5.95	Low	0.20	161
	Extractable Potassium (ppm)	74-336	140	Marginal	3.92	160
VEHARI	pH	7.6-9	8.28	Neutral	0.02	297
	Electrical Conductivity (dSm^{-1})	0.1-5.3	0.71	Slightly saline	0.04	297
	Organic Matter (%)	0.1-1.4	0.64	Low	0.01	297
	Available Phosphorus (ppm)	1-37	4.85	Low	0.22	297
	Extractable Potassium (ppm)	34-282	127	Marginal	3.08	297

ANNEXURE IV: CRITERIA FOR SOIL NUTRIENT ANALYSIS (mg/kg)

THE INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS (ICARDA)				
Nutrient/Organic Matter	**Test**	**Low**	**Marginal**	**Adequate**
Organic Matter	Walkley-Black Method (%)	< 0.86	0.86-1.29	>1.29
Phosphorus	$NaHCO_3$	< 8	8-15	>15
Potassium	NH_4OAc	<100	100-150	>150
Zinc	DTPA	<0.5	0.5-1.0	>1.0
Manganese	DTPA	<1.0	1.0-2.0	>2.0
Boron	HCl	<0.45	0.45-1.0	>1.0

(Source: ICARDA Manual 2013)

RAPID SOIL FERTILITY SURVEY AND SOIL TESTING INSTITUTE, PUNJAB				
Nutrient/Organic Matter	**Test**	**Low**	**Medium**	**Adequate**
Organic Matter	Walkley-Black Method (%)	< 0.86	0.86-1.29	>1.29
Phosphorus	$NaHCO_3$	<7	7-14	>14
Potassium	NH_4OAC	<80	80-180	>180

(Source: Rapid Soil Fertility Survey and Soil Testing Institute, Punjab)

FAUJI FERTILIZER COMPANY LIMITED		
pH	Acidic	<6.5
	Neutral	6.5-7.5
	Alkaline	>7.5
Electrical Conductivity (dSm^{-1})	Normal	<0.5
	Slightly saline	0.5-1.0
	Saline	>1.0

* Soil pH and Electrical Conductivity were measured in 1:2.5, soil:water extract.

(Source: Fauji Fertilizer Company Limited)

ANNEXURE V: ADDRESSES OF SOIL AND WATER TESTING FACILITIES IN PUNJAB

Soil Testing Facility	District	Address
Fatima Fertilizers Company Limited/Pak Arab Fertilizers Soil Fertility Lab	Multan	Pak Arab Plant, Multan
	Rahim Yar Khan	Fatima Plant, Rahim Yar Khan
	Muzaffargarh	Fatima Sugar Mills, Muzaffargarh
Engro Fertilizers Limited Soil Fertility Lab	Multan	Mehar Fatima Towers, Old Bahawalpur Road, Multan
Fauji Fertilizer Company Limited Farm Advisory Center	Sahiwal	Arifwala Road, Sahiwal
	Multan	Near Ibn-e-Sena Hospital, Southern Bypass, Multan
	Bahawalpur	Near Al-Rehman Oil Mills, Opposite Gulistan Textile Mills, KLP Road, Bahawalpur
	Hassan Abdal	7 Kilometers, Abbotabad Road, opposite AWC, Hassan Abdal
Rapid Soil Fertility Survey and Soil Testing Institute, Punjab Provincial Reference Lab	Lahore	Raiwind, Lahore
Rapid Soil Fertility Survey and Soil Testing Institute, Punjab Divisional Lab	Lahore	Thokar Niaz Baig, Lahore
	Rawalpindi	Data Ganj Bakhsh road, Murree Road, Rawalpindi
	Faisalabad	Ayub Agriculture Research Institute, Faisalabad
	Gujranwala	G.T Road, Divisional Public School, Gujranwala
	Multan	Agri. Farm, Old Shujabad Road, Multan
	D.G. Khan	Near Dar-ul-Aman, D.G. Khan
	Sargodha	Old Sulman Pura, Sargodha
	Bahawalpur	Regional Agriculture Research Institute, Bahawalpur
Rapid Soil Fertility Survey and Soil Testing Institute, Punjab District Lab	Attock	Kamra Road Attock
	Bahawalnagar	Haroonabad Road, near Khan Petroleum, Bahawalnagar
	Bhakkar	Stadium Road, near DHO Office, Bhakkar
	Chakwal	Talagang Road, Chakwal
	Chiniot	Tehsil Chowk near DCO Office, Chiniot
	Gujrat	Service Mor G.T. Road, Gujrat
	Hafizabad	District Complex, Hafizabad
	Jhang	Near Railway Phattak, Toba Road, Jhang
	Jhelum	Near District Accounts Office, Behind Kacheri, Jhelum
	Kasur	District Court Complex, Kasur
	Khanewal	Near Nizamabad Pulley, People's Colony, Khanewal
	Khushab	Soil and Water Testing Lab Khushab, opposite Joharabad
	Layyah	District complex, Layyah
	Lodhran	Bahawalpur Road, Lodhran
	Mandi Bahauddin	District Complex, Near Police Lines Mandi Bahauddin
	Mianwali	Near Tehsil Chowk, Mianwali
	Muzaffargarh	Jhang Road, Muzaffargarh
	Narowal	Shakargarh Road District Complex, Narowal City
	Okara	Katcheri Road, District Complex, Okara City
	Pakpattan	Besides Kacheri, Pakpattan
	Rahim Yar Khan	Opposite Veterinary Hospital, Rahim Yar Khan
	Rajanpur	Near Commerce College, Rajanpur
	Sahiwal	Pakpattan Road, Sahiwal
	Sheikhupura	Kiani Road, District Courts, Sheikhurpura
	Sialkot	Pasroor Road, Near Gulshan-e-Iqbal, Sialkot
	Toba Tek Singh	Jhang Road, Near Boys College, Toba Tek Singh
	Vehari	Near District Court Complex, Government Seed Farm, Vehari

ANNEXURE V: ADDRESSES OF SOIL AND WATER TESTING FACILITIES IN PUNJAB (URDU)

پنجاب میں موجود مٹی اور پانی کی تجزیہ گاہیں

تجزیاتی لیبارٹری فاطمہ فرٹیلائیزرز کمپنی لمیٹڈ	ملتان	پاک عرب پلانٹ۔ملتان
	رحیم یار خان	فاطمہ پلانٹ۔رحیم یار خان
	مظفر گڑھ	فاطمہ شوگر ملز۔پرانا بہاول پور روڈ۔ملتان
تجزیاتی لیبارٹری اینگرو فرٹیلائیزرز لمیٹڈ	ملتان	مہر فاطمہ شوگر ملز۔پرانا بہاول پور روڈ۔ملتان
فارم ایڈوائیزری سینٹر، فوجی فرٹیلائیزر کمپنی لمیٹڈ	ساہیوال	عارف والا روڈ ساہیوال
	ملتان	نزد ابن سینا ہسپتال سدرن بائی پاس ملتان
	بہاولپور	نزد الرحمان آئل ملز۔ بالمقابل گلستان ٹیکسٹائل ملز۔کے ایل پی روڈ بہاولپور
	حسن ابدال	7 کلو میٹر ایبٹ آباد روڈ بالمقابل اے ڈبلیو سی۔حسن ابدال
ڈائریکٹوریٹ برائے تحقیقی ادارہ زرخیزی زمین صوبائی تجزیہ گاہ	لاہور	نزد رائے ونڈ لاہور
	لاہور	ٹھوکر نیاز بیگ لاہور
	راولپنڈی	داتا گنج بخش روڈ مری روڈ راولپنڈی
	فیصل آباد	ایوب ایگریکلچر ریسرچ سنٹر فیصل آباد
	گوجرانوالہ	جی ٹی روڈ ڈویژنل پبلک سکول گوجرانوالہ
	ملتان	ایگری فارم پرانا شجاع آباد روڈ ملتان
	ڈیرہ غازی خان	نزد دارالامان ڈیرہ غازی خان
	سرگودھا	پرانا سلمان پورہ۔سرگودھا
ڈائریکٹوریٹ برائے تحقیقی ادارہ زرخیزی زمین ڈویژنل تجزیہ گاہ	بہاولپور	ریجنل ایگریکلچر ریسرچ انسٹیٹیوٹ۔بہاولپور

ڈائریکٹوریٹ برائے تحقیقی ادارہ زرخیزی زمین ضلعی تجزیہ گاہ	اٹک	کامرہ روڈ اٹک
	بہاولنگر	ہارون آباد روڈ نزد خان پٹرولیم بہاولنگر
	بھکر	سٹیڈیم روڈ نزد ڈی ایچ او آفس بھکر
	چکوال	تلہ گنگ روڈ چکوال
	چنیوٹ	تحصیل چوک نزد ڈی سی او آفس چنیوٹ
	گجرات	سروس موڑ جی ٹی روڈ گجرات
	حافظ آباد	ڈسٹرکٹ کمپلیکس حافظ آباد
	جھنگ	نزد ریلوے پھاٹک۔ٹوبہ روڈ جھنگ
	جہلم	نزد ڈسٹرکٹ اکاونٹ آفس۔کچہری جہلم
	قصور	ڈسٹرکٹ کورٹ کمپلیکس قصور
	خانیوال	نزد ناظم آباد پلی پیپلز کالونی خانیوال
	خوشاب	سائل اینڈ واٹر ٹیسٹنگ لیب خوشاب بالمقابل جوہر آباد
	لیہ	ڈسٹرکٹ کمپلیکس لیہ
	لودھراں	بہاولپور روڈ لودھراں
	منڈی بہاالدین	ڈسٹرکٹ کمپلیکس۔نزد پولیس لائنز منڈی بہاالدین
	میانوالی	نزد تحصیل چوک میانوالی
	مظفر گڑھ	جھنگ روڈ مظفر گڑھ
	نارووال	شکر گڑھ روڈ تحصیل ڈسٹرکٹ کمپلیکس۔نارووال شہر
	اوکاڑہ	کچہری روڈ۔ڈسٹرکٹ کمپلیکس اوکاڑہ سٹی
	پاکپتن	کچہری اوکاڑہ
	رحیم یار خان	بالمقابل وٹرنٹی ہسپتال۔رحیم یار خان
	راجن پور	نزد کامرس کالج راجن پور
	ساہیوال	پاکپتن روڈ ساہیوال
	شیخوپورہ	کیانی روڈ ڈسٹرکٹ کورٹس شیخوپورہ
	سیالکوٹ	پسرور روڈ نزد گلشن اقبال سیالکوٹ
	ٹوبہ ٹیک سنگھ	جھنگ روڈ نزد بوائز۔ٹوبہ ٹیک سنگھ
	وہاڑی	نزد ڈسٹرکٹ کورٹ کمپلیکس گورنمنٹ سیڈ فارم وہاڑی

ANNEXURE VI: DOMINANT SOIL SERIES, CLASSIFICATION AND AREAS OF THEIR OCCURRENCE

Soil Series	US Soil Taxonomy	FAO World Soil Map	Areas of Occurrence
Abbottabad	Haplaquepts	Calcaric Glevsols	Rawalpindi
Adilpur	Halic Camborthids	Haplic Yermosols	Multan North
Argan	Typic Ustoohrepts	Calcaric Cambisols	Gujrat, Rawalpindi, Gujranwala, Attock
Asni	Typic Torrifluvents	Calcaric Fluvisols	Dera Ghazi Khan
Awagat	Aquic Camborthids/Fluventic	Calcaric Gleysols/Haplic Yermosols	Multan
Bagh	Fluventic Camborthids	Haplic Yermosols	Faisalabad, Thal North, Sahiwal, Jhang, Multan South, Multan North
Bahawalnagar	Fluventic Camborthids	Haplic Yermosls	Bahawalnagar
Bahatar	Typic Ustochrepts	Calcaric Cambisols	Attock
Balkassar	Typic Camborthids/Typic Ustochrepts	Haplic Yermosls/Calcaric Cambisols	Rawalpindi, Attock
Bambul	Typic Ustochrepts	Calcaric Cambisols	Thal North
Basal	Typic Camborthids	Haplic Yermosols	Attock
Bhalwal	Fluventic Camborthids	Haplic Yermosols	Sahiwal, Gujrat, Sheikhupura, Gujranwala, Lahore, Jhang, Faisalabad, Sargodha
Bhakkar	Typic Ustochrepts	Calcaric Cambisols	Thal South, Thal North
Bhangriwala	Fluventic Camborthids	Haplic Yermosols	Cholistan
Bhareri	Typic Torriorthents	Calcaric Fluvisols	Thal South, Thal North
Bijnot	Typic Torripsamment	Calcaric Rhegosols	Cholistan
Burhan	Typic Ustochrepts	Calcaric Cambisols	Attock
Chakwal	Fluventic Camborthids	Haplic Yermosols	Rawalpindi
Chamba	Fluventic Ustochrepts	Eutric Cambisols	Rawalpindi
Chinni	Fluventic Camborthids	Haplic Yermosols	Dera Ghazi Khan
Cholistan	Typic Torripsamment	Calcaric Rhegosols	Bahawalnagar
Dad	Typic Camborthids	Haplic Yermosols	Thal South
Darra	Typic Camborthids	Haplic Yermosols	Cholistan
Daryakhan	Fluventic Camborthids	Haplic Yermosols	Thal South, Thal North
Dharanwala	Fluventic Camborthids	Haplic Yermosols	Bahawalnagar
Dhulian	Typic Ustochrepts	Calcaric Cambisols	Attock
Dhumman	Typic Camborthids	Typic Camborthids	Rawalpindi
Dhurnal	Lithic Ustocrepts	Lithic Calcaric Cambisols	Attock
Domel	Typic Ustochrepts	Calcaric Cambisols	Attock
Dungi	Ealic Camborthids	Haplic Yermosols	Sahiwal, Sheikhupura, Multan South, Multan North
Eminabad	Typic Halorthids	Orthic Solonetz	Sheikhupura, Gujranwala
Fazilpur	Torrertic Camborthids/Typic Torrerts	Haplic Yermosols/Chromic Vertisols	Dera Ghazi Khan
Firdous	Typic Camborthids	Haplic Xerosols/Haplic Yermosols	Thal South, Thal North
Firoz	Typic Halorthids	Orthic Solonetz	Sahiwal, Sheikhupura, Lahore, Sargodha, Multan North
Fort Abbas	Typic Torripsamment	Calcaric Rhegosols	Cholistan
Gajiana	Ealic Camborthids	Haplic Yermosols	Sahiwal, Sheikhupura, Gujranwala, Lahore, Multan South, Multan North, Sargodha
Gamber	Halic Camborthids	Haplic Yermosols	Sahiwal, Multan North
G&hra	Halic Camborthids	Haplic Yermosols	Sheikhupura, Multan South, Multan North, Sargodha
Ghazi	Typic Ustochrepts	Calcaric Cambisols	Attock
Godara	Typic Torriorthents	Calcaric Fluvisols	Thal South
Gujranwala	Typic Ustochrepts	Eurtic Cambisols	Gujrat, Gujranwala, Lahore, Sargodha, Attock, Sheikhupura
Guliana	Typic Ustochrepts	Eurtic Cambisols	Rawalpindi, Attock
Hadwar	Typic Torrifluvents	Calcaric Fluvisols	Dera Ghazi Khan
Hafizabad	Fluventic Camborthids	Haplic Yermosols	Sahiwal, Gujrat, Sheikhupura, Gujranwala, Lahore, Jhang, Faisalabad, Sargodha, Multan North

ANNEXURE VI: DOMINANT SOIL SERIES, CLASSIFICATION AND AREAS OF THEIR OCCURRENCE

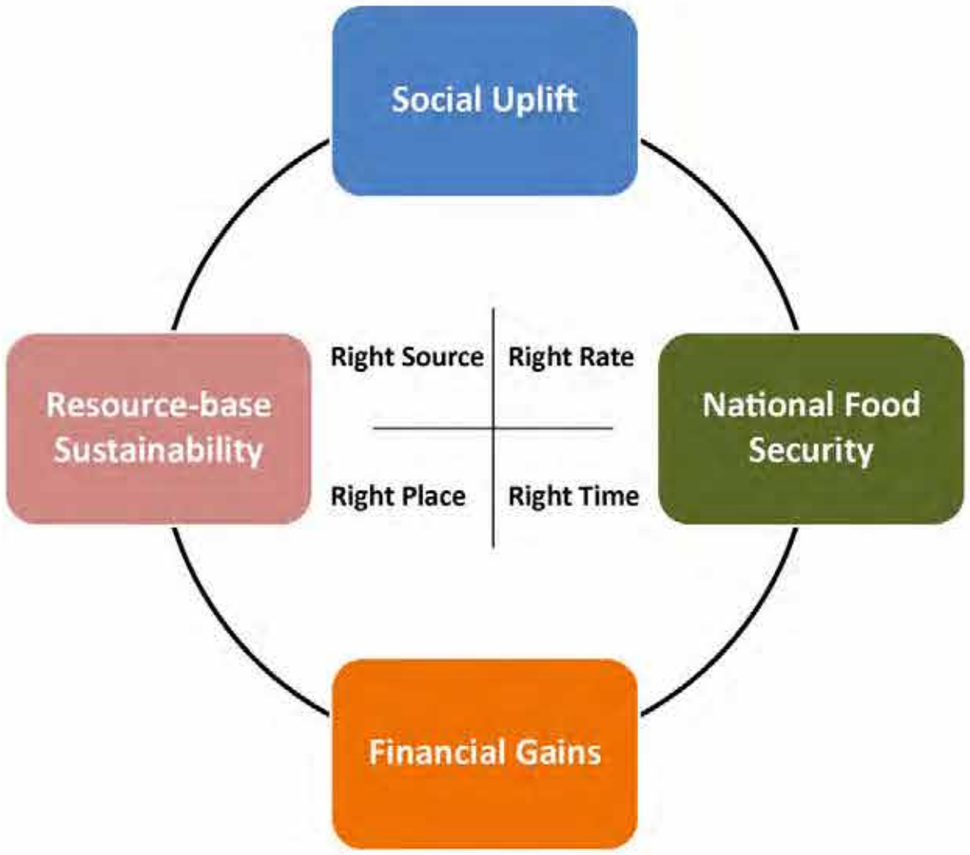
Soil Series	US Soil Taxonomy	FAO World Soil Map	Areas of Occurrence
Hyderabad	Ustic Torripsamment	Calcaric Fluvisols	Thal South, Thal North
Haripur	Typic Ustochrepts	Calcaric Cambisols	Rawalpindi
Harunabad	Fluventic Camborthids	Haplic Yermosols	Bahawalnagar
Hathiana	Fluventic Camborthids	Haplic Yermosols	Sheikhupura
Injra	Typic Ustipsamments	Calcaric Rhegosols	Attock
Isawala	Typic Camborthids	Haplic Yermosols	Thal South
Islamgarh	Typic Torripsamment	Calcaric Rhegosols	Cholistan
Jabbi	Typic Ustochrepts	Calcaric Cambisols	Attock
Jagan	Typic Camborthids	Orthic Solonchaks	Dera Ghazi Khan
Jamgarh	Fluventic Torriorthents	Calcaric Fluvisols	Cholistan
Jand	Typic Ustipsamments	Eurtic Fluvisols	Attock
Jaggan	Typic Torripsamment	Calcaric Rhegosols	Cholistan
Jalalpur	Typic Salorthids/Fluventic Camborthids	Orthic Solonchake	Multan South, Multan North
Jaranwala	Typic Camborthids	Haplic Yermosols	Sahiwal, Lahore, Faisalabad, Multan North
Jarwar	Typic Salorthids/Fluventic Camborthids	Orthic Solonchake	Muzaffargarh
Jaura	Typic Ustochrepts	Calcaric Cambisols	Gujrat
Jhang	Typic Torripsamment	Calcaric Rhegosols	Thal North, Jhang, Multan South, Multan North
Jhumra	Aquic Camborthids/Fluventic Camborthids	Calcaric Gleysols	Faisalabad
Joanna	Typic Halorthents	Orthic Solonchake	Sahiwal, Jhang, Multan South, Sargodha
Kahror	Halic Camborthids	Haplic Yermosols/Orthic Solonchake	Multan South, Multan North
Kahuta	Typic Ustochrepts	Eutric Cambisols	Rawalpindi, Attock
Kakki	Typic Camborthids	Haplic Yermosols	Cholistan
Kallarwala	Typic Camborthids	Haplic Yermosols	Dera Ghazi Khan
Kamoke	Typic Ustochrepts	Eutric Cambisols/Eurtic Gleysols	Gujranwala, Lahore
Kasur	Halic Ustorthents/Halic Torriorthents	Orthic Solonchaks/Gleysic Solonchaks	Lahore, Thal South, Sahiwal, Jhang, Multan South, Multan North, Sargodha
Khair	Typic Torriorthents/Typic Ustorthents	Calcaric Fluvisols	Sahiwal, Gujrat, Sheikhupura, Rawalpindi, Gujranwala, Lahore, Jhang, Multan South, Faisalabad, Sargodha, Muzaffargarh
Kharala	Typic Salorthids	Orthic Solochaks	Multan South, Multan North
Khatan	Fluventic Camborthids	Haplic Yermosols	Bahawalnagar, Cholistan
Khaur	Typic Ustochrepts	Calcaric Cambisols	Attock
Khokhar	Typic Camborthids	Haplic Yermosols	Thal South, Thal North
Khumbi	Typic Torriorthents	Calcaric Fluvisols	Thal South, Thal North
Khurrianwala	Typic Halorthids	Orthic Solonetz	Sahiwal, Sheikhupura, Gujranwala, Lahore, Jhang, Faisalabad, Multan North
Kotli	Udorthentic Chromusterts	Chromic Vertisols	Gujrat, Gujranwala
Kufri	Typic Ustochrepts	Calcaric Cambisols	Attock
Kunda	Typic Ustipsamments	Eurtic Fluvisols	Attock
Kunjah	Udorthentic Chromusterts	Chromic Vertisols	Gujrat, Gujranwala, Lahore, Sargodha
Lakhewala	Fluventic Camborthids	Haplic Yermosols	Bahawalnagar
Lalian	Typic Torriorthents	Calcaric Fluvisols	Thal South, Thal North, Sahiwal, Lahore, Jhang, Multan South, Multan North
Lunda	Typic Halorthids	Orthic Solonetz	Multan South, Multan North
Faisalabad	Fluventic Camborthids	Haplic Yermosols	Sahiwal, Gujrat, Sheikhupura, Gujranwala, Faisalabad, Lahore, Sargodha, Multan North
Malik	Typic Torriorthents (Typic Ustorthents)	Calcaric Fluvisols	Sahiwal, Sheikhupura, Lahore, Multan South, Gujranwala
Mankera	Typic/Halic Torripsamment	Calcaric Rhegosols	Thal South, Thal North
Mansehra	Typic Eutrochrepts	Eutric Cambisols	Rawalpindi

ANNEXURE VI: DOMINANT SOIL SERIES, CLASSIFICATION AND AREAS OF THEIR OCCURRENCE

Soil Series	US Soil Taxonomy	FAO World Soil Map	Areas of Occurrence
Mariala	Halic Camborthids	Haplic Yermosols/Orthic Solochaks	Multan North
Maruwala	Typic Torripsamment	Calcaric Rhegosols	Cholistan
Matli	Typic Calciorthids	Haplic Yermosols	Multan South, Multan North, Muzaffargarh
Mial	Typic Calciorthids	Haplic Yermosols/Haplic Xerosols	Attock, Chakwal
Miani	Typic Calciorthids/Ustochrepts	Haplic Yermosols/Calcaric Cambisols	Thal South, Thal North, Sahiwal, Gujrat, Sheikhupura, Gujranwala, Lahore, Jhang, Multan South, Multan North, Faisalabad
Miranpur	Aquic Ustochrepts	Eutric Cambisols/Eutric Gleysols	Sheikhupura, Gujranwala
Missa	Typic Calciorthids/Typic Ustochrepts	Haplic Yermosols/Calcaric Cambisols	Rawalpindi, Attock, Chakwal
Missan	Halic Camborthids	Haplic Yermosols	Sheikhupura, Sargodha, Multan North
Munda	Typic Camborthids	Haplic Yermosols	Thal South
Murad	Halic Camborthids	Haplic Yermosols	Bahawalpur
Muradwala	Typic Calciorthids	Calcic Yermosols	Cholistan
Murat	Typic Calciorthids	Haplic Yermosols/Haplic Xerosols	Attock
Nabipur	Typic Camborthids	Haplic Yermosols	Sheikhupura, Multan South, Multan North, Rahim Yar Khan, Chakwal
Nammal	Typic Camborthids	Haplic Yermosols	Attock, Chakwal
Nawankot	Typic Halorthents	Orthic Solochaks/Haplic Yermosols	Lahore, Multan South, Multan North
Niazbeg	Typic Camborthids	Haplic Yermosols	Thal South, Thal North
Notak	Typic Camborthids	Haplic Yermosols	Thal South, Thal North
Nurpur	Typic Camborthids	Haplic Yermosols	Thal South, Thal North
Pacca	Typic Camborthids/Aquic Camborthids	Haplic Yermosols/Calcaric Gleysols	Sahiwal, Sheikhupura, Gujranwala, Lahore, Jhang, Multan South, Multan North, Dera Ghazi Khan, Sargodha, Attock
Pasrur	Vertic Ustochrepts	Eutric Cambisols	Gujrat, Gujranwala
Pindorian	Typic Ustochrepts	Eutric Cambisols	Gujrat, Sheikhupura, Gujranwala, Lahore, Faisalabad, Sargodha, Attock
Pitafi	Typic Salorthids	Orthic Solonchaks	Multan South, Multan North, Muzaffargarh
Qadirabad	Typic Halorthids	Orthic Solochaks/Orthic Solonetz	Sahiwal
Qazian	Lithic Torripsamments	Calcaric Rhegosols	Rawalpindi, Attock
Qutbal	Typic Ustorthents	Calcaric Rhegosols	Attock, Chakwal
Rajanpur	Typic Camborthids/Typic Torrerts	Haplic Yermosols/Chromic Vertisols	Dera Ghazi Khan
Rajjar	Typic Ustorthents/Typic Torriorthents	Calcaric Rhegosols	Gujrat, Rawalpindi, Attock
Rangpur	Typic Torripsamments	Calcaric Rhegosols	Thal South, Thal North
Rasulpur	Typic Camborthids	Haplic Yermosols	Thal North, Gujrat, Sheikhupura, Gujranwala, Lahore, Jhang, Faisalabad, Sargodha, Multan North
Rawal	Typic Ustochrepts	Calcaric Cambisols	Rawalpindi
Rawalpindi	Typic Ustochrepts	Eutric Cambisols	Rawalpindi
Renhal	Typic Torripsamments	Calcaric Rhegosols	Cholistan
Rustam	Typic Torriorthents/Typic Torrifluvents	Calcaric Fluvisols	Thal North, Sahiwal, Sheikhupura, Lahore, Jhang, Multan South, Multan North, Sargodha
Sagar	Aeric Haplaquepts	Calcaric Gleysols	Sheikhupura, Gujranwala, Lahore
Salamsar	Fluventic Camborthids	Haplic Yermosols	Cholistan
Sanawan	Typic Halaquents	Takyric Solonchaks	Thal South
Satghara	Typic Halorthids	Orthic Solonetz/Solonchaks	Thal South, Thal North, Sahiwal, Sheikhupura, Gujranwala, Jhang, Multan South, Multan North, Sargodha
Satwal	Udortnentic Chromusverts	Chromic Vertisols	Rawalpindi, Chakwal
Shahdara	Typic Ustifluvents/Ustorthents Typic Torrifluvents/Torriorthents	Calcaric Fluvisols	Thal South, Thal North, Sahiwal, Gujrat, Sheikhupura, Rawalpindi, Muzaffargarh, Gujranwala, Lahore, Jhang, Multan South, Multan North, Dera Ghazi Khan, Rahim Yar Khan, Faisalabad, Sargodha
Shahpur	Fluventic Camborthids	Haplic Yermosols	Thal North, Sahiwal, Sheikhupura, Jhang, Sargodha, Multan North

ANNEXURE VI: DOMINANT SOIL SERIES, CLASSIFICATION AND AREAS OF THEIR OCCURRENCE

Soil Series	US Soil Taxonomy	FAO World Soil Map	Areas of Occurrence
Shakargarn	Typic Ustochrepts	Eutric Cambisols	Gujranwala
Shergarh	Typic Camborthids	Haplic Yermosols	Multan South, Multan North
Shikarpur	Typic Camborthids	Haplic Yermosols/Calcaric Gleysols	Multan North
Sialkot	Typic Ustochrepts	Eutric Cambisols	Gujranwala
Sindhelianwali	Typic Halorthids	Orthic Solonetz	Thal North, Sahiwal, Gujrat, Sheikhupura, Gujranwala, Lahore, Jhang, Multan South, Multan North, Faisalabad, Sargodha
Sindhwan	Typic Calciorthids	Calcic Yermosols	Gujranwala, Lahore, Faisalabad, Sargodha
Sirka	Typic Ustochrepts	Caolcaric Cambisols	Attock
Soan	Typic Torrifluvents/Typic Ustifluvents	Calcaric Fluvisols	Rawalpindi, Chakwal
Sodhra	Typic Torripsamments/Typic Ustipsamments	Calcaric Fluvisols/Eutric Fluvisols	Thal South, Thal North, Sahiwal, Gujrat, Dera Ghazi Khan, Sheikhupura, Lahore, Jhang, Multan South, Multan North, Faisalabad
Sukherwala	Fluventic Camborthids	Hapic Yermosols	Cholistan
Sultanpur	Typic Camborthids	Haplic Yermosols	Thal North, Sahiwal, Sheikhupura, Lahore, Jhang, Faisalabad, Multan North
Talai	Typic Torripsamments	Calcaric Rhegosols	Thal North
Talagang	Typic Ustocrepts/Fluventic Camborthids	Calcaric Cambisols/Hapic Yermosols	Attock, Chakwal
Thal	Typic Torripsamments	Calcaric Rhegosols	Thal South, Thal North
Theri	Typic Ustochrepts	Eutric Cambisols/Eutric Gleysols	Gujranwala
Therpal	Fluventic Camborthids	Haplic Yermosols	Rawalpindi
Tirnaul	Typic Ustochrepts	Calcaric Cambisols	Rawalpindi, Attock
Waryam	Halic Camborthids	Haplic Yermosols	Multan North
Wazirabad	Udic Haplustalfs	Orthic Luvisols	Gujrat, Sheikupura, Gujranwala
Yazman	Typic Torripsamments	Calcaric Rhegosols	Bahawalpur
Zahri	Fluventic/Vertic Camborthids	Haplic Yermosols	Bahawalpur



USAID FROM THE AMERICAN PEOPLE | USDA