SOIL FERTILITY ATLAS OF PAKISTAN

The Sindh Province

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The Sindh Province

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Project code: GCP/PAK/130/USA

Note for the Readers

The objective of this Atlas is to present information regarding availability of fertilizers, farmers' common practices, and crop yields under different nutrient use scenarios and cropping practices in the Sindh province. Thus, the overall trends and inferences drawn are valid (and justifed) 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 specifc for that crop. Thus, the stated inferences imply necessarily for the area under a specifc crop and not for the whole cropped area in a district. 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-specifc situation. All possible care has been taken in data analysis and presentation; suggestions for improvements are welcome.

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	Farm 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
USDA	U.S. Department of Agriculture
USAID	U.S. Agency for International Development

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FOREWORD

Agriculture sector is playing a vital role in driving economic growth in Pakistan. About 67% of the country's population is directly or indirectly dependent on agriculture for their livelihood. The agriculture sector accounts for 45% of employment equivalent to 26 million persons of the national workforce, and 22% of the country's GDP. Adequate and timely use of inputs like balanced fertilizers and certified seeds along with mechanization and provision of agricultural credits are prerequisites for better agricultural output. The Sindh province contributes significantly towards the overall national agricultural production in major crops including rice (36%), cotton (34%), sugarcane (29%), and wheat (15%). Thus, the economic development of Sindh province in the background of ever increasing population largely depends on further growth of agriculture sector.

The promotion of sustainable soil management is essential for meeting overarching human need for food, raw materials and energy. Among the major constraints that are hampering sustainable yields, imbalanced fertilizer use and high fertilizer prices are dominant factors. 4R nutrient stewardship, if duly implemented, can help decrease the cost of production and enhance fertilizer 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 - GCP/PAK/130/USA'. 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.

The loss of soil fertility in many developing countries poses an immediate threat to food security. One of the major causes of depletion of the soil fertility is mining of the essential plant nutrients from the soils due to intensive cultivation and unsustainable soil management practices. 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 fertilizers. However, imbalanced use of fertilizers (Nitrogenous, Phosphatic, Potassic and Micronutrients) and low fertilizer(s) efficiency still remain the major constraints in enhancing crop productivity in the country. The imbalanced use of fertilizers in Pakistan that results in lower incomes of the farmers can rightly be blamed to incorrect ratio of nutrients. Consequently, the agricultural production per unit area especially of grain crops has been stagnant in some of the cropping zones. On the other hand, the population is increasing at an alarming rate; it requires sustainable agriculture intensification. Organic manures, which can help restore soil health and its nutrient status, possess a huge potential. However, organic manures alone cannot meet the sizeable nutrient requirements of major crops. Therefore, the concept of integrated plant nutrition management system is need of the hour. This is especially true for soils that have been depleted of their nutrients for decades by intensive cropping.

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

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 Sindh and beyond.

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

ACKNOWLEDGEMENTS

The Soil Fertility Atlas for Sindh Province is the result of the efforts of many institutions and individuals. The U.S. Agency for International Development (USAID) and the U.S. Department of Agriculture (USDA) provided funding for this task while the Government of Pakistan and the Food and Agriculture Organization of the United Nations (FAO) contributed expertise and knowledge. FAO implemented the project with close collaboration of the Ministry of National Food Security & Research (MNFSR) and the Pakistan Agricultural Research Council (PARC). We acknowledge the cooperation and support extended by the following institutions and their experts in the process of development of this Atlas. Mr. Hidayatullah Chhajro (Director General, Agriculture Extension Sindh) and Mr. Riaz Ahmad Dayo (Director Extension) were very kind to involve their extension team in rapid fertilizer use assessment/survey. Dr. Nadeem Amjad, Member Natural Resources (PARC) took keen interest to include fertilizer use assessment at the farm-gate level in this Atlas.

The participating team from the Climate Change, Alternate Energy and Water Resources Institute (CAEWRI) of the National
Agricultural Research Center (NARC) included Dr. Munir Ahmad (Director), Dr. Bashir Ahmad, Dr. Arshad Ashraf, Mr. Muhammad Bilal Iqbal and Mr. Naveed Mustafa. From FAO, Ms. Mehwish Ali, Mr. Muhammad Afzal (Information Management Unit), Mr. Ajmal Jahangeer (Statistician) and Ms. Amina Tayyub (Graphic Designer) provided support in data processing, mapping and layout designing for this Atlas.

The preparation of the Sindh Soil Fertility Atlas for final publication has been led by Dr. Waqar Ahmad (Soil/NRM Expert - Project Manager, FAO). The kind support extended by Dr. Nisar Ahmad, Ex-Chief of the National Fertilizer Development Center (NFDC), Planning Commission of Pakistan in the form of technical discussions and feedback helped to finalize the fertilizer offtake trends and data interpretation. Thanks are also extended to his successor Mr. Abdul Jalil Marwat (Chief NFDC), Dr. Ahmad Ali Khan and Dr. Muhammad Islam (Assistant Chiefs NFDC) for sharing data on fertilizer offtake and postulation of different hypotheses for data interpretation.

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The editorial comments on the final product were provided by Dr. Kazi Suleman Memon (Professor (Retd.), Sindh Agriculture University, Tandojam), Prof. Dr. Zia-ul-Hassan Shah (Sindh Agriculture University, Tandojam), Dr. Khalid Mahmood (Ex-Deputy Chief Scientist, Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad), Dr. Muhammad Aslam (Principal Scientist, NIAB, Faisalabad), Dr. Munir H. Zia (FFCL), Dr. Arshad Ashraf (NARC), Dr. Nisar Ahmad (NFDC), Dr. Muhammad Salim (PARC) 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), Mr. Francisco Gamarro (Deputy Representative, FAO Pakistan) and Dr. Yuji Niino (Technical Officer, FAO Rome).

INTRODUCTION

Promotion of sustainable soil and crop management practices is crucial to ensure intensive agricultural production and maintain environmental quality - a major challenge being faced by the agriculture sector in Pakistan. Sustainable agricultural production system requires not only efficient use of the natural resources but it also involves recycling of the organic wastes of plant, animal and industrial origin without casting any negative impact on soil and the environment. With respect to fertilizers, the objective is to minimize nutrient losses that occur through leaching of nitrates, volatilization of ammonia, denitrification, soil fixation (due to alkaline calcareous nature, low organic matter content, etc.), soil erosion and to replenish nutrients that have been exhausted from the soil through crop uptake during intensive agricultural practices.

In consideration of the above concerns, Food and Agriculture Organization of the United Nations (FAO) in partnership with the Ministry of National Food Security & Research (MNFSR), Pakistan Agricultural Research Council (PARC) and U.S. Department of Agriculture (USDA) implemented 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 collaborated closely with both the public and private sector partners to:

- Conduct rapid fertilizer use assessment/survey;
- Assess district-wise soil fertility status;
- Identify best management practices that enhance soil health and productivity;
- Collect information related to soils classification;
- Promote 4R nutrient stewardship (commonly known as Right nutrient/fertilizer at the Right rate at the Right time in the Right place) through organizing commodity-based workshops, seminars and policy dialogues for balanced used of inputs;
- Strengthen the provincial and national capacity of relevant agricultural organizations for implementation of sustainable soil management practices with special focus on soil fertility and plant nutrition, and visualization of data;
- Prepare the baseline atlas of current soil fertility and soil health management practices; and
- Use outputs of the above activities for informed decision making at various levels, for example, setting provincial frameworks for Agriculture and Natural Resources Management in achieving Sustainable Development Goals (SDGs).

As an effort towards achievement of the objectives, use of appropriate balanced fertilizer inputs and 4R Nutrient Stewardship was 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 nutrientstewardship for the farming community of Pakistan;
- Use of public-private partnership as a mechanism for sustainable agriculture intensification in the country;
- Include farmers' experiences in devising soil and fertilizer management strategy for sustainable crop production; and
- Collaborative efforts are needed to address such issues in the best interest of the farming community.

This Soil Fertility Atlas for the Sindh province is comprised of four sections: 1) General Maps, 2) Rapid Fertilizer Use Assessment, 3) Mapping NFDC Nutrient Offtake Data, and 4) Soil Fertility Status Mapping. Besides, several annexures offer details of the important parameters of the fertilizers data used. The baseline atlas provides use of different fertilizers/nutrients for major commodities/crops grown in the Sindh 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. The desired soil fertility management changes for sustainable agriculture intensification could, thus, be better understood through identification of hot spots with regard to non-judicious use of nutrient applications (over or less than required) coupled with low use efficiency factors.

Mina Dowlatchahi
FAO Representative
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 Sindh province for gathering information and document experience from the national and provincial stakeholders. Considering the contribution of major crops/commodities in agricultural production, rice, sugarcane, cotton, wheat, mango and banana were selected to monitor the usage of fertilizers and/or yield trends. The 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 described below.

Rapid Fertilizer Use Assessment

The assessment was based on the assumption that Fertilizer Offtake data (a term used by NFDC Pakistan to describe fertilizer consumption based on the marketing of products) does not necessarily reflect the application of fertilizers at the farm-gate level. This communitybased assessment was conducted with the involvement of the Sindh Agriculture Extension Department. A questionnaire was developed in consultation with different stakeholders; and thereafter, district-wise farmers' interviews were conducted. The selection of farmers was presumably skewed towards medium level progressive farmers with whom the agriculture extension workers frequently interact. The sample population (farmers interviewed) was 60 per district. Overall, this sample size was found representative when aggregated at the crop production region and provincial scales. Further, the data 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 in the Sindh province. The validation of such trends in each district was based on field surveys, follow-up interviews and discussions with public and private sector entities/experts.

According to the climatic and soil conditions of Sindh, different areas are suitable for different crops, e.g., lower part of the province is considered best for sugarcane, coconut, banana and papaya plantation. The plains of middle Sindh are suitable for upland crops. In the upper Sindh and right bank areas of the Indus River, rice is grown abundantly. The eastern portions of the province and Kachho areas are suitable for rain-fed crops, like millets and guar. However, for comparison and consistency of presentation with Punjab Atlas, and development of this Atlas, the crop data was disaggregated by districts according to the following crop zones:

- **Cotton-Wheat**

  Ghotki, Khairpur, Shaheed Benazirabad, Naushahro Feroze, Sanghar, and Sukkur
- **Rice-Wheat**

  Badin, Dadu, Jacobabad, Kambar Shahdadkot, Kashmore, Larkana, Shikarpur, Sujawal, and Thatta
- **Mixed Crops**

  Hyderabad, Jamshoro, Karachi, Matiari, Mirpur Khas, Tando Allah Yar, Tando Muhammad Khan, Tharparkar, and Umer Kot

Regarding the application of different nutrient sources, all progressive, medium- and smallholder 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 NFDC offtake 2014-2015 was used for product-wise usage of the fertilizers across Sindh. Moreover, NPK nutrient use for five years outlook (2010-2015) was averaged and trend was monitored in three crop production regions, i.e., cotton-wheat, rice-wheat and mixed crops. Overall trends of one year and five years outlook (offtake of fertilizers) remained comparable across the past several years although minor fluctuations were observed. The patterns 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. The agricultural statistics data and addresses of soil and water testing facilities in the Sindh province have also been documented which would provide a fundamental baseline for future management and planning of nutrient(s) use in the province.

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 by incorporating all necessary mapping details. The soil fertility status and fertilizer offtake were 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 was presented by each crop and district.

Soil Fertility Status

For increasing agriculture production and economic returns at farm level, Fauji Fertilizer Company Limited (FFCL) is providing Advisory Services to the farming community throughout Pakistan since 1981, absolutely free of cost. For this purpose, the company is providing soil and water testing facilities through its five mobile Farm Advisory Centers (FACs). 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. For example, FAC Sukkur has been previously stationed at Hyderabad, Nawabshah, Mirpur Khas, and Hala. 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) were obtained and disaggregated by districts. It was assumed that EC, pH, OM, P and K values are indicative of the overall soil fertility status of each district. The farmers of a district may plan nutrient management practices as per the information mentioned for their respective district. However, the farmers are advised to consult with the nearest 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. National development is possible through efficient use and conservation of natural resources, particularly the soil/land which is nonrenewable. Unfortunately, unsustainable management practices have led to loss of soil fertility and health, compelling the use of chemical fertilizers which 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 Sindh 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 in Sindh is skewed towards nitrogen 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, <30% of the farmers use organic sources of nutrients predominantly in wheat-occupied cropping systems followed by the commodities like cotton, sugarcane and fruit orchards; whereas <15% farmers across the Sindh province apply micronutrients regardless of the product quality. Nevertheless, burning of crop residues and lack of scientific application of both inorganic and organic sources of nutrients still remain a great concern. This is to note that, the farmers in Sindh reported nutrient(s) application in eight different combinations (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, in general, into the increased yield for the 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. The temporal data of banana production shows that overall trends of district-wise banana yield have been similar in different cropping regions. Three districts, viz. Khairpur, Matiari and Thatta are leading with regard to average banana yield. Irrespective of the cropping regions or districts, banana yield has been stagnant over the last few years (2010-2015). In case of mango, data shows that overall trends of district-wise yield have been similar in different cropping regions. Three districts, *viz.* Sanghar, Mirpur Khas and Badin are leading with regard to average mango yield. Irrespective of the cropping regions or districts, mango yield has been stagnant over the last few years (2010-2015).

Soil-related constraints weighted 70% in the problem matrix that could hamper productivity, were reported by the farmers at the provincial scale. However, the degree of soil constraints varied in regional scenarios. Thus, 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 data-base/archives would allow moving towards nondestructive approaches for problem assessment and wisdom agriculture. The spatial distribution of constraints at similar scale could also be used to obtain the cost of lost production using soil-constraint 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 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 socioeconomic uplift. For this purpose, a network of soil, 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 farmers associated with 7.83 million acres of farms area in Sindh. Outreach linkages with the farmers may be strengthened for extensive surveys/assessments at the 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 the private sector for collaborative initiatives to achieve sustainable development.

SECTION 1

GENERAL MAPS

DISTRICTS OF SINDH

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 Sindh province. There are 24 districts which have variable land. Area-wise, Khairpur and Tharparkar are the largest districts.

Data Sources

The Government of Sindh, FAO and GAUL

Map Scale and Datum

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

Datum: WGS 84

N

0 30 60 90 120 150

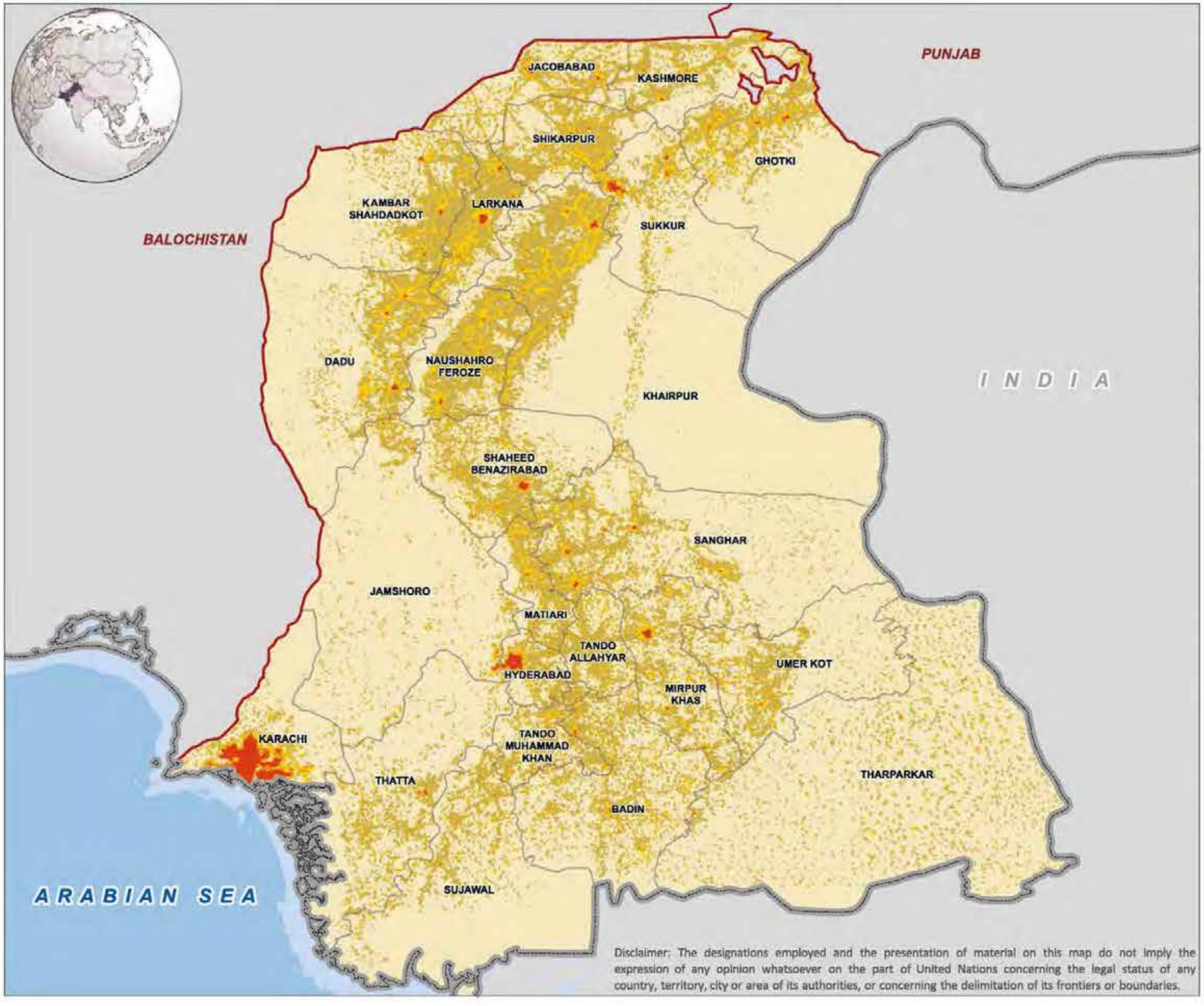
Kilometers

Date: 26 Jan 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_Districts_01_20160126

POPULATION OF SINDH
(per square kilometer)



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Map Legend

Administrative limits

- Country
- Province
- District

Population density (per square kilometer)

- 0 - 100
- 101 - 500
- 501 - 2,500
- 2,501 - 5,000
- 5,001 - 130,000

About Map

The map shows population density, i.e., number of persons per square kilometer. Out of the total population (approximately 56 million), majority lives in the two big cities, Karachi and Hyderabad.

Data Sources

FAO, GAUL, LandScan data 2011

Map Scale and Datum

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

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 26 Jan 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_Population_02_20160126

DISTRICT-WISE CULTIVATED AND NON-CULTIVATED AREA OF SINDH

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Map Legend

Administrative limits

- Country
- Province
- District

Land Use (in percentage)

- Cultivated Area
- Non-cultivated Area

About Map

The map shows the percentage of cultivated and non-cultivated area in each district of Sindh. The percentage of cultivated area is higher in upper Sindh and gradually decreases towards south being the lowest in the coastal districts.

Data Sources

FAO, GAUL, Agricultural Census 2010

Map Scale and Datum

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

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 03 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_cultiv_03_20160203

TOTAL AREA UNDER IRRIGATION IN SINDH
(hectares)

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PUNJAB

BALOCHISTAN

INDIA

ARABIAN SEA

KASHMORE
JACOBABAD
GHOTKI
KAMBAR SHAHDAD KOT
SHIKARPUR
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
MIRPUR KHAS
UMER KOT
HYDERABAD
KARACHI
TANDO MUHAMMAD KHAN
THARPARKAR
THATTA
BADIN
SUJAWAL

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Map Legend

Administrative limits

- Country
- Province
- District

Area under Irrigation (000 hectares)

- 0 - 100
- 101 - 200
- 201 - 300

About Map

The map shows the area under Irrigation in each district. The data is sourced from Agriculture Census 2010.

Data Sources

FAO, GAUL, Agricultural Census 2010

Map Scale and Datum

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

Datum: WGS 84

N

0 40 80 120 160

Kilometers

Date: 03 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_Irri_03_20160203

DISTRICT-WISE SOIL TYPE / PARENT MATERIAL IN SINDH

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PUNJAB

BALOCHISTAN

INDIA

ARABIAN SEA

JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIR ABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
UMER KOT
MIRPUR KHAS
HYDERABAD
TANDO MUHAMMAD KHAN
KARACHI
THATTA
BADIN
THARPARKAR
SUJAWAL

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Map Legend

Administrative limits

- Country
- Province
- District

Soil Type/ Parent Material

- Piedmont plains
- Reworked sandy deposits
- Sub-recent alluvial deposits
- Sub-recent river alluvium and marine deposits

About Map

The map shows the parent material for the soils in each district. The information is derived from soil survey reports of Soil Survey of Pakistan.

Data Sources

FAO, GAUL, Soil Survey of Pakistan

Map Scale and Datum

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

N

0 30 60 90 120 150

Kilometers

Date: 20 March 2017

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_PM_06_20160714

SOIL FERTILITY AND SOIL HEALTH MANAGEMENT PRACTICES IN SINDH

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BALOCHISTAN

PUNJAB

INDIA

ARABIAN SEA

JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIR ABAD
SANGHAR
MATIARI
JAMSHORO
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
KARACHI
TANDO MUHAMMAD KHAN
THATTA
BADIN
THARPARKAR
SUJAWAL

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Map Legend

Administrative limits

- Country
- Province
- District

Technologies by ICARDA (Agricultural Extension Department, Hyderabad, Sindh)

- Balanced use of N&P fertilizers using Fertilizer Prediction Model
- Micronutrients (B,Zn) for Mango orchards
- Composting of Banana residue and use of compost for Mango orchards, Wheat, and vegetables

About Map

The technologies mentioned above have been demonstrated on farmers' field under an ICARDA project in five districts of Sindh. Such activities need to be promoted/adopted throughout the province for productivity enhancement.

Data Sources

FAO, GAUL, ICADA

Map Scale and Datum

Datum: WGS84 Nominal scale: 1:2,698,500 at A3

N

0 30 60 90 120

Kilometers

Date: 13 July 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_ ICARDA_07_20160213

LAND COVER MAP OF SINDH

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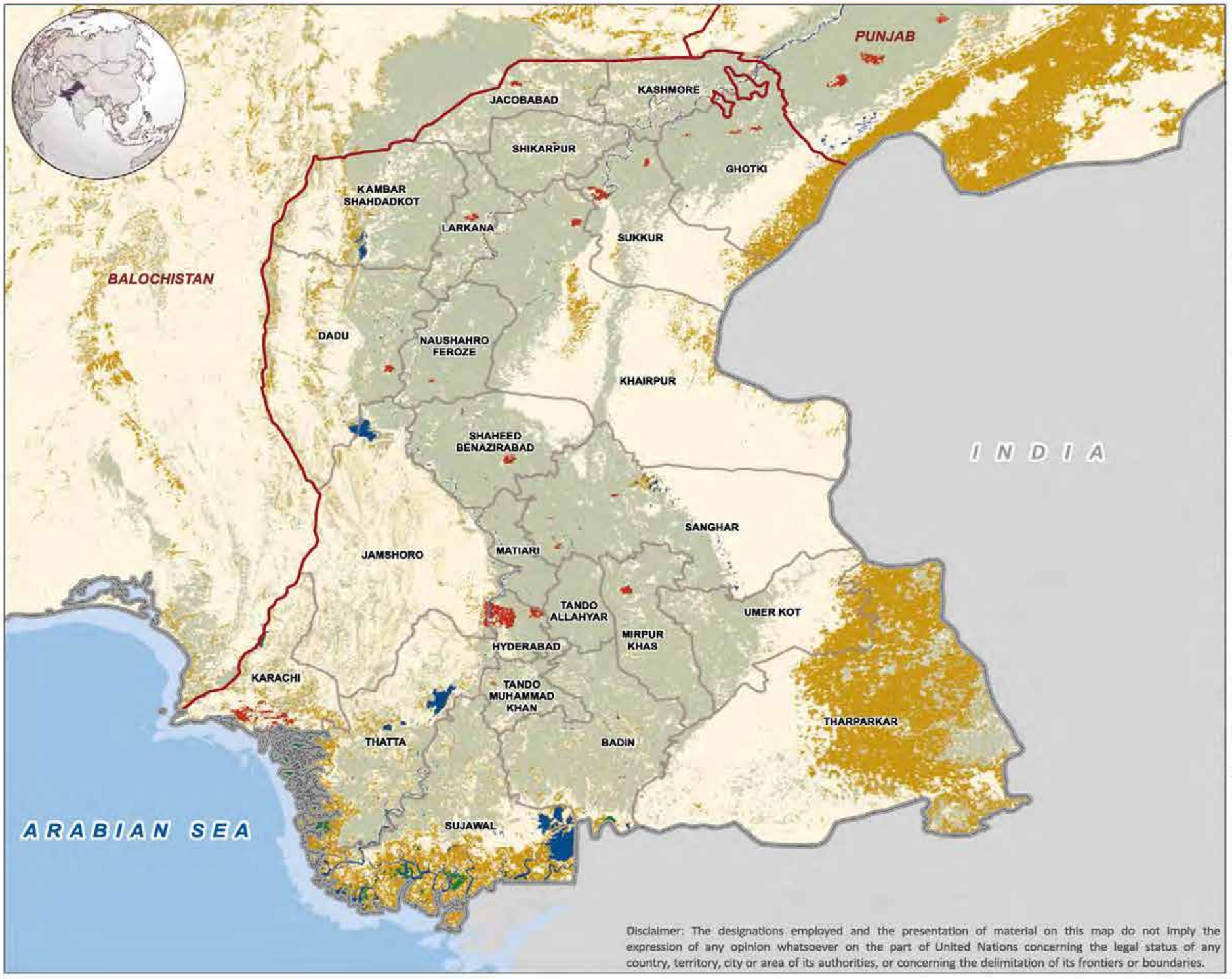

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Map Legend

Administrative limits

- Country
- Province
- District

Land Cover types

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

About Map

The map shows different types of land cover/natural vegetation in Sindh. The vast bare areas and even those with very sparse vegetation are potentially productive, and thus, need special attention for their development.

Data Sources

FAO, GAUL, GlobeCover data 2009

Map Scale and Datum

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

Datum: WGS 84

N

0 40 80 120 160

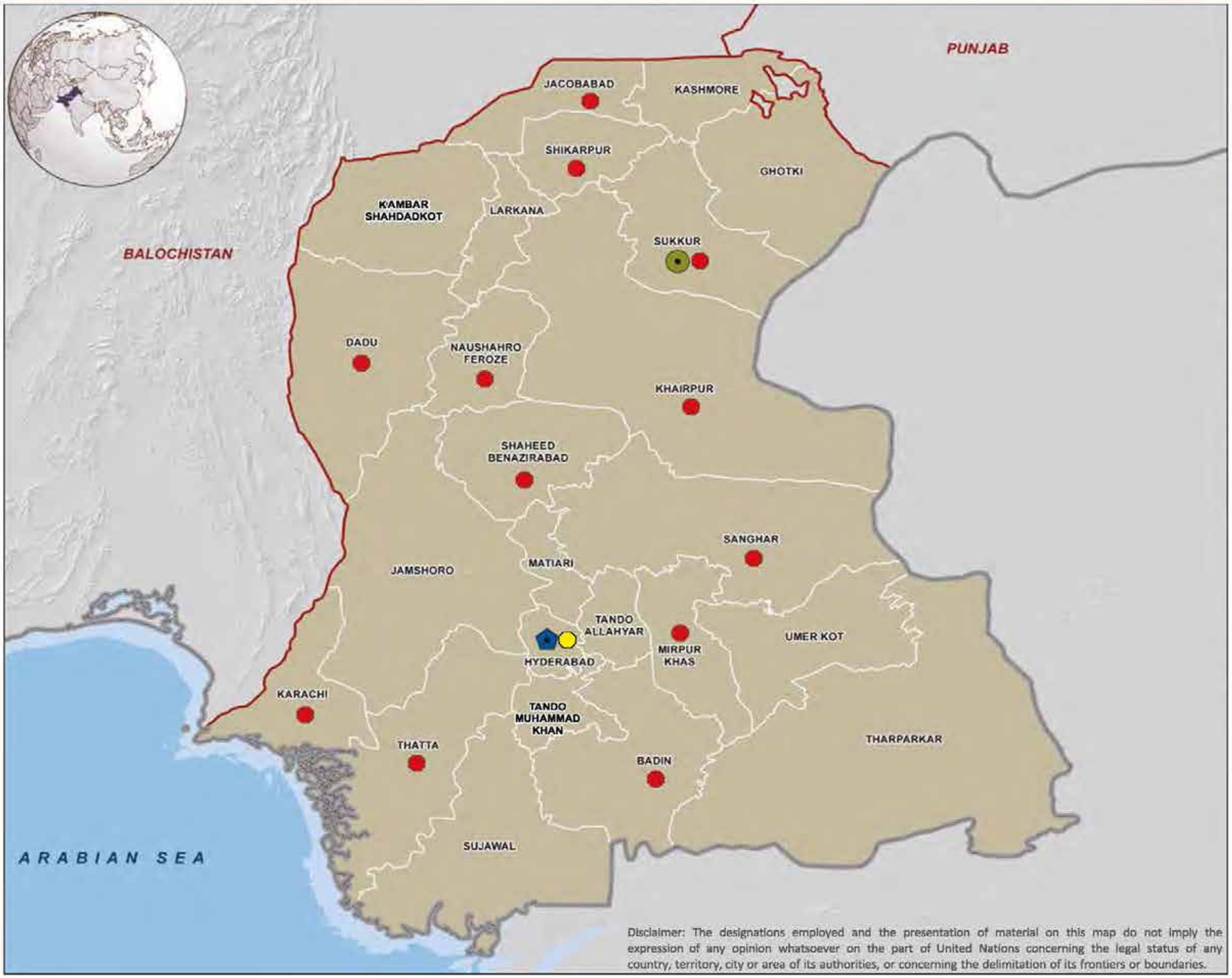
Kilometers

Date: 26 Jan 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_Landcover_08_20160126

SOIL AND WATER TESTING FACILITIES IN SINDH



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Map Legend

Administrative limits

- Country
- Province
- District

Soil and water testing facilities

Government of Sindh

- District Lab
- Central Analytical Lab

Fauji Fertilizer Company Limited

- Soil and Water Testing Lab/ Farm Advisory Centers

Engro Fertilizers Limited

- Soil Fertility Lab

About Map

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

Data sources

FAO, GAUL, FFCL, Government of Sindh, Engro Fertilizers Limited.

Map scale and Datum

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

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 23 Apr 2015

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_Soiltesting_9_20150423

SECTION 2

RAPID FERTILIZER USE ASSESSMENT

FERTILIZER USE AND CROP YIELD

To assess fertilizer use at the farm-gate level, a Rapid Fertilizer Use Assessment (RFUA) was carried out during 2015 in collaboration with the Provincial Agriculture Extension Department in twenty-four districts across Sindh. 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 number of farmers interviewed in each district was 60 (sample size) and the total farmers / respondents were 1440. The selection of farmers reveals that the sample was skewed towards medium level to progressive farmers with whom the 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 and improving soil health.

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

91% Wheat

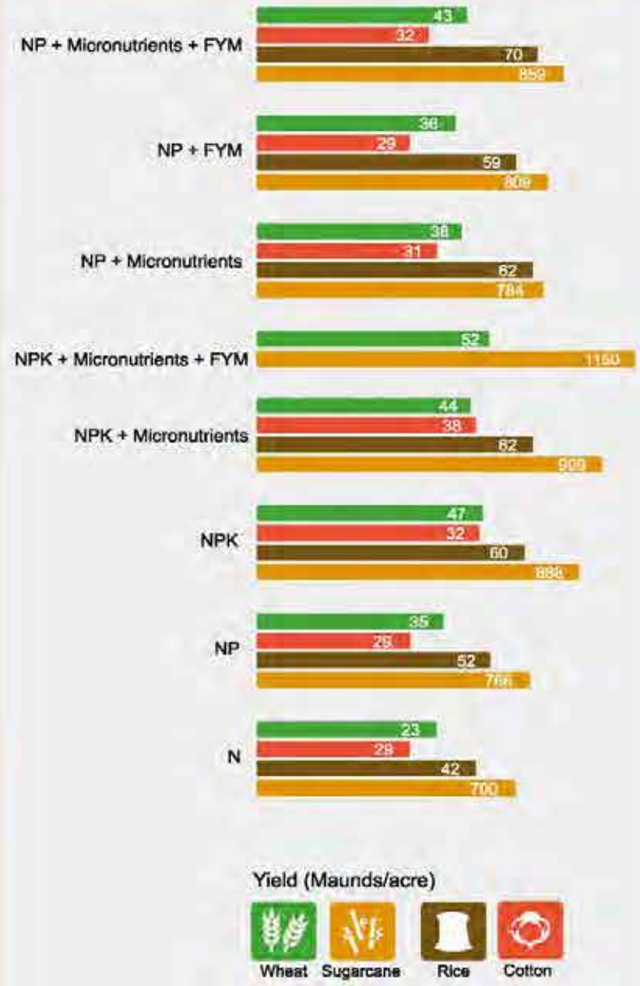
46% Cotton

44% Rice

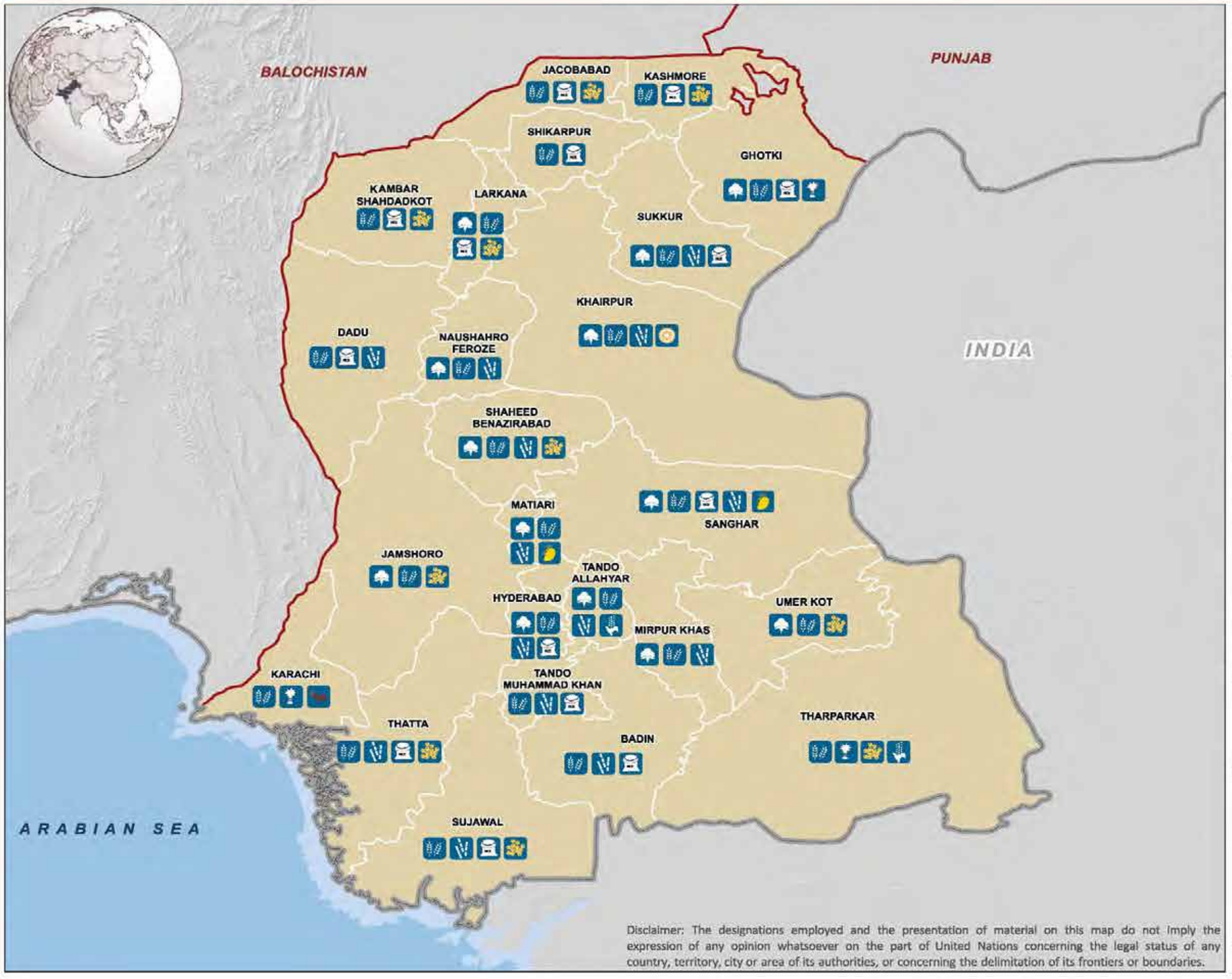
33% Sugarcane

3% Maize

Farm Size (Acres)	**Percent Farmers**
• < 5	06%
• 5-10	18%
• >10	76%
Laboratory Analysis	
• Soil Test	17%
• Water Test	09%
Major Problems	
• Soil-related Constraints	≈ 70%
• Salinity	35%
• Water-logging	36%
• Sodicity	08%
Others	≈ 30%
• Canal water shortage	
• Load shedding	
• High prices of fertilizers	
• Low commodity prices	
Use of Organic Sources	
• Wheat	17%
• Cotton	04%
• Rice/Paddy	03%
• Sugarcane	03%
• Other Crops	02%
• Maize	0.3%



MAJOR CROPS IN SINDH



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Map Legend

Administrative limits

- Country
- Province
- District

Major crops

- Wheat
- Rice
- Millet
- Cotton
- Sugarcane
- Vegetables
- Oilseeds and Pulses
- Fodder
- Mango
- Orchard

About Map

The map shows major crops grown in each district. The information is derived from the Development Statistics of Sindh (2013) by Sindh Bureau of Statistics.

Data Sources

FAO, GAUL, Bureau of Statistics, Government of Sindh

Map Scale and Datum

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

0 30 60 90 120 150

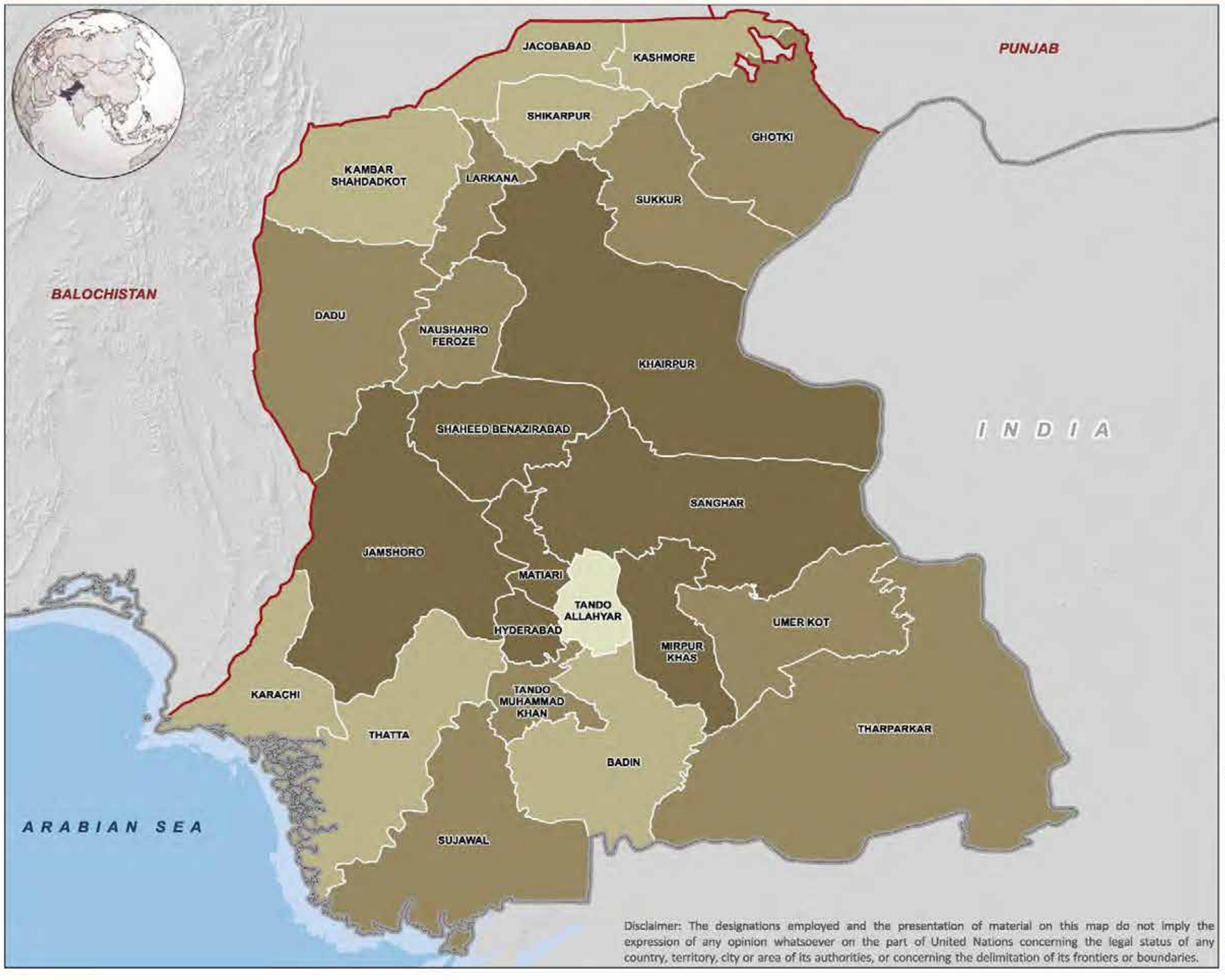
Kilometers

Date: 13 Feb 2015

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_MC_05_20150910

APPLICATION OF UREA TO WHEAT IN SINDH



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Map Legend

Administrative limits

- Country
- Province
- District

Application of Urea (kg/acre)

- <= 50
- 51 - 100
- 101 - 150
- 151 - 200

About Map

The map shows the use of Urea for Wheat in each district. The data indicates over use of Urea in central Sindh and lower use in upper rice growing districts as well as in coastal districts Badin and Thatta.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3
Datum: WGS 84

N

0 30 60 90 120 150
Kilometers

Date: 11 May 2016

Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_Punjab_UreaWheat_2.1_20160511

APPLICATION OF UREA TO RICE / PADDY IN SINDH

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Map Legend

Administrative limits

- Country
- Province
- District

Application of Urea (kg/acre)

- <= 50
- 51 - 100
- 101 - 150
- 151 - 200
- No significant data

About Map

The map shows use of Urea for Rice in each district. The data indicates the higher use of Urea in two districts in each of rice growing areas in lower (Badin and Tando Muhammad Khan) and upper (Larkana and Jacobabad) Sindh. Urea usage in other rice growing districts is low.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120

Kilometers

Date: 05 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_UreaRice _2.2_20160505

APPLICATION OF UREA TO COTTON IN SINDH

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GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIR ABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
KARACHI
TANDO MUHAMMAD KHAN
THATTA
BADIN
THARPARKAR
SUJAWAL

PUNJAB
BALOCHISTAN
INDIA
ARABIAN SEA

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Map Legend

Administrative limits

- Country
- Province
- District

Application of Urea (kg/acre)

- <= 100
- 101 - 150
- 151 - 200
- 201 - 250
- No significant data

About Map

The map shows use of Urea for cotton in each district. Higher usage is obvious in most central districts in the main cotton growing areas.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 12 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_UreaCot_2.4_20160511

APPLICATION OF UREA TO SUGARCANE IN SINDH

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Map Legend

Administrative limits

- Country
- Province
- District

Application of Urea (kg/acre)

- <= 100
- 101 - 150
- 151 - 200
- 201 - 250
- No significant data

About Map

The map shows the use of Urea for Sugarcane in each district. The data shows the higher usage of Urea in Mirpur Khas, Tando Muhammad Khan and Hyderabad followed by adjoining districts and Ghotki in upper Sindh. However, Urea use for Sugarcane is low in all other districts of the province.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

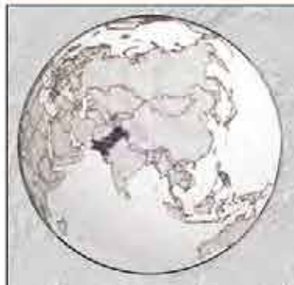
Kilometers

Date: 12 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_Urea Sugarcane_2.5_20160512

TOTAL USE OF UREA IN SINDH



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Map Legend

Administrative limits

- Country
- Province
- District

Total use of Urea per district (kg/acre)

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

About Map

The map shows the total use of Urea for major crops: Wheat, Rice, Cotton and Sugarcane. Higher use of Urea is obvious in Sanghar and Mirpur Khas followed by cotton growing districts. Rice growing districts in southern parts consume more Urea than those in the upper Sindh. In remaining districts of mixed crops, Urea usage is less.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 12 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_Urea_2.6_20160512

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

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JACOBABAD
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SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
KARACHI
TANDO MUHAMMAD KHAN
THATTA
BADIN
THARPARKAR
SUJAWAL

PUNJAB
BALOCHISTAN
INDIA
ARABIAN SEA

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Map Legend

Administrative limits

- Country
- Province
- District

Application of DAP (kg/acre)

- <= 50
- 51 - 75
- 76 - 100

About Map

The map shows use of DAP for Wheat in different districts. Higher usage of DAP is obvious in the wheat-cotton growing areas, being maximum in Jamshoro. Lower use of DAP is apparent in whole of southern and upper rice growing districts of Sindh.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 29 July 2015

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_DAP _4.1_20160513

APPLICATION OF DI-AMMONIUM PHOSPHATE (DAP) TO RICE IN SINDH

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PUNJAB

JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
BALOCHISTAN
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
INDIA
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
KARACHI
TANDO MUHAMMAD KHAN
THATTA
THARPARKAR
BADIN
ARABIAN SEA
SUJAWAL

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Map Legend

Administrative limits

- Country
- Province
- District

Application of DAP (kg/acre)

- <= 25
- 26 - 50
- 51 - 75
- No significant data

About Map

The map shows use of DAP for Rice in different districts. Maximum use of DAP is seen in Jacobabad and Larkana followed by other rice growing districts in upper Sindh and also in Sanghar and Badin.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 17 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_DAPRi_4.2_20160517

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

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JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
KARACHI
THATTA
BADIN
THARPARKAR
SUJAWAL

PUNJAB
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INDIA
ARABIAN SEA

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Map Legend

Administrative limits

- Country
- Province
- District

Application of DAP (kg/acre)

- <= 25
- 26 - 50
- 51 - 75
- 76 - 100
- No significant data

About Map

The map shows the use of DAP for cotton in each district. Overall DAP use is in the lower range in most of the cotton growing districts, except Naushahro Feroze and Jamshoro districts, respectively, with medium and higher DAP use.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

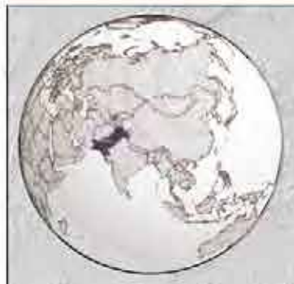
Kilometers

Date: 17 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_DAPCot_4.4_20160517

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



JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
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MIRPUR KHAS
KARACHI
TANDO MUHAMMAD KHAN
THATTA
THARPARKAR
BADIN
SUJAWAL

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Map Legend

Administrative limits

- Country
- Province
- District

Application of DAP (kg/acre)

- <= 50
- 51 - 75
- 76 - 100
- No significant data

About Map

The map shows use of DAP for Sugarcane in each district. The application of DAP in Cotton growing areas and a few Rice growing areas is predominantly high. In addition, more application rates are quite obvious in Mirpur Khas, Tando Allah Yar and Hyderabad districts.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

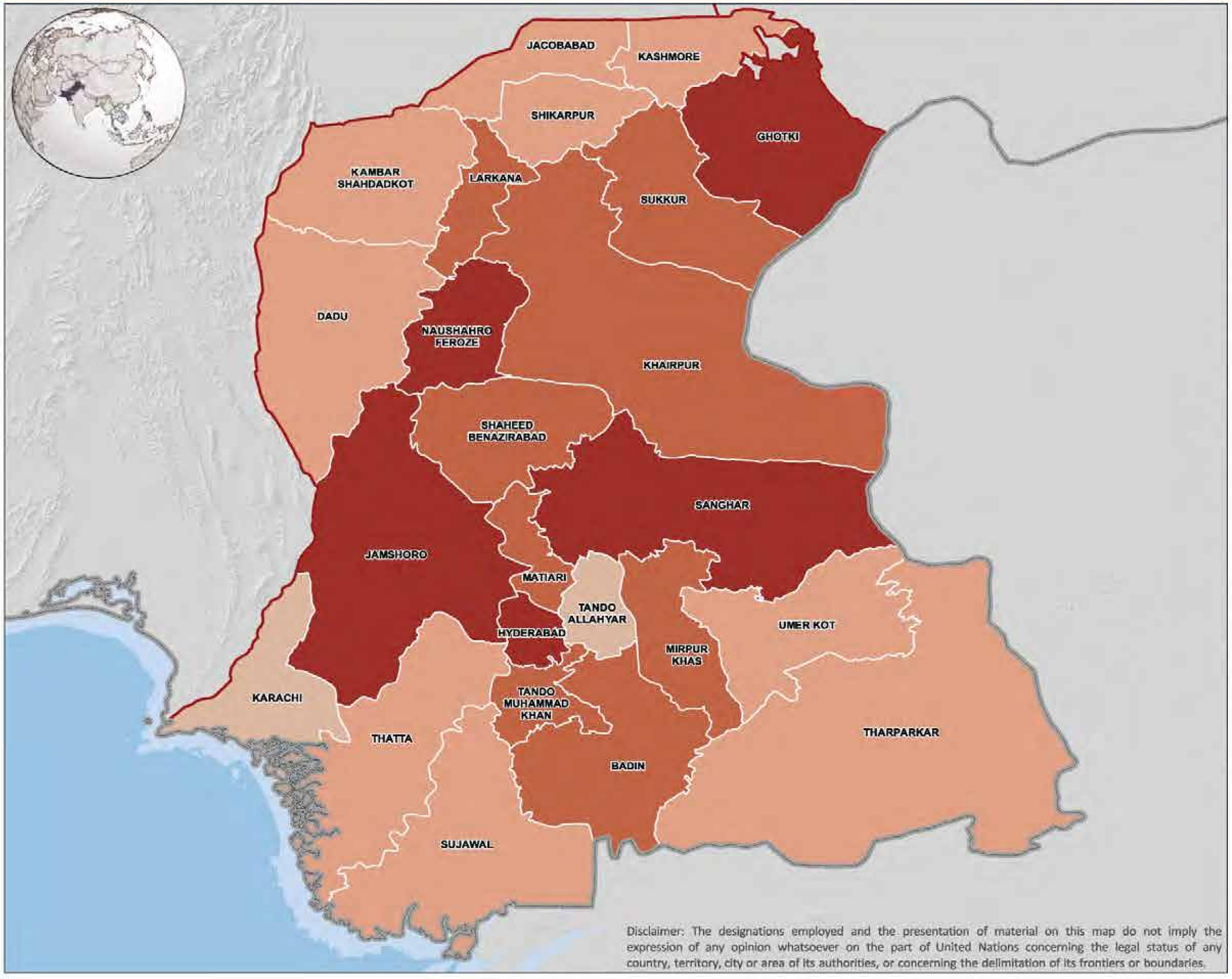
Kilometers

Date: 17 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_DAPSug_4.5_20160517

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



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Map Legend

Administrative limits

- Country
- Province
- District

Total use of DAP per district (kg/acre)

- <= 50
- 51 - 100
- 101 - 150
- 151 - 200

About Map

The map shows total DAP use for the four major crops: Wheat, Rice, Sugarcane and Cotton. The overall higher usage of DAP is obvious in the cotton growing districts. Further, the total usage did not appear to relate with percentage of cultivated area of different districts.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date:16 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_ DAP_4.6_20160516

TOTAL USE OF CALCIUM AMMONIUM NITRATE (CAN) IN SINDH

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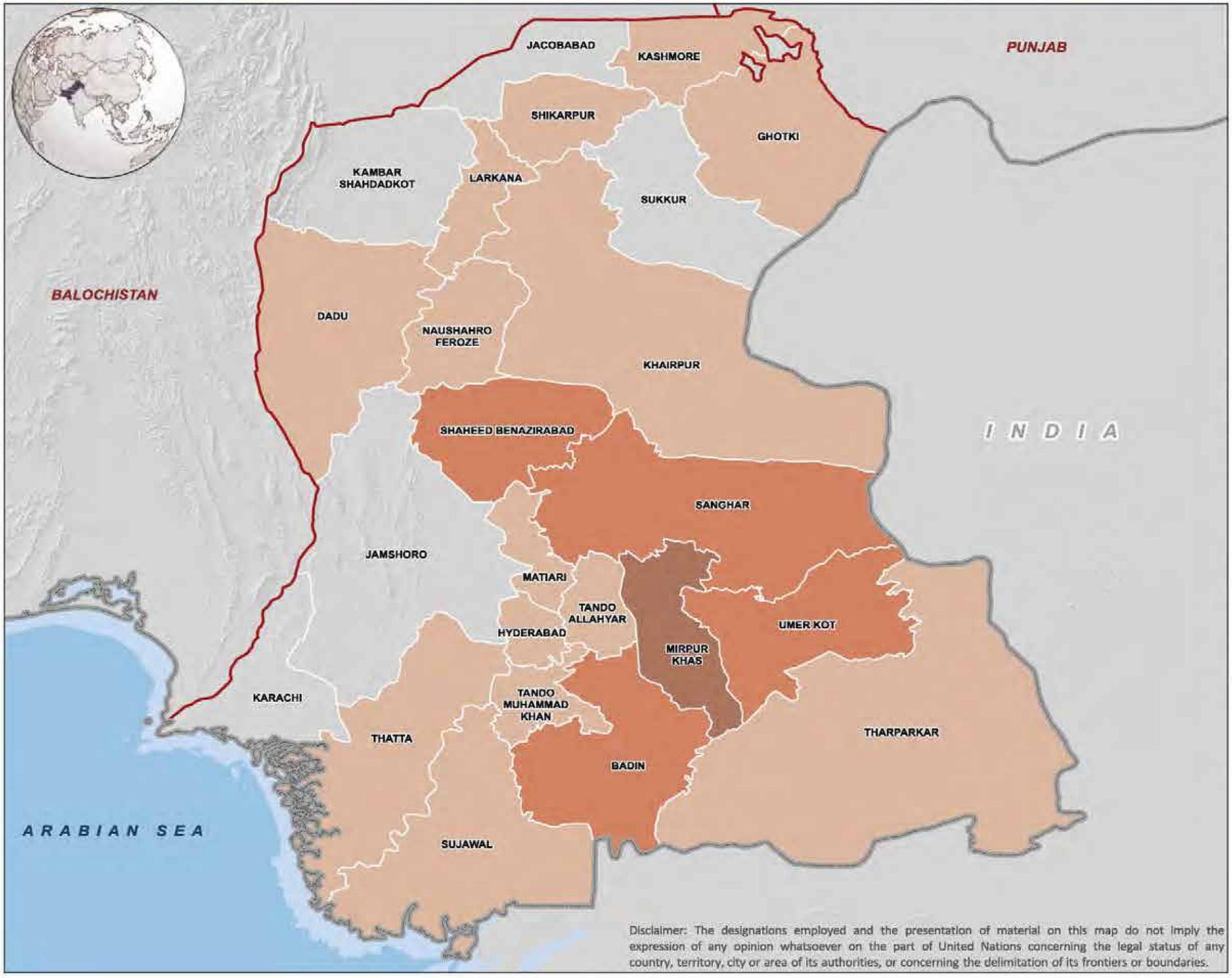

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Map Legend

Administrative limits

- Country
- Province
- District

Total use of CAN per district (kg/acre)

- <= 50
- 51 - 100
- 101 - 150
- No significant data

About Map

The map shows total use of CAN for major crops: Wheat, Rice, Cotton and Sugarcane. The use of CAN appears to be common throughout the province. Relatively higher use is indicated in Mirpur Khas with medium usage in four adjoining districts; whereas CAN use is low in all remaining districts irrespective of the crop regions.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

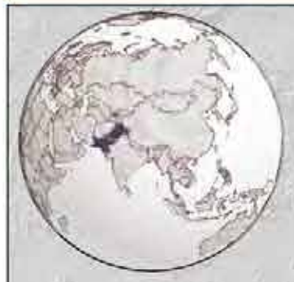
Kilometers

Date: 13 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_CANt _3.6_20160513

DISTRICT-WISE USE OF NITROGEN IN SINDH



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Map Legend

Administrative limits

- Country
- Province
- District

Amount of Nitrogen [N] (Kg/acre)

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

About Map

The map shows the use of N derived from Urea, DAP and CAN applied in each district. The data shows comparatively higher use of N in Sanghar and Mirpur Khas followed by most of the cotton growing districts. The variations in use of Nitrogen compared to Urea application may be due to the consideration of different sources for Nitrogen.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

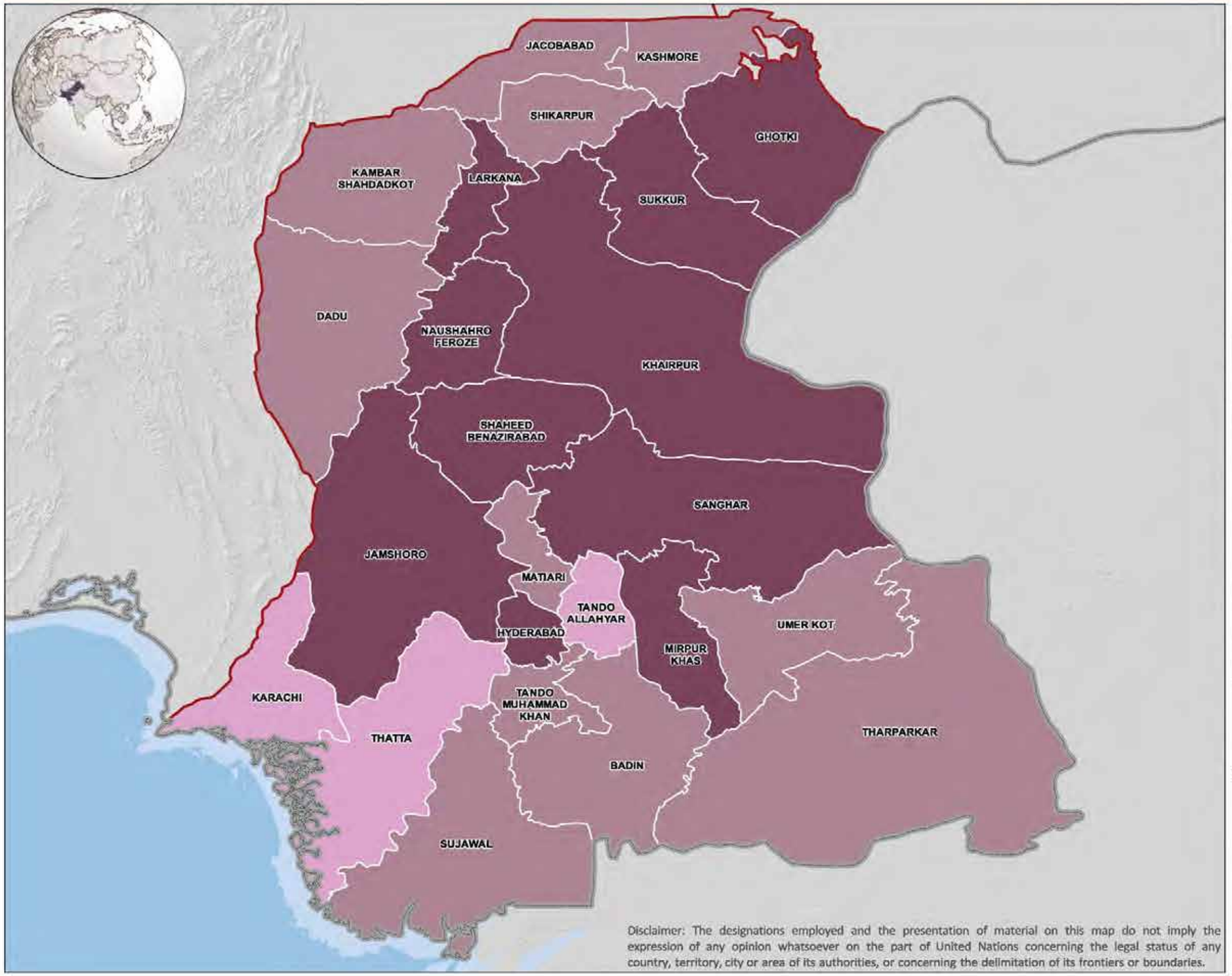
Kilometers

Date: 05 May 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Punjab_ N_5.1_20150516

DISTRICT-WISE USE OF PHOSPHORUS IN SINDH



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

Amount of Phosphorus
P_2O_5 (Kg/acre)

- < 25
- 26 - 50
- No significant data

About Map

The map shows overall use of Phosphorus irrespective of the source (fertilizer) applied in each district. Apparently, the total P applied is comparatively higher in most of the Cotton growing districts followed by Rice growing areas.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

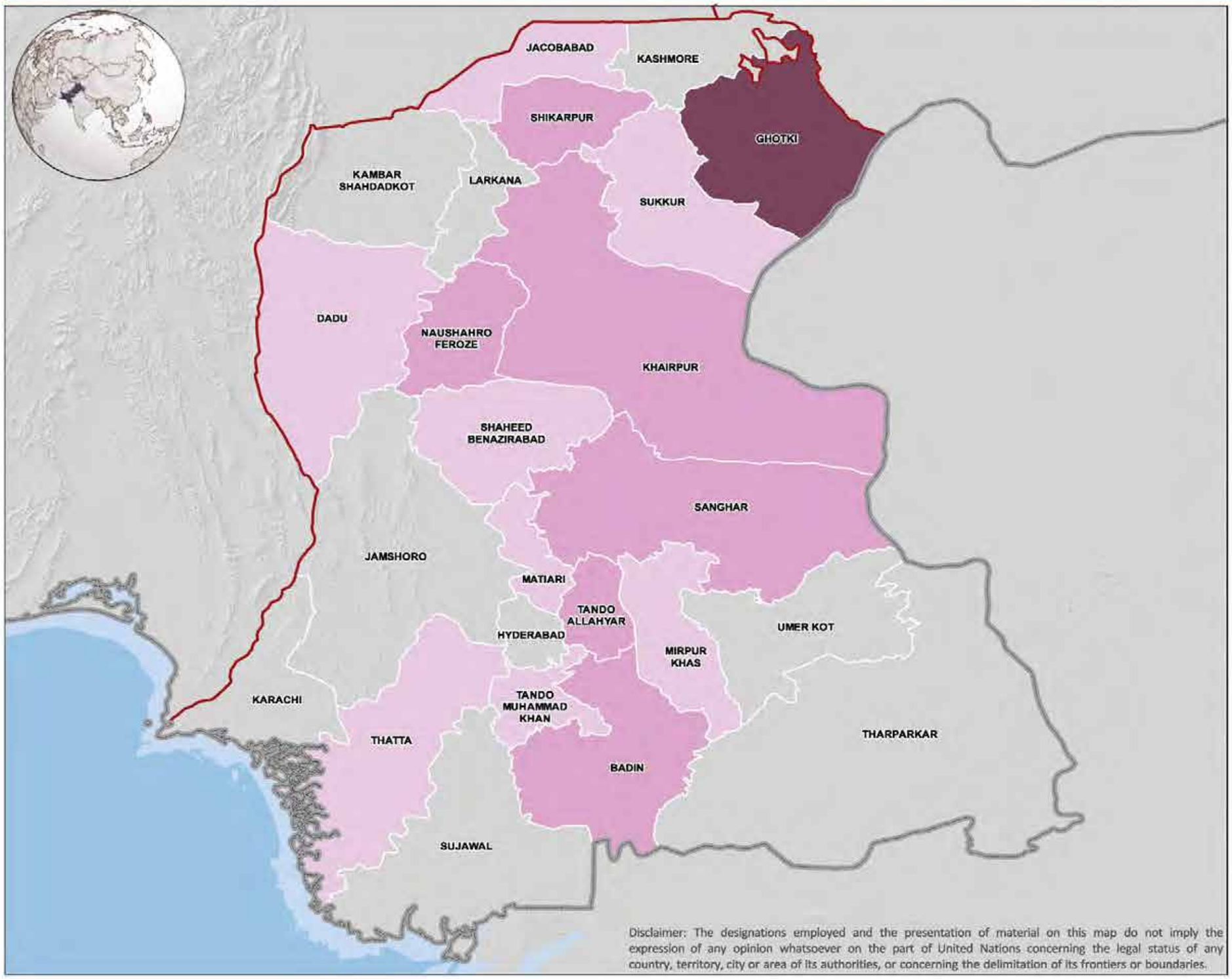
Kilometers

Date: 16 May 2016

Created by: IM Unit, FAO Pakistan

Map Number : PAK_Soil Fertility Atlas_Sindh_P_5.2_20160516

DISTRICT-WISE USE OF POTASSIUM IN SINDH



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

Amount of Potassium K_2O (Kg/acre)

- < 50
- 51 - 100
- 101 - 150
- Data not available/ No significant data

About Map

The map shows the use of K derived from SOP and MOP applied in each district. Apparently higher application rates are obvious in most of the Cotton and Rice growing districts.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 16 May 2016

Created by: IM Unit, FAO Pakistan

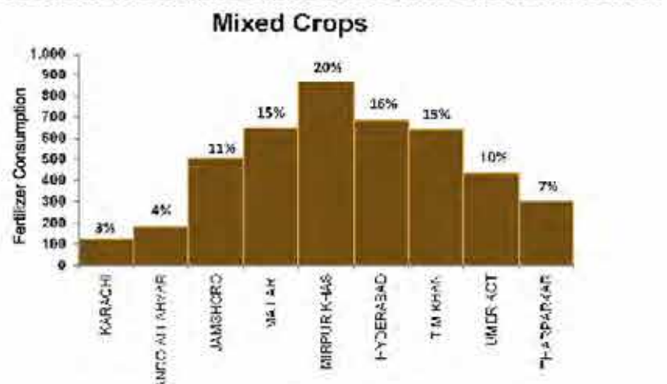
Map Number: PAK_Soil Fertility Atlas_Sindh_ Kd_5.3_20160516

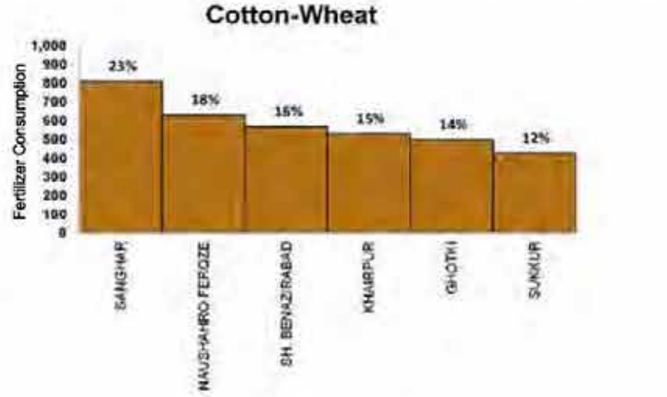
REGION-WISE COMPARATIVE FERTILIZER CONSUMPTION IN SINDH

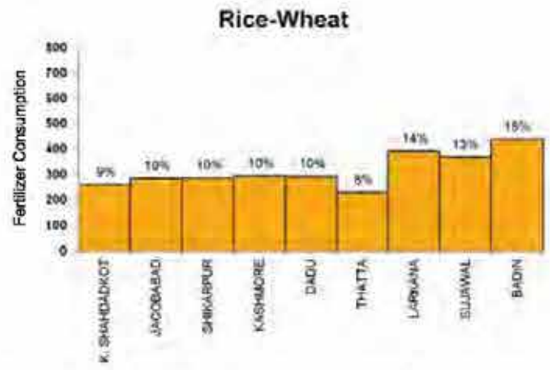
Mixed Crops
Cotton-Wheat
Rice-Wheat

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

Region	Total consumption of fertilizer (kg/acre)	Respondents
Mixed Crops	4,673	540
Cotton-Wheat	3,476	360
Rice-Wheat	2,848	540







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.

About Map

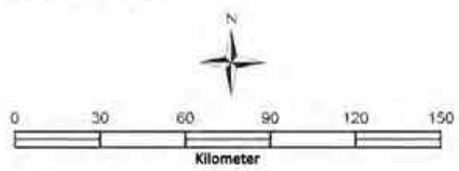
The map shows region-wise comparative fertilizer consumption in Sindh. The accumulated consumption was calculated for Wheat, Rice, Cotton and Sugarcane, if grown in the same field in a year. However, actual usage will vary depending on the crop(s) sown. This information is based on the Rapid Fertilizer Use Assessment. About 39% higher fertilizer use is evident from the Mixed Crops than the Rice-Wheat region. Moveover, the use of fertilizers in the Mixed Crops than the Cotton-Wheat region is about 26%. District-wise more fertilizers are being consumed in Mirpur Khas, Sanghar and Badin, respectively.

Data Source

The Government of Sindh, FAO, GAUL, RFUA (2015)

Map Scale and **Datum**

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



Date: 23 April 2017
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_Sindh_ Region-wise_ 9_20170423

AVERAGE YIELD OF WHEAT

JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
KARACHI
TANDO MUHAMMAD KHAN
THATTA
BADIN
THARPARKAR
SUJAWAL
PUNJAB
BALOCHISTAN
INDIA
ARABIAN SEA

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Map Legend

Administrative limits

- Country
- Province
- District

Average Yield (Maunds/acre)

- ≤ 20
- 21 - 40
- 41 - 60

About Map

The map shows average yield of wheat (maunds per acre; 1 maund = 40 kg) in each district. The trends of wheat yield reasonably correspond to the fertilizer use, particularly the K application in different districts.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 01 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_YieldWheatr_6.1_20150201

AVERAGE YIELD OF RICE/PADDY

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

Average Yield (Maunds/acre)

- ≤ 30
- 31 - 60
- 61 - 90
- No significant data

About Map

The map shows average yield of rice/paddy (maunds per acre; 1 maund = 40 kg) based on the results of RFUA 2015. Unlike wheat, a poor relation is noted between average rice yield and K fertilizer use in several districts like Tando Muhammad Khan, Badin, Dadu, Kashmore and Kambar Shahdadkot.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

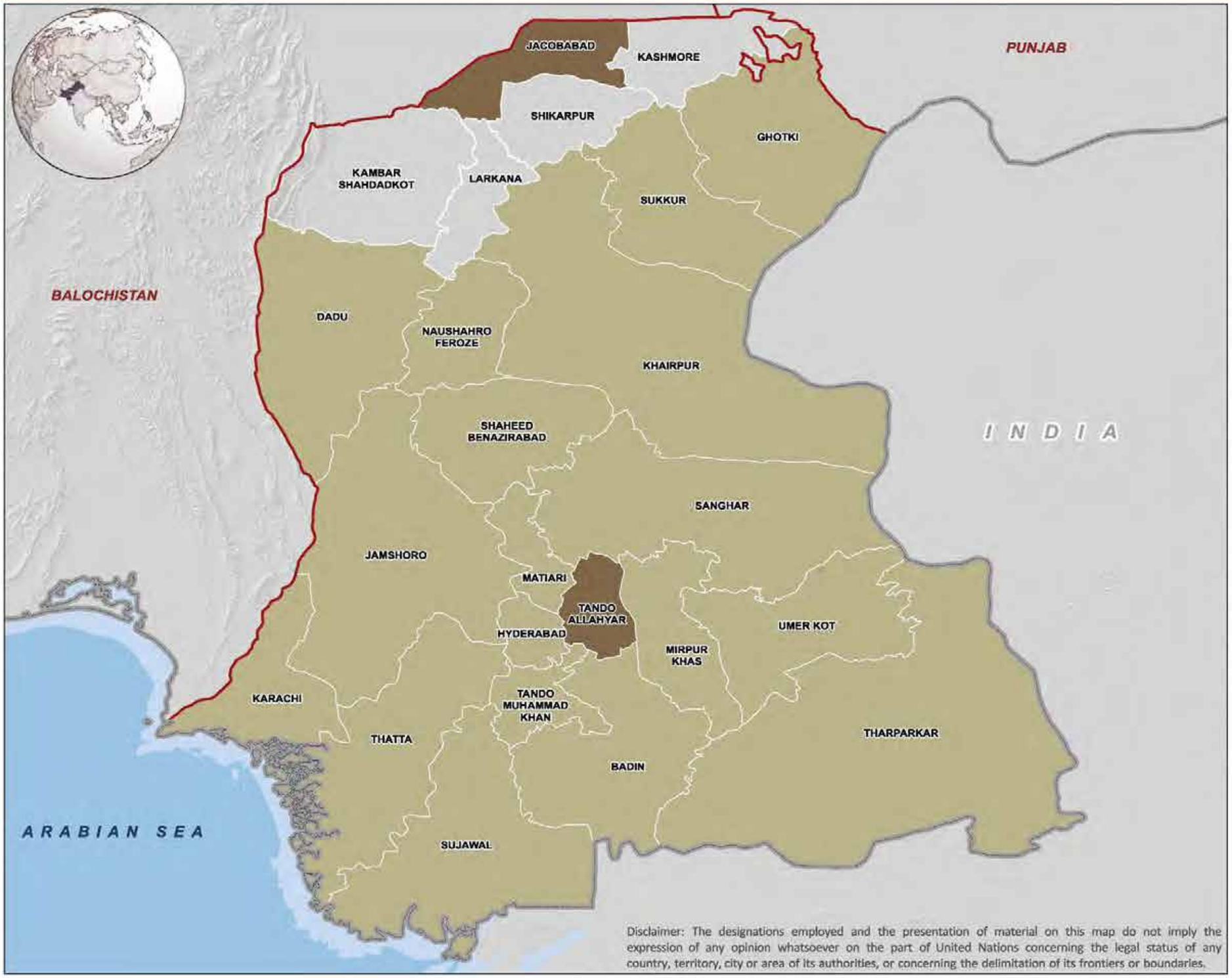
Kilometers

Date: 01 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_ YieldRir_6.2_20160201

AVERAGE YIELD OF COTTON



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Map Legend

Administrative limits

- Country
- Province
- District

Average Yield (Maunds/acre)

- 21 - 40
- 41 - 60
- No significant data

About Map

The map shows average yield of seed Cotton (maunds per acre; 1 maund = 40 kg) in each district based on the result of RFUA 2015. Overall cotton yield across the province is in the medium range. However, high (>40 maunds per acre) in Tando Allah Yar district indicates the prospects of higher cotton production in Sindh.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120

Kilometers

Date: 04 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_ YieldCott_6.4_20160204

AVERAGE YIELD OF SUGARCANE

JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
KARACHI
TANDO MUHAMMAD KHAN
THATTA
BADIN
THARPARKAR
SUJAWAL
PUNJAB
BALOCHISTAN
INDIA
ARABIAN SEA

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

Average Yield (Maunds/acre)

- ≤ 650
- 651 - 900
- 901 - 1200
- No significant data

About Map

The map shows average yield of Sugarcane (maunds per acre; 1 maund = 40 kg) in each district based on RFUA 2015. Except for the three districts (Tando Allah Yar, Hyderabad and Matiari), sugarcane yield is in the medium range (up to 900 maunds per acre).

Data Sources

FAO, GAUL, The Government of Sindh, RFUA (2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120

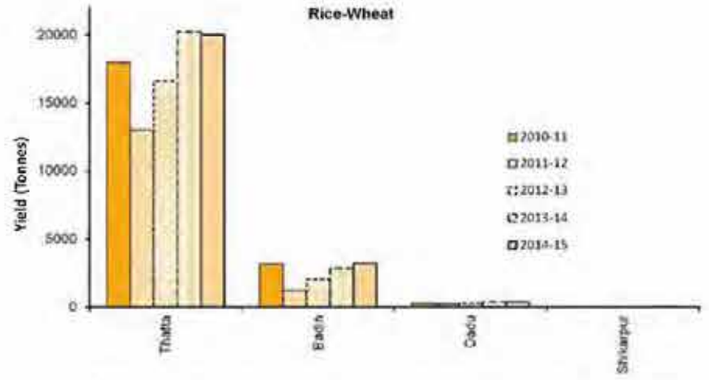
Kilometers

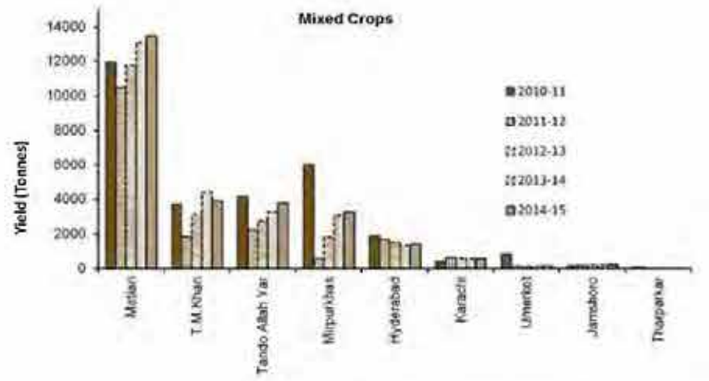
Date: 04 Feb 2016

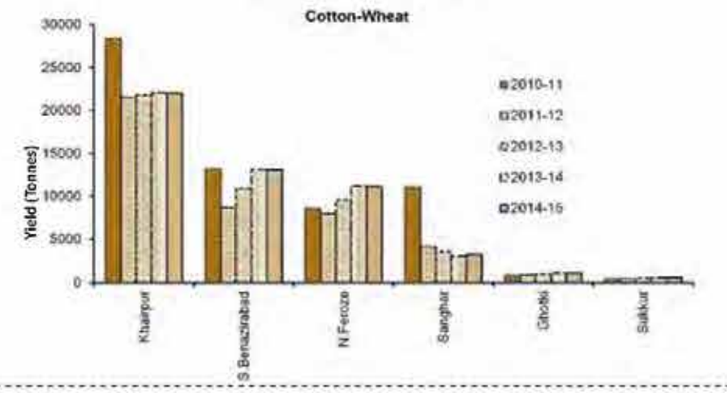
Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_YieldSugr_6.5_20160204

TEMPORAL VARIATION OF BANANA YIELD IN SINDH (2010 to 2015)







About Map

The map shows district-wise temporal variation of Banana yield in different cropping regions of Sindh (2010 - 2015).

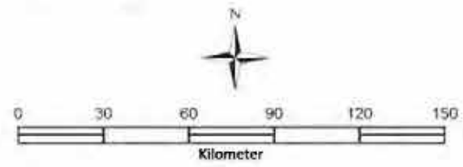
The temporal data shows that overall trends of district-wise banana yield have been similar in diffrent cropping regions. Three districts, viz. Khairpur, Matiari and Thatta are leading with regard to average annual Banana yield. Irrespective of the cropping regions or districts, Banana yield has been stagnant over the last few years (2010 – 2015).

Data Source

FAO, GAUL, Crop Reporting Services, Sindh, Ministry of National Food Security and Research

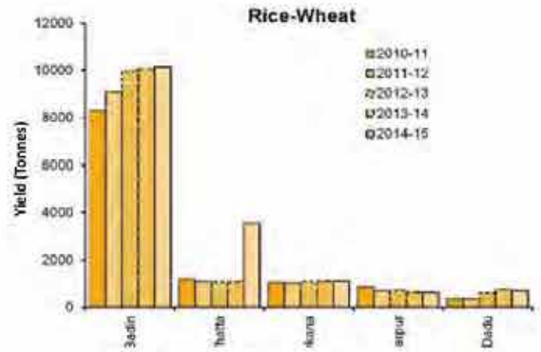
Map Scale and Datum

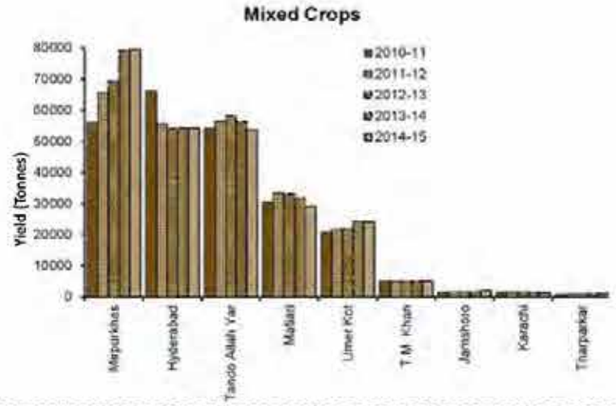
Nominal scale: 1:2,698,500 at A3
Datum: WGS 84

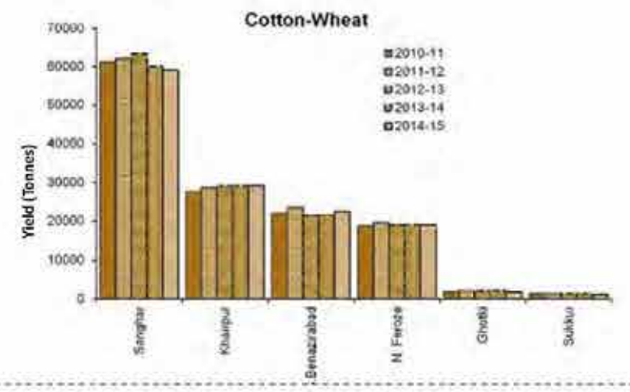


Date: 23 April 2017
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_Sindh_ BananayeildSoiltesting_ 9_20170423

TEMPORAL VARIATION OF MANGO YIELD IN SINDH (2010 to 2015)







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.

About Map

The map shows district-wise temporal variation of Mango yield in different cropping regions of Sindh (2010 - 2015).

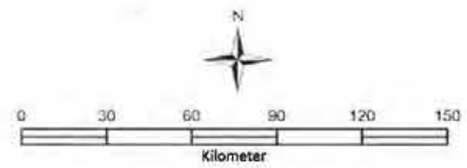
The temporal data shows that overall trends of district-wise Mango yield have been similar in diffrent cropping regions. Three districts, viz. Sanghar, Mirpur Khas and Badin are leading with regards to average Mango yield. Irrespective of the cropping regions or districts, Mango yield has been stagnant over the last few years (2010 – 2015).

Data Source

FAO, GAUL, Crop Reporting Services, Sindh, Ministry of National Food Security and Research

Map Scale and Datum

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

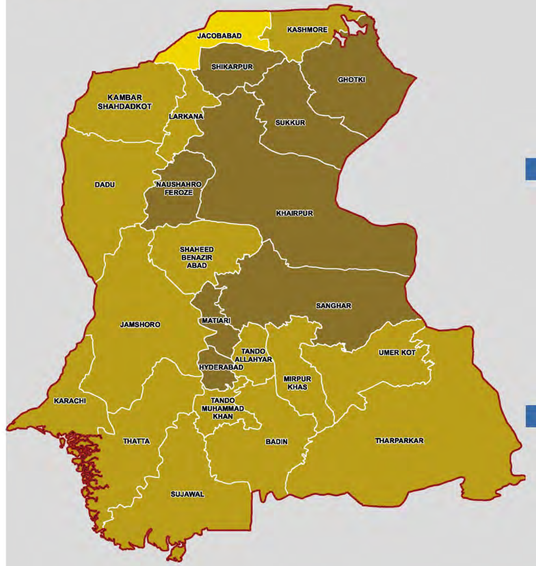


Date: 23 April 2017
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_Sindh_ BananayeildSoiltesting_ 9_20170423

YIELD OF WHEAT UNDER DIFFERENT SCENARIOS OF FERTILIZER USE IN SINDH

NP

56%



NP + Micronutrients

20%

NP + FYM

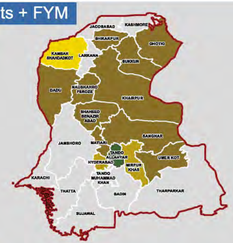
14%

N

3%

NP + Micronutrients + FYM

3%



NPK

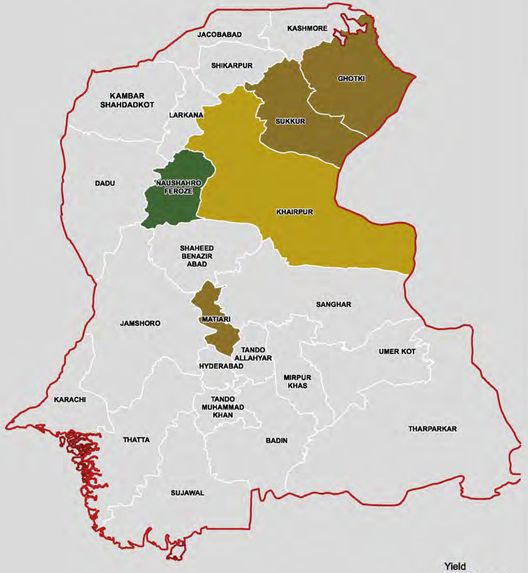
1%

NPK+ Micronutrients

0.5%

NPK + Micronutrients + FYM

0.4%



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 Sindh. The scenarios include: N only; NP; NPK; NPK + MN; NPK + MN + FYM; NP + MN; NP + FYM; NP + MN + FYM;
where,

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

The data shows that NP application is the most common practice of majority (56%) farmers. Addition of micro-nutrients and/or FYM seems to improve wheat yield. However, addition of any nutrient(s) may not necessarily always impact crop production.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA 2015

Map Scale and Datum

Datum: WGS 84

0 100 200 300 400 500
Kilometers

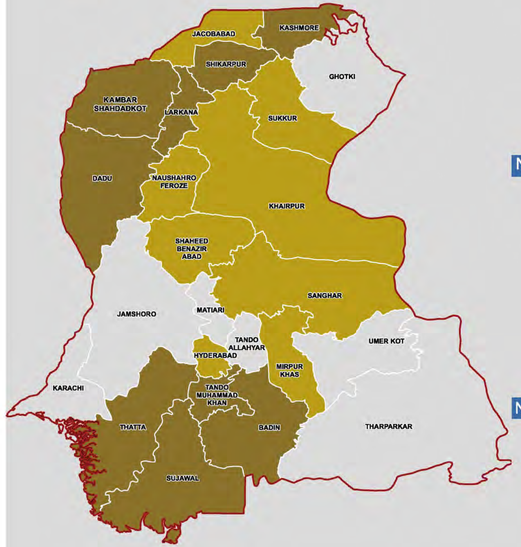
Date: 09 May 2016
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_Sindh_wheatscen_17.1_20160509

N

YIELD OF RICE UNDER DIFFERENT SCENARIOS OF FERTILIZER USE IN SINDH

NP + Micronutrients

48%



NP

27%

N + Micronutrients

11%

NP + Micronutrients + FYM

5%

N

5%

NP + FYM

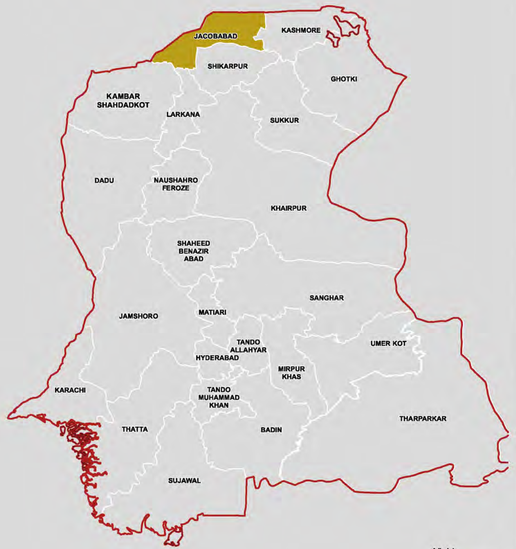
1%

NPK + Micronutrients

0.5%

NPK

0.2%



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 Sindh. The scenarios include: N only; NP; NPK + MN; N + MN; NP + MN; NP + FYM; NP + MN + FYM;
where,

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

The data shows that the use of micro-nutrients along with NP is practiced by majority farmers (48%), and this has an impact on rice yield compared with NP alone. However, addition of any nutrient(s) may not necessarily always impact crop production.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA 2015

Map Scale and Datum

Datum: WGS 84

0 100 200 300 400 500
Kilometers

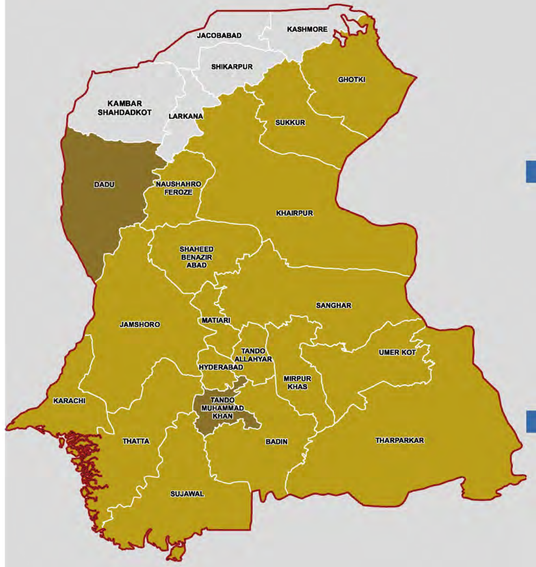
Date: 09 May 2016
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_ Sindh_Ricescen_17.2_20160509

N

YIELD OF COTTON UNDER DIFFERENT SCENARIOS OF FERTILIZER USE IN SINDH

NP

62%



NP + Micronutrients

23%

NP + FYM

5%

N

3.5%

NP + Micronutrients + FYM

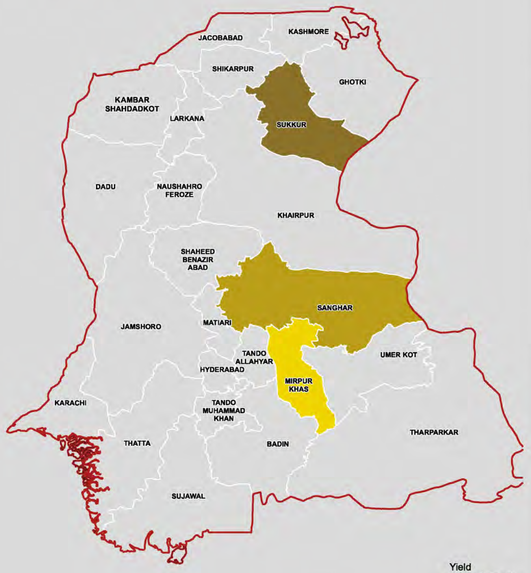
3%

NPK + Micronutrients

0.6%

NPK

0.5%



Yield (Maunds/acre)
- < 20
- 21-40
- 41-60
- 61-80

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 Sindh. The scenarios include: N only; NP; NPK; NPK + MN; NP + MN; NP + FYM; NP + MN + FYM;
where,

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

The map shows yield of cotton under different scenarios of fertilizer use. Majority of the farmers (62%) use only N and P. Addition of micro-nutrients along with NP, followed by 23% farmers, results in improved yield.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA 2015

Map Scale and Datum

Datum: WGS 84

0 100 200 300 400 500
Kilometers

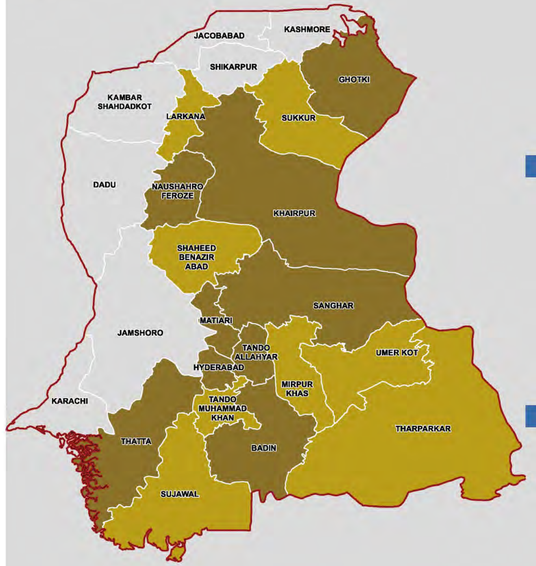
Date: 09 May 2016
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_ Sindh_Cottonscen_17.4_20160509

N

YIELD OF SUGARCANE UNDER DIFFERENT SCENARIOS OF FERTILIZER USE IN SINDH

USAID FROM THE AMERICAN PEOPLE | USDA

NP
55%

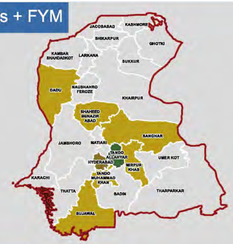


NP + Micronutrients
23%

NPK
5%

NP + FYM
4%

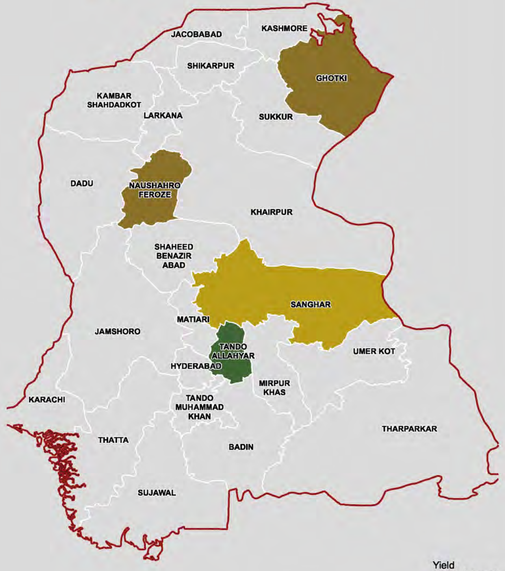
NP + Micronutrients + FYM
3%



NPK + Micronutrients
2%

N
1%

NPK + Micronutrients + FYM
1%



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 Sindh. The scenarios include: N only; NP; NPK; NPK + MN; NPK + MN + FYM; NP + MN; NP + FYM; NP + MN + FYM;
where,

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

NP is the most common practice by 55% farmers. The addition of micro-nutrients with NP by 23% farmers did not seem to improve cane yield. However, addition of any nutrient(s) may not necessarily always impact crop production.

Data Sources
FAO, GAUL, The Government of Sindh, RFUA 2015

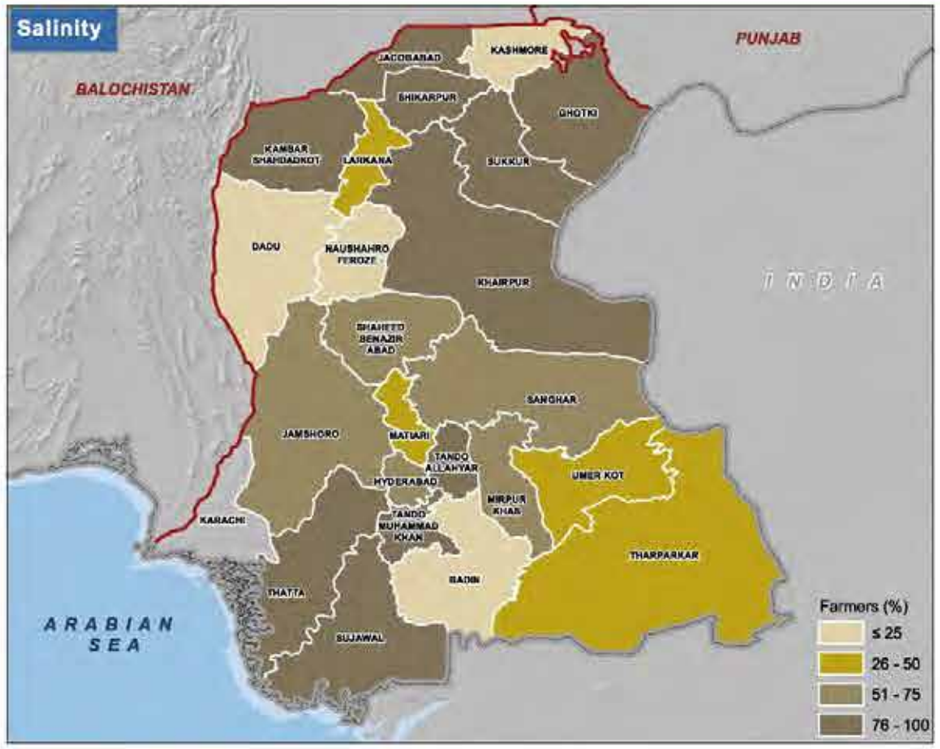
Map Scale and Datum
Datum: WGS 84

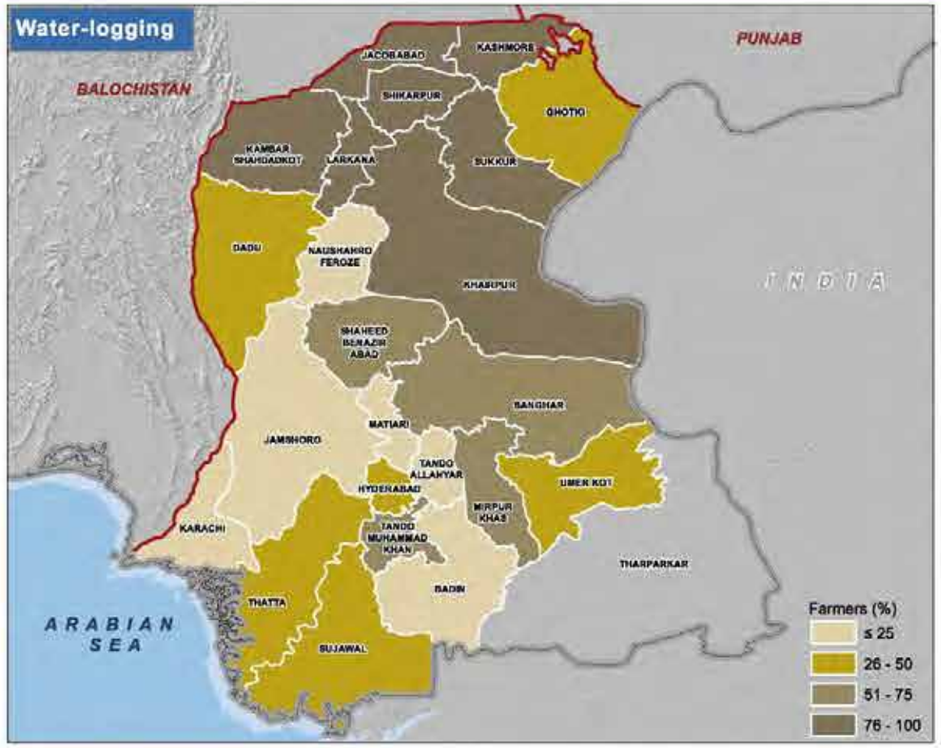
0 100 200 300 400 500
Kilometers

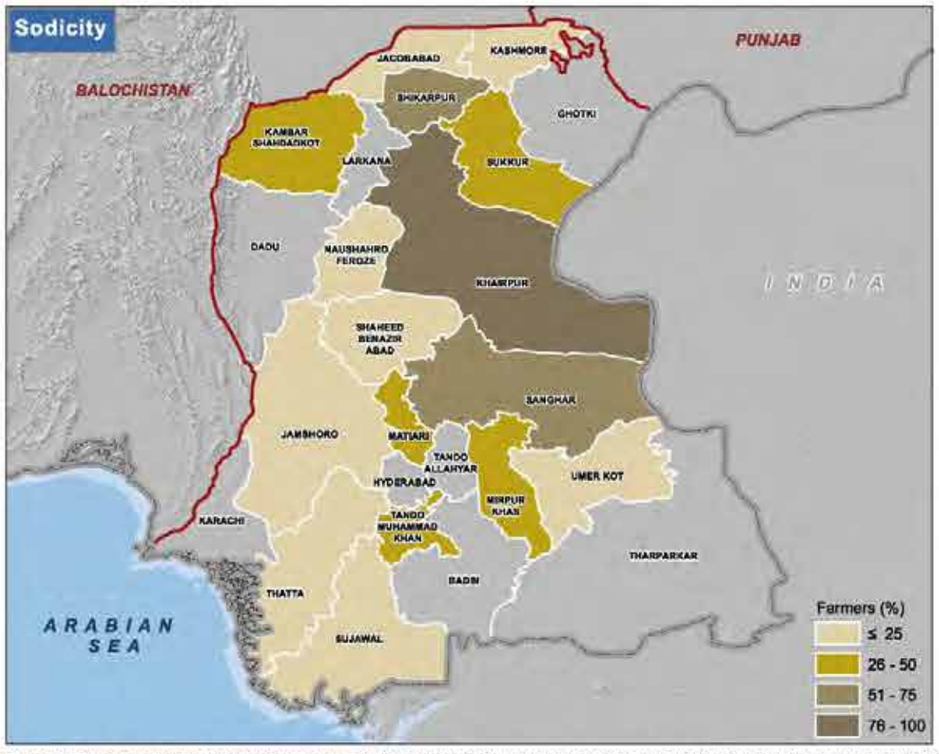
Date: 09 May 2016
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_ sindh_sugarscen_17.5_ 20160509

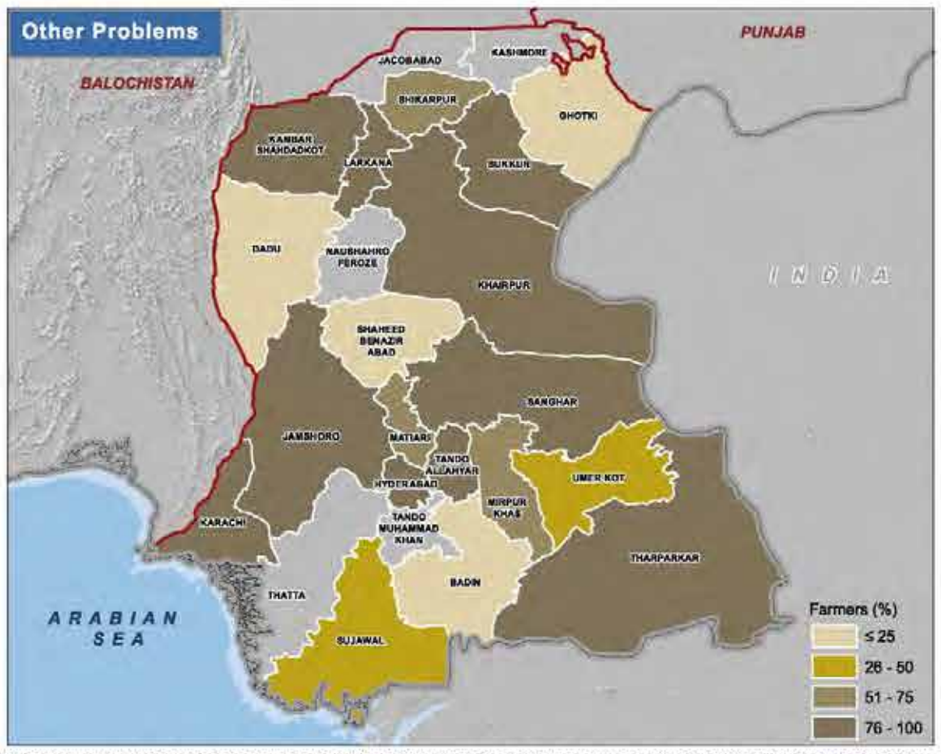
N

MAJOR SOIL PROBLEMS









Map Legend

Administrative limits

- Country
- Province
- District

About Map

Majority of the farmers identified soil salinity and water-logging problems which happen to be major constraints facing agricultural productivity in Sindh province. Other problems like shortage of water, load shedding, high inputs and low commodity prices are the common problems of farmers throughout the province.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA 2015

Map Scale and Datum

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

Datum: WGS 84

N

0 40 80 120 160 200

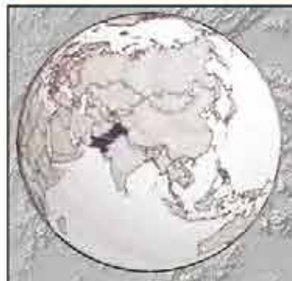
Kilometers

Date: 17 Feb 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_SoilProbl_16.1_20160217

SOIL AND WATER TESTING FACILITIES AVAILED BY FARMERS



BALOCHISTAN

PUNJAB

INDIA

ARABIAN SEA

JACOBABAD — 24 / 56
KASHMORE — 5
SHIKARPUR
GHOTKI — 8 / 20
KAMBAR SHAHDADKOT — 8
LARKANA — 32 / 31
SUKKUR — 4 / 21
DADU — 2
NAUSHAHRO FEROZE — 5 / 14
KHAIRPUR — 7
SHAHEED BENAZIR ABAD — 28 / 19
SANGHAR — 8 / 48
JAMSHORO — 3 / 5
MATIARI — 28 / 36
HYDERABAD — 5 / 10
TANDO ALLAHYAR — 100 / 90
MIRPUR KHAS — 19 / 29
UMER KOT — 3 / 7
KARACHI — 8 / 10
TANDO MUHAMMAD KHAN — 2 / 2
THATTA — 6
BADIN — 7
THARPARKAR — 50
SUJAWAL — 6

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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 avail soil and water testing facilities before crop sowing. Except for one district Tando Allah Yar, only fewer farmers consider soil and water testing with other inputs for crop management. This aspect is very weak and needs special attention by the way of creating awareness and improvement of analytical facilities.

Data Sources

FAO, GAUL, The Government of Sindh, RFUA 2015

Map Scale and Datum

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

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 18 Feb 2016

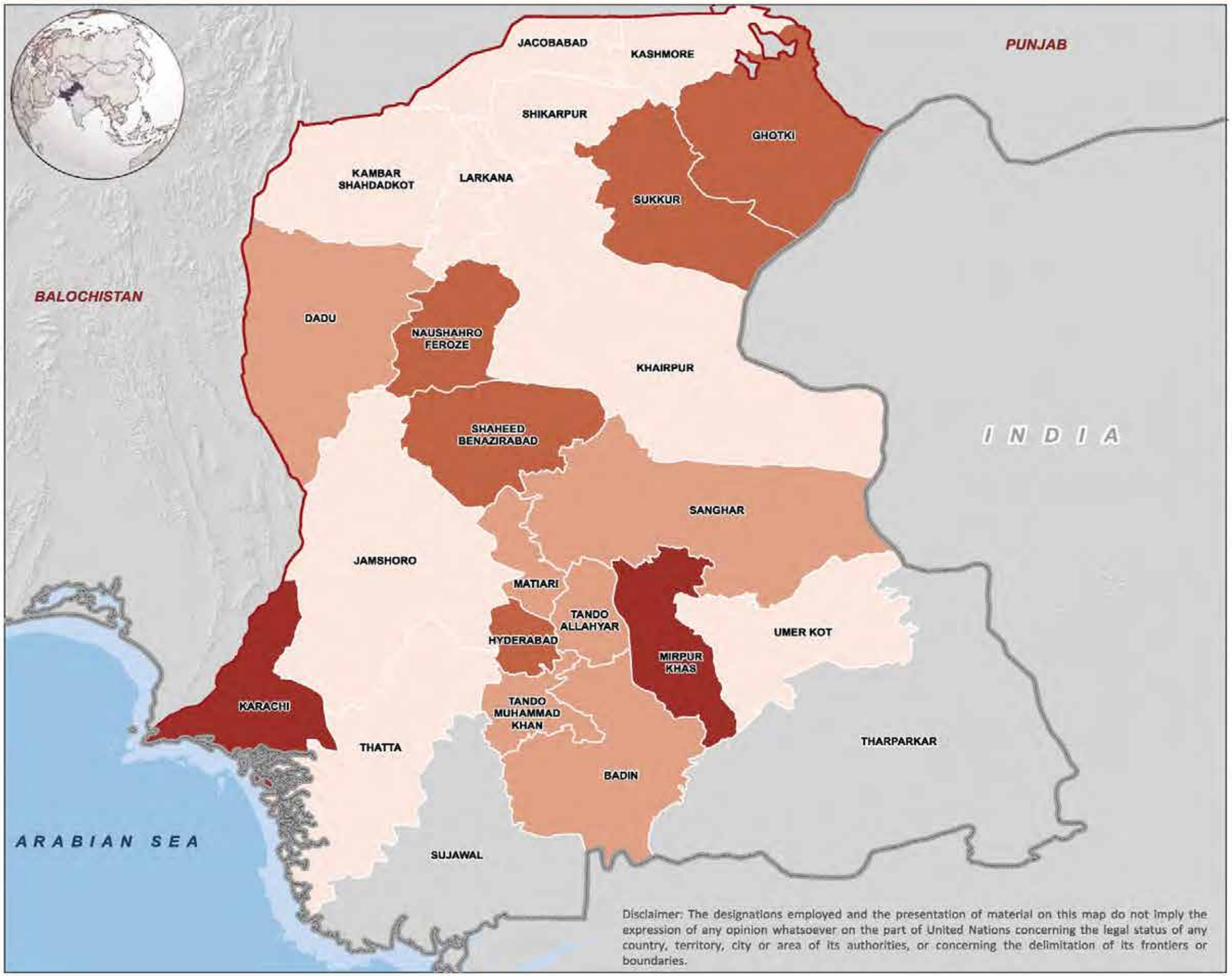
Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_Soiltest _16.2_20160218

SECTION 3

MAPPING FERTILIZER OFFTAKE DATA

TOTAL OFFTAKE OF UREA IN SINDH



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Map Legend

Administrative limits

- Country
- Province
- District

Total offtake of Urea per district (kg/acre)

- <= 500
- 501 - 1000
- 1001 - 1500
- > 1500
- No significant data

About Map

The map shows the total offtake of Urea for Wheat, Rice, Cotton and Sugarcane in each district. Higher offtake for the four districts does not mean necessarily that this fertilizer is used on crops grown in the respective districts,i.e., Karachi, Hyderabad, Mirpur Khas and Ghotki.

Data Sources

FAO, GAUL, NFDC fertilizer offtake data (2014-2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 14 April 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_Ureatotnf_8.6_20160414

TOTAL OFFTAKE OF DI-AMMONIUM PHOSPHATE (DAP) IN SINDH

USAID FROM THE AMERICAN PEOPLE | USDA

JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
MIRPUR KHAS
UMER KOT
KARACHI
TANDO MUHAMMAD KHAN
THATTA
BADIN
THARPARKAR
SUJAWAL

PUNJAB
BALOCHISTAN
INDIA
ARABIAN SEA

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Map Legend

Administrative limits

- Country
- Province
- District

Total offtake of DAP per district (kg/acre)

- <= 100
- 101 - 200
- 201 - 400
- > 400
- No significant data

About Map

The map shows the total offtake of Di-ammonium Phosphate (DAP) for Wheat, Rice, Cotton and Sugarcane in each district. Higher offtake for Karachi and Hyderabad does not mean the use of this fertilizer necessarily in these districts.

Data Sources

FAO, GAUL, NFDC fertilizer offtake data (2014-2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120

Kilometers

Date created: 19 Apr 2016

Created by: IM unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_DAPtotaln_10.6_20160419

TOTAL USE OF CALCIUM AMMONIUM NITRATE (CAN) IN SINDH

USAID FROM THE AMERICAN PEOPLE | USDA

JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
KARACHI
TANDO MUHAMMAD KHAN
THATTA
BADIN
THARPARKAR
SUJAWAL

PUNJAB
BALOCHISTAN
INDIA
ARABIAN SEA

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Map Legend

Administrative limits

- Country
- Province
- District

Total Offtake of CAN per district (kg/acre)

- 0 - 25
- 26 - 50
- 51 - 100
- 101 - 567
- No significant data

About Map

The map shows total use of CAN for major crops: Wheat, Rice, Cotton and Sugarcane. The use of CAN appears to be common throughout the province. Relatively higher use indicated in Mirpur Khas with medium usage in four adjoining districts; whereas CAN use is low in all remaining districts irrespective of the crop regions.

Data Sources

FAO, GAUL, NFDC fertilizer offtake data (2014-2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

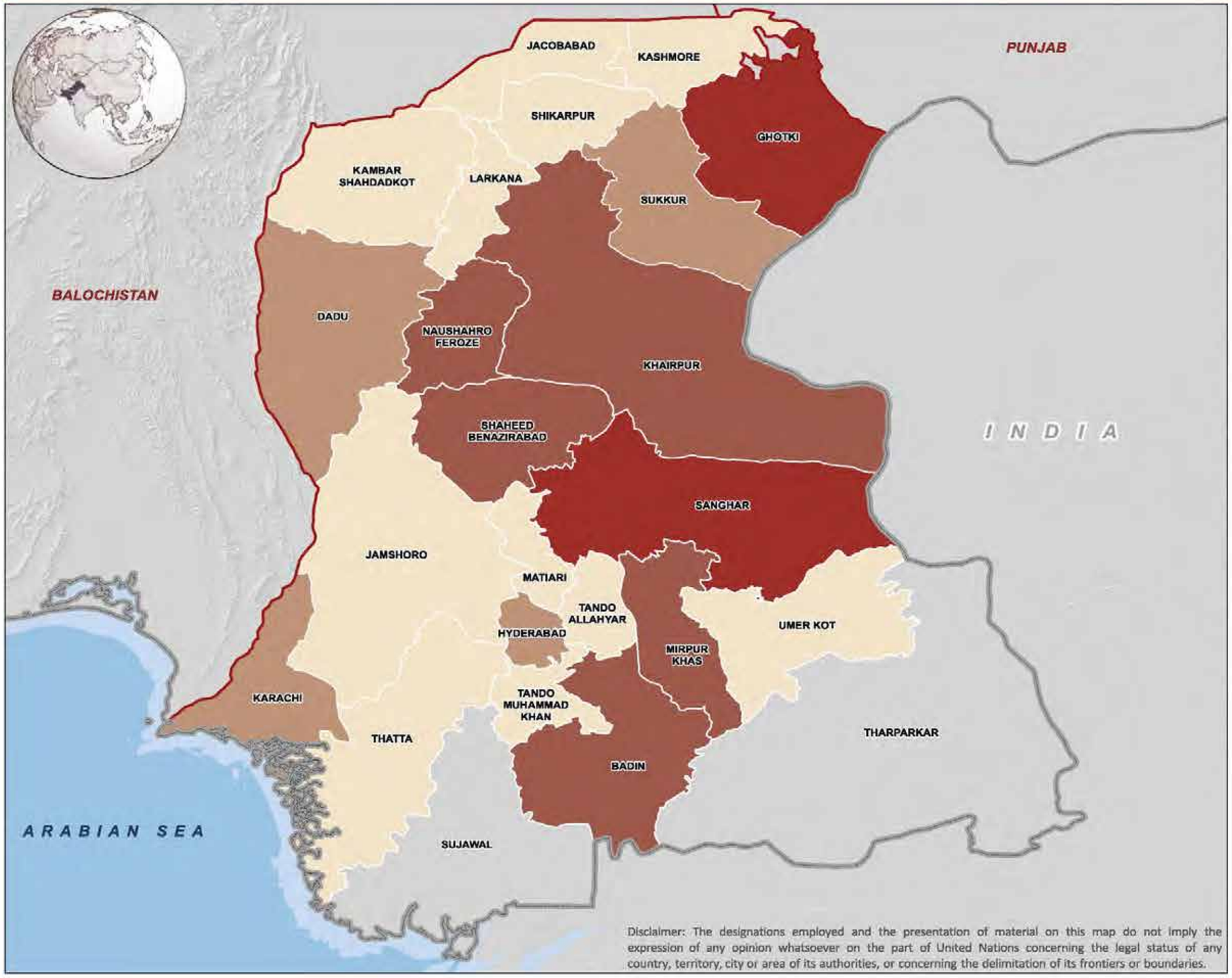
Kilometers

Date: 18 April 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_CANtotaln_9.6_20160418

DISTRICT-WISE USE OF NITROGEN IN SINDH



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Map Legend

Administrative limits

- Country
- Province
- District

Offtake of Nitrogen Fertilizer (tonnes)

- ≤ 20,000
- 20,001 - 40,000
- 40,001 - 60,000
- 60,001 - 80,000
- No significant data

About Map

The map shows offtake of Nitrogen in each district. The number shows offtake in tonnes. The data is based on the findings of NFDC fertilizer offtake data.

Data Sources

FAO, GAUL, NFDC Annual Fertilizer Review (2014-2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120

Kilometers

Date: 19 Apr 2016

Created by: IM Unit, FAO Pakistan

Map Number:PAK_Soil Fertility Atlas_Sindh_Nitn_ _11.1_20160419

DISTRICT-WISE USE OF PHOSPHORUS IN SINDH

USAID FROM THE AMERICAN PEOPLE | USDA

JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
KARACHI
TANDO MUHAMMAD KHAN
THARPARKAR
THATTA
BADIN
SUJAWAL

PUNJAB
BALOCHISTAN
INDIA
ARABIAN SEA

Map Legend

Administrative limits

- Country
- Province
- District

Offtake of Phosphorus Fertilizer (tonnes)

- ≤ 4000
- 4001 - 8000
- 8001 - 12000
- 12001 - 16000
- No significant data

About Map

The map shows offtake of Phosphorus in each district. The number shows offtake in tonnes. The data is based on the findings of NFDC fertilizer offtake data.

Data Sources

FAO, GAUL, NFDC Annual Fertilizer Review (2014-2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120
Kilometers

Date: 19 Apr 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_Phospn_11.2_20160419

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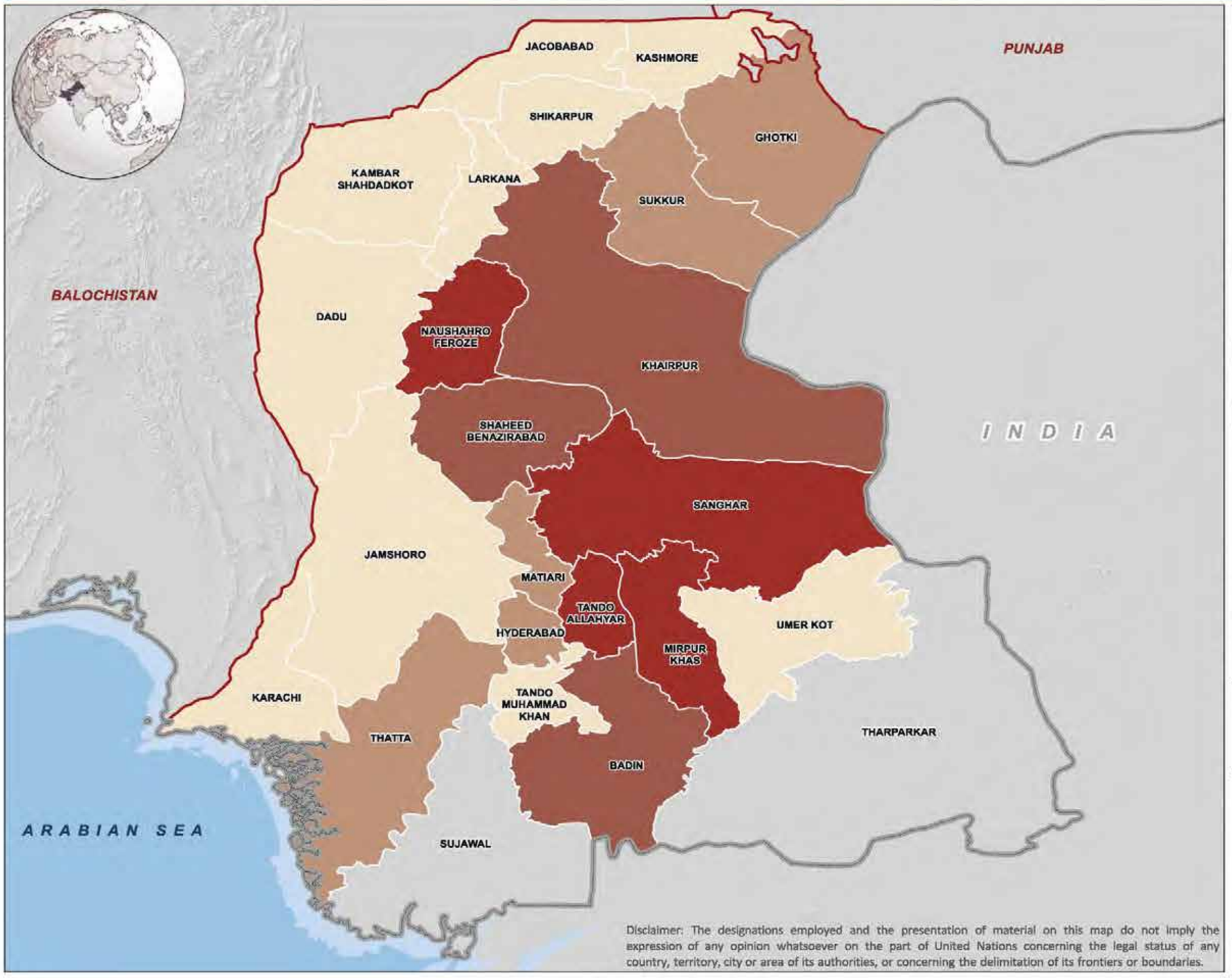
DISTRICT-WISE USE OF POTASSIUM IN SINDH



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Map Legend

Administrative limits

- Country
- Province
- District

Offtake of Potassium Fertilizer (tonnes)

- 16 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- No significant data

About Map

The map shows offtake of Potassium in each district. The number shows offtake in tonnes. The data is based on the findings of NFDC fertilizer offtake data.

Data Sources

FAO, GAUL, NFDC Annual Fertilizer Review (2014-2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120

Kilometers

Date: 19 Apr 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_Potassiumn_ _11.3_20160419

DISTRICT-WISE NPK OFFTAKE IN SINDH

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JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
MIRPUR KHAS
UMER KOT
KARACHI
TANDO MUHAMMAD KHAN
THATTA
THARPARKAR
BADIN
SUJAWAL
SUJAWAL

PUNJAB
BALOCHISTAN
INDIA
ARABIAN SEA

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Map Legend

Administrative limits

- Country
- Province
- District

Offtake of NPK (tonnes)

- ≤ 20,000
- 20,001 - 40,000
- 40,001 - 60,000
- 60,001-80,000
- No significant data

About Map

The map shows district-wise average offtake (five years, i.e., 2010-2015) of NPK for all the crops grown in Sindh. Ghotki, Mirpur Khas, Naushahro Feroze and Shaheed Benazirabad are consuming relatively more NPK.

Data Sources

FAO,GAUL, NFDC fertilizer/nutrient offtake (2010-2015)

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120

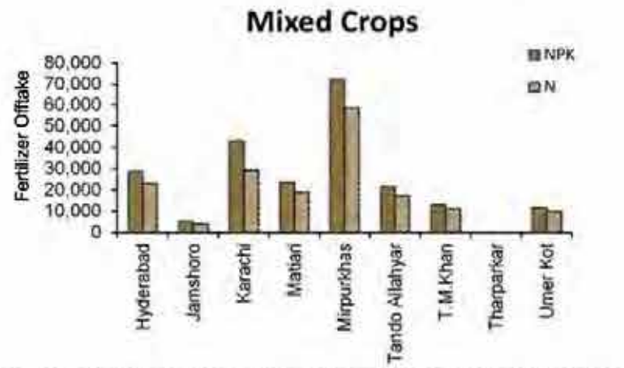
Kilometers

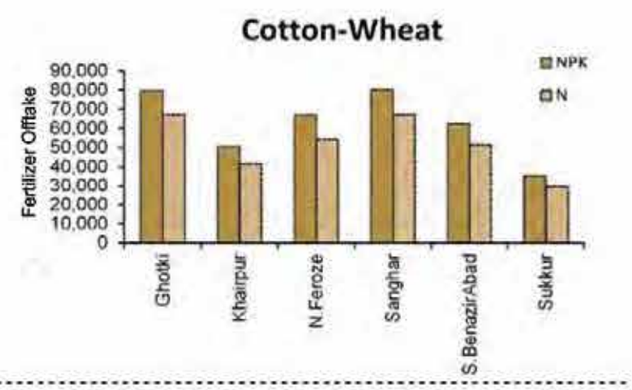
Date: 19 Apr 2016

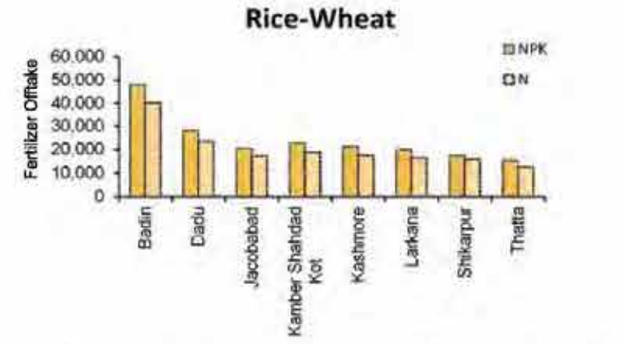
Created by: IM Unit, FAO Pakistan

Map Number:PAK_Soil Fertility Atlas_Sindh_Nitn_ _11.1_20160419

REGION-WISE COMPARATIVE NPK FERTILIZER OFFTAKE IN SINDH







About Map

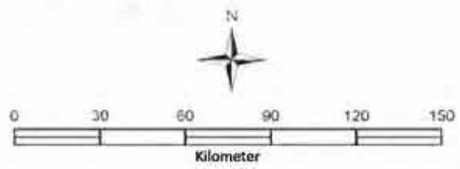
This map shows the five year outlook of NPK offtake in three selected crop production regions of Sindh (Tonnes). Cotton-Wheat region consumed most of the NPK followed by Mixed Crops and Rice-Wheat region. Moreover, data indicates that Mirpur Khas, Badin and Ghotki were the highest consumers of NPK amongst three regions. The proportional contribution of N ranged from 78 to 84% across three production regions reflecting that the application of nutrients/fertilizers is predominantly skewed towards N.

Data Source

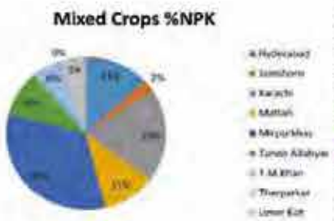
FAO,GAUL, NFDC fertilizer/nutrient offtake in Tonnes (2010-2015)

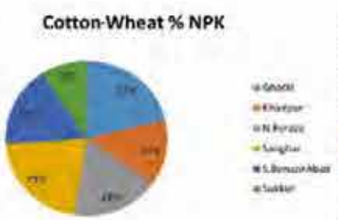
Map Scale and Datum

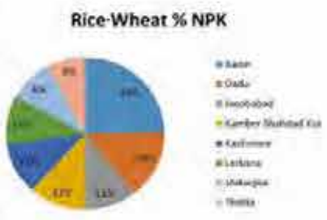
Nominal scale: 1:2,698,500 at A3
Datum: WGS 84



Date: 23 April 2017
Created by: IM Unit, FAO Pakistan
Map Number: PAK_Soil Fertility Atlas_Sindh_ Region-wise_ 9_20170423







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SECTION 4

SOIL FERTILITY STATUS MAPPING

DISTRICT-WISE AVERAGE pH

JACOBABAD
KASHMORE
PUNJAB
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
BALOCHISTAN
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
INDIA
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
UMER KOT
HYDERABAD
MIRPUR KHAS
KARACHI
TANDO MUHAMMAD KHAN
THARPARKAR
THATTA
BADIN
ARABIAN SEA
SUJAWAL

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Map Legend

Administrative limits

- Country
- Province
- District

pH value

- ≤ 8.00
- 8.01 - 8.20
- 8.21 - 8.41
- Data not available

About Map

The map shows average pH of soils (1:2.5, soil: water ratio) in each district. Three categories of soil based on pH are obvious; pH values <8.5 throughout the province may not be a big factor impacting crop productivity. For details, please see Annexure III.

Data Sources

FAO, GAUL, Fauji Fertilizer Company Limited, Rawalpindi

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 24 Mach 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_pH_ _15.1_20160419

DISTRICT-WISE AVERAGE ELECTRICAL CONDUCTIVITY (EC)

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JACOBABAD
KASHMORE
SHIKARPUR
KAMBAR SHAHDADKOT
LARKANA
GHOTKI
SUKKUR
KHAIRPUR
DADU
NAUSHAHRO FEROZE
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
TANDO MUHAMMAD KHAN
KARACHI
THATTA
BADIN
THARPARKAR
SUJAWAL

PUNJAB
BALOCHISTAN
INDIA
ARABIAN SEA

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Map Legend

Administrative limits

Country
Province
District

EC value (dSm^{-1})

≤ 0.51
0.52 - 1.00
1.01 - 1.50
> 1.50
Data not available

About Map

The map shows the average EC (1: 2.5, soil: water extract) in soils of each district. Including two districts Sukkur and Naushahro Feroze, soils in most of the rice growing and mixed crops of cotton-wheat regions seem to be affected by salinity. For details, please see Annexure III.

FAO, GAUL, Fauji Fertilizer Company Limited, Rawalpindi

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150
Kilometers

Date: 24 March 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_EC_ _15.2_20160324

DISTRICT-WISE AVERAGE ORGANIC MATTER CONTENT

JACOBABAD
KASHMORE
SHIKARPUR
KAMBAR SHAHDADKOT
LARKANA
GHOTKI
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
TANDO MUHAMMAD KHAN
KARACHI
THATTA
BADIN
THARPARKAR
SUJAWAL
PUNJAB
BALOCHISTAN
INDIA
ARABIAN SEA

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Map Legend

Administrative limits

- Country
- Province
- District

Organic Matter (%)

- Very weak (≤ 0.5)
- Weak (0.5-1.0)
- Moderate fertile (1.0-1.5)
- Fertile (>1.5)
- Data not available

About Map

The map shows fertility status of soils based on average organic matter content. Except for the district Qambar Shahdadkot, soil organic matter content is lower than the level (>1.5%) considered adequate for fertile soils. For details, please see Annexure III.

Data Sources

FAO, GAUL, Fauji Fertilizer Company Limited, Rawalpindi

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 24 March 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_OM_ _15.3_20160324

DISTRICT-WISE AVERAGE AVAILABLE PHOSPHORUS

JACOBABAD
KASHMORE
SHIKARPUR
GHOTKI
KAMBAR SHAHDADKOT
LARKANA
SUKKUR
DADU
NAUSHAHRO FEROZE
KHAIRPUR
SHAHEED BENAZIRABAD
SANGHAR
JAMSHORO
MATIARI
TANDO ALLAHYAR
HYDERABAD
UMER KOT
MIRPUR KHAS
KARACHI
TANDO MUHAMMAD KHAN
THATTA
THARPARKAR
BADIN
SUJAWAL
PUNJAB
BALOCHISTAN
INDIA
ARABIAN SEA

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Map Legend

Administrative limits

- Country
- Province
- District

Available Phosphorus (ppm)

- Very weak (≤5.0)
- Weak (5.1 - 10.0)
- Data not available

About Map

The map shows fertility status of soils based on plant available phosphorus. Soils in all districts of Sindh are weak with respect to phosphorus level required for healthy crop growth. For details, please see Annexure II.

Data Sources

FAO, GAUL, Fauji Fertilizer Company Limited, Rawalpindi

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

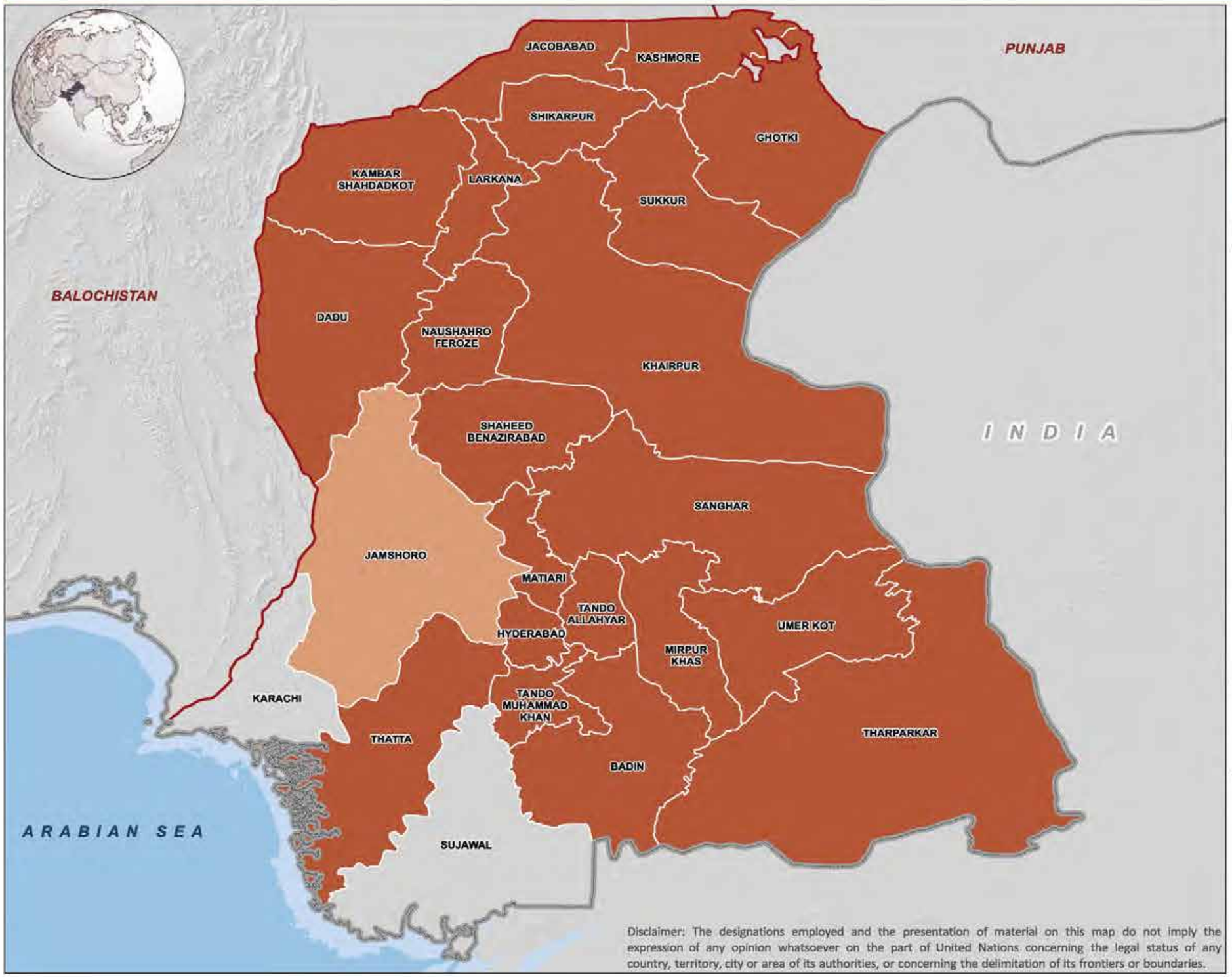
Kilometers

Date: 24 March 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_P_ _15.4_20160324

DISTRICT-WISE AVERAGE EXTRACTABLE POTASSIUM



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

Extractable Potassium (ppm)

- Low (≤ 100)
- Marginal (101 - 150)
- Adequate (> 150)
- Data not available

About Map

The map shows fertility status of soils based on extractable potassium. Overall, the soils in all districts except, Jamshoro, of Sindh have adequate K levels. For details, please see Annexure II.

Data Sources

FAO, GAUL, Fauji Fertilizer Company Limited, Rawalpindi

Map Scale and Datum

Nominal scale: 1:2,036,900 at A3

Datum: WGS 84

N

0 30 60 90 120 150

Kilometers

Date: 24 March 2016

Created by: IM Unit, FAO Pakistan

Map Number: PAK_Soil Fertility Atlas_Sindh_ExtK_ _15.5_20160324

DISTRICT PROFILES

BADIN

Badin district is situated along the coast in the east of the Indus River. Numerous shrines of Sufi saints are located in Badin including Saman Shah. The climate is generally hot and humid in summer, and mild in winter. The region is damp and fertile for growing rice. Main crops of the district are rice, wheat, sugarcane, oilseeds and seasonal vegetables. There are five tehsils in the district: Badin, Matli, Shaheed Fazil Rahu, Talhar and Tando Bago. The district headquarter is situated at Badin.

AGRICULTURAL INFORMATION

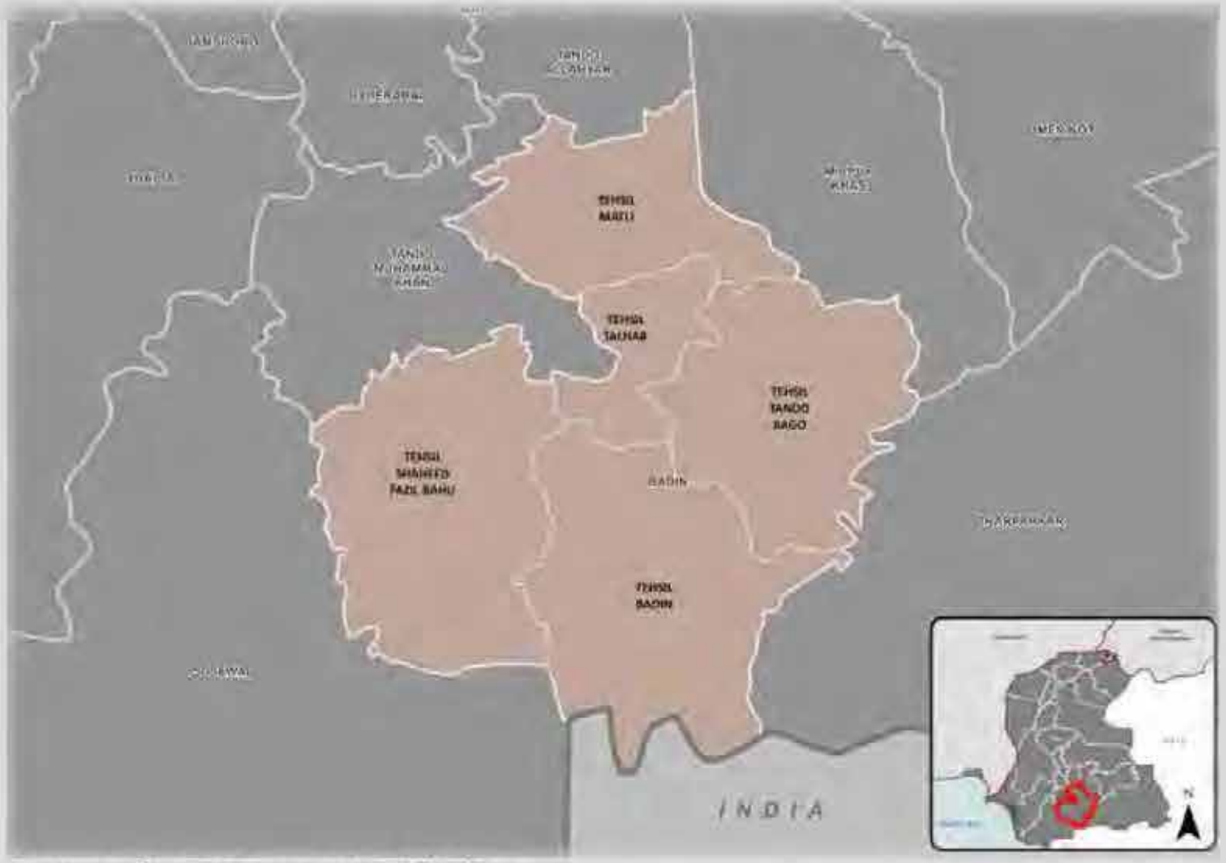
Total Cultivated Area (hectares)	281,067
Total Non-cultivated Area (hectares)	170,692
Total Area under Irrigation (hectares)	273,119
Major Rabi Crop(s)	Wheat, Fodders
Major Kharif Crop(s)	Rice, Sugarcane
Total Livestock Population	2,256,070

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Calcareous material of deltaic and tidal plains
Dominant Soil Series	Dhand, Golarchi, Gujo, Matli, Nabipur
pH	7.4 – 10.5 (Average 8.22)
Electrical Conductivity (dSm^{-1})	0.1 – 47.2 (Average 3.65)
Organic Matter (%)	0.1 – 2.13 (Average 0.84)
Available Phosphorus (ppm)	1 – 32 (Average 3.42)
Extractable Potassium (ppm)	38 – 400 (Average 211)
Farmers availing soil-test facility (%)	7
Farmers availing water-test facility (%)	0

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



Map source: Information Management Unit, FAO Pakistan

DADU

Dadu district is situated on the western side of Indus River. The district is famous for Gorakh; a hill station at an altitude of 1,734 meters. The climate is hot and dry during the summer and moderately cold in the winter. Main crops of the district Dadu include rice, wheat, cotton, vegetables and fodders. There are four tehsils in the district: Mehar, Khairpur Nathan Shah, Dadu and Johi. The district headquarter is located at Dadu.

AGRICULTURAL INFORMATION

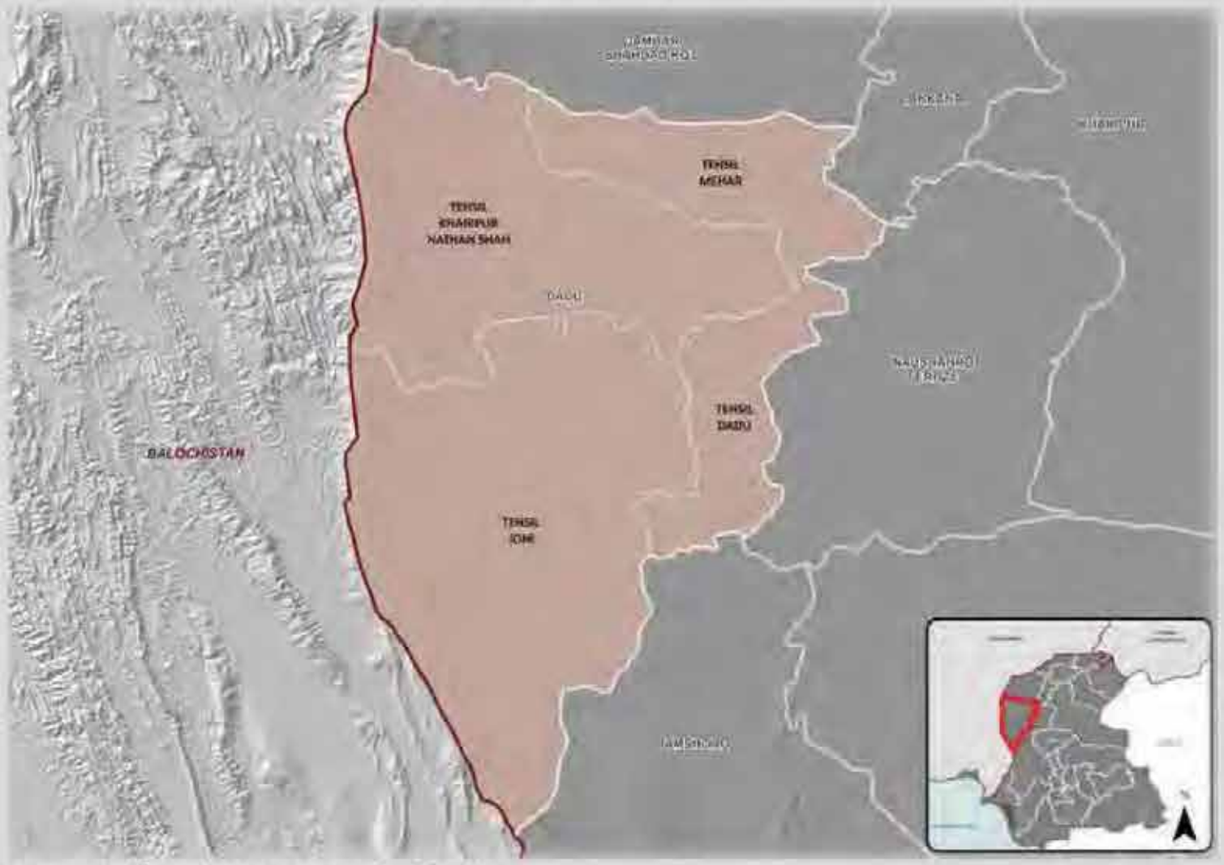
Total Cultivated Area (hectares)	133,710
Total Non-cultivated Area (hectares)	12,688
Total Area under Irrigation (hectares)	128,361
Major Rabi Crop(s)	Wheat, Fodders
Major Kharif Crop(s)	Rice, Cotton
Total Livestock Population	2,825,540

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Alluvial deposits of piedmont and river plains
Dominant Soil Series	Jacobabad, Jhatpat, Matli, Nabipur, Shahdara
pH	7.6 – 9.1 (Average 8.20)
Electrical Conductivity (dSm^{-1})	0.2 – 10.8 (Average 1.59)
Organic Matter (%)	0.2 – 1.6 (Average 0.81)
Available Phosphorus (ppm)	1 – 15 (Average 2.60)
Extractable Potassium (ppm)	40 – 400 (Average 176)
Farmers availing soil-test facility (%)	2
Farmers availing water-test facility (%)	0

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



Map source: Information Management Unit, FAO Pakistan

GHOTKI

Ghotki is located in the northern part of Sindh. It is the bordering district between Sindh and Punjab. Jamia Masjid Ghotki is a historical grand mosque in the district. The climate is that of a desert with hot summers and mild winters. The main crops include cotton, wheat, sugarcane and vegetables. Ghotki is also well known for production of mangoes, dates and vegetables. There are five tehsils in the district: Daharki, Ghotki, Mirpur Mathelo, Ubauro and Khangarh. The district headquarter is situated at Mirpur Mathelo.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	193,082
Total Non-cultivated Area (hectares)	19,493
Total Area under Irrigation (hectares)	192,217
Major Rabi Crop(s)	Wheat
Major Kharif Crop(s)	Cotton, Sugarcane
Total Livestock Population	1,453,133

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Recent and sub-recent alluvial deposits and rolling sand ridges
Dominant Soil Series	Adilpur, Dungi, Pacca, Pitafi, Shahpur
pH	7.6 – 10.9 (Average 8.34)
Electrical Conductivity (dSm^{-1})	0.1 – 14.8 (Average 0.91)
Organic Matter (%)	0.1 – 1.78 (Average 0.64)
Available Phosphorus (ppm)	1 – 22 (Average 3.40)
Extractable Potassium (ppm)	26 – 400 (Average 186)
Farmers availing soil-test facility (%)	20
Farmers availing water-test facility (%)	8

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

Map source: Information Management Unit, FAO Pakistan

HYDERABAD

Hyderabad district is situated in the east of River Indus. There are two famous forts located in Hyderabad: Pakka (bricks) and Kacha (mud blocks) fort. Climate is arid subtropical continental with hot summer and mild winter. Main crops of the district include wheat, cotton, orchards and vegetables. Hyderabad city is well known for the bangle production. There are four tehsils in the district: Hyderabad city, Hyderabad rural, Latifabad and Qasimabad. The district headquarter is located at Hyderabad.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	72,940
Total Non-cultivated Area (hectares)	26,195
Total Area under Irrigation (hectares)	71,583
Major Rabi Crop(s)	Wheat, Fodders, Orchards
Major Kharif Crop(s)	Orchards, Cotton
Total Livestock Population	1,045,031

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Mixed alluvial deposits
Dominant Soil Series	Jacobabad, Jarwar, Nabipur, Pacca, Shahdara
pH	7.4 – 9.9 (Average 8.19)
Electrical Conductivity (dSm^{-1})	0.08 – 29 (Average 1.55)
Organic Matter (%)	0.11 – 2.5 (Average 0.77)
Available Phosphorus (ppm)	1 – 30 (Average 4.30)
Extractable Potassium (ppm)	30 – 400 (Average 181)
Farmers availing soil-test facility (%)	10
Farmers availing water-test facility (%)	5

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

Map source: Information Management Unit, FAO Pakistan

JACOBABAD

Jacobabad, founded in 1847 by General John Jacob, is located on the border of Baluchistan. The district has hot desert climate with extremely hot summers and mild winters. Main crops of the district include wheat, rice, pulses, oilseeds, and vegetables. There are three tehsils in the district: Ghari Khairo, Jacobabad and Thul. The district headquarter is located at Jacobabad.

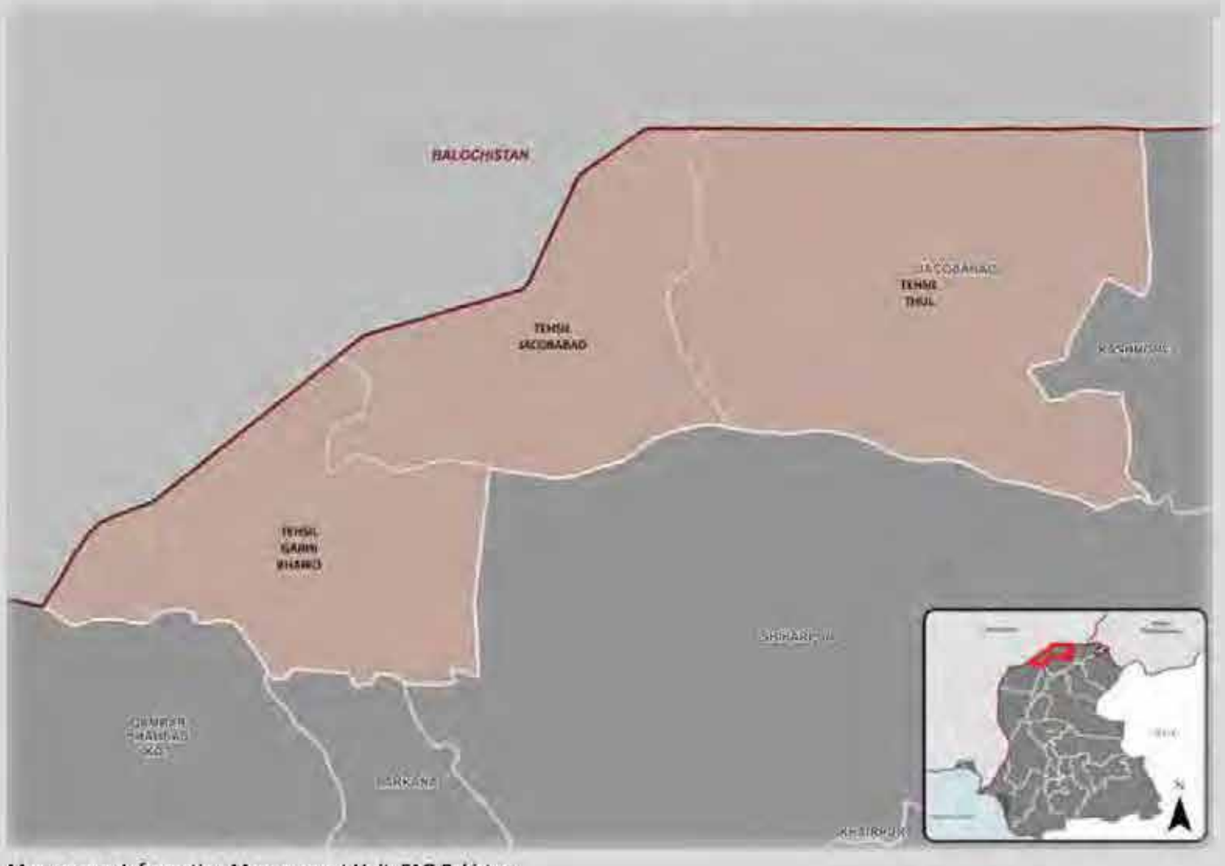
AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	97,972
Total Non-cultivated Area (hectares)	10,909
Total Area under Irrigation (hectares)	97,698
Major Rabi Crop(s)	Wheat, Pulses
Major Kharif Crop(s)	Rice
Total Livestock Population	3,019,814

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Alluvial deposits of piedmont and river plains
Dominant Soil Series	Jacobabad, Jhatpat, Shahdara, Sindhelianwali, Sultanpur
pH	7.8 – 10.2 (Average 8.18)
Electrical Conductivity (dSm^{-1})	0.3 – 25.6 (Average 2.63)
Organic Matter (%)	0.1 – 2.1 (Average 0.66)
Available Phosphorus (ppm)	1 – 25 (Average 3.16)
Extractable Potassium (ppm)	34 – 400 (Average 189)
Farmers availing soil-test facility (%)	-
Farmers availing water-test facility (%)	-



Map source: Information Management Unit, FAO Pakistan

JAMSHORO

Jamshoro lies at right bank of Indus River and is famous for its educational institutes. The shrine of Lal Shahbaz Qalandar, a well known saint is located in Jamshoro district. Manchar Lake, one of the largest lakes in Asia, is also located in Jamshoro. Climate is arid subtropical continental with hot summer and mild winter. Main crops include wheat, gram, sorghum and onion. There are four tehsils in the district: Sehwan Sharif, Manjhand, Kotri, Jamshoro and Thano Bula Khan. The district headquarter is Kotri.

AGRICULTURAL INFORMATION

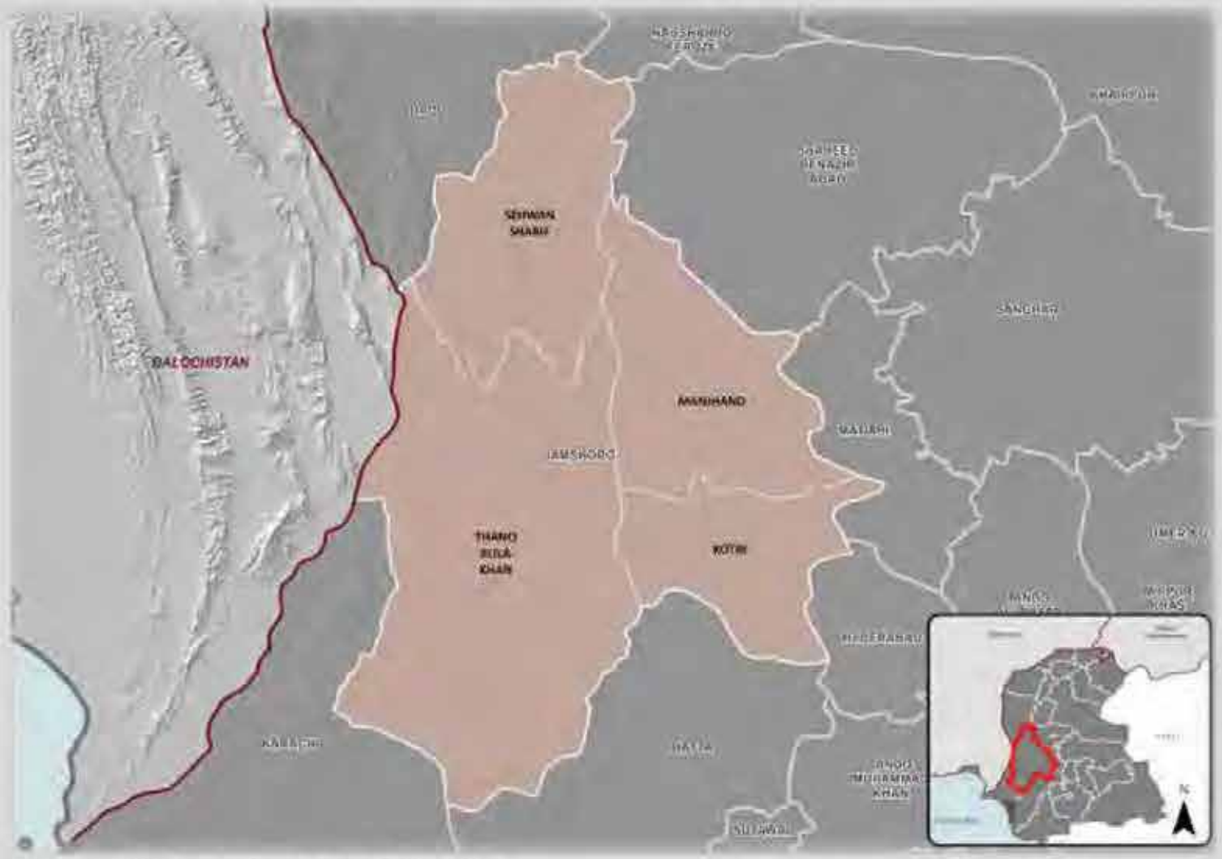
Total Cultivated Area (hectares)	65,021
Total Non-cultivated Area (hectares)	22,965
Total Area under Irrigation (hectares)	41,983
Major Rabi Crop(s)	Wheat, Gram, Onion
Major Kharif Crop(s)	Sorghum
Total Livestock Population	1,184,670

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Medium and coarse textured material and narrow river valleys of Kirthar range
Dominant Soil Series	Nabipur, Naodero, Pacca, Shahdara, Petaro
pH	7.5 – 8.9 (Average 8.11)
Electrical Conductivity (dSm^{-1})	0.1 – 10.7 (Average 0.79)
Organic Matter (%)	0.1 – 1.85 (Average 0.47)
Available Phosphorus (ppm)	1 – 35 (Average 3.53)
Extractable Potassium (ppm)	30 – 400 (Average 129)
Farmers availing soil-test facility (%)	5
Farmers availing water-test facility (%)	3

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



Map source: Information Management Unit, FAO Pakistan

KARACHI

Karachi is the provincial capital of Sindh. It is the largest city of Pakistan with the highest population density. It is Pakistan's main seaport and center of banking, industry, economic activity and trade. Karachi is the 3rd largest city in the world by population (within city limits) and the 11th largest urban agglomeration. The district has a moderate climate, hot and humid in summer and cold and dry in winter. Main crops include vegetables and fodders.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	14,715
Total Non-cultivated Area (hectares)	8,680
Total Area under Irrigation (hectares)	13,324
Major Rabi Crop(s)	Vegetables
Major Kharif Crop(s)	Vegetables, Fodders, Orchards
Total Livestock Population	1,763,059

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Piedmont alluvium derived from Kirthar range
Dominant Soil Series	Khair, Matli, Pacca
pH	-
Electrical Conductivity (dSm^{-1})	-
Organic Matter (%)	-
Available Phosphorus (ppm)	-
Extractable Potassium (ppm)	-
Farmers availing soil-test facility (%)	10
Farmers availing water-test facility (%)	8

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

Map source: Information Management Unit, FAO Pakistan

KASHMORE

Kashmore district is situated in the northern part of Sindh, surrounded by Ghotki, Jacobabad, Shikarpur and Sukkur districts. The south-eastern side of Kashmore district is covered with forest of Kacho area that supports wildlife. The climate is hot and dry during the summer and moderately cold in the winter. Main crops grown in the district are wheat, rice, gram and vegetables. There are three tehsils in the district: Kashmore, Kandhkot and Tangwani. The district headquarter is located at Kashmore.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	99,743
Total Non-cultivated Area (hectares)	10,002
Total Area under Irrigation (hectares)	99,602
Major Rabi Crop(s)	Wheat, Gram
Major Kharif Crop(s)	Rice
Total Livestock Population	1,232,526

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Shahdara, Sultanpur, Pacca, Jacobabad, Sindhelianwali
pH	7.8 – 10.6 (Average 8.40)
Electrical Conductivity (dSm^{-1})	0.3 – 13.9 (Average 1.96)
Organic Matter (%)	0.2 – 1.67 (Average 0.89)
Available Phosphorus (ppm)	1 – 13 (Average 2.40)
Extractable Potassium (ppm)	134 – 400 (Average 261)
Farmers availing soil-test facility (%)	5
Farmers availing water-test facility (%)	0

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

Map source: Information Management Unit, FAO Pakistan

KHAIRPUR

Khairpur district is situated in the south of Sukkur district and is famous for Kot Diji Fort. The north western part of Thar desert lies in Khairpur district. The climate is that of a desert with hot summers and mild winters. Khairpur is well known for production of dates, cotton, banana and strawberry. There are eight tehsils in the district: Faiz Ganj, Gambat, Khairpur, Kingri, Kot Diji, Mirwah, Nara and Sobho Dero. The district headquarter is located at Khairpur.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	184,976
Total Non-cultivated Area (hectares)	19,856
Total Area under Irrigation (hectares)	183,642
Major Rabi Crop(s)	Wheat, Fodders, Orchards
Major Kharif Crop(s)	Cotton, Orchards, Sorghum
Total Livestock Population	3,546,697

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Calcareous river alluvium
Dominant Soil Series	Gambat, Shahdara, Sultanpur, Pacca, Sindhelianwali
pH	7.0 – 10.4 (Average 8.18)
Electrical Conductivity (dSm^{-1})	0.1 – 39.2 (Average 1.32)
Organic Matter (%)	0.1 – 2.1 (Average 0.73)
Available Phosphorus (ppm)	1 – 49 (Average 4.28)
Extractable Potassium (ppm)	26 – 400 (Average 176)
Farmers availing soil-test facility (%)	7
Farmers availing water-test facility (%)	0

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

Map source: Information Management Unit, FAO Pakistan

LARKANA

Larkana district is located in the north-western part of Sindh province. The climate is hot and dry in summers and moderately cold in winters. Main crops of the district include rice, wheat and oilseeds besides sugarcane, vegetables and guava. Moenjo-Daro, one of the largest settlements of the ancient Indus Valley Civilization, and one of the world's earliest major urban settlements is also located in this district. There are four tehsils in the district: Dokri, Baqrani, Larkana and Ratodero. The district's headquarter is located at Larkana.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	87,187
Total Non-cultivated Area (hectares)	8,628
Total Area under Irrigation (hectares)	87,030
Major Rabi Crop(s)	Wheat, Oilseeds
Major Kharif Crop(s)	Rice
Total Livestock Population	2,021,031

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Alluvial deposits of piedmont and river plains
Dominant Soil Series	Jacobabad, Jhatpat, Matli, Nabipur, Shahdara
pH	7.5 – 8.2 (Average 7.95)
Electrical Conductivity (dSm^{-1})	0.17 –0.9 (Average 0.4)
Organic Matter (%)	0.36 – 1.32 (Average 0.88)
Available Phosphorus (ppm)	2 – 8 (Average 4.74)
Extractable Potassium (ppm)	78 – 266 (Average 156)
Farmers availing soil-test facility (%)	31
Farmers availing water-test facility (%)	32

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

Map source: Information Management Unit, FAO Pakistan

MATIARI

Matiari district was established in 2005 out of Hyderabad district. It is surrounded by Sanghar on the east, Jamshoro on the west, Shaheed Benazirabad on the north and Hyderabad and Tando Allah Yar on the south. Indus River flows alongside the western border of the district. The climate is hot in summers and mild in winters. Main crops of the district are cotton, wheat, sugarcane and fruits. There are three tehsils in the district: Saeedabad, Hala and Matiari. The district headquarter is situated at Matiari City.

AGRICULTURAL INFORMATION

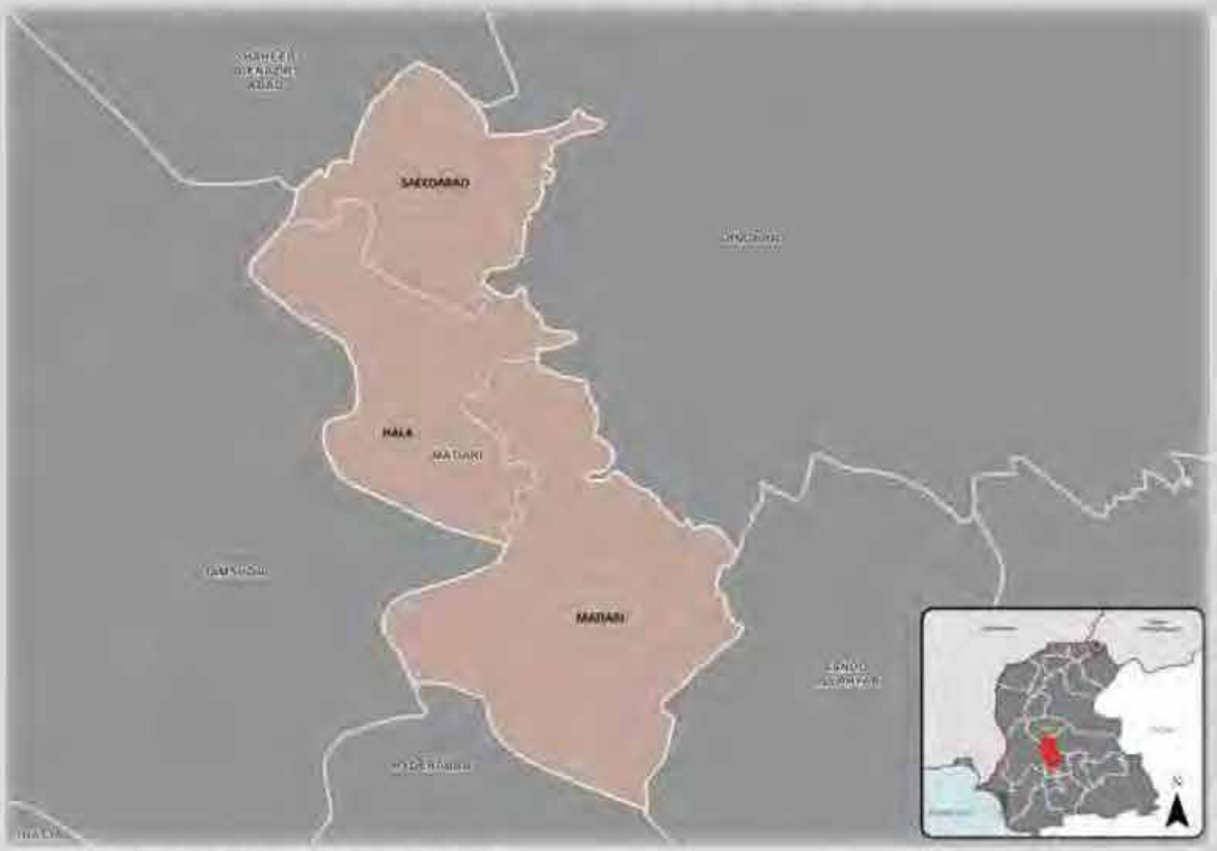
Total Cultivated Area (hectares)	62,560
Total Non-cultivated Area (hectares)	5,922
Total Area under Irrigation (hectares)	62,139
Major Rabi Crop(s)	Wheat, Fodders, Orchards
Major Kharif Crop(s)	Sugarcane, Cotton
Total Livestock Population	1,119,229

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Jarwar, Miani, Nabipur, Pacca, Shahdara
pH	7.3 – 10.7 (Average 8.17)
Electrical Conductivity (dSm^{-1})	0.1 – 27.3 (Average 1.28)
Organic Matter (%)	0.1 – 2.21 (Average 0.91)
Available Phosphorus (ppm)	1 – 48 (Average 3.80)
Extractable Potassium (ppm)	26 – 400 (Average 184)
Farmers availing soil-test facility (%)	36
Farmers availing water-test facility (%)	26

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



Map source: Information Management Unit, FAO Pakistan

MIRPUR KHAS

Mirpur Khas is bounded by Umer Kot on the east, Sanghar on the north, Tando Allah Yar on the west, Badin on the south-west and Tharparkar on the south. The climate is that of a desert with hot summers and mild winters. Main crops include wheat, rice, sugarcane and cotton. The district is renowned for its mango orchards. The district has a well-established canal irrigation system. It has six tehsils, namely Mirpur Khas, Sindhri, Digri, Hussain Bux Mari, Kot Ghulam Muhammad and Jhuddo. The district headquarter is located at Mirpur Khas.

AGRICULTURAL INFORMATION

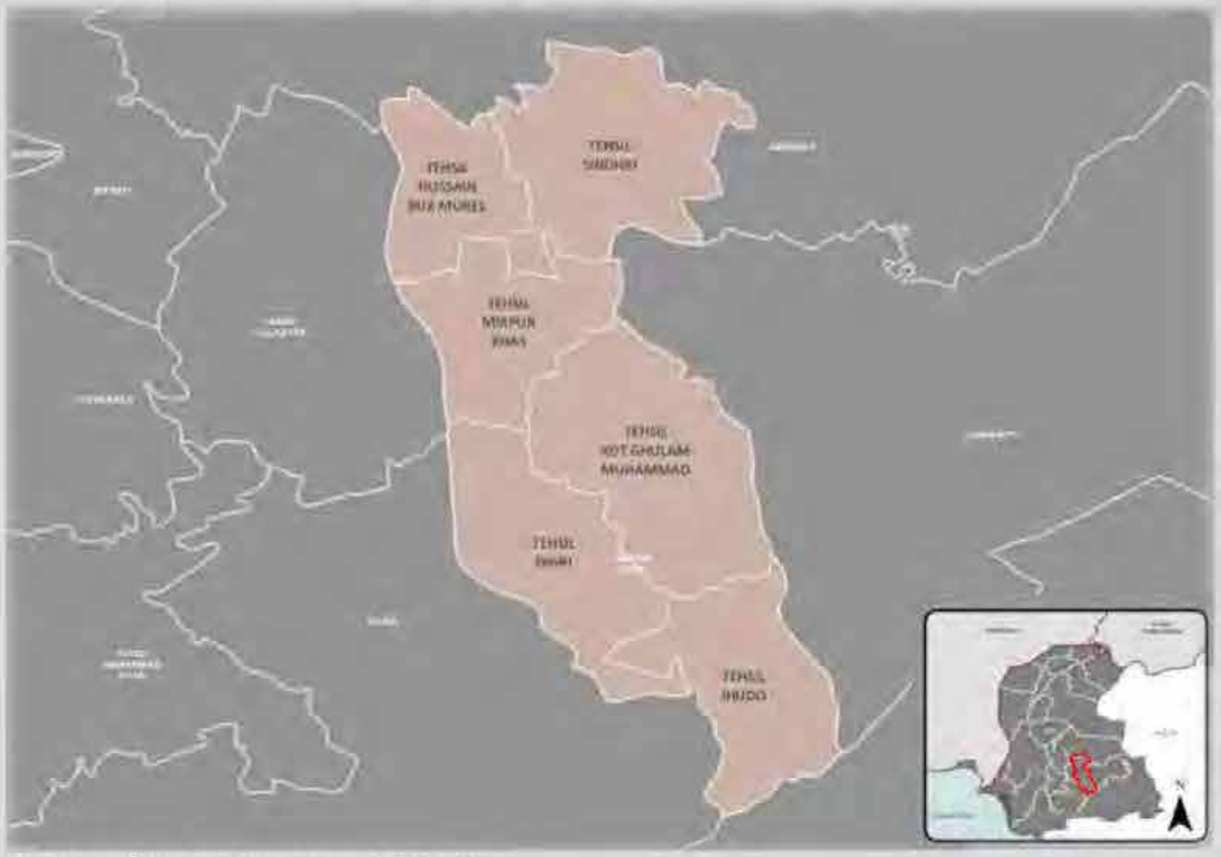
Total Cultivated Area (hectares)	206,482
Total Non-cultivated Area (hectares)	118,244
Total Area under Irrigation (hectares)	202,837
Major Rabi Crop(s)	Wheat, Orchards
Major Kharif Crop(s)	Sugarcane, Cotton, Fodders
Total Livestock Population	1,554,256

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	River alluvium
Dominant Soil Series	Sultanpur, Matli, Miani, Rustam, Sindhelianwali
pH	7.15 – 9.7 (Average 8.20)
Electrical Conductivity (dSm^{-1})	0.08 – 36.8 (Average 2.10)
Organic Matter (%)	0.1 – 2.11 (Average 0.81)
Available Phosphorus (ppm)	1 – 52 (Average 4.90)
Extractable Potassium (ppm)	26 – 400 (Average 203)
Farmers availing soil-test facility (%)	29
Farmers availing water-test facility (%)	19

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



Map source: Information Management Unit, FAO Pakistan

NAUSHAHRO FEROZE

Nausharo Feroze is located on the eastern bank of Indus River. The district has a hot desert climate with extremely hot summers and mild winters. There is very little rain, which mainly falls in the monsoon season from July to September. Main crops of the district include cotton, sugarcane, fruits and vegetables. There are five tehsils in the district: Moro, Naushahro Feroze, Bhiria, Kandiaro and Mehrabpur. The district headquarter is situated at Naushahro Feroze.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	187,694
Total Non-cultivated Area (hectares)	16,551
Total Area under Irrigation (hectares)	186,892
Major Rabi Crop(s)	Wheat, Fodders, Orchards
Major Kharif Crop(s)	Cotton, Sugarcane
Total Livestock Population	2,710,415

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Mainly loamy and clayey soils of sub-recent river plains
Dominant Soil Series	Rustam, Matli, Shahdara, Sindhelianwali, Sultanpur
pH	7.5 – 10.4 (Average 8.28)
Electrical Conductivity (dSm^{-1})	0.12 – 54.3 (Average 2.95)
Organic Matter (%)	0.1 – 2.09 (Average 0.80)
Available Phosphorus (ppm)	1 – 36 (Average 3.86)
Extractable Potassium (ppm)	32 – 400 (Average 206)
Farmers availing soil-test facility (%)	14
Farmers availing water-test facility (%)	5

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

Map source: Information Management Unit, FAO Pakistan

KAMBAR SHAHDADKOT

Qambar Shahdadkot was the part of Larkana District until December 2004. It is located in the north-west of Sindh province near Hamal lake. The climate is hot and dry in summers and moderately cold in winters. Main crops are wheat, rice, oilseeds and vegetables. There are seven tehsils in the district: Qambar Ali Khan, Warah, Meero Khan, Nasirabad, Sujawal Junejo, Qubo Seed Khan and Shahdadkot. The district headquarter is located at Qambar.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	90,175
Total Non-cultivated Area (hectares)	3,738
Total Area under Irrigation (hectares)	89,743
Major Rabi Crop(s)	Wheat, Oilseeds
Major Kharif Crop(s)	Rice
Total Livestock Population	2,318,157

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Alluvial deposits of piedmont and river plains
Dominant Soil Series	Jacobabad, Jhatpat, Matli, Nabipur, Shahdara
pH	7.5 – 8.8 (Average 8.16)
Electrical Conductivity (dSm^{-1})	0.18 – 13 (Average 2.95)
Organic Matter (%)	0.23 – 1.65 (Average 1.02)
Available Phosphorus (ppm)	1 – 16 (Average 3.12)
Extractable Potassium (ppm)	60 – 400 (Average 205)
Farmers availing soil-test facility (%)	8
Farmers availing water-test facility (%)	0

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

Map source: Information Management Unit, FAO Pakistan

SANGHAR

Sanghar district is situated in the western part of Sindh province. The climate is that of a desert with hot summers and mild winters. Main crops of the district include cotton, sugarcane, oilseeds, fruits and vegetables. There are six tehsils in the district: Jam Nawaz Ali, Khipro, Sanghar, Shahdadpur, Sinjhoro and Tando Adam. The district headquarter is located at Sanghar.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	298,364
Total Non-cultivated Area (hectares)	71,081
Total Area under Irrigation (hectares)	283,612
Major Rabi Crop(s)	Wheat, Fodders, Orchard
Major Kharif Crop(s)	Sugarcane, Cotton, Millet
Total Livestock Population	1,966,097

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	River alluvium and rolling sand ridges
Dominant Soil Series	Bagh, Jarwar, Nabipur, Pacca, Sultanpur
pH	7.1 – 10.5 (Average 8.21)
Electrical Conductivity (dSm^{-1})	0.11 – 49 (Average 2.05)
Organic Matter (%)	0.1 – 2.19 (Average 0.79)
Available Phosphorus (ppm)	1 – 39 (Average 3.78)
Extractable Potassium (ppm)	26 – 400 (Average 190)
Farmers availing soil-test facility (%)	48
Farmers availing water-test facility (%)	8

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

Map source: Information Management Unit, FAO Pakistan

SHAHEED BENAZIRABAD

The name of the district was changed from Nawabshah to Shaheed Benazirabad district in April 2008. The district is situated on the left bank of the Indus River. The climate is generally hot and dry in summer and mild in winter. There are two irrigation water supply divisions called "Nusrat Division" and "Dad Division" in the district. The main crops include cotton, sugarcane, fruits and vegetables. There are four tehsils in the district. The district headquarter is located at Nawabshah.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	169,820
Total Non-cultivated Area (hectares)	45,993
Total Area under Irrigation (hectares)	168,026
Major Rabi Crop(s)	Wheat, Orchard
Major Kharif Crop(s)	Cotton, Sugarcane
Total Livestock Population	1,713,343

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Jarwar, Miani, Nabipur, Pacca, Shahdara
pH	7.2 – 10.2 (Average 8.10)
Electrical Conductivity (dSm^{-1})	0.1 – 46 (Average 1.50)
Organic Matter (%)	0.1 – 1.99 (Average 0.83)
Available Phosphorus (ppm)	1 – 28 (Average 4.0)
Extractable Potassium (ppm)	30 – 400 (Average 179)
Farmers availing soil-test facility (%)	19
Farmers availing water-test facility (%)	28

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

Map source: Information Management Unit, FAO Pakistan

SHIKARPUR

Shikarpur district is surrounded by Larkana, Jacobabad, Kashmore, Khairpur and Sukkur districts. Shikarpur was a forted city with seven gates. The climate is hot and dry during the summer and moderately cold in the winter. Main crops of the district include rice, wheat, oilseeds and vegetables. It is also well-known for pickle production. There are four tehsils in the district: Garhi Yasin, Khanpur, Lakhi Ghulam Shah and Shikarpur. The district headquarter is situated at Shikarpur.

AGRICULTURAL INFORMATION

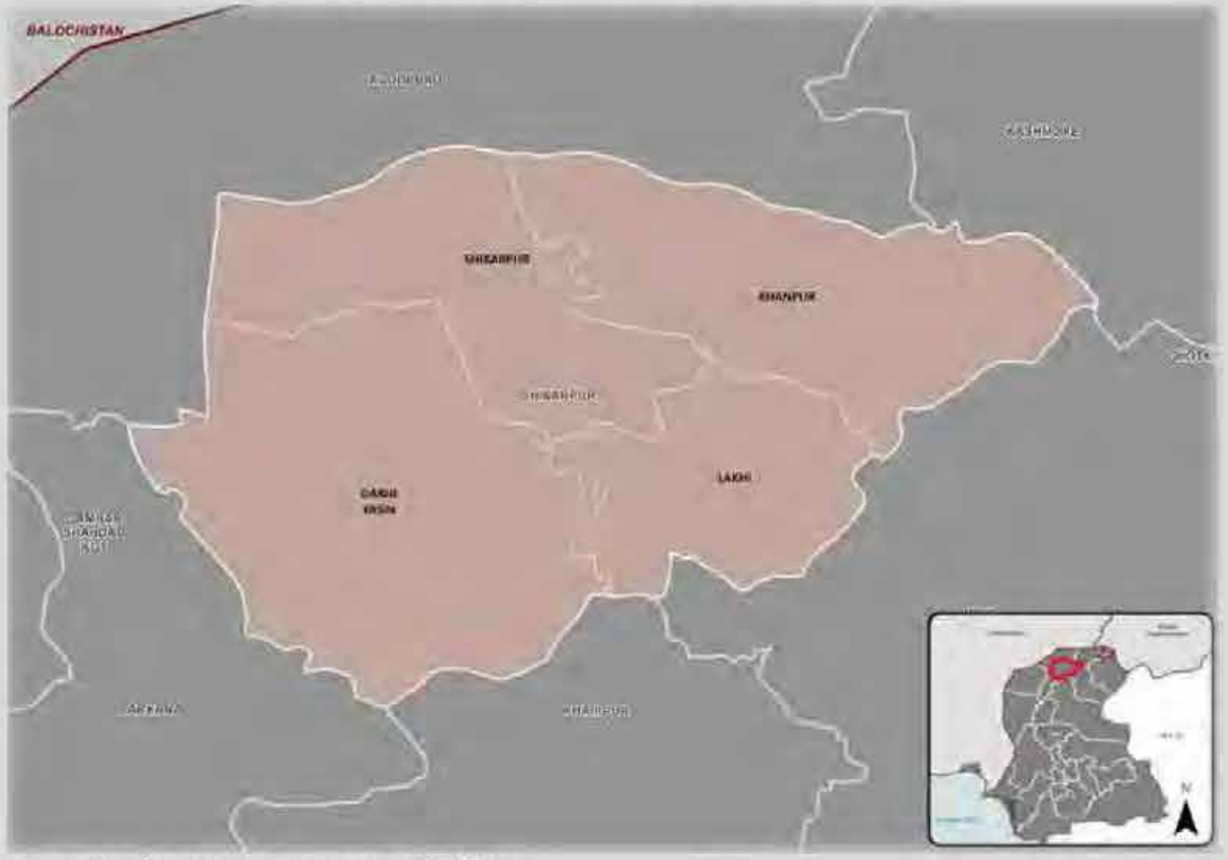
Total Cultivated Area (hectares)	96,191
Total Non-cultivated Area (hectares)	3,343
Total Area under Irrigation (hectares)	94,530
Major Rabi Crop(s)	Wheat, Pulses, Oilseeds
Major Kharif Crop(s)	Rice
Total Livestock Population	2,823,437

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Recent and sub-recent river alluvium
Dominant Soil Series	Kambar, Miani, Kandare, Kandhkot, Shahdara
pH	7.5 – 10.5 (Average 8.40)
Electrical Conductivity (dSm^{-1})	0.1 – 37.2 (Average 2.19)
Organic Matter (%)	0.1 – 1.95 (Average 0.75)
Available Phosphorus (ppm)	1 – 42 (Average 4.28)
Extractable Potassium (ppm)	30 – 400 (Average 192)
Farmers availing soil-test facility (%)	56
Farmers availing water-test facility (%)	24

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



Map source: Information Management Unit, FAO Pakistan

SUJAWAL

Sujawal is a new district of the Sindh province, which was previously a part of Thatta district. It is bordered in the northwest by the Indus River and Badin on the east. Indus River separates it from Thatta District. This district has a moderate climate, hot in summer and cold in winter. Main crops of the district are wheat, oilseeds, rice, sugarcane and vegetables. There are five tehsils in the district: Jaati, Mirpur Bathoro, Shah Bunder, Kharo Chan and Sujawal.

AGRICULTURAL INFORMATION

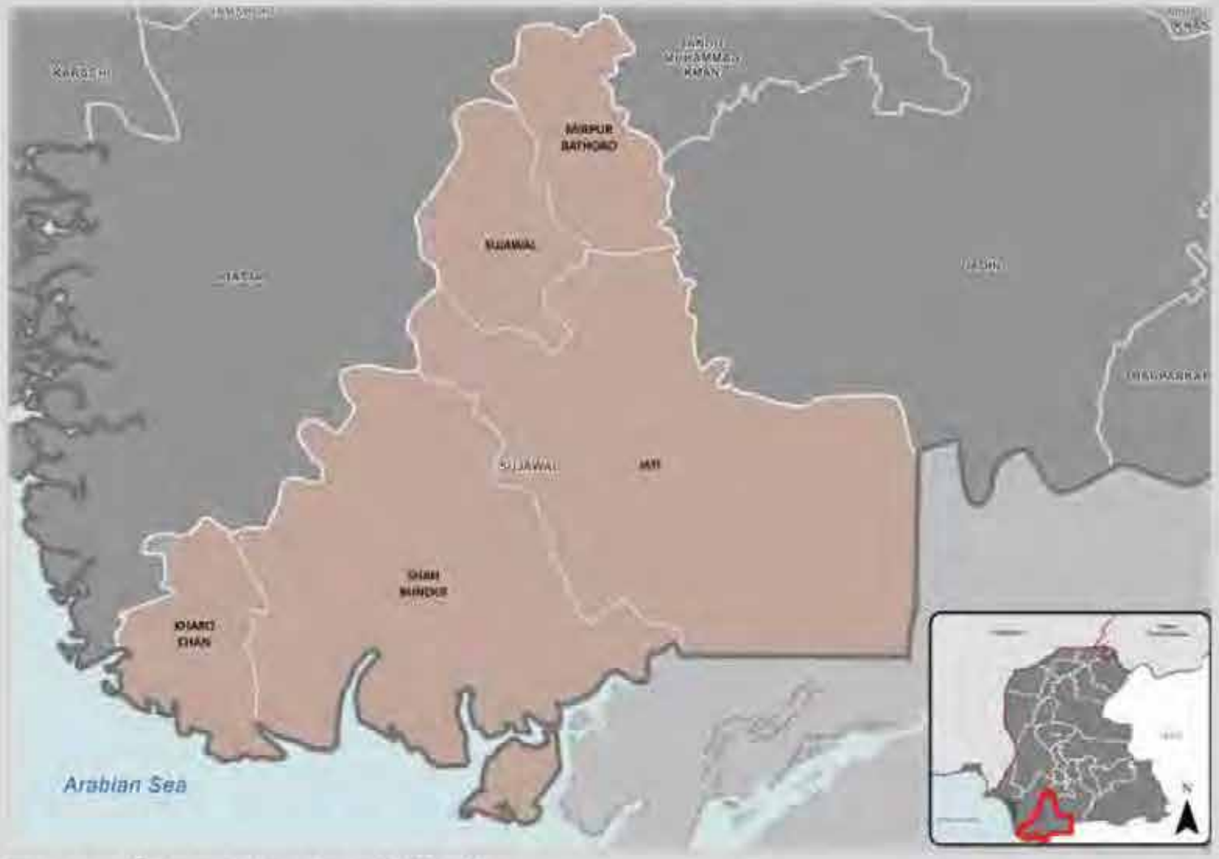
Total Cultivated Area (hectares)	-
Total Non-cultivated Area (hectares)	-
Total Area under Irrigation (hectares)	-
Major Rabi Crop(s)	Wheat, Oilseeds
Major Kharif Crop(s)	Rice, Fodders, Sugarcane
Total Livestock Population	-

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Calcareous material of deltaic and tidal plains
Dominant Soil Series	Matli, Nabipur, Jarwar, Rustam, Shahdara
pH	-
Electrical Conductivity (dSm^{-1})	-
Organic Matter (%)	-
Available Phosphorus (ppm)	-
Extractable Potassium (ppm)	-
Farmers availing soil-test facility (%)	6
Farmers availing water-test facility (%)	-

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



Map source: Information Management Unit, FAO Pakistan

SUKKUR

Sukkur is located in the northeast of Sindh province and is renowned for its date orchards. The climate is that of a desert with hot summers and mild winters. Main crops of the district include cotton, wheat, sugarcane, oil seeds, fruits and vegetables. The most famous historical landscapes are Sukkur barrage and Lansdowne Bridge Rohri. The district has one of the ancient railway junctions, the Rohri junction. There are five tehsils in the district: New Sukkur, Sukkur, Rohri, Salehpat and Pano Aqil. The district headquarter is at Sukkur.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	110,957
Total Non-cultivated Area (hectares)	8,489
Total Area under Irrigation (hectares)	109,955
Major Rabi Crop(s)	Wheat, Orchard, Gram
Major Kharif Crop(s)	Cotton
Total Livestock Population	1,160,799

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Mixed calcareous alluvium
Dominant Soil Series	Jarwar, Miani, Nabipur, Pacca, Shahdara
pH	7 – 10.8 (Average 8.37)
Electrical Conductivity (dSm^{-1})	0.11 – 55.6 (Average 2.28)
Organic Matter (%)	0.1 – 1.92 (Average 0.69)
Available Phosphorus (ppm)	1 – 50 (Average 3.73)
Extractable Potassium (ppm)	28 – 400 (Average 183)
Farmers availing soil-test facility (%)	21
Farmers availing water-test facility (%)	4

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

Map source: Information Management Unit, FAO Pakistan

TANDO ALLAH YAR

Tando Allah Yar district is renowned for its mango orchards. A variety of mangoes are grown in the district. The climate is hot in summers and mild in winters. Main cash crops of the district are sugarcane, wheat, onions and cotton. The district is also well known for the production of large quantity of sugarcane. There are three tehsils in the district· Chamber, Jhando Mari and Tando Allah Yar. The district headquarter is located at Tando Allah Yar.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	133,382
Total Non-cultivated Area (hectares)	25,718
Total Area under Irrigation (hectares)	130,003
Major Rabi Crop(s)	Wheat, Gram
Major Kharif Crop(s)	Sugarcane, Cotton
Total Livestock Population	679,165

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Mixed alluvial deposits
Dominant Soil Series	Jacobabad, Jarwar, Nabipur, Pacca, Shahdara
pH	7.1 – 9.9 (Average 8.24)
Electrical Conductivity (dSm^{-1})	0.11 – 40.3 (Average 1.36)
Organic Matter (%)	0.1 – 1.99 (Average 0.82)
Available Phosphorus (ppm)	1 – 53 (Average 5.26)
Extractable Potassium (ppm)	30-400 (Average 200)
Farmers availing soil-test facility (%)	10
Farmers availing water-test facility (%)	5

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

Map source: Information Management Unit, FAO Pakistan

TANDO MUHAMMAD KHAN

Tando Muhammad Khan is located on south of Hyderabad. The climate is hot in summers and mild in winters. Main crops of the district include rice, sugarcane, wheat and cotton. There are three tehsils in the district: Tando Muhammad Khan, Bulri Shah Karim and Tando Ghulam Hyder. The district headquarter is situated at Tando Muhammad Khan.

AGRICULTURAL INFORMATION

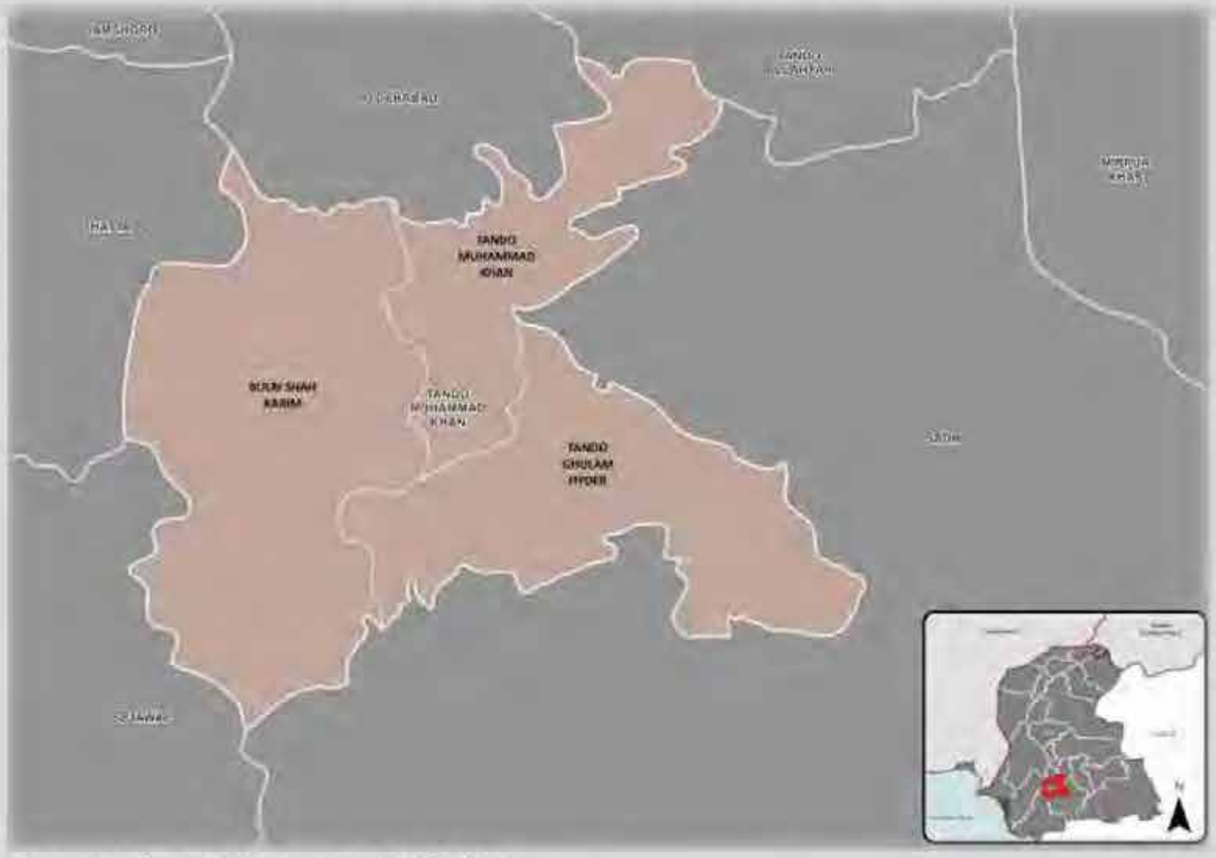
Total Cultivated Area (hectares)	58,969
Total Non-cultivated Area (hectares)	13,021
Total Area under Irrigation (hectares)	55,023
Major Rabi Crop(s)	Wheat, Onion
Major Kharif Crop(s)	Rice, Sugarcane, Cotton
Total Livestock Population	626,320

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Mixed alluvial deposits
Dominant Soil Series	Maitli, Shahdara, Pacca, Jarwar, Nabipur
pH	7.5 – 10.5 (Average 8.35)
Electrical Conductivity (dSm^{-1})	0.1 – 35 (Average 1.82)
Organic Matter (%)	0.1 – 1.93 (Average 0.83)
Available Phosphorus (ppm)	1 – 26 (Average 4.47)
Extractable Potassium (ppm)	38 – 400 (Average 169)
Farmers availing soil-test facility (%)	2
Farmers availing water-test facility (%)	2

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



Map source: Information Management Unit, FAO Pakistan

THARPARKAR

A vast portion of the district is occupied by Thar desert, and there are very few agricultural areas. The beauty of Tharparkar is enhanced due to Karronjhar hills located in Nagarparkar tehsil. The climate is that of a desert with hot summers and mild winters. Handicrafts and livestock rearing are the key business activities in Mithi, which is the district headquarter. There are six tehsils in the district: Chachro, Diplo, Islamkot, Mithi, Dahli and Nagarparkar.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	156,684
Total Non-cultivated Area (hectares)	31,192
Total Area under Irrigation (hectares)	21,305
Major Rabi Crop(s)	Fodders
Major Kharif Crop(s)	Millet, Fodders
Total Livestock Population	4,857,029

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Reworked old sandy deposits
Dominant Soil Series	Bhakkar, Bhareri, Bijnot, Hyderabad, Jhakkar
pH	7.7 – 8.2 (Average 7.93)
Electrical Conductivity (dSm^{-1})	0.16 – 1.21 (Average 0.31)
Organic Matter (%)	0.13 – 1.39 (Average 0.86)
Available Phosphorus (ppm)	1 – 5 (Average 2.10)
Extractable Potassium (ppm)	56 – 330 (Average 185)
Farmers availing soil-test facility (%)	7
Farmers availing water-test facility (%)	3

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

Map source: Information Management Unit, FAO Pakistan

THATTA

Thatta has served as a capital of Sindh and center for Islamic arts in the ancient period. The district has a moderate climate, hot in summer and cold in winter. It is famous for hand-printed fabrics, glass bangles and Sindhi embroidery. Main crops of the district include rice, wheat, sugarcane, oilseeds and vegetables. Famous Shah Jehan Mosque built by Mughal Emperor Shah Jahan is also situated in this district. There are four tehsil in the district: Mirpur Sakro, Ghorabari, Thatta and Keti Bander. The district headquarter is located at Thatta.

AGRICULTURAL INFORMATION

Total Cultivated Area (hectares)	155,006
Total Non-cultivated Area (hectares)	75,924
Total Area under Irrigation (hectares)	153,829
Major Rabi Crop(s)	Wheat, Oilseeds
Major Kharif Crop(s)	Rice, Sugarcane
Total Livestock Population	2,297,937

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Calcareous material of deltaic and tidal plains
Dominant Soil Series	Dhand, Gujo, Matli, Rustam, Shahdara
pH	7.4 – 10.2 (Average 8.23)
Electrical Conductivity (dSm^{-1})	0.1 – 53 (Average 4.09)
Organic Matter (%)	0.11 – 2.21 (Average 0.80)
Available Phosphorus (ppm)	1 – 32 (Average 4.32)
Extractable Potassium (ppm)	26 – 400 (Average 206)
Farmers availing soil-test facility (%)	6
Farmers availing water-test facility (%)	-

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 Sindh (FAO, SUPARCO and Government of Sindh)

Map source: Information Management Unit, FAO Pakistan

UMER KOT

Umer Kot district was previously known as Amarkot, which was the capital of Greater Sindh Province. It also included some parts of present Rajasthan state of India. The Mughal king Akbar was born in Umer kot. The climate is that of a desert with hot summers and mild winters. Main crops include red chili, wheat, cotton and fodders. There are four tehsils in the district; Umer Kot, Samaro, Pithoro and Kunri. The district headquarter is situated at Umer Kot, which is famous for historical fort and museum.

AGRICULTURAL INFORMATION

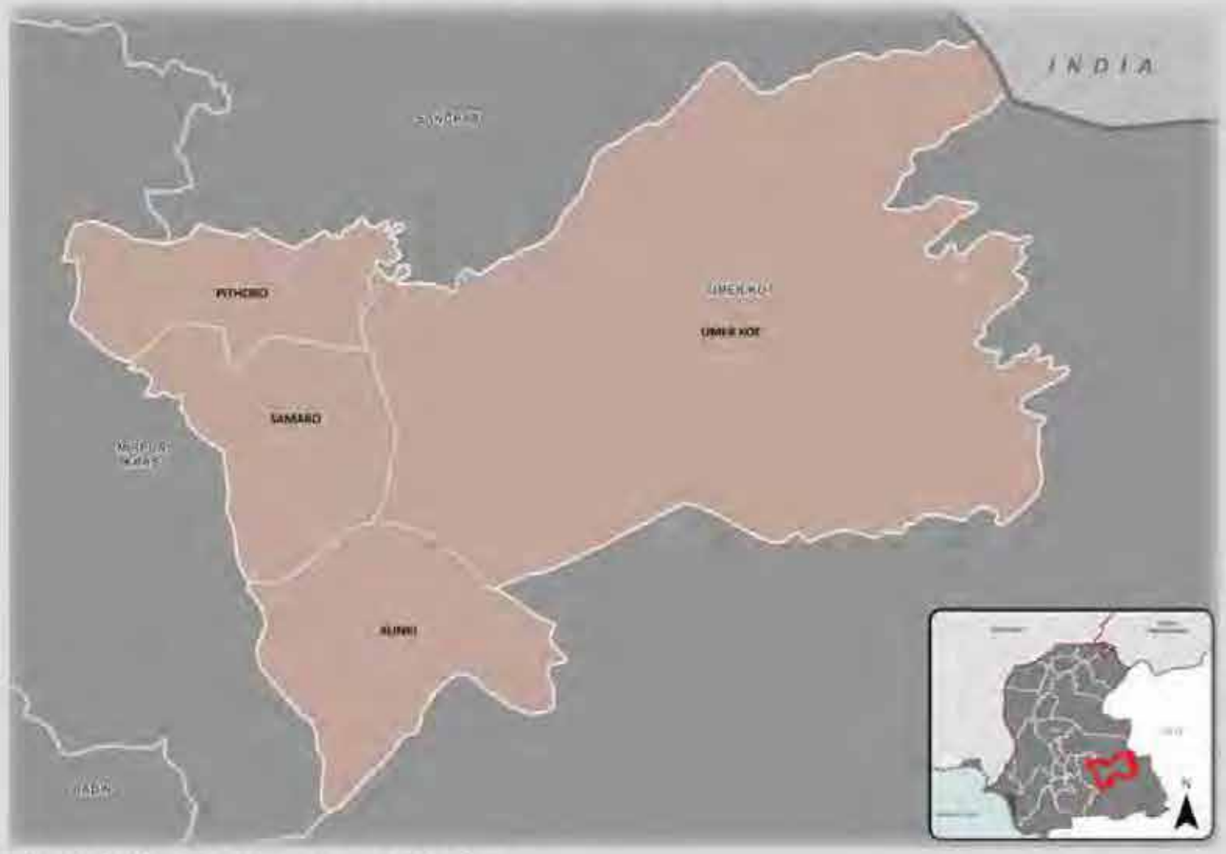
Total Cultivated Area (hectares)	136,590
Total Non-cultivated Area (hectares)	171,224
Total Area under Irrigation (hectares)	131,990
Major Rabi Crop(s)	Wheat, Chili
Major Kharif Crop(s)	Cotton, Fodder
Total Livestock Population	1,196,131

Source: Crop Reporting Services, Sindh; Agriculture Census 2010; Livestock Census 2006

SOIL ATTRIBUTES

Parent Material	Reworked old sandy deposits
Dominant Soil Series	Bhambro, Dungi, Bijnot, Hyderabad, Jhakkar
pH	7.5 – 10.6 (Average 8.20)
Electrical Conductivity (dSm^{-1})	0.12 – 48.6 (Average 3.74)
Organic Matter (%)	0.1 – 2.14 (Average 0.77)
Available Phosphorus (ppm)	1 – 28 (Average 4.17)
Extractable Potassium (ppm)	26 – 400 (Average 190)
Farmers availing soil-test facility (%)	7
Farmers availing water-test facility (%)	3

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 Sindh (FAO, SUPARCO and Government of Sindh)



Map 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 agricultural soils in Sindh have become deficient in various nutrients required for healthy plant growth. Consequently, adoption of Fertilizer Best Management Practices (FBMP) is essential for sustainable crop production and maintenance of soil health as per the prevailing farming system(s) in Sindh. Therefore, following recommendations are formulated for the benefit of farming communities.

In various cropping zones, Management Practices differ according to the soil conditions and farming systems; therefore, the fertilizers (nutrients) should be applied following the guiding principles of 4R Stewardship, as described below:

- Right source
- Right rate
- Right time
- Right placement

01

Soil and Water Testing

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

02

Ensure Use of Quality Fertilizers

Unless fertilizers are of good quality, the money and effort to correct soil-plant nutrient deficiencies cannot be remunerative. Therefore, farmers are advised to purchase quality fertilizers from trusted/authorized dealers appointed by the reputed manufactures. Special care is recommended while purchasing phosphate and potash fertilizers.

KEY MESSAGES

03

Integrated Plant Nutrient Management System
Balanced and integrated nutrient management is the key to soil health, crop productivity, and farmers' profitability. It is highly recommended to integrate the use of inorganic fertilizers with other sources of nutrients (organic fertilizers: green manure, farm yard manure, compost, poultry waste, etc.) including bio-fertilizers to enhance nutrient use efficiency, improve soil fertility and organic matter, soil physical and chemical properties, and ensure sustainable crop production.

04

Minimization of Urea Losses
In light textured soils, always apply urea in 2 or more splits, but never use more than the recommended rates. Apply urea in the late afternoon when temperature is low to avoid volatilization losses. In case of rice crop, special best management practices should be followed to enhance fertilizer use efficiency. Excessive use of urea may damage the crop likely through more vulnerability to insect pest attack and depressed fruiting because of excessive vegetative growth that might also lead to crop lodging.

05

Phosphorus Management
Farmers can reduce P fixation in soils through application of farm yard manure and such other organic sources including poultry manure. Placement of phosphatic fertilizer at 2-5 cm away from the seeding rows and 5 cm below the soil surface can also help reduce fertilizer requirement by way of improved fertilizer use efficiency, particularly in narrow-rowed crops such as wheat. In case, phosphatic fertilizer is missed at sowing, it can be applied through fertigation during the first irrigation (or even with second irrigation under special circumstances). Fertigation of phosphatic fertilizers especially in row crops is highly efficient on calcareous soils and can enhance grain yield by 15%.

06

Crop Residue Management
Crop residues are an excellent source of nutrients. Instead of burning, as is usually practiced, crop residues should be recycled for improving crop nutrition and soil fertility and organic matter contents. For example, banana residues abundantly available in Sindh are not recycled into the soil. Burning of residues of banana and other crops like paddy/sugarcane trash, etc., should be discouraged; instead these should be incorporated into the soil directly or through compost made out of these residues. There is a dire need to develop an economical technology to utilize banana residues either directly by crushing into micro-sized residues or by developing value-added compost products for improving soil fertility and organic matter and to sustain high productivity of soils.

KEY MESSAGES

07

Management of Salt-affected Areas

In case of salt-affected soils, first priority should be given to soil and water testing. Management practices differ according to the category of salt-affected soil, i.e., saline soils would only need good quality irrigation for reclamation and drainage whereas saline-sodic and sodic soils would require gypsum or acid treatment. A special attention should also be given to right source of nutrients; the fertilizers containing both nitrogen and phosphorus, and possibly calcium as well may be preferred in saline-sodic soils. Integrated use of soil amendments and organic fertilizers (farm manure, compost, green manuring, etc.) improves efficiency of inorganic fertilizers. Farmers are recommended to consult literature published by Agriculture Department in local language to gain further knowledge about reclamation of such soils.

08

Use of Gypsum

The application of gypsum is an efficient way to preserve soil moisture and also meet calcium and sulfur requirements of crops in arid areas. Since it has no negative impact on soils and crops, farmers may even apply gypsum @ 20 bags per acre to normal soils after every 3 years in the absence of soil testing facility. However, for reclamation of saline-sodic and sodic soils, gypsum application is highly recommended since it is at least five times cheaper than acid. Where available, the rate of gypsum application should be based on gypsum requirement according to exchangeable sodium percentage of soil and availability of irrigation water. Sulfur is very useful for those areas where oil seed crops and peanuts are grown.

09

Improving Produce Quality

Potassium is the quality nutrient element. Use of potash fertilizers on K deficient soils and for high value fruit and vegetable crops is recommended. Sandy soils and soils irrigated with tube-well water are often deficient in potassium. Under situation where high crop yields are harvested through application of enhanced rates of nitrogen and phosphate fertilizers, it becomes essential to apply potash fertilizers as well for balanced nutrition and produce quality. Zinc can also improve grain quality through meeting much needed zinc.

10

Brackish Water Management

Management of brackish water is very important factor with reference to the water quality for optimal crop production, particularly under salinity stress conditions. Therefore, brackish water should be used in cyclic manner, i.e., one or two irrigations with brackish water should be followed by canal water application at critical growth stages of the crop. In Sindh, this aspect is very important during canal water shortage at the tail end. Quality of brackish water, soil salinity status, and the crop grown are the guiding factors to be considered in brackish water management.

KEY MESSAGES

11

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, citrus and other orchards. Deficiency of micronutrient(s) may be catered through soil application or foliar spray, for example:

i. Wheat grains in Pakistan are generally low in zinc (25 mg Zn kg^{-1}). Since more than 65% of calorific needs of the poor are met by wheat flour alone; therefore, it is highly recommended that farmers are educated about enrichment of their grains while using micronutrient fertilizers. Zinc concentration in wheat grains can be increased effectively at farmers' fields by applying two foliar sprays of Zn (350 gram of zinc sulfate 33% Zn dissolved in 100 liter of water is sufficient for 1 acre spray) – preferably at booting stage, i.e., within 15 days before head emergence. In case one kg of Urea fertilizer is also mixed in 100 liter of water (being used for foliar zinc spray) that would further enhance Zn translocation towards grains.

ii. Boron (B) 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 (B) may help reduce boll drop in cotton and sterility in rice. Uptill now, no toxicity of boron has been reported in Pakistan.

iii. Most fruit orchards in Sindh, for example mango and banana crops, suffer from Zn deficiency which may be corrected by applying 2 to 3 foliar sprays of Zn as well as by soil application (maintenance dose). Research data about Fe deficiency in orchards across Sindh is lacking. In a study, only 16% soils of banana orchards were found deficient in Zn. Only foliar application of Fe is considered effective and economical.

Soil applications of micronutrient fertilizers leave beneficial residual effects on soil that can last for 3 to 6 subsequent crops, in certain cases. Therefore, it is not necessary to apply micronutrient fertilizer each season 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.

ANNEXURES

ANNEXURE I: QUESTIONNAIRE FOR RAPID FERTILIZER USE ASSESSMENT

Farmer Name ---------- Village Name ----------
Tehsil Name ---------- District ---------- Farm 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											

*Farm Yard Manure/Green Manure/Crop Residue Incorporation (if any)

Irrigation Sources

Irrigated		
Canal ☐	Tube-well ☐	Rain-fed ☐

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
BAHAWALNAGAR	BADIN	34
	DADU	21
	GHOTKI	714
	HYDERABAD	465
	JACOBABAD	243
	KASHMORE	27
	KHAIRPUR	1,420
	MIRPUR KHAS	162
	SHAHEED BENAZIRABAD	300
	NAUSHAHRO FEROZE	365
	SANGHAR	270
	SHIKARPUR	486
	SUKKUR	1,054
	THATTA	50
HALA	BADIN	1,136
	DADU	116
	GHOTKI	250
	HYDERABAD	710
	JACOBABAD	33
	JAMSHORO	228
	KASHMORE	23
	KHAIRPUR	2,257
	MATIARI	4,551
	MIRPUR KHAS	2,740
	SHAHEED BENAZIRABAD	1,158
	NAUSHAHRO FEROZE	419
	KAMBAR SHAHDAKOT	130
	SANGHAR	3,029
	SHIKARPUR	210
	SUKKUR	189
	TANDO ALLAH YAR	2,143
	TANDO MUHAMMAD KHAN	303
	THARPARKAR	41
	THATTA	479
	UMER KOT	614
SHAHKOT	GHOTKI	10
	KHAIRPUR	11
	SHAHEED BENAZIRABAD	11
	NAUSHAHRO FEROZE	1
	SHIKARPUR	1
SUKKUR	BADIN	28
	DADU	12
	GHOTKI	310
	HYDERABAD	120
	JACOBABAD	45
	JAMSHORO	4
	KHAIRPUR	1,540
	LARKANA	19
	MATIARI	25
	MIRPUR KHAS	278
	SHAHEED BENAZIRABAD	670
	NAUSHAHRO FEROZE	103
	SANGHAR	650
	SHIKARPUR	217
	SUKKUR	590
	TANDO ALLAH YAR	128
	TANDO MUHAMMAD KHAN	83
	THATTA	125
	UMER KOT	137

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
BADIN	pH	7.4-10.5	8.2	Neutral	0.01	1,198
	Electrical Conductivity (dSm^{-1})	0.1-47.2	3.6	Highly saline	0.14	1,198
	Organic Matter (%)	0.1-2.13	0.84	Low	0.01	983
	Available Phosphorus (ppm)	1-32	3.4	Low	0.11	997
	Extractable Potassium (ppm)	38-400	211	Adequate	2.69	1,081
DADU	pH	7.6-9.1	8.2	Neutral	0.03	149
	Electrical Conductivity (dSm^{-1})	0.2-10.8	1.6	Highly saline	0.19	149
	Organic Matter (%)	0.2-1.6	0.81	Low	0.03	148
	Available Phosphorus (ppm)	1-15	2.6	Low	0.13	149
	Extractable Potassium (ppm)	40-400	176	Adequate	6.71	141
GHOTKI	pH	7.6-10.9	8.3	Neutral	0.01	1,284
	Electrical Conductivity (dSm^{-1})	0.1-14.8	0.9	Slightly saline	0.04	1,284
	Organic Matter (%)	0.1-1.78	0.64	Low	0.01	1,279
	Available Phosphorus (ppm)	1-22	3.4	Low	0.07	1,284
	Extractable Potassium (ppm)	26-400	187	Adequate	2.61	1,179
HYDERABAD	pH	7.4-9.9	8.2	Neutral	0.01	1,295
	Electrical Conductivity (dSm^{-1})	0.08-29	1.5	Highly saline	0.08	1,295
	Organic Matter (%)	0.11-2.5	0.8	Low	0.01	1,293
	Available Phosphorus (ppm)	1-30	4.3	Low	0.12	1294
	Extractable Potassium (ppm)	30-400	181	Adequate	2.23	1,197
JACOBABAD	pH	0-10.2	8.2	Neutral	0.03	321
	Electrical Conductivity (dSm^{-1})	0-25.6	2.6	Highly saline	0.20	321
	Organic Matter (%)	0.1-2.1	0.66	Low	0.02	320
	Available Phosphorus (ppm)	1-25	3.2	Low	0.13	320
	Extractable Potassium (ppm)	34-400	189	Adequate	4.90	300
JAMSHORO	pH	7.5-8.9	8.1	Neutral	0.02	232
	Electrical Conductivity (dSm^{-1})	0.1-10.7	0.8	Slightly saline	0.09	232
	Organic Matter (%)	0.1-1.85	0.47	Low	0.02	229
	Available Phosphorus (ppm)	1-35	3.5	Low	0.31	231
	Extractable Potassium (ppm)	30-400	129	Marginal	4.09	231
KAMBER SHAHDAD KOT	pH	7.5-8.8	8.2	Neutral	0.03	130
	Electrical Conductivity (dSm^{-1})	0.18-13	3.0	Highly saline	0.23	130
	Organic Matter (%)	0.23-1.65	1.02	Marginal	0.03	130
	Available Phosphorus (ppm)	1-16	3.1	Low	0.22	130
	Extractable Potassium (ppm)	60-400	205	Adequate	8.02	108

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. Government Printing Office, Washington DC, USA. 19 pp.
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 pp.
Walkley A (1947). Examination of a rapid method for determining organic carbon in soils: Effect of variations in digestions 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
KASHMORE	pH	7.8-10.6	8.4	Alkaline	0.10	50
	Electrical Conductivity (dSm^{-1})	0.32-13.97	2.0	Highly saline	0.32	50
	Organic Matter (%)	0.22-1.67	0.89	Marginal	0.04	50
	Available Phosphorus (ppm)	1-13	2.4	Low	0.29	50
	Extractable Potassium (ppm)	134-400	261	Adequate	12.66	34
KHAIRPUR	pH	7-10.4	8.2	Neutral	0.00	5,228
	Electrical Conductivity (dSm^{-1})	0.1-39.2	1.3	Saline	0.03	5,228
	Organic Matter (%)	0.1-2.1	0.73	Low	0.00	5,210
	Available Phosphorus (ppm)	1-49	4.3	Low	0.05	5,225
	Extractable Potassium (ppm)	26-400	176	Adequate	1.21	4'856
LARKANA	pH	7.5-8.2	8.0	Neutral	0.04	19
	Electrical Conductivity (dSm^{-1})	0.17-0.9	0.4	Normal	0.05	19
	Organic Matter (%)	0.36-1.32	0.88	Marginal	0.07	19
	Available Phosphorus (ppm)	2-8	4.7	Low	0.44	19
	Extractable Potassium (ppm)	78-266	156	Adequate	11.74	19
MATIARI	pH	7.3-10.7	8.2	Neutral	0.00	4,576
	Electrical Conductivity (dSm^{-1})	0.1-27.3	1.3	Saline	0.04	4,576
	Organic Matter (%)	0.1-2.21	0.91	Marginal	0.01	4,555
	Available Phosphorus (ppm)	1-48	3.8	Low	0.06	4,575
	Extractable Potassium (ppm)	26-400	184	Adequate	1.28	4,254
MIRPURKHAS	pH	7.15-9.7	8.2	Neutral	0.01	3,180
	Electrical Conductivity (dSm^{-1})	0.08-36.8	2.1	Highly saline	0.05	3,179
	Organic Matter (%)	0.1-2.11	0.81	Low	0.01	3,166
	Available Phosphorus (ppm)	1-52	4.9	Low	0.09	3,176
	Extractable Potassium (ppm)	26-400	203	Adequate	1.43	2,928
SHAHEED BENAZIRABAD	pH	7.2-10.2	8.1	Neutral	0.01	2,139
	Electrical Conductivity (dSm^{-1})	0.1-46	1.5	Saline	0.06	2,139
	Organic Matter (%)	0.1-1.99	0.83	Low	0.01	2,135
	Available Phosphorus (ppm)	1-28	4.0	Low	0.07	2,139
	Extractable Potassium (ppm)	30-400	179	Adequate	1.94	1,961
NOUSHAHRO FEROZE	pH	7.5-10.4	8.3	Neutral	0.01	888
	Electrical Conductivity (dSm^{-1})	0.12-54.3	3.0	Highly saline	0.16	888
	Organic Matter (%)	0.1-2.09	0.80	Low	0.01	887
	Available Phosphorus (ppm)	1-36	3.9	Low	0.11	888
	Extractable Potassium (ppm)	32-400	206	Adequate	3.28	756
SANGHAR	pH	7.1-10.5	8.2	Neutral	0.01	3,949
	Electrical Conductivity (dSm^{-1})	0.11-49	2.0	Highly saline	0.05	3,949
	Organic Matter (%)	0.1-2.19	0.79	Low	0.01	3,893
	Available Phosphorus (ppm)	1-39	3.8	Low	0.06	3,948
	Extractable Potassium (ppm)	26-400	190	Adequate	1.48	3,667

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
SHIKARPUR	pH	7.5-10.5	8.4	Alkaline	0.02	914
	Electrical Conductivity (dSm^{-1})	0.1-37.2	2.2	Highly saline	0.10	914
	Organic Matter (%)	0.1-1.95	0.75	Low	0.01	914
	Available Phosphorus (ppm)	1-42	4.3	Low	0.14	914
	Extractable Potassium (ppm)	30-400	192	Adequate	3.12	797
SUKKUR	pH	7-10.8	8.4	Alkaline	0.01	1,833
	Electrical Conductivity (dSm^{-1})	0.11-55.6	2.3	Highly saline	0.10	1,833
	Organic Matter (%)	0.1-1.92	0.69	Low	0.01	1,828
	Available Phosphorus (ppm)	1-50	3.7	Low	0.07	1,833
	Extractable Potassium (ppm)	28-400	183	Adequate	2.28	1,544
TANDO ALLAH YAR	pH	7.1-9.9	8.2	Neutral	0.01	2,271
	Electrical Conductivity (dSm^{-1})	0.11-40.3	1.4	Saline	0.05	2,271
	Organic Matter (%)	0.1-1.99	0.82	Low	0.01	2,262
	Available Phosphorus (ppm)	1-53	5.3	Low	0.11	2,270
	Extractable Potassium (ppm)	30-400	200	Adequate	1.78	2,037
TANDO MUHAMMAD KHAN	pH	7.5-10.5	8.4	Neutral	0.03	386
	Electrical Conductivity (dSm^{-1})	0.1-35	1.8	Highly saline	0.15	386
	Organic Matter (%)	0.1-1.93	0.83	Low	0.02	381
	Available Phosphorus (ppm)	1-26	4.5	Low	0.22	386
	Extractable Potassium (ppm)	38-400	169	Adequate	4.14	371
THARPARKAR	pH	7.7-8.2	7.9	Neutral	0.02	41
	Electrical Conductivity (dSm^{-1})	0.16-1.21	0.3	Normal	0.03	41
	Organic Matter (%)	0.13-1.39	0.86	Marginal	0.06	41
	Available Phosphorus (ppm)	1-5	2.1	Low	0.19	41
	Extractable Potassium (ppm)	56-330	185	Adequate	9.91	41
THATTA	pH	7.4-10.2	8.2	Neutral	0.02	654
	Electrical Conductivity (dSm^{-1})	0.1-53	4.1	Highly saline	0.24	654
	Organic Matter (%)	0.11-2.21	0.80	Low	0.02	646
	Available Phosphorus (ppm)	1-32	4.3	Low	0.15	654
	Extractable Potassium (ppm)	26-400	206	Adequate	3.79	580
UMER KOT	pH	7.5-10.6	8.2	Neutral	0.01	750
	Electrical Conductivity (dSm^{-1})	0.12-48.6	3.7	Highly saline	0.22	751
	Organic Matter (%)	0.1-2.14	0.77	Low	0.01	741
	Available Phosphorus (ppm)	1-28	4.2	Low	0.13	751
	Extractable Potassium (ppm)	26-400	191	Adequate	3.19	700

ANNEXURE IV: CRITERIA FOR SOIL NUTRIENT ANALYSIS (mg kg^{-1})

THE INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY ARES (ICARDA)				
Nutrient/Organic Matter	**Test**	**Low**	**Marginal**	**Adequate**
Organic Matter (%)	Walkley-Black Mathod	<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
Maganese	DTPA	<1.0	1.0-2.0	>2.0
Boron	HCl	<0.45	0.45-1.0	>1.0

(Source: ICARDA Manual 2013)

CRITICAL LIMITS OF SOIL PARAMETERS ADOPTED BY GOVERNMENT OF SINDH (mg kg^{-1})						
Nutrient/Organic Matter	**Test**	**Limits**				
Electrical Conductivity (dSm^{-1})	1:2, Soil:Water Extract	Salt free	Very Slightly Saline	Moderately Saline	Strongly Saline	Very Strongly Saline
		0-2	2-4	4-6	6-8	>8
pH	1:2, Soil:Water Extract	Neutral	Mildly Alkaline	Moderately Aklaline	Strongly Alkaline	Very Strongly Alkaline
		6.6-7.3	7.4-7.8	7.9-8.4	8.5-9.0	>9.1
Organic Matter (%)	Walkley-Black Method	Low	Marginal	Adequate		
		<0.86	0.86-1.29	>1.29		
Phosphorus	AB-DTPA Method	Low	Marginal	Adequate		
		<3	3-7	>7		
Potassium	AB-DTPA Method	Low	Marginal	Adequate		
		<60	60-120	>120		

(Source: FAO (1980), Sultanpur (1985), Ludwick (1995), Martens and Lindsay (1990), Jhonsen and Fixen (1990), Soil and Plant Analysis Council (1992), Mathar et al. (1992)

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 measured in 1:2.5, soil:water extract.
(Source: Fauji Fertilizer Company Limited)

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

Soil Testing Facility	District	Address
Engro Fertilizers Limited **Soil and Water Testing Facility**	Hyderabad	6th Floor State Life Building, Thandi Sarak, Hyderabad
Fauji Fertilizer Company Limited **Farm Advisory Center**	Sukkar	Opposite Motorway Police Station, National Highway, Karam Abad, District Khairpur
Government of Sindh **Central Analytical Lab**	Hyderabad	Agriculture Chemistry, ARI, Tandojam
Government of Sindh **District Lab**	Shaheed Benazirabad	Near District Agriculture Extension Office, Sakrand
	Mirpur Khas	Sindh Horticulture Research Institute, Mirpur Khas
	Sanghar	Near District Agriculture Extension Office, Sanghar
	Sukkur	Near District Agriculture Extension Office, Rohri
	Thatta	Near District Agriculture Extension Office, Makli
	Shikarpur	Near Oilseeds Sub-Station, Shikarpur
	Badin	Near DCO Office, Badin
	Khairpur	Near District Agriculture Extension Office, Khairpur
	Dadu	Near Millet Research Station Dadu
	Jacobabad	Near Director Agriculture Extension Office, Jacobabad
	Karachi	Near Session Court Malir, Karachi
	Naushahro Feroze	Near DCO Office, Naushehro Feroze

سندھ میں موجود مٹی اور پانی کی تجزیہ گاہیں

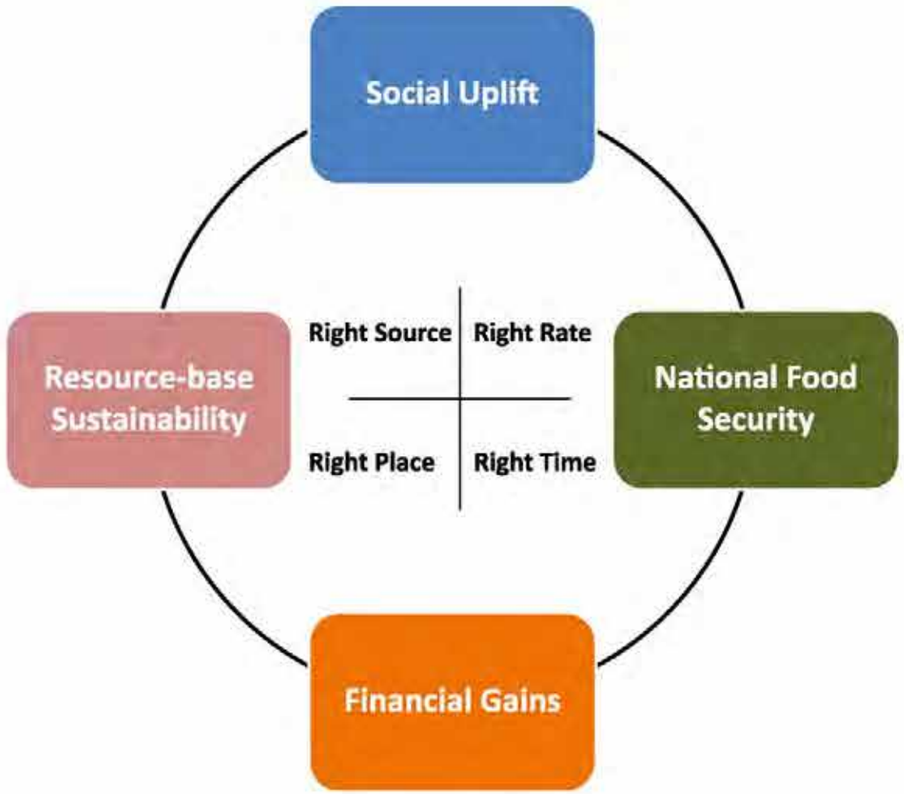
تجزیہ گاہ	ضلع	پتہ
تجزیاتی لیبارٹری، اینگرو فرٹیلائیزرز لمیٹڈ	حیدرآباد	فلور نمبر 6، اسٹیٹ لائف بلڈنگ، ٹھنڈی سڑک، حیدرآباد
فارم ایڈوائیزری سینٹر، فوجی فرٹیلائیزر، کمپنی لمیٹڈ	سکھر	بالقابل موٹروے پولیس اسٹیشن نیشنل ہائی وے، سکھر
مرکزی مٹی اور پانی کی تجزیاتی لیبارٹری	حیدرآباد	ایگریکلچر کیمسٹری، اے آر آئی، ٹنڈو جام
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	شہید بینظیر آباد	نزد ایگریکلچر ایکسٹینشن آفس سکرنڈ
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	میرپور خاص	سندھ تحقیقاتی ادارہ برائے باغبانی، میرپور خاص
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	سانگھڑ	نزد ڈسٹرکٹ ایگریکلچر ایکسٹینشن آفس سانگھڑ
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	سکھر	نزد ڈسٹرکٹ ایگریکلچر ایکسٹینشن آفس روہڑی
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	ٹھٹھہ	نزد ڈسٹرکٹ ایگریکلچر ایکسٹینشن آفس، مکلی
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	شکارپور	نزد آئیل سیڈ سب سیکشن
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	بدین	نزد ڈی سی او آفس
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	خیرپور	نزد ڈسٹرکٹ ایگریکلچر ایکسٹینشن آفس خیرپور
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	دادو	کالج روڈ دادو
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	جیکب آباد	نزد ڈسٹرکٹ ایگریکلچر ایکسٹینشن آفس
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	کراچی	نزد سٹیشن کورٹ ملیر کراچی
ضلعی مٹی اور پانی کی تجزیاتی لیبارٹری	نوشہرو فیروز	نزد ڈی سی او آفس، نوشہرو فیروز

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

Soil Series	US Soil Taxonomy	FAO World Soil Map	Survey Areas Mapped
Adilpur	Halic Camborthids	Haplic Yermosols	Ghotki, Larkana, Dadu
Badin	Typic Camborthids	Haplic Yermosols	Badin
Bagh	Fluventic Camborthids	Haplic Yermosols	Jacobabad, Ghotki, Nawabshah, Hyderabad, Sanghar
Bagodaro	Fluventic Camborthids	Orthic Solonchaks	Dadu, Larkana
Bahadarpur	Typic Torripsamment	Calcaric Fluvisols	Jacobabad, Larkana
Bhambhro	Typic Torripsamment	Calcaric Rhegosols	Ghotki
Bulri	Typic Salorthids	Orthic Solonchaks	Thatta East, Badin
Chhater	Typic Torripsamment	Calcaric Fluvisols	Jacobabad, Dadu, Larkana
Chinni	Fluventic Camborthids	Haplic Yermosols	Dadu
Dari	Typic Torrifluvents	Calcaric Fluvisols	Thatta East, Badin
Daro	Aquic Camborthids	Calcaric Gleysols	Thatta, Badin
Dhand	Ustertic Camborthids	Haplic Yermosols / Calcaric Gleysols	Thatta East, Badin
Dungi	Ealic Camborthids	Haplic Yermosols	Ghotki
Gambat	Aeric Haplaquepts	Calcaric Gleysols	Khairpur
Garhi	Typic Torriorthents	Orthic Solonchaks	Ghotki
Ghaibi	Typic Camborthids	Haplic Yermosols	Larkana, Dadu
Golarchi	Typic Salorthids	Orthic Solonchaks	Badin
Guddu	Typic Salorthids/Fluventic Camborthids	Orthic Solonchaks	Jacobabad
Gujo	Typic Salorthids	Orthic Solonchaks	Thatta East, Badin
Gungro	Fluventic Camborthids	Orthic Solonchaks	Thatta East, Badin
Humayun	Vertic Torriorthents	Orthic Solonchaks	Jacobabad
Jacobababad	Typic Camborthids	Orthic Solonchaks	Jacobabad, Hyderabad, Nawabshah, Sanghar, Larkana, Dadu
Jagan	Typic Camborthids	Orthic Solonchaks	Jacobabad, Larkana, Dadu
Jarwar	Typic Salorthids/Fluventic Camborthids	Orthic Solonchake	Ghotki, Jacobabad, Nawabshah, Sanghar, Hyderabad
Jati	Typic Salorthids	Orthic Solonchake	Thatta East, Badin
Jhakkar	Halic Camborthids	Haplic Yermosols/Orthic Solonchake	Jacobabad, Ghotki
Jhatpat	Torretic Camborthids	Haplic Yermosols/ Chromic Vertisols	Jacobabad, Larkana, Dadu
Joanna	Typic Halorthents	Orthic Solonchake	Ghotki
Johi	Typic Salorthids/ Vertic Torriorthents	Orthic Solonchake	Dadu
Kabil	Fluventic Camborthids	Haplic Yermosols	Larkana, Dadu
Kahror	Halic Camborthids	Haplic Yermosols / Orthic Solonchake	Jacobabad, Larkana, Dadu
Kamber	Fluventic Camborthids	Orthic Solonchake	Larkana, Dadu
Kashmore	Typic Salorthids/Typic Camborthids	Orthic Solochaks	Jacobabad, Dadu, Larkana
Kasur	Halic Ustorthents/Halic Torriorthents	Orthic Solonchaks/Gleysic Solonchaks	Ghotki, Jocobabad, Larkana, Dadu
Katchar	Typic Torriorthents	Calcaric Fluvisols	Jacobabad, Larkana, Dadu
Katiar	Typic Salorthids / Typic Torriorthents	Takyric Solochaks	Thatta East, Badin
Khair	Typic Torriorthents /Typic Ustorthents	Calcaric Fluvisols	Larkana, Dadu, Hyderabad
Kirthar	Halic Camborthids	Orthic Solochaks	Larkana, Dadu

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

Soil Series	US Soil Taxonomy	FAO World Soil Map	Survey Areas Mapped
Kundi	Typic Camborthids	Haplic Yermosols	Jacobabad
Lalian	Typic Torriorthents	Calcaric Fluvisols	Ghotki, Larkana, Dadu
Larkana	Typic Camborthids	Haplic Yermosols	Larkana, Dadu
Lodra	Typic Halorthids	Orthic Solonetz	Ghotki, Jacobabad
Makai	Typic Torriorthents	Calcaric Fluvisols	Ghotki, Jacobabad, Sanghar
Manchar	Fluventic Camborthids	Haplic Yermosols	Dadu
Matli	Typic Calciorthids	Haplic Yermosols	Thatta East, Badin, Hyderabad, Dadu, Larkana, Nawabshah, Sanghar
Miani	Typic Calciorthids / Ustochrepts	Haplic Yermosols / Calcaric Cambisols	Dadu, Larkana, Sanghar, Nawabshah, Jacobabad, Sargodha, Hyderabad, Ghotki
Mirzapur	Halic Camborthids	Orthic Solonchaks	Larkana, Dadu
Nabipur	Typic Camborthids	Haplic Yermosols	Jacobabad, Sanghar, Dadu, Larkana, Hyderabad, Nawabshah, Badin
Nangin	Typic Salorthids / Typic Torriorthents	Orthic Solonchaks	Thatta East
Naodero	Fluventic Camborthids	Haplic Yermosols	Larkana, Dadu
Pacca	Typic Camborthids / Aquic Camborthids	Haplic Yermosols / Calcaric Gleysols	Sanghar, Badin, Thatta East, Jacobabad, Ghotki, Hyderabad, Nawabshah, Dadu
Pandi	Fluventic Camborthids	Haplic Yermosols	Dadu
Petaro	Fluventic Camborthids	Haplic Yermosols	Dadu
Phulji	Fluventic Camborthids	Orthic Solonchaks	Dadu
Pitafi	Typic Salorthids	Orthic Solonchaks	Ghotki, Larkana, Dadu
Ratodero	Typic Salorthids / Typic Camborthids	Orthic Solonchaks	Dadu, Larkana
Rojhan	Fluventic Camborthids	Orthic Solonchaks	Jacobabad, Larkana, Dadu
Roshan	Typic Salorthids or Fluventic Camborthids	Orthic Solonchaks	Ghotki, Larkana, Dadu, Nawabshah, Sanghar
Rustam	Typic Torriorthents or Typic Torrifluvents	Calcaric Fluvisols	Thatta East, Larkana, Dadu, Badin, Jacobabad, Hyderabad
Sarhad	Typic Torripsamments	Calcaric Fluvisols	Ghotki
Satghara	Typic Halorthids	Orthic Solonetz / Solonchaks	Jacobabad
Shahdara	Typic Ustifluvents / Typic Torrifluvents	Calcaric Fluvisols	Hyderabad, Thatta East, Jacobabad, Ghotki, Badin, Larkana, Dadu, Nawabshah
Shahpur	Fluventic Camborthids	Haplic Yermosols	Nawabshah, Sanghar, Dadu,Ghotki, Jacobabad, Hyderabad, Larkana
Shergarh	Typic Camborthids	Haplic Yermosols	Jacobabad, Nawabshah, Sanghar, Larkana, Dadu
Shikarpur	Typic Camborthids	Haplic Yermosols / Calcaric Gleysols	Sanghar
Sindhelianwali	Typic Halorthids	Orthic Solonetz	Jacobabad, Ghotki
Sodhra	Typic Torripsamments/Typic Ustipsamments	Calcaric Fluvisols / Eutric Fluvisols	Thatta East, Larkana, Dadu, Jacobabad, Hyderabad, Ghotki
Sultanpur	Typic Camborthids	Haplic Yermosols	Thatta East, Nawabshah, Jacobabad, Sanghar, Ghotki
Takkar	Typic Torri fluvents	Calcaric Fluvisols	Thatta East
Thar	Typic Torripsamments	Calcaric Rhegosols	Ghotki
Vas	Typic Torripsamments	Calcaric Fluvisols	Ghotki
Wagan	Typic Torripsamments	Calcaric Fluvisols / Orthic Solonchaks	Larkana



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