SOIL GOVERNANCE AND INTEGRATED PLANT NUTRIENT MANAGEMENT FOR AGRICULTURAL PRODUCTION & SUSTAINABLE ECOSYSTEM IN DISTRICT CHAKWAL- PAKISTAN

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Introduction

- Agriculture for sustaining life on Earth.

- Growing human population.

- Agricultural approaches.

- Soil quality and ecosystem (air, water, and soil).

- Chakwal: A rainfed district in Punjab-Pakistan.

- Main Crops: Wheat & Groundnut

- Main Vegetables: Onion, Turnip & Gourd.

- Main Fruits: Olive, Grapes & Citrus.

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Problems

- Soil erosion.

- Mono-cropping pattern.

- Uncertain rainfall pattern and extreme temperatures.

- Lack of canal water and poor quality of ground water.

- Imbalanced fertilizer use.

- Low trend of soil and water testing.

Objectives

To collect and analyze the soil samples from farmer fields with the objective of better soil governance and sustainable agricultural production by adopting integrated plant nutrient management for a safe ecosystem.

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Methodology

- Soil sampling and processing
- No. of samples=1689

Parameters Tested

1. Soil ECe (Extract taken & conductivity meter (Sper Scientific 860032)).
2. Soil pH (Saturated paste prepared & pH meter (Hanna instruments 8520).
3. Organic matter % (Titration & determination by Walkley-Black method).
4. Available phosphorus (NaHCO$_3$ extraction and P determination by T70 UV/VIS spectrometer PG instruments Ltd., at 880 nm wavelength).
5. Extractable potassium (NH$_4$OAc extraction and K determination by flame photometer (Model: Digiflame 2000/GDV)).
6. Saturation percentage (Soil : Water W/V method)
7. Soil texture (Saturation % method)

Criteria of Salt-Affected Soils

Parameter	Saline Soils	Non-Saline Alkali/ Sodic Soils	Saline Sodic Soils
Soil ECe	$\geq$ 4 mS/cm	Variable, mostly < 4 mS/cm	> 4 mS/cm
Soil pH	< 8.5	$\geq$ 8.5	$\geq$ 8.5
		Source: Adapted from *(Richards, 1954) and (Malik et al., 1984)*	

Soil Fertility Classification Criteria

Parameter	Unit	Low	Satisfactory	Adequate
Organic Matter	%	<0.86%	0.86–1.29%	>1.29
Available Phosphorus	mgKg^{-1}	<7.0	7.0-14.0	>14.0
Extractable Potassium	mgKg^{-1}	<80	80-180	>180

Reference: Malik *et al., 1984*

Soil Textural Classification Based on Saturation (%)

Saturation %	Textural Class
<20	Sand
20-30	Sandy Loam
31-45	Loam
46-60	Clay Loam
>60	Clay

Reference: *Malik et al.,* 1984

Soil Categorization

Soil ECe

Category	Non saline	Saline	Saline Sodic	Sodic
% Samples	99.35	-	0.65	-

Soil pH

Category	<7.5	7.5-8.5	>8.5
% Samples	2.07	97.28	0.65

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Soil Categorization

Organic matter			
Category	Low	Satisfactory	Adequate
% Samples	67.26	25.75	6.99

Available phosphorus			
Category	Low	Satisfactory	Adequate
% Samples	68.09	28.42	3.49

Soil Categorization

Extractable potassium			
Category	Low	Satisfactory	Adequate
% Samples	43.69	43.64	12.67

Soil Texture			
Category	Light	Medium	Heavy
% Samples	49.08	49.62	1.30

Ranges and Average

Parameter	Unit	Minimum	Maximum	Average
Soil ECe	dSm^{-1}	0.16	18.80	0.90
Soil pH	-	7.29	9.64	7.89
Organic Matter	%	0.06	4.19	0.76
Available Phosphorus	$mgKg^{-1}$	1.60	20.20	6.42
Extractable Potassium	$mgKg^{-1}$	20	963	110
Saturation %	%	22	48	30.66

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Recommendations

- Soil and water testing for better site specific fertilizer recommendations.

- IPNM & balanced fertilizer use especially application of potassium & micronutrient fertilizers.

- Crop rotation for nutrient cycling and disease/pest control.

- Organic and green manuring.

- Biofertilizer and microbial inoculants.

- Biochar and compost application etc.

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Any Question / Suggestion!

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Thanks

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