# INSTITUTE OF SOIL CHEMISTRY AND ENVIRONMENTAL SCIENCES

## INTRODUCTION

The former Soil Chemistry Section was established with the establishment of Punjab Agricultural College Lyallpur (Faisalabad) in 1907. The limited objectives of the section were to determine the nutritional requirements of major crops. With time and according to the need new sections and directorates were emerged from this section like Biochemistry in 1954, Soil Fertility Survey and Soil Testing Institute in 1968, Soil Bacteriology in 1975 and Soil Salinity Research Institute in 1981. During restructuring phase of Ayub Agricultural Research Institute Faisalabad, the Soil Chemistry Section was upgraded as Institute of Soil Chemistry and Environmental Sciences in January 2009 by bringing the Soil Chemistry Section, Pesticide Quality Control Labs Faisalabad, Kala Shah Kaku, Multan, Bhalwalpur and Pesticide Residue Research Lab Kala Shah Kaku under one umbrella. With the establishment of this institute the work related to soil chemistry, the pollution problem caused by the agricultural inputs i.e. fertilizers and pesticides and pesticide quality control is being dealt more effectively and efficiently.

## OBJECTIVES

- To study the long term effect of chemical fertilizers on soil health and crops yield.
- To monitor the environmental pollution caused by agricultural inputs and safe use of domestic and industrial waste and sewage/industrial water.
- To find out the optimum doses of macro and micro nutrients for crops, vegetables and fruits.
- To study the integrated use of chemical fertilizers and organic manures
- To evaluate the effect of organic & inorganic farming
- To test the pesticide for quality control in Punjab under APO 1971.
- To conduct research on pesticides residue in crops, vegetables and fruits

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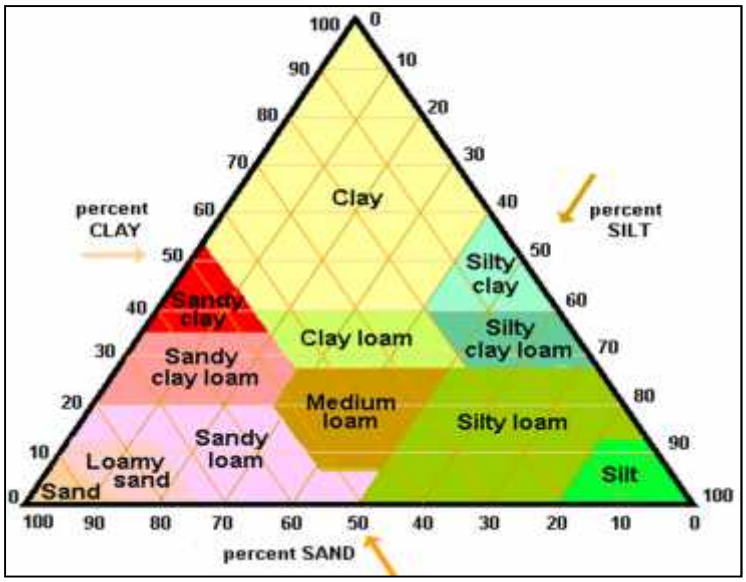
| **TITLE-1** | **EFFECT OF DIFFERENT SOIL TEXTURES ON WHEAT ROOT DEVELOPMENT AND NUTRIENT USE EFFICIENCY** |
| OBJECTIVE | This study is planned to examine the impacts of soil texture on wheat root growth and nutrient use efficiency. |
| RESEARCHERS | I. Saleem, S.S.H. Shah and S. Javid |
| DURATION | 2012-13 to 2014-15 |
| LOCATION | Soil Chemistry Section, ISCES, Faisalabad |

**TEXTURAL TRIANGLE**

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| METHODOLOGY | Soil texture: | 12 as described by USDA |
| | Lysimeter: | 1meter high and 30cm diameter |
| | Fertilizer dose: | 60-45-30 NPK mg/kg of soil |
| | Wheat variety: | Millat-11 |
| | Soil Analysis: | Basic soil analysis will be done before sowing and after harvest of wheat. |
| | Plant Analysis: | The grain and straw samples will be analyzed for N, P, K content and nutrient use efficiency will be calculated. |
| | Yield data: | Wheat grain and straw yield data will be recorded. |

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| | Root Parameters: Root length, weight and volume will be recorded.<br>Design: CRD with 3 replications |
| PREVIOUS RESULTS | New experiment |

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| **TITLE-2** | **SOIL PHYSICAL DEGRADATION ASSESSMENT USING "S- INDEX" AS AFFECTED BY LONG TERM USE OF FERTILIZERS** |
| OBJECTIVE | This study is being designed to assess the soil physical degradation as affected by long term use of fertilizers by using "S- index" |
| RESEARCHERS | S.S.H. Shah, I.Saleem S. Javid and R. A. Sial |
| DURATION | 2012-2015 |
| LOCATION | Soil Chemistry Section, ISCES, Faisalabad |
| METHODOLOGY | **<u>Measurement of soil physical degradation</u>:**<br>Soil samples will be collected after harvesting of wheat and maize fodder crops from the long term experiment where organic and inorganic fertilizers are being used since 1978.<br>Saturated water contents ($\Theta_s$), residual water contents ($\Theta_r$) and shape of the soil water characteristics curve parameter (n) will be determined by using "Pedo-transfer functions" proposed by Wosten *et al*. (1999).<br>After determining these parameters, Soil physical degradation will be assessed from each treatment plot by using soil physical quality index 'S' proposed by Dexter (2004) in the following equation:<br>$S = -n (\Theta_s - \Theta_r). [1 + 1/m]- (1+m)$<br>For the measurement of 'm' Mualem (1986) constraint model (m = 1-1/n) will be used.<br>Textural analysis will also be performed.<br>$S \geq 0.050$ very good<br>0.050 to 0.035 good<br>0.035 to 0.020 poor<br>$S < 0.020$ very poor |
| PREVIOUS RESULTS | New Experiment |

| **TITLE-3** | **POTASSIUM ADSORPTION /DESORPTION CAPACITIES OF DIFFERENT SOIL SERIES OF THE PUNJAB** |
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| OBJECTIVE | This study is planned to estimate the maximum potassium adsorption and desorption capacities of different soil series of Punjab varying in texture and calcium carbonate contents. |
| RESEARCHERS | I. Saleem, A. Niaz and S. Javid |
| DURATION | 2012-13 to 2013-14 |
| LOCATION | Soil Chemistry Section, ISCES, Faisalabad |
| METHODOLOGY | Following soil series varying in clay and calcium carbonate contents will be collected and used for potassium adsorption and desorption behavior.<br>1.Non calcareous soil (traces):<br>Pindorian, Gujranwala, Guliana, Kotli<br>2. Moderately calcareous soils (1- 5%):<br>Hafizabad, Lyalpur, Bhalwal, Sultanpur, Matli<br>3.Strongly calcareous (> 10 % ):<br>Rajar, Jhatpat<br>4.Stratified Soils:<br>Shahdra, Rustam<br>Adsorption isotherm will be developed by adding the series of potassium solution ranging from 0-50 µg/g and equilibrated for 24 hour. The potassium left in the solution will be measured and isotherm will be developed. Adsorption data will be examined by Langmuir and Freundlich model. The sample equilibrated with potassium will be used for desorption of potassium in 10 mM $CaCl_2$ . |
| PREVIOUS RESULTS | New Experiment |

| **TITLE-4** | **EFFECT OF BORON APPLICATION ON QUALITY AND YIELD OF CARROT** |
|---|---|
| OBJECTIVE | This study has been planned to improve the yield and quality of carrots by boron application in alkaline calcareous soils. |
| RESEARCHERS | S. Sultana, A.Niaz and M.Anwar |
| DURATION | 2012-13 to 2014-15 |
| LOCATION | Soil Chemistry Section, ISCES, Faisalabad |
| METHODOLOGY | VEGETABLE: Carrot<br>B Levels:<br>1. Control<br>2. Recommended NPK (100-65-65 kg/ha)<br>3. Recommended NPK +B @ 0.5 kg $ha^{-1}$<br>4. Recommended NPK + B @ 0.75 kg $ha^{-1}$<br>5. Recommended NPK +B @ 1.0 kg $ha^{-1}$<br>6. Recommended NPK +B @ 1.25 kg $ha^{-1}$<br>Design: RCBD with three replications<br>Soil Analysis: Basic soil analysis will be done before sowing.<br>Plant Analysis: The carrot leaves and roots samples will be analyzed for N, P, K and B content at maturity.<br>Yield data: Carrot roots yield data will be recorded and percentage of damaged carrot roots will also be calculated |
| PREVIOUS RESULTS | New Experiment |

| **TITLE-5** | **EFFECT OF MICRONUTRIENTS APPLICATION ON GROWTH AND YIELD OF ONION (FIELD AND POT)** |
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| OBJECTIVE | To study the effect of micronutrients through soil and foliar application on growth and productivity of onion. |
| RESEARCHERS | A. Wakeel, A.Muhmood, Z.A. Ahmad and K. Mahmood |
| DURATION | 2012-13 to 2013-14 |

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| LOCATION | VRI, AARI, Faisalabad. |
| METHODOLOGY | Vegetable: Onion<br>Treatments:<br>1. Control (No fertilizer)<br>2. RD of NPK (130:50:100 kg/ha)<br>3. NPK + Zn @ 3 kg/ha as soil application<br>4. NPK + B @ 1 Kg/ha as soil application<br>5. NPK + Cu @ 1 kg/ha as soil application<br>6. NPK + Zn+B<br>7. NPK + Zn+ Cu<br>8. NPK + B + Cu<br>9. NPK + Zn+Cu + B soil application<br>10. NPK + Zn +Cu+ B foliar application 0.1% solution of each after 30, 45 and 60 DAT<br>Design : RCBD (Field) CRD (Pots)<br>Replication: 3<br>Soil analysis: Basic soil analysis before sowing.<br>Plant analysis: Onion bulb will be analysed for N, P, K, Zn, Cu, Fe, Mn and B.<br>Yield data: The data regarding onion bulb yield will be recorded. |
| PREVIOUS RESULTS | New Experiment |

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| **TITLE-6** | **BIO-FORTIFICATION OF ZINC IN WHEAT GRAIN** |
| OBJECTIVES | To increase zinc concentration in wheat grain for improving the health of masses. |
| RESEARCHERS | M. Abbas, S.S.H. Shah and S. Javid |
| DURATION | 2012-2015 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | The wheat variety will be selected with the collaboration of WRI, Faisalabad.<br>Zinc levels: 0, 2.5, 5 and 7.5 kg /ha<br>Design: RCBD<br>Replications: 3 |

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| | Soil analysis: Basic soil analysis will be done before sowing of wheat including soil zinc status.<br>Plant analysis: Straw and grain samples will be analyzed for zinc concentration.<br>Yield data: Wheat grain and straw yield data will be recorded. |
| PREVIOUS RESULTS | New experiment |

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| **TITLE-7** | **EFFECT OF HUMIC ACID FOLIAR SPRAY AND NITROGEN FERTILIZER MANAGEMENT ON WHEAT YIELD** |
| OBJECTIVE | The study is aimed to investigate the influence of foliar application of humic acid and different levels of N fertilizer on yield and nitrogen use efficiency of wheat. |
| RESEARCHERS | S. Ehsan, S.Sultana and S. Javid |
| DURATION | 2012-13 to 2014-15 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad. |
| METHODOLOGY | Crop: Wheat<br>Treatments:<br>N Levels kg/ha<br>1. Control<br>2. 0<br>3. 60<br>4. 90<br>5. 120<br>6. 150<br>Analytical grade humic acid @ 0 and 40 mg/liter will be sprayed at tillering and booting stage at all N levels.<br>Design: RCBD<br>Replication: 3<br>Soil analysis: Basic soil analysis<br>Plant analysis: Grain samples will be analyzed for N,P & K.<br>Yield data: The data regarding grain, straw and biological yield will be recorded. |
| PREVIOUS RESULTS | New Experiment |

| **TITLE-8** | **EVALUATION OF DIFFERENT MODELS OF FERTILIZER REQUIREMENT FOR YIELD PREDICTION OF WHEAT** |
|---|---|
| OBJECTIVE | This study is planned to verify various models for wheat yield prediction. |
| RESEARCHERS | T. Majeed, I. Saleem, Z.A. Ahmed and S. Javid |
| DURATION | 2012-13 to 2014-15 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | Treatments:<br>1. Farmer Practice 100-56-0 kg/ha (I DAP, 1 ½ bag urea /acre)<br>2. Departmental recommendation 120-90-50 kg/ha<br>3. Fertilizer according to prediction model of UAF, on the basis of soil organic matter, Soil P and location.<br>4. Fertilizer according to prediction model of FFC, on the basis of organic matter, soil P&K and nutrient removal by crop.<br>Design: RCBD<br>Replication: 3<br>Yield data : Wheat grain yield data will be recorded and compared with model prediction. |
| PREVIOUS RESULTS | New Experiment |

| **TITLE-9** | **NITRATE STATUS OF SOIL PROFILE UNDER LONG TERM FERTILIZER USE** |
|---|---|
| OBJECTIVE | The study has been planned to evaluate nitrate status at different depths where continuous nitrogen is being applied through organic and inorganic sources. |
| RESEARCHERS | A.H. Shah, A. Muhmood, and A. Niaz |
| DURATION | 2011-12 to 2013-14 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad<br>Farmer's Field |
| METHODOLOGY | Soil samples will be collected from the field where organic and |

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| | inorganic fertilizer sources are being applied for 34 years.<br>Treatments:<br>1. Control<br>2. Only N from chemical fertilizer<br>3. NP from chemical fertilizer<br>4. NPK from chemical fertilizer<br>5. FYM on the basis of nitrogen<br>6. ½ nitrogen from fertilizer and ½ from FYM<br>7. ½ NP from fertilizer<br>Replications: 3<br>Soil analysis: Soil samples up to 120cm depth with 20cm interval will be collected and analyzed for $NO_3$-N. |

**PREVIOUS RESULTS**

| **Nitrate content (mg $kg^{-1}$) in soil profile** | | |
|---|---|---|
| Treatments | Depth (cm) | Mean |
| Control | 0-20 | 4.98 |
| | 20-40 | 5.22 |
| | 40-60 | 5.42 |
| | 60-80 | 6.51 |
| | 80-100 | 9.88 |
| | 100-120 | 7.30 |
| NP | 0-20 | 7.13 |
| | 20-40 | 7.21 |
| | 40-60 | 6.43 |
| | 60-80 | 6.95 |
| | 80-100 | 11.60 |
| | 100-120 | 9.13 |
| SOP | 0-20 | 5.95 |
| | 20-40 | 6.23 |
| | 40-60 | 10.13 |
| | 60-80 | 5.84 |
| | 80-100 | 6.38 |
| | 100-120 | 7.15 |

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| MOP | 0-20 | 8.68 |
| | 20-40 | 8.56 |
| | 40-60 | 14.04 |
| | 60-80 | 9.86 |
| | 80-100 | 7.71 |
| | 100-120 | 8.44 |

| **TITLE-10** | **NITRATE STATUS OF SOIL AND WATER IN AREAS WHERE HIGH DOSES OF NITROGEN ARE BEING APPLIED (VEHARI)** |
|---|---|
| OBJECTIVE | This study is planned to survey /monitor the nitrate in soil and underground water in Vehari district where high doses of nitrogen is being applied for BT cotton. |
| RESEARCHERS | A.H. Shah, A. Niaz and S. Javid |
| DURATION | 2009-10 to 2013-14 |
| LOCATION | Vehari |
| METHODOLOGY | A survey of Vehari district will be carried out and soil samples (from 0-15, 15-30, 30-60, 60-90 and 90-120 cm depth) and water samples (hand pump and tube well) will be collected.<br>Soil and water analysis<br>The soil and water samples will be analyzed for nitrates. |

**PREVIOUS RESULTS**

**NITRATE STATUS OF SOIL AND WATER (DISTRICT JHANG)**

| | **Range** | **Average** |
|---|---|---|
| Nitrate in water (Av. of 24 samples) | 2.48-39.63 | 12.69±6.42 |
| $NO_3$–N in soil (Av. of 50 samples) | | |
| 0-15 cm | 2.13-8.42 | 5.10±2.45 |
| 15-30 cm | 3.45-9.36 | 6.31±3.46 |
| 30-60 cm | 3.16-9.78 | 7.16±1.63 |
| 60-90 cm | 4.10-10.63 | 7.93±1.87 |
| 90-120 cm | 1.03-3.46 | 3.12±1.10 |

| **TITLE-11** | **CADMIUM AND LEAD CONTENTS IN WHEAT GROWN ACROSS THE HIGHWAYS AND WITH SEWAGE WATER** |
|---|---|
| OBJECTIVE | A survey will be conducted to assess Pb and Cd contents in wheat grain and straw grown across the highways and by sewage water especially in Sambrial and Muridkay area. |
| RESEARCHERS | T. Majeed, A. Mahmood, S. Javid and R. A. Sial |
| DURATION | 2011-12 to 2013-14 |
| LOCATION | Soil Chemistry Section, ISCES, Faisalabad |
| METHODOLOGY | Plant analysis:<br>The wheat grain and straw samples will be collected from the field adjacent to the highways and wheat grown with sewage water. The samples will be analyzed for Pb and Cd.<br>Soil analysis:<br>From same site soil samples will also be collected for Pb and Cd analysis. |
| PREVIOUS RESULTS | Approved in Kharif 2012 |

| **TITLE-12** | **REMOVAL AND DETOXIFICATION OF SOIL CONTAMINANT (LEAD) THROUGH PHYTOREMEDIATION** |
|---|---|
| OBJECTIVE | Heavy metals can be removed from soil through hyper accumulation after enhancing their solubility in soil through different amendments. This study is planned to enhance lead solubility and phytoextraction through amendments and hyper accumulated plants. |
| RESEARCHERS | A. Mahmood, T.Majeed and S. Javid |
| DURATION | 2011-12 to 2013-14 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad (pot experiment) |
| METHODOLOGY | Crop: *Brassica Juncea*<br>Lead level : 600 ppm<br>Treatments:<br>1. Control (contaminated soil) |

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| | 2. EDTA 3 mmol/kg<br>3. FYM 10 t/ha<br>4. Citric acid 3 mmol/kg<br>Design: CRD<br>Replication: 3<br>Soil Analysis:<br>Soil samples will be analyzed for lead before sowing and after harvesting of crop<br>Plant Analysis:<br>Plant shoot, stem, root and leaf samples will be taken and analyzed for lead contents and uptake. |
| PREVIOUS RESULTS | Approved in Kharif 2012 |

| **TITLE-13** | **TO STUDY THE EFFICIENCY OF DIFFERENT ORGANIC SOURCES FOR REDUCING LEAD ACCUMULATION IN SOIL AND CROPS** |
|---|---|
| OBJECTIVE | To assess the efficiency of organic sources in minimizing the Pb accumulation in soil and crops. |
| RESEARCHERS | A. Majeed, T. Majeed, S. Javid and R.A. Sial |
| DURATION | 2012-13 to 2013-14 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | Organic sources:<br>1. Control<br>2. FYM<br>3. Pressmud<br>4. Poultry litter<br>The organic sources will be applied @ 10 t/ha on the basis of organic matter content.<br>Lead level: 600 mg/kg<br>Crop: Wheat<br>Design: CRD with 3 Replications<br>Soil analysis:<br>Basic soil analysis including Pb status before application of organic sources and soil samples will be collected after 1, 15, 30, 45 and 60 days intervals and will be analyzed for Pb.<br>Plant analysis:<br>The leaf, grain and straw samples will be analyzed for Pb Bio-concentration factor (BCF) and Translocation Ratio (TR) will be |

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| | determined to study the translocation pattern of Pb in plant.<br>Yield data: Total biomass will be recorded. |
| PREVIOUS RESULTS | Approved in Kharif 2012 |

| **TITLE-14** | **HEAVY METAL STATUS OF SOIL AND VEGETABLES GROWN AROUND THE BIG CITIES (Gujrat)** |
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| OBJECTIVE | Sewage and industrial waste water is commonly used for growing of vegetables near big cities. These waters may contain heavy metals like lead, nickel and cadmium and may contaminate the soil and vegetables. This study is therefore planned to monitor the accumulation of these pollutants in soils and vegetables. |
| RESEARCHERS | T. Majeed, A. Mahmood, I. Saleem and S. Javid |
| DURATION | 2009-10 to 2013-14 |
| LOCATION | Gujrat district |
| METHODOLOGY | A survey of Gujrat district will be carried out and soil (from 0-15 and 15-30 cm depth) & vegetable samples will be collected<br>Soil, water and plant analysis:<br>The soil, water and vegetable samples will be analyzed for Pb, Ni Cd, Cr and As. |
| PREVIOUS RESULTS | Sewage/industrial water and vegetable samples have been collected. The heavy metal contents are as under. |

**Waste Water Analysis**

| **Metal (mg/kg)** | **Range** | **Mean** | **Safe Limits** | **Samples above safe limit (%)** |
|---|---|---|---|---|
| Pb | ND – 0.09 | 0.045 | 5.0 | Nil |
| Ni | 0.011 – 0.19 | 0.10 | 0.2 | Nil |
| Cd | N.D | - | 0.01 | Nil |
| Zn | 0.023 – 0.33 | 0.18 | 2.0 | Nil |
| Cu | N.D – 0.132 | 0.06 | 0.2 | Nil |
| Fe | 1.15 – 5.25 | 3.2 | - | Nil |
| Mn | N.D – 0.41 | 0.20 | 0.2 | 24 |
| No of samples = 50 | | | | |

**Soil Analysis**

| Metals (mg/ kg) | Range | Mean | Safe Limits | samples above safe limit | Range | Mean | Safe Limits | Sample above safe limit |
|---|---|---|---|---|---|---|---|---|
| | 0-15 cm | | | | 15-30 cm | | | |
| Pb | 0.68 – 4.82 | 2.750 | 300 | Nil | 0.15 – 3.43 | 1.79 | 300 | Nil |
| Ni | 0.52 – 0.73 | 0.625 | 75 | Nil | 0.23 – 0.56 | 0.39 | 75 | Nil |
| Cd | 0.005–0.047 | 0.026 | 3 | Nil | 0.001-0.021 | 0.011 | 3 | Nil |
| Zn | 0.58 – 4.63 | 2.60 | 300 | Nil | 0.34 – 3.98 | 2.16 | 300 | Nil |
| Fe | 24- 55.2 | 39.6 | - | - | 5.78 – 39.5 | 22.6 | - | - |
| Cu | 2.56- 4.51 | 3.54 | 140 | Nil | 1.78 – 4.24 | 3.01 | 140 | Nil |
| Mn | 35.4- 47 | 41.2 | - | - | 19 – 36.7 | 27.8 | - | - |
| Extractant used: DTPA | | | | Total No of Samples = 100 | | | | |

**Plant Analysis**

| Metals (mg/ kg) | Range | Mean | Safe Limits | Samples above safe limit (%) | Range | Mean | Safe Limits | Sample above safe limit % |
|---|---|---|---|---|---|---|---|---|
| | Leaf | | | | Fruit | | | |
| Pb | 4.23 – 23.1 | 13.66 | 5.0 | 85 | 3.12- 19.5 | 11.31 | 2.0 | 100 |
| Ni | 3.98 -23.6 | 13.79 | 10.0 | 87 | 2.98- 18.97 | 10.97 | 10.0 | 86 |
| Cd | 1.31 – 5.82 | 3.56 | 0.2 | 100 | 0.98- 6.79 | 3.87 | 0.02 | 100 |
| Zn | 34.6 - 188 | 111.3 | 60 | 95 | 15.6 -98.6 | 57.10 | 5.0 | 100 |
| Fe | 436 - 1632 | 1034 | - | - | 240 -896 | 568 | 150 | 100 |
| Cu | 6.34 - 174 | 180.3 | 40 | 90 | 5.89 – 89.7 | 95.59 | 10.0 | 92 |
| Mn | 46.2 – 186.8 | 116.1 | - | - | 38.3 – 156.2 | 97.25 | 6.61 | 100 |
| Total No of Samples = 100 | | | | | | | | |

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| **TITLE-15** | **EFFECT OF INDUSTRIAL EFFLUENTS ON THE UPTAKE OF HEAVY METALS BY WINTER VEGETABLES (A LYSIMETER STUDY)** |
| OBJECTIVE | Continuous application of industrial effluents may load the soil with heavy metals. This study is planned to examine the buildup of these contaminants in soil and vegetables under controlled conditions. |
| RESEARCHERS | F. Habib, A. Mahmood, and S. Javid |
| DURATION | 2010-11 to 2013-14 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | Irrigation water:<br>1. Industrial effluent<br>2. Canal water<br>Vegetables:<br>1. Spinach<br>2. Turnip<br>NPK will be applied according to the recommended rate. (for spinach : 55-76-0 and for turnip: 60-50-60 kg/ ha).<br>Design: CRD with 3 replications<br>Soil analysis:<br>Zn, Cu, Fe, Mn, Pb, Ni, Cr, Cd before and after harvest of vegetables.<br>Water analysis:<br>EC, pH, Zn, Cu, Fe, Mn, Ni, Cr, Pb, Cd and Se in industrial waste water.<br>Plant analysis:<br>Zn, Cu, Fe, Mn, Pb, Ni, Cr, Cd and Se at each harvest.<br>Yield data:<br>The vegetable yield data will be recorded. |

**PREVIOUS RESULTS**

**Water Analysis:**

**Table 1. Heavy metals concentrations (mg $kg^{-1}$) in industrial effluents/ waste waters (average of 10 samples).**

| Stat. Parameters | Zn | Fe | Pb | Ni | Mn | Cd |
|---|---|---|---|---|---|---|
| Mean | 0.12 | 0.09 | 0.69 | 0.02 | 0.06 | N.D |
| Range | 0.10- 0.15 | 0.05-0.11 | 0.10-0.83 | 0.01-0.10 | 0.02-0.10 | N.D |

**Table 2. Soil Analysis of industrial effluents irrigated plots before sowing of Spinach & turnip.**

| Soil Depth (cm) | $pH_s$ | $EC_e$ | OM | Texture | Zn | Fe | Mn | Cu | Pb | Cd |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ($dSm^{-1}$) | (%) | | ←---------(mg $kg^{-1}$)----------→ | | | | | |
| 0-15 | 8.42 | 2.30 | 0.59 | Sandy clay loam | 0.50 | 0.60 | 0.93 | 0.50 | ND | ND |
| 15-30 | 8.39 | 2.05 | 0.51 | Sandy clay loam | 0.48 | 0.76 | 0.81 | 0.67 | ND | ND |

**Effect of industrial effluents and canal irrigation water on fresh yield of spinach and turnip (kg/plot)**

| Sources of water | Spinach (total of 10 cuttings) | Turnip (total of 3 pickings) |
|---|---|---|
| Industrial effluent | 4.17 | 1.70 |
| Canal irrigated | 3.40 | 1.45 |
| % increase over canal water | 22.64 % | 1.38 % |

| **TITLE-16** | **LONG-TERM EFFECT OF ORGANIC AND INORGANIC FERTILIZER USE ON MICRONUTRIENTS AND HEAVY METALS STATUS OF SOIL** |
|---|---|
| OBJECTIVE | To study the micronutrients and heavy metals in soil where inorganic, organic and integrated sources of nutrients are being used since 1978. |
| RESEARCHERS | A. Majeed, S. Sultana and M. Anwar |
| DURATION | 2012 - 2014 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | Soil sampling :<br>The soil samples from a long term study (since 1978) having following treatments will be collected from 0-120 cm with 20cm intervals.<br>1. Control<br>2. Only N from chemical fertilizer<br>3. NP from chemical fertilizer<br>4. NPK from chemical fertilizer<br>5. FYM on the basis of nitrogen<br>6. ½ nitrogen from fertilizer and ½ from FYM<br>7. ½ NP from fertilizer<br>Soil analysis: Soil samples will be analyzed for Zn, Cu, Fe, Mn, Pb, Ni and Cd. |
| PREVIOUS RESULTS | Approved in Kharif 2012 |

| **TITLE-17** | **TO DETERMINE THE HEAVY METAL CONCENTRATION IN INDIGENOUS ROCK PHOSPHATE** |
|---|---|
| OBJECTIVE | This study is planned to monitor the concentration of heavy metals in different sources of indigenous rock phosphate. |
| RESEARCHERS | A. Muhmood, S. Ehsan and S. Javid |
| DURATION | 2011-12 to 2012-13 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | Rock phosphate samples from various locations will be collected and analyzed for Zn, Cu, Fe Mn, Cd, Pb, Ni, Cr and Co. |

**PREVIOUS RESULTS**

**Heavy Metal contents of Fertilizers**

| Fertilizer Type | Metals (mg/kg) | Range | Average | Safe Limit | Sample above safe limit |
|---|---|---|---|---|---|
| SSP | Zn | 38 - 357 | 197 | 420 | - |
| | Cu | 58- 92 | 75 | - | - |
| | Fe | 3658 -11218 | 7438 | - | - |
| | Mn | 61- 574 | 317 | - | - |
| | Pb | ND - 27 | 13 | 61 | - |
| | Ni | 85- 150 | 118 | 50 | 100 |
| | Cd | ND – 10.75 | 5 | 10 | 25 |
| | Cr | 26 - 363 | 195 | 100 | 17 |
| NP | Zn | 94- 255 | 174 | 420 | - |
| | Cu | 62 - 78 | 70 | - | - |
| | Fe | 417- 27850 | 14133 | - | - |
| | Mn | 46- 535 | 290 | - | - |
| | Pb | ND - 7.75 | 4 | 61 | - |
| | Ni | 60- 133 | 96 | 50 | 100 |
| | Cd | ND - 0.65 | 0.325 | 10 | - |
| | Cr | 10 - 131 | 71 | 100 | 13 |
| DAP | Zn | 46 - 447 | 246 | 420 | 14 |
| | Cu | 63 - 183 | 123 | - | - |
| | Fe | 387- 8398 | 4392 | - | - |
| | Mn | 26 - 96 | 61 | - | - |
| | Pb | ND | - | 61 | - |
| | Ni | 81 - 154 | 118 | 50 | 100 |
| | Cd | ND - 15 | 8 | 10 | 43 |
| | Cr | 9 - 402 | 206 | 100 | 50 |

| | | | | | |
|---|---|---|---|---|---|
| NPK | Zn | 124 -153 | 138 | 420 | - |
| | Cu | 51 - 67 | 59 | - | - |
| | Fe | 373 - 1861 | 1117 | - | - |
| | Mn | 132 - 421 | 276 | - | - |
| | Pb | 11 - 13 | 12 | 61 | - |
| | Ni | 116 -124 | 117 | 50 | 100 |
| | Cd | ND - 0.204 | 0.102 | 10 | - |
| | Cr | 26- 28 | 27 | 100 | - |

**Plant Analysis:**

**Heavy metals concentrations (mg $kg^{-1}$) in Spinach leaves and Turnip**

| **Heavy Metal (mg/kg)** | **Industrial effluent irrigated plots** | | **Canal water irrigated plots** | |
|---|---|---|---|---|
| | **Spinach** | **Turnip** | **Spinach** | **Turnip** |
| Zn | 48.3 | 38.51 | 22.6 | 11.1 |
| Cu | 13.9 | 41.6 | 5.3 | 13.2 |
| Fe | 290.5 | 112.7 | 172.3 | 89.8 |
| Mn | 70.1 | 32.6 | 33.3 | 17.4 |
| Pb | 0.37 | 0.58 | N.D | N.D |
| Ni | 0.11 | 0.09 | N.D | N.D |
| Cd | 0.56 | 0.08 | N.D | N.D |
| Cr | 0.03 | 0.01 | N.D | N.D |

| **TITLE-18** | **MAGNESIUM STATUS OF SOILS AND PLANTS** |
|---|---|
| OBJECTIVE | It is generally felt that magnesium (Mg) is not deficient in our soils. But its deficiency has been observed in some crops at early growth stages. This survey is planned to assess the available magnesium in soil and total magnesium in sugarcane leaves in sugarcane growing area of the Punjab. |
| RESEARCHERS | T.Majeed, A. Mahmood, A.Niaz and S.Javid |
| DURATION | 2011-12 to 2012-13 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | For this survey study, soil and plant samples will be collected initially |

| | |
|---|---|
| | from the Sugarcane Research Institute, AARI Faisalabad. These samples will be analyzed for available and water soluble Mg in soil and total Mg content in plant samples. |
| PREVIOUS RESULTS | The results of 40 soil samples provided by Director Soil Fertility Lahore for soluble Mg, Ammonium acetate extractable Mg and exchangeable Mg are given below. |

**Magnesium status of Soil**

| **Magnesium Type** | **Range** | **Average** | **S. D.** |
|---|---|---|---|
| | ←----------mg $kg^{-1}$----------→ | | |
| Water Soluble Mg | 76 - 196 | 145 | 23 |
| $NH_4OAc$ Extractable Mg | 268 - 345 | 312 | 18 |
| Exchangeable Mg | 126- 228 | 166 | 26 |

| **TITLE-19** | **ZINC ADSORPTION CAPACITY OF SOILS VARYING IN TEXTURE** |
|---|---|
| OBJECTIVE | Zn is generally recommended for various crops. Little information is available about its behavior in our soils. The present study is planned to determine zinc adsorption capacity of our soils. |
| RESEARCHERS | I. Saleem, F. Bibi and S.Javid |
| DURATION | 2009-10 to 2012-13 |
| LOCATION | Soil Chemistry Section, ISCES, Faisalabad |
| METHODOLOGY | Following soil series varying in calcium carbonate and clay contents will be used.<br>Non calcareous soil:<br>• Pindorian , Gujranwala, Guliana, Kotli<br>Moderately calcareous soils:<br>• Hafizabad, Lyalpur, Bhalwal, Sultanpur, Matli<br>Strongly calcareous:<br>• Rajar,Jhatpat<br>Stratified Soils:<br>• Shahdra, Rustam<br>Zn solution of different concentrations ranging from 0-30 mg /l will be applied in 10 mmolar $CaCl_2$. The soil will be equilibrated for 24 hours. The adsorption data will be plotted. The Langmuir and Freundlich models will be used to calculate maximum adsorption |

| | |
|---|---|
| | capacity of the soils. |
| PREVIOUS RESULTS: | SERIES Zn (mg/kg)<br>Sindhwan 200<br>Matli 476<br>Rajar 666<br>Gujranwala 526<br>Pindorian 434 |

| **TITLE-20** | **NUTRIENTS REMOVAL BY DIFFERENT WINTER VEGETABLES** |
|---|---|
| OBJECTIVE | Information on the removal of nutrients by vegetables is limited. Therefore this study is planned to determine the removal of nutrients (N, P, K, Cu, Zn, Fe, Mn and B) from soil by various vegetables. |
| RESEARCHERS | I. Saleem, F. Habib, S.Javid and K. Mahmood |
| DURATION | Continuous |
| LOCATION | VRI, AARI, Faisalabad |
| METHODOLOGY | Vegetable<br>Cauliflower<br>Onion<br>The samples will be collected from the research areas of Agronomic Research Institute and Vegetable Research Institute. Yield data of these vegetables will also be collected. The samples will be analyzed for N, P, K, Cu, Zn, Fe, Mn and B and nutrients removal will be calculated. |

**NUTRIENT REMOVAL BY SPINACH AND TURNIP**

| **Vegetables** | **Dry matter yield** | **N** | **P** | **K** | **Zn** | **Cu** | **Fe** | **Mn** |
|---|---|---|---|---|---|---|---|---|
| | **kg/ha** | **kg/ha** | | | **g/ha** | | | |
| Spinach | 3560 | 185 | 10 | 135 | 90 | 64 | 677 | 115 |
| Turnip (fruit) | 9430 | 356 | 30 | 341 | 733 | 134 | 777 | 690 |
| Turnip (leaves) | 3050 | 84 | 12 | 96 | 204 | 36 | 287 | 185 |
| Total | 12480 | 439 | 42 | 437 | 937 | 170 | 1064 | 875 |

| | |
|---|---|
| **TITLE-21** | **TO STUDY THE NITROGEN USE EFFICIENCY IN WHEAT THROUGH BED PLANTING** |
| OBJECTIVE | It is reported that the bed planting of wheat not only saves the water but also saves the fertilizer. This study is planned to monitor the saving of nitrogen by bed planting. |
| RESEARCHERS | A. Majeed, A. Niaz and S.Javid |
| DURATION | 2010-11 to 2012-13 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | Treatments:<br>N levels kg/ha<br>1. Control<br>2. 60<br>3. 80<br>4. 100<br>5. 120<br>6. 120 (conventional method of sowing)<br>7. Control (Flat)<br>In beds, the above nitrogen levels will be applied at the top of bed by topdressing. The basal dose of P and K will also be applied.<br>Recommended rate of fertilizer: 120-90-60 kg/ha<br>Soil analysis:<br>Basic soil analysis before sowing of wheat.<br>Plant analysis:<br>Grain and straw samples will be analyzed for N, P and K .<br>Yield data:<br>Wheat grain and straw yield data will be recorded.<br>Root data: Root length, weight and volume will be recorded in bed and flat sowing wheat. |

**PREVIOUS RESULTS**

**WHEAT BED PLANTING**

| Treatments | Grain yield t/ha | Straw yield ton/ha | % NPK at booting stage | | |
|---|---|---|---|---|---|
| | | | % N | % P | % K |
| N levels (kg/ha)Control | 1.54 D | 2.45 E | 1.43 D | 0.11 D | 2.58 C |
| 60 | 3.74 C | 6.12 D | 2.38 C | 0.17 C | 3.17 B |
| 80 | 4.51 B | 6.77 C | 2.69 B | 0.18 BC | 3.35 A |
| 100 | 4.93 A | 7.15 B | 2.71 AB | 0.20 A | 3.28 AB |
| 120 | 5.10 A | 7.37 AB | 2.81 A | 0.19 AB | 3.29 AB |
| 120 (Flat sowing) | 4.63 B | 7.66 A | 2.59 B | 0.19 AB | 3.19 B |
| Control (Flat) | 1.43 D | 2.54 E | 1.40 D | 0.12 D | 2.52 C |
| LSD | 0.25 | 0.30 | 0.12 | 0.013 | 0.14 |
| pH : 8.11; EC: 1.57 dS $m^{-1}$ ; O.M : 0.67 (%); Av. P: 8.74 ppm Av.K: 224 ppm | | | | | |

| **TITLE-22** | **TO EXAMINE THE EFFICIENCY OF SLOW RELEASING UREA WITH ORDINARY UREA IN RICE-WHEAT CROPPING SYSTEM (FIELD AND POT)** |
|---|---|
| OBJECTIVE | To compare the efficiency of various slow releasing urea with ordinary urea in rice-wheat rotation. |
| RESEARCHERS | F. Habib, S. Ihsan, A. Niaz and S. Javid |
| DURATION | 2012-13 to 2014-15 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| | METHODOLOGY<br>Rotation: Rice-wheat<br>Treatments:<br>1. Control<br>2. Recommended dose (120-90-60 kg/ha)<br>3. Farmer practice<br>4. K1 (Government recommended dose)<br>5. K1 (Farmer practice)<br>6. N1 (Government recommended dose)<br>7. N1 (Farmer practice) |

| | |
|---|---|
| | 8. L1 (Government recommended dose)<br>9. L1 (Farmer practice)<br>The urea treated with different compounds to inhibit nitrification will be provided by Dowood Hercules Fertilizer Limited. Before application, the products will be analyzed for nitrogen content. The recommended dose of NPK will be applied to wheat crop.<br>Design: RCBD in field and CRD in pots<br>Replication: 3<br>Soil analysis:<br>Before sowing and after harvest of crop for fertility status.<br>**Plant Analysis:**<br>The chlorophyll content will be monitored after 10, 20, 30, 40 and 50 days after germination of wheat. Sample at booting stage and at maturity (grain and straw) will be analyzed for nitrogen content.<br>Yield data:<br>Yield parameters and wheat grain and straw yield data will be recorded. |
| PREVIOUS RESULTS | Approved in Kharif 2012 |

| **TITLE-23** | **EFFECT OF DIFFERENT ORGANIC SOURCES ON THE AVAILABILITY OF APPLIED PHOSPHATE IN DIFFERENT TEXTURED SOILS** |
|---|---|
| OBJECTIVE | The present study is planned to find out the organic source which can reduce maximum P sorption and hence improve the P availability. |
| RESEARCHE | F. Bibi, S. Javid and M. Anwar |
| DURATION | 2010-11 to 2011-12 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad (pot experiment) |
| METHODOLOGY | <u>Soil</u><br>Two soil textures will be tested, i.e.<br>i. Clay Loam<br>ii. Sandy clay loam<br><u>Phosphorus level</u><br>200 mg/kg<br><u>Organic sources</u> (10 t/ha)<br>i. Press mud<br>ii. Processed City waste<br>iii. FYM |

| | |
|---|---|
| | iv. Poultry litter<br>Design: CRD with factorial arrangement of treatments<br>Replication: 3<br>Ten kg soil in each pot will be incubated in glasshouse with phosphorus and organic sources. During the course of study the soils will be kept at field capacity level. The soil samples at 0,10,20,30,60, 120 and 180 days will be collected for Olsen P estimation. |
| PREVIOUS RESULTS | Soil samples were collected and analyzed for Olsen P. Results are as follow. |

**Olsen P mg/kg after:**

| Treatments | | 1 day | 10 days | 60 days | 120 days |
|---|---|---|---|---|---|
| Sandy clay loam | Control | 128 | 97 | 45 | 37 |
| | Press mud | 203 | 214 | 63 | 69 |
| | City waste | 164 | 155 | 32 | 36 |
| | FYM | 129 | 141 | 43 | 48 |
| | Poultry litter | 195 | 133 | 33 | 33 |
| Clay loam | Control | 131 | 165 | 22 | 32 |
| | Press mud | 197 | 166 | 32 | 38 |
| | City waste | 188 | 180 | 35 | 38 |
| | FYM | 203 | 162 | 27 | 34 |
| | Poultry litter | 215 | 181 | 25 | 34 |

| **TITLE-24** | **TO STUDY THE EFFICIENCY AND ECONOMICS OF PHOSPHOCOMPOST ON WHEAT YIELD** |
|---|---|
| OBJECTIVE | The efficiency and economics of phosphocompost made from rock phosphate and organic manure will be tested for wheat crop. |
| RESEARCHERS | A. Majeed, A.H. Shah, Z. A. Ahmad and R.A. Sial |
| DURATION | 2011-12 to 2013-14 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |

| | |
|---|---|
| METHODOLOGY | Treatments:<br>1. Control<br>2. Recommended dose of NPK from fertilizer<br>3. Recommended dose of NPK + FYM<br>4. Phosphocompost (enriched with SSP on the basis of P)<br>5. Phosphocompost (enriched with rock phosphate on the basis of P)<br>The analysis of phosphocompost will be done before application.<br>Recommended rate of fertilizer = 120-90-60 kg/ha<br>Design: RCBD with 3 Replications<br>Soil analysis:<br>Basic soil analysis before sowing and after harvest of wheat.<br>Phosphocompost analysis:<br>N, P, K, Zn, Cu, Fe and Mn<br>Plant analysis:<br>Grain and straw samples will be analyzed for N, P,K and Zn<br>Yield data:<br>Wheat grain and straw yield data will be recorded |

**PREVIOUS RESULTS**

| Treatments | Grain yield t/ha | Straw yield t/ha | % NPK at booting stage | | |
|---|---|---|---|---|---|
| | | | % N | % P | % K |
| 1. Control | 1.62 D | 2.74 D | 1.73 D | 0.12 D | 2.25 C |
| 2. R.D of NPK | 3.96 B | 6.19 B | 2.5 BC | 0.18 B | 3.17 B |
| 3. NPK+FYM | 4.10 B | 6.75 A | 2.63 AB | 0.20 AB | 3.54 A |
| 4.Phosphocopost (enriched with SSP) | 4.41 A | 6.80 A | 2.66 A | 0.21 A | 3.61 A |
| 5.Phosphocopost (enriched with R.P) | 3.48 C | 5.53C | 2.41 C | 0.16 C | 3.07 B |
| LSD | 0.24 | 0.49 | 0.15 | 0.015 | 0.16 |
| pH : 8.17; EC: 1.92 dS $m^{-1}$ ; O.M : 0.67 (%); Av. P: 8.84 ppm Av.K: 206 ppm | | | | | |

| TITLE-25 | TO STUDY THE EFFICIENCY OF PHOSPHORIC ACID FOR WHEAT PRODUCTION |
|---|---|
| OBJECTIVE | This study is planned to compare the efficiency of phosphoric acid with traditional phosphatic fertilizers for wheat yield. |
| RESEARCHE | F. Bibi, I. Saleem and M. Anwar |
| DURATION | 2011-12 to 2013-14 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad (pot experiment) |
| METHODOLOGY | Treatments:<br>i. Control<br>ii. Recommended dose (RD) of P from SSP<br>iii. RD of P from DAP<br>iv. RD of P from phosphoric acid<br>v. RD of P from SSP + Humic Acid<br>vi. RD of P from DAP + Humic Acid<br>RD of NPK for wheat = 120-90-60 kg/ha<br>Design: RCBD with 3 replication<br>The phosphoric acid will be analyzed for heavy metals.<br>Soil analysis: Basic soil analysis<br>Plant analysis:<br>The wheat grain and straw samples will be analyzed for N, P, K, Zn, Cu, Fe, B, and Mn.<br>Yield data<br>The wheat grain and straw yield data will be recorded. |

**PREVIOUS RESULTS**

**EFFECT OF PHOSPHORIC ACID ON GRAIN YIELD AND NUTRIENTS CONCENTRATION**

| Treatment | Grain Yield | P | K | Zn | Cu | Fe | Mn |
|---|---|---|---|---|---|---|---|
| | t/ha | % | | ppm | | | |
| Control | 2.51 d | 0.54 | 0.4 | 36 | 4.6 | 126 | 56 |
| SSP | 4.48 b | 0.53 | 0.5 | 40 | 5.6 | 263 | 53 |
| DAP | 5.06 a | 0.54 | 0.6 | 44 | 6.8 | 563 | 56 |
| PA | 4.57 b | 0.56 | 0.5 | 50 | 7.1 | 378 | 63 |
| SSP + HA | 4.27 c | 0.53 | 0.4 | 39 | 5.5 | 231 | 56 |
| DAP +HA | 4.15 c | 0.54 | 0.4 | 47 | 6.7 | 319 | 59 |

| Treatments | Cost/ha | Yield (t/ha) | Price (Rs.) | Net Price (Rs) | CBR |
|---|---|---|---|---|---|
| Control | 0 | 2.51 | 65887 | -- | -- |
| SSP | 11150 | 4.48 | 117600 | 51713 | 4.64 |
| DAP | 15015 | 5.06 | 132825 | 66938 | 4.46 |
| PA | 19014 | 4.57 | 119962 | 54075 | 2.84 |
| SSP+ HA | 12838 | 4.27 | 112087 | 46200 | 3.60 |
| DAP + HA | 16703 | 4.15 | 118937 | 43050 | 2.58 |

LSD 0.16

| **TITLE-26** | **INTEGRATED USE OF BIO-GAS SLURRY AND CHEMICAL FERTILIZERS FOR WHEAT PRODUCTION** |
|---|---|
| OBJECTIVE | To compare the efficiency of biogas slurry with FYM alone and with different fertilizer combinations for wheat production. |
| RESEARCHERS | A. Mahmood, A.H. Shah and S. Javid |
| DURATION | 2012-13 to 2014-15 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | Crop: Wheat<br>Treatments:<br>1. RD of NPK (120-90-60 kg/ha)<br>2. Slurry on basis of RD of N through fertigation<br>3. Solid slurry on basis of RD of N<br>4. FYM on basis of RD of N<br>5. ½ N from slurry + ½ N from fertilizer<br>6. ½ N from solid slurry + ½ N from fertilizer<br>7. ½ N from FYM + ½ N from fertilizer<br>Design: RCBD<br>Replication 3<br>Slurry and FYM analysis<br>The analysis of slurry, solid and FYM will be done for N, P, K, Zn, Cu, Fe and Mn before application.<br>Soil analysis<br>Basic soil analysis will be carried out to evaluate the fertility status<br>Yield data<br>The data regarding wheat yield will be collected |

**PREVIOUS RESULTS**

**Nutrient contents of farm yard manure and slurry**

| | N | P | K | Zn | Cu | Fe | Mn | Ca | Mg |
|---|---|---|---|---|---|---|---|---|---|
| | % | | | Ppm | | | | | |
| Liquid Slurry | 0.85 | 0.58 | 0.88 | 74.4 | 28.6 | 1910 | 484 | 5934 | 6730 |
| Solid Slurry | 0.96 | 0.60 | 0.9 | 81.1 | 36 | 2000 | 464 | 6220 | 6580 |
| FYM | 0.79 | 0.53 | 0.77 | 73.6 | 22.6 | 1560 | 396 | 4200 | 5621 |

**EFFECT OF BIO-SLURRY AND CHEMICAL FERTILIZER ON CARROT YIELD (AT FARM)**

| Treatment | Carrot Yield (t/ha) | P (%) | K (%) | Zn (ppm) | Cu (ppm) | Fe (ppm) | Mn (ppm) |
|---|---|---|---|---|---|---|---|
| T1 | 42.89 a | 0.13 a | 3.70 a | 33.9 a | 7.77 a | 558 a | 42.7 a |
| T2 | 37.11 bc | 0.12 a | 3.50 a | 33.1 ab | 6.32 c | 471 b | 33.2 b |
| T3 | 36.89 c | 0.12 a | 3.43 a | 27.6 b | 6.15 c | 478 b | 30.3 b |
| T4 | 33.11 c | 0.11 a | 3.22 a | 29.3 ab | 6.49 bc | 484 b | 31.1 b |
| T5 | 41.33 ab | 0.13 a | 3.63 a | 33.8 a | 7.49 ab | 529 ab | 41.7 a |
| T6 | 36.89 c | 0.12 a | 3.56 a | 30.3 ab | 7.01 abc | 495 b | 37.9 ab |
| T7 | 36.0 c | 0.12 a | 3.57 a | 31.3 ab | 6.61 bc | 507 ab | 36.1 ab |
| LSD | 4.31 | 0.03 | 0.56 | 5.6 | 1.11 | 58.2 | 6.6 |
| pH: 8.23 ; EC : 1.98 dS $m^{-1}$ ; O.M : 0.76 % ; Av. P : 11.63 ppm, Av. K: 200 ppm | | | | | | | |

**Effect of bio-slurry and chemical fertilizer on carrot yield (at farmer's field)**

| Treatment | Carrot Yield (t/ha) | P (%) | K (%) | Zn (ppm) | Cu (ppm) | Fe (ppm) | Mn (ppm) |
|---|---|---|---|---|---|---|---|
| T1 | 34.64 a | 0.137 a | 3.63 a | 35.6 a | 6.72 a | 462 a | 31.7 a |
| T2 | 29.12 cd | 0.133 a | 3.09 b | 28.5 c | 6.45 a | 437 a | 23.2 b |
| T3 | 28.89 cd | 0.137 a | 3.29 ab | 27.7 c | 6.53 a | 459 a | 21.3 b |
| T4 | 31.34 bc | 0.130 a | 3.16 b | 28.3 c | 6.57 a | 454 a | 20.1 b |
| T5 | 32.45 ab | 0.143 a | 3.63 a | 32.3 b | 6.61 a | 461 a | 27.7 a |
| T6 | 27.56 d | 0.123 a | 3.43 ab | 28.9 c | 6.55 a | 433 a | 26.9 ab |
| T7 | 26.89 d | 0.134 a | 3.36 ab | 29.5 bc | 6.54 a | 460 a | 25.1 ab |
| LSD | 2.63 | 0.025 | 0.42 | 3.20 | 0.54 | 33.3 | 3.3 |
| pH: 8.46 ; EC : 2.14 dS $m^{-1}$ ; O.M : 0.64 % ; Av. P : 10.78 ppm, Av. K: 160 ppm | | | | | | | |

| **TITLE-27** | **COMPARISON OF ZINC ENRICHED COMPOST AND MINERAL ZINC FERTILIZER ON GROWTH AND ZINC USE EFFICIENCY IN WHEAT** |
|---|---|
| OBJECTIVE | This study has been planned to assess whether Zn enriched compost improves the Zn-availability or not in our soils. |
| RESEARCHERS | A. H. Shah, A. Mahmood, A. Niaz and R.A. Sial |
| DURATION | 2012-13 to 2014-15 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |

| | |
|---|---|
| METHODOLOGY | Treatments:<br>1. Control<br>2. RD NPK<br>3. RD NPK + Compost<br>4. RD NPK + Zn @ 5 kg $ha^{-1}$<br>5. RD NPK + enriched compost with Zn @ 2.5 kg $ha^{-1}$<br>6. RD NPK + enriched compost with Zn @ 5 kg $ha^{-1}$<br>Recommended NPK = 120-90-60 kg $ha^{-1}$<br>Design: RCBD with 3 replications<br>Soil analysis:<br>Basic soil analysis before sowing of wheat including Zn status.<br>Zinc enriched compost analysis:<br>N, P, K and Zn<br>Plant analysis:<br>Wheat grain and straw samples will be analyzed<br>for N, P,K and Zn<br>Yield data:<br>Wheat grain and straw yield data will be recorded |
| PREVIOUS RESULTS | Approved in Kharif 2012 |

| **TITLE-28** | **IMPACTS OF MORINGA LEAF EXTRACT (MLE) ON GROWTH, YIELD AND NUTRIENT UPTAKE OF WHEAT** |
|---|---|
| OBJECTIVES | It is claimed that moringa leaf extract contains plant growth hormones which can increase yields by 25-30 %. This study is planned to assess its efficacy on wheat yield. |
| RESEARCHERS | S.S.H. Shah, A.Nawaz, A. Niaz and S.Javid |
| DURATION | 2012-13 to 2014-15 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | Following treatments will be tested on wheat.<br>1. Recommended NPK.<br>2. NPK + 2 % three sprays of MLE (from two leaves stage at 15 days interval).<br>3. NPK + 2 % six sprays of MLE (from two leaves stage at 15 days interval).<br>4. NPK + 3 % six sprays of MLE (at two leaves stage, tillering and booting stage).<br>5. NPK + 4 % four sprays of MLE (from two leaves stage at 15 |

| | |
|---|---|
| | days interval).<br>6. NPK + 4 % six sprays of MLE (from two leaves stage at 15 days interval).<br>Formulation of MLE:<br>Leaf extract will be formulated by grinding 10 kg fresh material of young moringa shoots in 1 L distilled water and then filter the solid out of the solution by placing the solution in a cloth and wringing-out the liquid. After filtration the extract will be diluted up to 2, 3 and 4 percent solutions with water (e.g. 2 %=2 L moringa leaf extract/100 L water). The diluted material will be sprayed directly onto wheat plants in each treatment plot.<br>Design: RCBD with three replications.<br>Soil Analysis: Basic soil analysis to evaluate the soil fertility.<br>Plant Analysis:<br>Wheat grain and straw samples will be collected and analyzed for N, P, K, Zn, Mn, B, Cu and Fe concentrations. Uptake will be calculated.<br>Yield Data: Wheat grain and straw yield data will be recorded. |
| PREVIOUS RESULTS | Approved in Kharif 2012 |

| **TITLE-29** | **RESPONSE OF VEGETABLES (CAULIFLOWER) TO MORINGA LEAF EXTRACT (MLE)** |
|---|---|
| OBJECTIVES | It is being reported that moringa leaf extract can increase yields up to 25-30 % for many vegetables. This study is initiated to evaluate the response of cauliflower to moringa leaf extract (MLE). |
| RESEARCHERS | A.Mahmood, S.S.H.Shah and M. Anwar |
| DURATION | 2012-13 to 2014-15 |
| LOCATION | Soil Chemistry Section, ISCES, Faisalabad |
| METHODOLOGY | Following treatments will be tested on cauliflower<br>1. Control (RD of NPK 111-86-62 kg/ha).<br>2. NPK + 2 % four sprays of MLE (15 days interval after transplanting).<br>3. NPK + 3 % four sprays of MLE (15 days interval after transplanting).<br>4. NPK + 4 % four sprays of MLE (15 days interval after transplanting).<br>All P, K and ½ N will be applied at sowing of cauliflower while remaining ½ N will be applied with first irrigation. |

| | |
|---|---|
| | Design: RCBD with three replications.<br>Soil Analysis: Basic soil analysis for fertility evaluation.<br>Plant Analysis: Cauliflower samples at maturity will be analyzed for N, P, K, Zn, Mn, B, Cu and Fe concentrations and total uptake will be calculated.<br>Yield data: Cauliflower yield data will be recorded. |
| PREVIOUS RESULTS | New experiment. |

| **TITLE-30** | **EFFECTS OF GREEN MANURING ON SOIL PROPERTIES AND CROP GROWTH UNDER RICE-WHEAT CROPPING SYSTEM** |
|---|---|
| OBJECTIVE | The study is planned to evaluate the impact of green manuring (Sesbania aculeate) in combination with different levels of NPK on crops yield and soil physico-chemical properties in rice-wheat cropping system. |
| RESEARCHERS | S.Ehsan, A. Mahmood, A. Niaz and S.Javid |
| DURATION | 2012-13 to 2013-14 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | Treatments:<br>1. Control<br>2. Recommended NPK + no green manuring<br>3. Recommended NPK + green manuring<br>4. 50 % of recommended NPK + green manuring<br>5. 75 % of recommended NPK + green manuring<br><br>Recommended dose of NPK for wheat and rice will be 120-90-60 and 150-90-60 kg $ha^{-1}$, respectively. All P and K at seed bed preparation and N will be applied in two splits.<br>Design: RCBD with three replications.<br>Yield data: Grain and straw yield of wheat and rice will be recorded.<br>Soil Analysis: Basic soil analysis (ECe, pHs, OM, Texture, bulk density, N, P, K, Zn, Fe, B, Mn and Cu concentrations before sowing and after harvest of each crop.<br>Root data: Root length, weight and volume will be recorded in all plots.<br>Plant Analysis:<br>N, P, K, Zn, Fe, B, Mn and Cu contents and uptake of NPK by wheat and rice crops. |

## PREVIOUS RESULTS

### EFFECT OF GREEN MANURING ON WHEAT GRAIN AND STRAW YIELD

| **Treatments** | **Grain Yield (t/ha)** | **Straw Yield (t/ha)** |
|---|---|---|
| Control | 2.83 d | 4.77 b |
| NPK (no green manuring) | 4.10 a | 8.05 a |
| Recommended NPK + green manuring | 4.11 a | 7.73 a |
| 75 % of recommended NPK + green manuring | 3.93 b | 8.66 a |
| 50 % of recommended NPK + green manuring | 3.73 c | 7.38 a |
| LSD | 0.097 | 2.46 |

| **TITLE- 31** | **FERTILIZER REQUIREMENT OF DIFFERENT ADVANCE LINES OF WHEAT CROP** |
|---|---|
| OBJCTIVES | This study was planned to calculate the fertilizer requirement of different advance lines of wheat crop. |
| RESEARCHERS | A. Nawaz, A. Naiz and S. Javid |
| DURATION | 2011-12 to 2013-14 |
| LOCATION | Soil Chemistry section, ISCES, Faisalabad |
| METHODOLOGY | <u>Treatments kg/ha</u> <u>Wheat Advance lines</u><br>i. Control V-7076<br>ii. 90-60-30 V-8171<br>iii. 120-90-60 V-8173<br>iv. 150-120-90 V-8203<br>v. 180-150-90 V-7096<br>Design : Split plot design<br>Replications: 3<br>Yield Data:<br>Agronomic parameters and grain & straw yield will be recorded. |

**PREVIOUS RESULTS**

**Effect of fertilizer doses on grain yield of wheat advance lines**

| Treatments (N-P- K kg ha$^{-1}$) | V-7076 | V-8171 | V-8173 | V-8203 | V-7096 |
|---|---|---|---|---|---|
| T1 (Control) | 1.97C | 1.64B | 1.98C | 2.10C | 2.09B |
| T2 (90-60-30) | 3.54B | 3.59A | 3.36B | 3.8B | 3.68A |
| T3 ( 120- 90-60) | 4.12AB | 3.80A | 3.74B | 3.90B | 3.96A |
| T4 (150-120-90) | 4.08AB | 4.07A | 3.92B | 4.63A | 4.03A |
| T5 (180-150-90) | 4.35A | 4.19A | 4.37A | 4.48 AB | 4.10A |

**Effect of fertilizer doses on biomass yield of different advance lines.**

| Treatments (N-P- K kg ha$^{-1}$) | V-7076 | V-8171 | V-8173 | V-8203 | V-7096 |
|---|---|---|---|---|---|
| T1 (Control) | 5.64C | 5.10C | 5.19C | 5.82B | 5.72C |
| T2(90-60-30) | 7.53B | 10.48 B | 9.95B | 10.13AB | 10.30A |
| T3 ( 120- 90-60) | 12.28A | 12.01AB | 11.56AB | 13.08A | 10.30A |
| T4(150-120-90) | 12.43A | 12.90A | 11.94AB | 13.44A | 10.21A |
| T5(180-150-90) | 12.37A | 11.37AB | 13.63A | 12.99A | 10.02B |

| **TITLE-32** | **EVALUATION OF FOLIAR VS SOIL APPLICATION OF POTASSIUM FOR WHEAT** |
|---|---|
| OBJECTIVE | A study is planned to test efficiency of foliar applied potassium with soil applied potassium fertilizer on wheat yield. |
| RESEARCHERS | A.H. Shah, S. Javid and R.A.Sial |
| DURATION | 2011-12 to 2012-13 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | 1. Control |

| | |
|---|---|
| | 2. Recommended NPK (K as soil application)<br>3. Recommended NP + 2 % $KNO_3$ as foliar application (2 sprays)<br>4. Recommended NP + 3 % $KNO_3$ as foliar application (2 sprays)<br>5. Recommended NP + ½ soil applied K + 2 % $KNO_3$ as foliar application<br>Recommended NPK @ 120-90-60 kg/ha<br>Source of Potassium = Potassium nitrate<br>Design: RCBD<br>Replication: 3<br>Soil analysis: Pre sowing soil analysis for pH, EC, K. P. OM.<br>Plant analysis: Potassium uptake curve will be studied in plants. NPK at booting stage and at harvesting.<br>Yield data: The wheat grain and straw yield data will be recorded. |

PREVIOUS RESULTS

| Treatments | Grain yield t/ha | Straw yield ton/ha | % NPK at booting stage | | |
|---|---|---|---|---|---|
| | | | % N | % P | % K |
| 1.Control | 1.82B | 3.66C | 1.71 C | 0.17 B | 2.4 C |
| 2. NPK | 5.41A | 8.76AB | 2.30 B | 0.20 AB | 3.34 B |
| 3. NP+2%$KNO_3$ | 5.41A | 8.43AB | 2.30 B | 0.23 A | 4.32 A |
| 4. NP+3%$KNO_3$ | 5.36A | 7.93B | 2.36 A | 0.23 A | 4.00 AB |
| 5. NP+1/2 soil K+2%$KNO_3$ | 5.62A | 9.93 A | 2.40 A | 0.21 AB | 4.9 A |
| LSD | 0.33 | 1.65 | 0.049 | 0.062 | 0.67 |
| pH : 7.58; EC: 1.34 dS $m^{-1}$ ; O.M : 0.67 (%); Av. P: 10.23 ppm Av. K: 220 ppm | | | | | |

| **TITLE-33** | **POTASSIUM REQUIREMENT OF TOMATO FOR OPTIMUM YIELD AND QUALITY IN ALKALINE CALCAREOUS SOILS** |
|---|---|
| OBJECTIVE | This study is planned to assess the effect of potassium on the optimum growth, quality and yield of Tomato. |
| RESEARCHERS | A. MAhmood, M. Sarfraz and A. Niaz |

| | |
|---|---|
| DURATION | 2011-12 to 2013-14 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | Treatments:<br>1. Control (Recommended NP)<br>2. NP+100 % Recommended K as basal dose<br>3. NP+ 100 % Recommended K as ½ basal + ½ at 40 DAT<br>4. NP+ 150 % Recommended K as basal dose<br>5. NP+ 150 % Recommended K as ½ basal + ½ at 40 DAT<br>6. NP+ 200 % Recommended K as basal dose<br>7. NP+ 200 % Recommended K as ½ basal + ½ at 40 DAT<br>Recommended NPK will be applied @ 100-90-60 kg $ha^{-1}$.<br>Design: RCBD with three replications.<br>Quality parameters:<br>Soluble solids %, citric acid, pH, reducing sugars (%), dry wt(%).<br>Yield data: Fruit yield data will be recorded.<br>Soil Analysis:<br>Basic soil analysis before sowing and after harvest of crop.<br>Plant Analysis:<br>N, P, K, Zn, Fe, B, Mn and Cu content and uptake of K by tomato crop. |

PREVIOUS RESULTS

**Effect of Potassium application on yield and nutrient concentrations in tomato leaves**

| Treatment | Tomato yield | Zn | Cu | Fe | Mn |
|---|---|---|---|---|---|
| | t/ha | -ppm- | | | |
| T1 | 18.10 b | 57.6 cd | 10.3 c | 434.7 c | 18.0 cd |
| T2 | 19.77 ab | 52.9 d | 11.0 bc | 436.7 c | 16.5 d |
| T3 | 22.31 ab | 65.1 ab | 12.2 ab | 476.3 a | 23.4 b |
| T4 | 19.88 ab | 58.2 cd | 11.9 abc | 449.2 bc | 24.9 ab |
| T5 | 19.69 ab | 59.3 bc | 12.3 ab | 443.7 a | 22.3 bc |
| T6 | 23.59 a | 69.4 a | 12.9 a | 471.6 bc | 29.2 a |
| T7 | 20.06 ab | 62.5 bc | 12.2 ab | 453.5 abc | 21.0 bcd |
| LSD | 4.85 | 5.17 | 1.64 | 24.0 | 4.12 |
| pH : 8.00; EC: 1.23 dS $m^{-1}$ ; O.M : 0.71 (%); Av. P: 6.72 ppm Av. K: 125 ppm, Zn 0.51ppm, B: 0.31ppm. | | | | | |

**Effect of Potassium application on quality of tomato**

| Treatments | Fresh weight (g) | TSS | Vit. C mg/ 100 ml |
|---|---|---|---|
| T1 | 81.32 | 3.63 | 24.4 |
| T2 | 79.61 | 4.00 | 26.9 |
| T3 | 85.08 | 4.00 | 33.3 |
| T4 | 92.19 | 4.03 | 20.5 |
| T5 | 111.42 | 3.67 | 21.8 |
| T6 | 96.38 | 4.17 | 20.5 |
| T7 | 105.80 | 4.10 | 28.2 |

**Effect of Potassium application on quality of tomato**

| Treat-ments | Acidity | Dry matter | Moisture | Ash | Firmness | Reducing sugar | Non Reducing sugar | Total invert Sugar |
|---|---|---|---|---|---|---|---|---|
| | -%- | | | | | | | |
| T1 | 0.69 | 5.09 | 94.9 | 0.71 | 6.23 | 2.45 | 3.91 | 1.38 |
| T2 | 0.75 | 5.99 | 94.0 | 0.67 | 7.19 | 2.18 | 3.90 | 1.64 |
| T3 | 0.84 | 6.35 | 93.7 | 0.60 | 7.47 | 2.17 | 3.91 | 1.65 |
| T4 | 0.76 | 5.93 | 94.1 | 0.61 | 7.62 | 3.17 | 4.00 | 0.78 |
| T5 | 0.72 | 5.66 | 94.3 | 0.77 | 7.92 | 2.88 | 4.05 | 1.11 |
| T6 | 0.69 | 6.37 | 93.6 | 0.79 | 10.09 | 3.18 | 4.10 | 0.88 |
| T7 | 0.94 | 6.02 | 84.0 | 0.63 | 9.15 | 2.35 | 3.94 | 1.51 |

| | |
|---|---|
| TITLE-34 | **LONG-TERM EFFECT OF ORGANIC AND INORGANIC FERTILIZER USE ON SOIL CARBON & NITROGEN SEQUESTRATION** |
| OBJECTIVE | To study the carbon and nitrogen dynamics and their sequestration potential in inorganic, organic and integrated treated plots since 1978. |
| RESEARCHERS | A.Majeed, M. Abbas and S.Javid |
| DURATION | 2011-12 to 2012-13 |
| LOCATION | Soil Chemistry Section, ISC&ES, Faisalabad |
| METHODOLOGY | The soil samples of a long term field study (since 1978) having the following treatments will be collected from 0-15 and 15-30 cm depth. |

| | |
|---|---|
| | • Control<br>• Only N from chemical fertilizer<br>• NP from chemical fertilizer<br>• NPK from chemical fertilizer<br>• FYM on the basis of nitrogen<br>• ½ nitrogen from fertilizer and ½ from FYM<br>• ½ NP from fertilizer<br>The soil aggregates will be separated through wet sieving (2.0, 0.25 and 0.05 mm) and carbon and nitrogen will be measured. The bulk density will also be measured to calculate the soil organic stock on per hectare by depth basis. |

PREVIOUS RESULTS

| Treatments | SOC (g/kg) | Bulk Density ($Mg/m^3$) | SOC pool after 34 years (Mg/ha) | Change in SOC stock (0-15 cm) after 34 years | |
|---|---|---|---|---|---|
| | | | | SOC change (Mg/ha) | Rate of Carbon Sequestration (kg/ha/year) |
| Control | 3.03 F | 1.48 A | 6.74 F | -2.39 F | -70.43 F |
| N | 3.62 E | 1.46 B | 7.93 E | -1.21 E | -35.41 E |
| NPK | 5.02 C | 1.41 D | 10.61 C | 1.47 C | 43.19 C |
| ½ N urea + ½ N FYM | 5.36 B | 1.38 E | 11.13 B | 1.98 B | 58.32 B |
| FYM | 6.39 A | 1.35 F | 12.97 A | 3.83 A | 112.66 A |
| ½ NP | 3.98 D | 1.43 C | 8.58 D | -0.56 D | -16.61 D |
| NP | 4.94 C | 1.41 E | 10.47 C | 1.33 C | 39.19 C |
| LSD | 0.16 | 0.015 | 0.36 | 0.36 | 10.68 |

| **TITLE-35** | **LONG-TERM EFFECT OF FERTILIZER USE ON SOIL PROPERTIES** |
|---|---|
| OBJECTIVE | To determine the long-term fertilizer use effects on soil properties. |
| RESEARCHERS | Z.A. Ahmad, A. Mahmood and M. Anwar |
| DURATION | Since 1978 |

| | | | | |
|---|---|---|---|---|
| LOCATION | Soil Chemistry Section, ISCES, Faisalabad | | | |
| METHODOLOGY | CROP ROTATION: Wheat-maize fodder- wheat<br>Crop : Wheat<br>Fertilizer rate : 120-90-60 kg/ha | | | |
| | Treatments | N | $P_2O_5$ | $K_2O$ |
| | Control | 0 | 0 | 0 |
| | N | 120 | 0 | 0 |
| | NP | 120 | 90 | 0 |
| | NPK | 120 | 90 | 60 |
| | N-FYM | 120 kg N from FYM | | |
| | ½ N from urea +½N from FYM | 60 kg N from urea+60 kg N from FYM | | |
| | ½ NP | 60 | 45 | 0 |
| | *N in FYM was 0.65% on oven dry basis. | | | |
| Soil analysis: BD and PR after every two years whereas EC, pH, OM, available P & K after every crop and total P, K and Ext. Cd after every 2 years. | | | | |

**PREVIOUS RESULTS**

**Wheat grain yield and soil properties before sowing**

| **Treatments** | **Wheat grain yield t/ha** | **pH** | **ECe (dS $m^{-1}$)** | **O.M. %** | **P mg/kg** | **K mg/kg** |
|---|---|---|---|---|---|---|
| Control | 2.018 | 8.35 | 1.76 | 0.38 | 7.8 | 197 |
| N | 2.998 | 8.38 | 1.75 | 0.42 | 7.5 | 216 |
| NP | 4.697 | 8.25 | 1.54 | 0.60 | 16.1 | 216 |
| NPK | 4.883 | 8.18 | 1.57 | 0.70 | 14.1 | 197 |
| N from FYM | 3.053 | 8.35 | 2.14 | 1.15 | 16.6 | 276 |
| ½ Urea-N+½FYM-N | 3.112 | 8.18 | 2.16 | 1.04 | 16.3 | 236 |
| ½ NP | 3.968 | 8.33 | 1.54 | 0.70 | 15.0 | 197 |

# PESTICIDE QUALITY CONTROL LABS

<table>
<tr><td>1</td><td>TITLE</td><td>TESTING OF PESTICIDE QUALITY CONTROL SAMPLES UNDER AGRICULTURAL PESTICIDE ORDINANCE 1971</td></tr>
<tr><td></td><td>OBJECTIVES</td><td>To test the pesticide quality control samples received in pesticide quality control laboratories from pesticide inspectors and purchasers of pesticides under the Agricultural Pesticide Ordinance (APO) 1971 and Agricultural Pesticide Rules 1973.</td></tr>
<tr><td></td><td>RESEARCH WORKER(S)</td><td>Technical staff of respective Labs</td></tr>
<tr><td></td><td>DURATION</td><td>Continuous</td></tr>
<tr><td></td><td>LOCATION</td><td>▪ Pesticide Quality Control Laboratory, Faisalabad.<br>▪ Pesticide Quality Control Laboratory, Kala Shah Kaku.<br>▪ Pesticide Quality Control Laboratory, Multan.<br>▪ Pesticide Quality Control Laboratory, Bahawalpur</td></tr>
<tr><td></td><td>PLAN OF WORK</td><td>Samples of pesticides (insecticides, herbicides, fungicides etc.) registered under APO, 1971 will be received from the Govt. nominated pesticide inspectors. Registered specifications of these pesticide samples will be checked by following Standard Test Methods (STM). Analysis reports of pesticide sample will be sent to the concerned quarters. Purchasers/user of pesticides will also be provided pesticide analytical services on receipt of prescribed fee.</td></tr>
<tr><td></td><td>PREVIOUS RESULTS</td><td>▪ Pesticide samples analyzed during Rabi 2011-12(From November, 2011 to April, 2012) under section-17 of APO.
<table>
<tr><td>Laboratory</td><td>Total</td><td>Fit</td><td>Unfit</td></tr>
<tr><td>Faisalabad</td><td>1002</td><td>979</td><td>23</td></tr>
<tr><td>Kala Shah Kaku</td><td>1008</td><td>988</td><td>20</td></tr>
<tr><td>Multan</td><td>622</td><td>603</td><td>19</td></tr>
<tr><td>Bahawalpur</td><td>380</td><td>370</td><td>10</td></tr>
<tr><td>Total</td><td>3012</td><td>2940</td><td>72</td></tr>
<tr><td>%</td><td>-</td><td>97.60</td><td>2.40</td></tr>
</table>
▪ Pesticide samples analyzed during 2011-12 (From November, 2011 to April, 2012) under section-20 of APO.
<table>
<tr><td>Laboratory</td><td>Total</td><td>Fit</td><td>Unfit</td></tr>
<tr><td>Faisalabad</td><td>20</td><td>16</td><td>4</td></tr>
<tr><td>%</td><td></td><td>80</td><td>20</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>2</td><td>TITLE</td><td>STUDIES ON THE STORAGE STABILITY OF DIFFERENT PESTICIDE FORMULATION AT AMBIENT TEMPERATURE AND HUMIDITY</td></tr>
<tr><td></td><td>OBJECTIVES</td><td>▪ To determine the storage stability/ shelf life of different pesticide formulation at ambient temperature and humidity<br>▪ To determine how long these products continue to conform to the registered specifications under ambient temperature and humidity storage conditions.</td></tr>
<tr><td></td><td>RESEARCH WORKER(S)</td><td>Technical staff of respective Labs</td></tr>
<tr><td></td><td>DURATION</td><td>Continuous</td></tr>
</table>

| | | |
|---|---|---|
| | LOCATION | ▪ Pesticide Quality Control Laboratory, Faisalabad.<br>▪ Pesticide Quality Control Laboratory, Kala Shah Kaku.<br>▪ Pesticide Quality Control Laboratory, Multan.<br>▪ Pesticide Quality Control Laboratory, Bahawalpur |
| | TREATMENTS | Selected registered pesticides will be kept in store under local condition of storage i.e. ambient temperature and humidity. |
| | PLAN OF WORK | Different pesticide formulations will be kept in store under local storage condition i.e. ambient temperature and humidity. The products under study will be analyzed at the start of the experiment and subsequently after every three months for their physical and chemical characteristics. The experiment will be continued until these products continue to conform to the registered specifications. |

| | |
|---|---|
| | PREVIOUS RESULTS |

| **Pesticides** | **Physical / a. i. test results on specified dates** | | **Remarks** |
|---|---|---|---|
| | 04/12 | 07/12 | |
| Faisalabad Lab | | | |
| Bifenthrin 10 EC | Creaming = Nil<br>10.95 / 11.0 % | Creaming = Nil<br>10.80 / 11.0 % | Fit |
| Difenconzole 2.5 EC | Creaming = Nil<br>24.86/25.0 % | Creaming = Nil<br>24.70/25.0 % | Fit |
| Emamectin Benzoate 1.9EC | Creaming = Nil<br>2.07 / 2.10 % | Creaming = Nil<br>2.01 / 2.10 % | Fit |
| | 05/12 | 08/12 | |
| Kala Shah Kaku | | | |
| Carbofuran 3 G | 3.0 % / 3.0 % | 2.96 % / 3.0 % | Fit |
| Imida 25 WP | 24.90% / 25.0 % | 24.72% / 25.0 % | Fit |
| Emamectin Benzoate 1.9EC | 2.10 / 2.10 %<br>Creaming = Nil | 2.02 / 2.10 %<br>Creaming = Nil | Fit |

| | | | |
|---|---|---|---|
| | 05/12 | 08/12 | |
| Multan Lab | | | |
| Pyriproxyfen 10.8 EC | Creaming = Nil<br>11.40 / 11.40 % | Creaming = Nil<br>11.28 / 11.40 % | Fit |
| Acetochlor 50 EC | Creaming = Nil<br>50.0 / 50.0 % | Creaming = Nil<br>49.3 / 50.0 % | Fit |
| Imida 25 wp | 24.8/25.0 % | 24.5 / 25.0 % | Fit |

| | | |
|---|---|---|
| 3 | TITLE | **STUDIES ON THE STORAGE STABILITY OF PESTICIDES AT HIGH TEMPERATURE i.e. 54 ± 2 °C** |
| | OBJECTIVES | To test the storage stability of different pesticide formulation by applying standard storage stability test at temperature 54 ± 2 °C for 14 days |
| | RESEARCH WORKER(S) | Technical staff of respective Labs |
| | DURATION | Continuous |
| | LOCATION | Pesticide Quality Control Laboratories at Faisalabad, Multan, Kala Shah Kaku and Bahawalpur. |
| | TREATMENTS | Some selected registered pesticides will be subjected to temperature treatment at 54 ± 2 °C for 14 days in an oven as per CIPAC method. |
| | PLAN OF WORK | The selected pesticides samples will be collected from different sources. Pesticides will be analyzed for their Physico-chemical characteristics before and after treating them at 54 ± 2 °C for 14 days. |
| | PREVIOUS RESULTS | **Faisalabad Lab**<br>Four pesticide formulations were tested (Glyphosate 48 SL, Endusulfan 35 EC, Monomehypo 5% G and Pyriproxyfen 10.8 EC). All the formulations were found as per specifications and qualified the standard storage stability test. |
| | | **Kala Shah Kaku Lab**<br>Three pesticides samples i.e., Butachlor 60 EC, Imidacloprid 20 SL and Dimethoate 40 EC were tested. All the formulations were found as per specifications after treating at 54±2°C for 14 days and qualified the standard storage stability test. |
| | | **Bahawalpur Lab**<br>Three pesticide formulations were tested (Deltamethrin 2.5 EC, Cure 1.8 EC and Clodinafop 15 wp). All the formulations were found as per specifications and qualified the standard storage stability test. |

| | | |
|---|---|---|
| 4 | TITLE | **RESIDUAL EFFECT OF WEEDICIDES IN WHEAT CROP** |
| | OBJECTIVES | To study the weedicides residues in wheat grains. |
| | RESEARCH WORKER(S) | Sarfraz Hussain; Khalid Mehmood; Muhammad Arif & Ghulam Yaseen |
| | DURATION | 2012-2014 |
| | LOCATION | Plant Pathology Research Institute Area, AARI, Faisalabad. |
| | TREATMENTS | $T_1$= Clodinafop 15% WP @ 100 g $acre^{-1}$<br>$T_2$= Clodinafop 15% WP @ 120 g $acre^{-1}$<br>$T_3$= Clodinafop 15% WP @ 150 g $acre^{-1}$<br>$T_4$= Control |
| | PLAN OF WORK | The experiments will be conducted at AARI Faisalabad in RCBD with three replications. The herbicide will be sprayed after first irrigation. Grain samples will be collected and will be analyzed for residual analysis. The samples will be analyzed at Pesticide Residue Lab, Kala Shah Kaku. |
| | PREVIOUS RESULTS | New trial. |

| | | |
|---|---|---|
| 5 | TITLE | **STUDY OF THE BIFENTHRIN 10% EC RESIDUES IN GUAVA** |
| | OBJECTIVES | To study bifenthrin residues in Guava. |
| | RESEARCH WORKER(S) | Sarfraz Hussain; Muhammad Javaid Ahmad; Muhammad Arif & Sarfraz Nawaz |
| | DURATION | 2012-2014 |
| | LOCATION | Horticultural Garden, AARI, Faisalabad. |
| | TREATMENTS | $T_1$= Bifenthrin 10% EC @ 0.5 ml $L^{-1}$<br>$T_2$= Bifenthrin 10% EC @ 0.75 ml $L^{-1}$<br>$T_3$= Bifenthrin 10% EC @ 1.0 ml $L^{-1}$<br>$T_4$= Control |
| | PLAN OF WORK | The experiments will be conducted at AARI Faisalabad in CRD with three replications. Bifenthrin will be sprayed against insects at fruiting stage. Samples will be collected from all the treatments (after 2 to 3 days). The samples will be analyzed at Pesticide Residue Lab, Kala Shah Kaku for Bifenthrin residues. |
| | PREVIOUS RESULTS | New trial. |

| | | |
|---|---|---|
| 6 | TITLE | **BIOAUGUMENTATION AS A TOOL FOR DECONTAMINATION OF AGRICULTURAL SOILS POLLUTED WITH HERBICIDE ISOPROTURON** |
| | OBJECTIVES | To ensure the quality and quantity of wheat production, crop is extensively treated with Isoproturon weedicide. There are limited studies on the fate of Isoproturon in soil. This experiment was planned to study the biodegradation potential of this herbicides in the agricultural fields. |
| | RESEARCH WORKER(S) | Riaz Ahmad Sial; Sarfraz Hussain;<br>Sabir Hussain, GC University, Faisalabad.<br>Muhammad Arif |
| | DURATION | 2012-2014 |
| | LOCATION | Pesticide Quality Control Laboratory, Faisalabad.<br>GC University, Faisalabad. |
| | PLAN OF WORK | Soil samples will be collected from the wheat fields with the history of treated with Isoproturon. The soil samples will be |

| | | |
|---|---|---|
| | | analyzed for Isoproturon residues. The microbes having the potential of biodegradation of this herbicide will be tested according to following procedure:-<br>1. Isolation and purification of microbes capable of degrading this herbicide<br>2. Identification of microbes through 16sRNA<br>3. Optimization of environmental parameters to accelerate biodegradation<br>4. Application in the field |
| | PREVIOUS RESULTS | New trial. |

| | | |
|---|---|---|
| 7 | TITLE | **STANDARDIZATION OF ANALYTICAL METHODS FOR PESTICIDE FORMULATION ANALYSIS** |
| | OBJECTIVES | Every year some new pesticides are being introduced into the markets by companies to meet the ever changing demand of the pesticide trade. It is imperative to standardize analytical methods of those new products under prevailing local lab conditions and facilities before applying it for quality control of pesticides regulatory samples. |
| | RESEARCH WORKER(S) | Technical staff of respective Labs |
| | DURATION | Continuous |
| | LOCATION | ▪ Pesticide Quality Control Laboratory, Faisalabad.<br>▪ Pesticide Quality Control Laboratory, Kala Shah Kaku.<br>▪ Pesticide Quality Control Laboratory, Multan.<br>▪ Pesticide Quality Control Laboratory, Bahawalpur |
| | PLAN OF WORK | Methods of analysis for new pesticides will be standardized according to local lab conditions and testing facilities available. Methods of existing pesticides will also be standardized according to the latest techniques, where necessary. |
| | PREVIOUS RESULTS | Methods for the Fenoxanil, Pymetrazin, Nicosulfuran + Atrazine, Bispyribac Sodium, Temephos, clofentrazine and Pyriproxyfen have been standardized. |

# PESTICIDE RESIDUE LAB KAKA SHAH KAKU

| **TITLE: 1** | **BASKET MARKET SURVEY FOR THE EVALUATION OF PESTICIDE RESIDUE STUDY IN FRUIT AND VEGETABLES** |
|---|---|
| OBJECTIVE | To study the pesticide residue in fruits and vegetables. |
| RESEARCH WORKERS | R. A. Sial, G. A Mand, R. Ahmad and M. Rahim |
| PROJECT DURATION | 2012-13 |
| LOCATION | Fruit and Vegetable Market of Lahore and Sheikhupura. |
| PLAN OF WORK | Samples of Citrus, Banana, Strawberry, Falsa and vegetables i-e Cauliflower, Spinach, Brinjal and Okra will be collected from Fruit and Vegetable Markets of Lahore and Sheikhupura. These samples will be analyzed for the residue of unknown pesticides on GCMS and LCMS. |
| PREVIOUS RESULTS | New Experiment |

| **TITLE: 2** | **RESIDUE STUDY OF WEEDICIDE IN WHEAT GRAIN** |
|---|---|
| OBJECTIVE | To study the weedicide residue in Wheat grain |
| RESEARCH WORKERS | R. A. Sial, G. A Mand, R. Ahmad and M. Rahim |
| PROJECT DURATION | Rabi, 2012-13. |
| LOCATION | Gujranwala District. |
| TREATMENTS | T1 = Control<br>T2 = Weedicide (Bromoxynil + MCPA) @ 250 ml/acre<br>T3 = Weedicide (Bromoxynil + MCPA) @ 300 ml/acre<br>T4 = Weedicide (Bromoxynil + MCPA) @ 350 ml/acre |
| PLAN OF WORK | The experiment will be conducted at farmer's field in RCBD design with four replications. The weedicide will be applied after first irrigation. The grain samples will be collected at harvesting and shall be analyzed for residual analysis. |
| PREVIOUS RESULTS | New Experiment. |

| **TITLE: 3** | **PESTICIDE RESIDUE STUDY IN CAULIFLOWER** |
|---|---|
| OBJECTIVE | To study the pesticide residue in cauliflower |
| RESEARCH WORKERS | R. A. Sial, G. A Mand, R. Ahmad and M. Rahim |
| PROJECT DURATION | Rabi, 2012-13\ |

| | |
|---|---|
| LOCATION | Gujranwala/Sheikhupura District |
| TREATMENTS | T1 = Control<br>T2 = Emamektin Benzoate @100 ml/Acre<br>T3 = Emamektin Benzoate @150 ml/Acre<br>T4 = Emamektin Benzoate @200 ml/Acre |
| PLAN OF WORK | The experiment will be conducted at farmer's field in RCBD design with four replications. The insecticide Emamektin Benzoate will be applied at stages i-e before head emergence, after head emergence and then after 15 days. The samples will be collected at the time of harvesting and analyzed for residue. |
| Previous Result | New Experiment. |

| **TITLE: 4** | **PESTICIDE RESIDUE STUDY IN SPINACH** |
|---|---|
| OBJECTIVE | To study the pesticide residue in spinach |
| RESEARCH WORKERS | R. A. Sial, G. A Mand, R. Ahmad and M. Rahim |
| PROJECT DURATION | Rabi, 2012-13 |
| LOCATION | Gujranwala/Sheikhupura District. |
| TREATMENTS | T1 = Control<br>T2 = Chlorpyriphos @200 ml/Acre<br>T3 = Chlorpyriphos @250 ml/Acre<br>T4 = Chlorpyriphos @300 ml/Acre |
| PLAN OF WORK | The experiment will be conducted at farmer's field in RCBD design with four replications. The insecticide Chlorpyriphos will be applied at stages i-e after 15 days of germination and then again after 15 days. The samples will be collected at the time of harvesting and analyzed for residue. |
| PREVIOUS YEAR RESULT | New Experiment. |

| **TITLE: 5** | **RESIDUE STUDY OF FUNGICIDE IN TOMATOES** |
|---|---|
| OBJECTIVE | To study the residue of fungicide in tomatoes. |
| RESEARCH WORKERS | R. A. Sial, G. A Mand, R. Ahmad and M. Rahim |
| PROJECT DURATION | Rabi, 2012-13 |
| LOCATION | Gujranwala/Sheikhupura District. |
| TREATMENTS | T1 = Control<br>T2 = Metaloxil + Mancozeb @200 gm/100lit of water<br>T3 = Metaloxil + Mancozeb @300 gm/100lit of water<br>T4 = Metaloxil + Mancozeb @400 gm/100lit of water |

| | |
|---|---|
| PLAN OF WORK | The experiment will be conducted at farmer's field (under poly tunnels) in RCBD design with four replications. The fungicide Metaloxil + Mancozeb will be applied against fungal disease at stages i-e before flowering, flowering and fruiting time. The fruit samples will be collected at the time of harvesting and analyzed for residue. |
| PREVIOUS RESULT | New Experiment |

| **TITLE: 6** | **RESIDUE STUDY OF FUNGICIDE IN CUCUMBER** |
|---|---|
| OBJECTIVE | To study the residue of fungicide in Cucumber. |
| RESEARCH WORKERS | R. A. Sial, G. A Mand, R. Ahmad and M. Rahim |
| PROJECT DURATION | Rabi, 2012-13 |
| LOCATION | Gujranwala/Sheikhupura District. |
| TREATMENTS | T1 = Control |
| | T2 = Thiophanate Methyle @200 gm/100lit of water |
| | T3 = Thiophanate Methyle @250 gm/100lit of water |
| | T4 = Thiophanate Methyle @300 gm/100lit of water |
| PLAN OF WORK | The experiment will be conducted at farmer's field (under poly tunnels) in RCBD design with four replications. The fungicide Thiophanate Methyle will be applied against fungal disease at stages i-e before flowering, flowering and fruiting time. The fruit samples will be collected at the time of harvesting and analyzed for residue |
| PREVIOUS RESULT | New Experiment |

| **TITLE: 7** | **RESIDUE STUDY OF FUNGICIDE IN DIFFERENT WHEAT VARIETIES TO ESTABLISH THE MRL** |
|---|---|
| OBJECTIVE | To study the fungicide residue in different wheat varieties |
| RESEARCH WORKERS | R. A. Sial, G. A Mand, R. Ahmad and M. Rahim |
| PROJECT DURATION | Rabi, 2012-13 |
| LOCATION | Gujranwala / Sheikhupura |
| TREATMENTS | T1 = Control<br>T2 = Thiophanate Methyle 2 gm/Kg of seed of Sehar 2006<br>T3 = Thiophanate Methyle 2 gm/Kg of seed of Watan 2007<br>T4 = Thiophanate Methyle 2 gm/Kg of seed of Lasani 2008 |
| PLAN OF WORK | The experiment will be conducted at farmer's field in RCBD design with four replications. The fungicide will be use as seed treatment. The grain samples will be collected at harvesting and analyzed for residual analysis. |
| PREVIOUS RESULT | New Experiment |

| | |
|---|---|
| **TITLE: 8** | **RESIDUE STUDY OF WEEDICIDE IN DIFFERENT WHEAT VARIETIES TO ESTABLISH THE MRL** |
| OBJECTIVE | To study the weedicide residue in different wheat varieties |
| RESEARCH WORKERS | R. A. Sial, G. A Mand, R. Ahmad and M. Rahim |
| PROJECT DURATION | Rabi, 2012-13 |
| LOCATION | Gujranwala / Sheikhupura |
| TREATMENTS | T1 = Control<br>T2 = Isoproton 800gm/Acre for Sehar 2006<br>T3 = Isoproton 800 gm/Acre for Watan 2007<br>T4 = Isoproton 800gm/Acre for Lasani 2008 |
| PLAN OF WORK | The experiment will be conducted at farmer's field in RCBD design with four replications. The fungicide will be use as seed treatment. The grain samples will be collected at harvesting and analyzed for residual analysis. |
| PREVIOUS RESULT | New Experiment. |

# ANNUAL RESEARCH PROGRAM

# RABI 2012-13

**INSTITUTE OF SOIL CHEMISTRY AND ENVIRONMENTAL SCIENCES FAISALABAD**

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