OVERVIEW

Better nutrient management is key to achieving better crop yields. Use of nitrogen, phosphorous and potash fertilizers in balanced amounts leads to improved yields. To achieve this objective, provision of soil, water and fertilizer testing services to farmers and development of fertilizer recommendations for crops is main main task of this institute. For provision of advisory services to farmers, 97738 advisory soil and 94911 advisory water samples were analysed by various laboratories established by this institute in all districts during 2018-19. In addition to these, 4918 and 3918 soil and water samples respectively were analysed from various research activities. A total of 40939 soil samples were analysed under Extension 2.0 project for farmers’ facilitation. Under regulatory services, this institute analysed 6693 fertilizer samples. To develop fertilizer recommendations for different crops, field experiments were conducted at farmers’ fields in Punjab Province. During Rabi 2017-18, 307 field trials were conducted; and during Kharif 2018, 288 field experiments were conducted. Data were analysed using appropriate statistical techniques. Optimum rate of fertilizer application was calculated. Experimental results indicated that various crops responded to increasing dose of fertilizer. This appeared due to introduction of high yielding new vegetable varieties and decreasing fertility levels of soil. Micronutrients application was also responded positively by high value crops. In addition to these, this institute is also providing facility of laboratory testing of commercial fertilizers, growth regulators and amendments for their quality monitoring and registration under Fertilizer Control Order.

KHARIF- 2018

Evaluation of Zinc (liquid) Fertigation to Bt. Cotton (April/May Sown)
The experiment was conducted with the objective to compare efficiency of liquid Zn with dust and spray Zn sources on Bt cotton. The results indicated that highest seed cotton yield (2748 kg/ha) was obtained from the treatment where liquid Zn (10%) was applied @ 16 L/ha with first irrigation.

Effect of Zinc Application on Bt. Cotton (April/May Sown)
The studies were conducted at twenty two sites to observe effect of Zn application Bt cotton. NPK was applied to all treatments @ 250-125-100 kg/ha alongwith 1.25 kg/ha of boron. The data showed that maximum seed cotton yield (2536 kg/ha) was obtained from the treatment where Zn was applied @ 20 kg/ha (Fig.1).

Response of Bt. Cotton (April Sown) to Combination of Different Nitrogen and Phosphorus Fertilizers

Fig.1. Effect of zinc application on yield of Bt. cotton
The said experiment was conducted at sixteen different locations in Central, Cotton and Thal zones of Punjab. It was revealed that highest seed cotton yield (2617 kg/ha) was obtained where Urea or CAN was used alongwith DAP (Figure 2).

Response of Fine Rice to Variable Nitrogen Doses
The said experiment was conducted at seven sites. It was found that maximum yield (5752 kg/ha) was obtained from T7 in rice zone, where nitrogen was applied @ 140 kg/ha.

Response of Fine Rice to Variable Phosphorus Doses
To formulate phosphorus dose recommendations for fine rice, the experiment was conducted at nineteen different locations. Phosphorus doses ranged from 22.5 to 112.5 kg/ha. The data revealed that highest paddy yield (5519 kg/ha) was harvested where phosphorus was applied @ 112.5 kg/ha. Response line is presented in Figure 4.

Impact Evaluation of Leguminous Crop in Rice-Wheat Cropping System to Improve Soil Fertility
To evaluate the impact of inclusion of legume crop on soil fertility and crop yield in rice-wheat cropping system was the main objective of said experiment. The highest paddy yield of basmati (6444 kg/ha) was obtained from the treatment where N-P2O5-K2O were applied @ 135-90-60 kg/ha with incorporation of Jantar into soil during first year at sites in cotton zone. At older site, incorporation of jantar in soil improved the rice yield.

Response of Fine Rice to Variable Nitrogen Doses
The said experiment was conducted at seven sites. It was found that maximum yield (5752 kg/ha) was obtained from T7 in rice zone, where nitrogen was applied @ 140 kg/ha.
maximum paddy yield (6985 kg/ha) was harvested from T8 where NPK were applied @ 174-156-80 kg/ha.

**Response Curve Studies on Fine Rice**
Studies were conducted at twenty two sites of rice, central and cotton zones to formulate fertilizer recommendations for fine rice. The data showed that highest yield (5389 kg/ha) was harvested from T9 where N-P2O5-K2O were applied @ 135-135-60 kg/ha which indicated that still dose of P can be increased.

**Bio-Fortification of Fine and Coarse Rice Varieties with Zinc and Iron**
The objective of studies was the bio fortification of rice grains. Foliar spray of iron and zinc was done twice on coarse and fine rice varieties. Foliar spray improved zinc and iron contents in all varieties.

**Impact of Burning of Rice Crop Residues on Bacterial Population in Rice-Wheat System**
The objective of study was to assess soil bacterial population and organic carbon after stubble burning in rice-wheat cropping system. The results revealed that organic carbon in unburnt field was 0.47% and in the burnt field was 0.36%. Similarly microbial population in unburnt portion of field was 4.11 @ 10^6 GFU^-1. Soil and in the burnt portion of field, it was 2047 @ 10^6 GFU^-1.

**Evaluation of Comparative Efficiency of BNFF Urea for Basmati Rice**
Study was conducted to assess efficiency of BNFF urea vs common urea. It was found that maximum paddy yield (5409 kg/ha) was harvested where BNFF urea and common DAP were applied @ 135-90-60 kg/ha.

**Fertilizer Response Curve Studies on Maize Fodder (Non-Hybrid Varieties)**
The main objective of study was to formulate fertilizer recommendations for maize fodder. The highest maize yield in Barani irrigated areas (60.07 t/ha) and in barani zone (44.44 t/ha) was recorded where NPK were applied @ 130-90-30 kg/ha.

**Field Evaluation of IPNI-Nutrient Expert Fertilizer Model for Seasonal Maize**
The experiments were conducted with the idea to evaluate Nutrient Expert Fertilizer Model (IPNI). The yield data revealed that maximum maize yield (7643 kg/ha) was obtained from the treatment where recommended NPK (225-150-125 kg/ha) was applied. Moreover, dose recommended by Nutrient Expert Model (T5) gave higher yield as compared to Farmer Practice (T2). These were first year results. More experiments are needed to conclude (Fig.5).

**Effect of Different Sources of Sulphur on Maize Yield**
The experiment was conducted to evaluate efficiency of different sources of sulphur i.e. elemental, bentonite and gypsum. In Barani irrigated areas, the highest maize grain yield (8569 t/ha) was obtained where elemental sulphur was applied @ 22 kg/ha which was at par with (8416 kg/ha) gypsum @ 169 kg/ha (Figure 6).

**Effect of Phosphoric Acid (10%) on Sugarcane Yield**
The objective of reported studies was to assess response of sugarcane to phosphoric acid (10%
by weight) product. Cane yields with DAP and Phosphoric acid at Faisalabad were at par.

**Response Curve Studies on Sorghum Fodder**
The said experiment was conducted at twenty four sites with the objective to formulate fertilizer recommendations. The highest sorghum yield (57.04 t/ha) was harvested from the treatment where NPK were applied @ 80-90-30 kg/ha and it was statistically at par with T5 (56.20 t/ha) where NPK were applied @ 120-60-30 kg/ha.

**Fertilizer Response Curve Studies on New Varieties of Groundnut**
Experiment reported herein was conducted at three locations in Barani zone. The highest pod yield (2513 kg/ha) was obtained from T9 where NPK were applied @ 69-87-30 kg/ha.

**Fertilizer Response Curve Studies on a New Variety (th-6) of Sesamum**
The main objective of said study was to formulate fertilizer recommendations. For this purpose, said experiment was designed with eleven treatments and sown at six sites. The highest sesamum yield (1047 kg/ha) was obtained from T8 where NPK were applied @ 60-90-30 kg/ha.

**Response Curve Studies on Fertilizer Requirement of Turmeric (Confirmatory Study)**
The said confirmatory study with six treatments was conducted at Kasur. The results revealed that highest yield (35.25 t/ha) was obtained from T6 where P2O5 was applied @ 200 kg/ha. Yield kept increasing at all levels (Fig.7).

**Mung Response to Potassium**
The experiment was conducted at eight locations in Rice and Thal zones to observe response of Mung to K. The yield data envisaged that maximum yield (1485 kg/ha) was harvested from T6 where K2O was applied 60 kg/ha (Fig.8).

**Fertilizer Response Curve Studies on Wheat in Irrigated Areas**
These experiments were conducted in agro-ecological zones of Punjab with eleven treatments. Maximum wheat grain yield (4651 kg/ha) was obtained from T9 where NPK were applied @ 160-171-60 kg/ha.

**Fertilizer Response Curve Studies on Wheat under Rainfed Conditions**
These experiments were conducted in high rainfall areas of Barani zone with different levels of N, P and K in a single experimental
plan of eleven treatments. Highest wheat grain yield (4700 kg/ha) was obtained from T9 where NPK were applied @ 90-135-60 kg/ha.

Bio-Fortification of Wheat Grains with Different Modes of Zinc and Iron Application
Studies reported herein were conducted at 33 and 24 sites for Zn and Fe respectively in Punjab. Soil and foliar applications were tested for Zn and Fe. These elements increased grain yield of wheat. However, grain analysis is in progress.

Testing the Effectiveness of Bop (Bio-Organic Phosphates) in Enhancing Wheat Yield
To test the effectiveness of BOP, experiment was conducted at nine sites and highest wheat yield (4216 kg/ha) was obtained from T1 where recommended dose of NPK were applied @ 160-114-60 kg/ha without BOP.

Effect of Burning of Rice Crop Residues on Bacterial Population in Rice-Wheat System
Sixty samples were collected from burnt and unburned portions of rice fields. Analysis showed that total organic carbon and microbial population decreased due to burning of rice crop residues (Table 1).

Table 1. Soil parameters as affected by rice crop residue burning November 2018, 60 sites Sargodha and Faisalabad Divisions

<table>
<thead>
<tr>
<th>Total Organic Carbon (%)</th>
<th>Microbial Population @ 10^6 CFU G^{-1} Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Un-Burnt</td>
<td>Burnt</td>
</tr>
<tr>
<td>0.45</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>Un-Burnt</td>
</tr>
<tr>
<td></td>
<td>3.84</td>
</tr>
</tbody>
</table>

To Compare Efficiency of ‘Urea + DAP’ with ‘Nitrophos + CAN’ Combinations as to be used per their Recommended Times for Wheat crop.
Various sources of nitrogen and phosphorus were compared using recommended (160-114-60 kg/ha) and lower doses (120-85-60 kg/ha) of nitrogen and phosphorus. Urea+DAP and Nitrophos+CAN yield similar results at recommended and lower doses (Figure 9).

Field evaluation of IPNI-Nutrient Expert Fertilizer Model for Wheat
Experiment was conducted at 23 sites in Punjab. Results showed that wheat grain yield from IPNI model was higher than Farmers Practice viz. 4359 vs 3954 kg/ha (Figure 10).

RABI 2017-18 Other Crops
The results of other crops which were harvested and processed after the compilation of previous report are as under.

Fertilizer Response Curve Studies on Tomatoes
Results showed that highest tomato yield (31.02 t/ha) was obtained with @ 150-320-100 kg/ha. Response of tomato increased from 170 to 320 kg/ha of P_2O_5.

Tomatoes Response to Zinc and Boron
Maximum tomato yield (22.15 t/ha) was obtained where both zinc and boron was applied at @ 5kg/ha and 1 kg/ha respectively. However, it was at par (21.78 t/ha) with 2 sprays of 0.2%
Zn and 0.1% B solution alongwith half dose of Zn and B through soil application.

**Fertilizer Response Curve Studies on Onion**

Results of increasing doses of P$_2$O$_5$ from 160 to 360 were compiled from 9 sites which indicated that onion bulb yield (17.39 t/ha) was increased from 160 to 260 kg/ha of P$_2$O$_5$. Further increasing dose of P had non-significant increase.

**Fertilizer Response Curve Studies on Potato**

Results collected from 11 sites showed that NPK @450-150-150 and 300-225-150 kg/ha gave highest potato tuber yield (27.42 and 28.35 t/ha).

**Role of Potash Application in Higher Doses in Enhancing the Yield of Chillies**

Potash was applied @ 80, 160, 240 and 320 kg/ha. Maximum chilli yield (16.38 t/ha) was obtained where K$_2$O was applied @ 160 kg/ha. In central zone, yield progressed slowly with increasing dose of K (Fig. 11).

**Fertilizer Response Curve Studies on Cabbage**

This experiment was conducted at four sites with eleven treatments. The results indicated that highest cabbage yield (59.12 t/ha) was obtained where NPK were applied @ 100-150-100 kg/ha.

**Best Combination of NPK for Grapes Grown under High Efficiency Irrigation System (Drip Irrigation)**

The significant highest grape yield (25.79 kg/plant) was obtained from T$_2$ where NPK were applied @ 360-120-300 g/plant. Increasing fertilizer beyond this had little increase in yield.

**Micronutrients Management and Demonstration for Citrus Orchards**

Experiments were conducted at farmers’ fields. On average basis, both soil and foliar application were at par with each other with 744 fruits per plant. Similarly, on fruit in kg/plant basis, both treatments were high yielder with 123 kg fruits per plant. Both these treatments had NPK application of 1000-500-1000 kg/plant.

**Exploring the Best Fertilizer Combination for Spring Hybrid Maize**

Experiments were conducted at farmers’ fields at 11 sites. On average basis, increasing N, P and K increased maize grain yield. Highest dose of NPK was 392-261-218 kg/ha where the yield (8495 kg/ha) was still increasing with which shows the responsiveness of spring maize to fertilizer application.

**Fertilizer Response Curve of Chillies**

Highest fruit yield (24.29 t/ha) was obtained from T4 with viz. NPK @ 160-60-60 kg/ha. Increasing the fertilizer dose did not give significant yield increase.

**MISCELLANEOUS ACTIVITIES**

**Regulatory Samples**

Regulatory Samples / heavy metal samples.  
**Fertilizer Regulatory: 2018-19**  
Total samples analysed: 6693  
Fit samples: 6299  
Unfit samples: 238

**Soil & Water Samples under Advisory Services 2018-19**  
Soil samples analysed: 97738  
Water samples analysed: 94911

**Soil & Water Samples of Research Activities 2018-19**  
Soil samples analysed: 4918  
Water samples analysed: 3918

**Soil Samples under Extension Services 2.0 2018-19**  
Total samples analysed: 409399

**List of Trainings Received in FY 2018-19 by Officers**

![Fig.11. Effect of potash application on chillies yield (Central zone)](image-url)
1. Forty six officers of this institute attended training on “Implementation of Procurement Management Information System” in December 2018 which was arranged by RAEDC Vehari.

2. Forty officers of this institute attended PPRA rules 2014 training which was arranged by AARI Faisalabad.

3. Muhammad Nadeem Agricultural Officer/Ex-ARO SSRI, Pindi Bhattian, on “Application of Statistical Techniques In Agricultural Research” 24 to 26 Sept 2018 by AARI.

4. Muhammad Nadeem Agricultural Officer/Ex-ARO SSRI, Pindi Bhattian, Hands on Training on “Soil, water and plant” analysis, 30-10-2018 to 1-11-2018 by NIAB.

5. Dr. Sumreen Siddiq and Mr Nadeem Raza on “Training on Monitoring and Evaluation” 30-10-2018 by AARI.

6. Dr. Muhammad Mazhar Iqbal and Dr. Muhammad Iqbal Hussain; Training of Tehil and District Committees on crop appraisal, maintenance of record and harvesting techniques for Holding Rice Yield Competition, 2018-19 dated 9-10-2018 by AARI.

7. Four scientists from Soil Fertility Faisalabad on “Emerging Technologies in Research , Advanced MS Office & Digital Resources” 24-25 Sept 2018 by AARI.

8. Dr. Ubaid-Ur-Rehman and Muhammad Ihsan on “Management of natural resource (Land, water & forest) for sustainable development” 6 to 10 Aug 2018 by AHK NCRD Islamabad.


10. Abdul Waheed and Mr Sher Afzal on “Managing Employees’ Performance Through Motivation at Workplace” 22 to 24 Oct 2018 by PMI Islamabad.


14. Five persons on “Environmental Management in rural areas” 5 to 7 Nov 2018 by AHK NCRD Islamabad.

15. Dr. Ubaid-Ur-Rehman on “Training on Irrigation System and Water Management” 11 to 20 Dec 2018 by AHK NCRD Islamabad.


17. Imran Hussain, Mahreen Khalid and Rehman Gul on Training Course on Geographical Information System (GIS)” 14 to 16 Nov 2018.


19. Five persons on “Monitoring and evaluation of development projects” 31-12-2018 to 4-1-2018 by AHK NCRD Islamabad.

20. “Financial management training” on 24-6-2019 at AARI attended by five persons from SFRI.

List of Foreign Visits during 2018-19 by Director / Scientists
1. Dr. Muhammad Shakir, On Training on advance analytical methods of pH, EC, Moisture percentage, Soil Texture and other Macro/Micro nutrients at Soil & Foundation Co. Ltd. Tabouk, Kingdom of Saudi Arabia.

2. Dr. Muhammad Shakir attended 3rd Asian Conference on Science, Technology and Medicine at Dubai UAE. Presented research work entitled “Green Remediation of Saline-Sodic Pb-Contaminated Soil by Growing Salt-Tolerant Rice Cultivar along with Soil Applied Inorganic Amendments” at Carlton Plance Hotel, Al Makhtoum Street, Deira Near Deira Clock Tower, Dubai, United Arab Emirates.

3. Mussarat Nawaz, attended seminars on "Some insights into the human dimension of the Great Barrier Reef using results from the Social Economical Long Term Monitoring Program (SELTMP) "Entomopathogenic Fungi and Host-Parasite Community Dynamics at Different Latitudes and in Adjoining Agricultural and Hedgerow Habitats "Millennial-Scale Reconstruction of Burdekin River Discharge” Does Habitat

**Farmer days/Farmer Training organized in 2018-19**
No. of Farmer Days: 12 in various districts Toba Tek Singh, Sargodha, Bhakkar, Layyah, Sahiwal etc. About 70-200 participants came in each event.

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