

ANNUAL TECHNICAL REPORT 2019-20

RAPID SOIL FERTILITY SURVEY AND SOIL TESTING INSTITUTE, THOKAR NIAZ BAIG, LAHORE

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OVERVIEW

For obtaining better yields and maintenance of soil health, balanced use of nitrogen, phosphorous and potash fertilizers is inevitable. To achieve this objective, this institute is carrying field experimentation for development of fertilizer recommendations and maintenance/improvement of soil health. After development of fertilizer recommendations, common farmers are provided soil, water and fertilizer testing services to use recommended fertilizers and other amendments. For provision of advisory services to farmers, 91037 advisory soil and 13510 advisory water samples were analysed by various laboratories working under the umbrella of this institute in all districts during 2019-20. In addition to these, 3372 and 40506 soil and water samples respectively were analysed from various research activities. A total of 170782 soil samples were also analysed under Extension 2.0 project for farmer's facilitation. Under regulatory services, this institute analysed 5470 fertilizer samples. To develop fertilizer recommendations for different crops, 554 field experiments were conducted at farmers' fields in Punjab Province which included 276 in Kharif 2019 and 278 in Rabi 2019-20. Optimum rate of fertilizer application was calculated using appropriate statistical techniques. This appeared due to introduction of high yielding new vegetable varieties and decreasing fertility levels of soil. 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.

DETAILED REPORT

Two main activities carried out by this institute includes conducting field experiments and carrying out analysis of soil, water, and fertilizer samples. The analysis is carried out for advisory, research and regulatory purposes. First of all, salient field experiments are presented in brief here.

LABORATORY SERVICES (2019-20)

The institute is providing facilities for analysis of soil analysis of farmers under Extension 2.0 project. During the current year following number of samples were analysed

Table 1. Soil Samples analysed under Ext 2.0 Project (2019-20)

Name of District	Samples collected	Samples analysed by Divisional Labs.	Samples analysed by District Labs.
Lahore	6096	15010	7650
Okara	9477		7150
Kasur	7150		1620
Sheikhupura	4776		10700

Nankana Sahib	13653		
Lahore Division	41152	15010	27120
Gujranwala	13517	1500	7650
Sialkot	9477		13946
Narowal	11646		7650
M.B. Din	4425		14000
Gujrat	13022		7625
Hafizabad	3336		
Gujranwala Division	55423	1500	50871
Sargodha	10200	14700	6080
Khushab	6659		5137
Mianwali	1809		8992
Bhakkar	9964		
Sargodha Division	28632	14700	20209
Faisalabad	26377	21199	
Chiniot	12081		21871
T.T. Singh	14553		18063
Jhang	12898		18802
Faisalabad Division	65909	21199	58736
Multan	9342	39864	6911
Sahiwal	8359		7200
Pakpattan	8994		8635
Khanewal	8635		9186
Lodhran	9186		14110
Vehari	14876		
Multan+Sahiwal Divisions	59392	39864	46042
Bahawalpur	7159	31831	
Bahawalnagar	7400		7400
R.Y. Khan	10413		9650
Bahawalpur Division	24972	31831	17050
D.G. Khan	9127	21652	6310
Muzaffargarh	5670		9780
Layyah	9026		9189
Rajanpur	5710		
D.G. Khan Division	29533	21652	25279
Rawalpindi	5079	25026	
Attock	5022		8851
Chakwal	5902		7991
Jhelum	5421		7175
Rawalpindi Division	21424	25026	24017
Grand Total	326437	170782	269324

Fertilizer samples are collected by Agri Extension department and brought to the divisional laboratory for analysis.

Table 2. Fertilizer samples analysed under anti-adulteration campaign of fertilizer

Financial Year / fortnight	No. of Samples Received	Total No. of Samples Analysed				No of samples Pending for Analysis / Under Process
		No of Sample Analysed (including court cases)	Fit	Unfit	Analysed but test result are not declared due to court cases	
2018-19	4896	4667	4438	152	77	229
2019-20	7016	5470	5156	190	124	1546

Soil and water samples brought by farmers or collected from field are analysed. Soil samples are analysed for EC, pH, OM, AvP, ExK and texture. Whereas water samples are analysed EC, SAR and RSC in addition to cations and anions. Fertilizer recommendations are granted on the basis of soil analysis or reclamation is recommended in case of Saline/Sodic soils. Details of samples are as under.

Table 3. Number of samples analysed under advisory service (2019-20)

Months	Advisory		Research		Miscellaneous	Number of Beneficiaries
	Soil	Water	Soil	Water		
Months						
July	7955	1482	577	500	178	966
August	6624	987	281	887	81	1124
September	7059	1502	298	2394	377	1188
October	8622	1337	227	1005	172	1780
November	9202	1195	391	2935	122	2123
December	7546	1033	311	2966	121	1306
Januray	6268	1181	250	2230	78	990
Febraury	7748	1104	144	15921	96	956
March	5057	758	221	2097	282	730
April	7478	468	287	1847	45	727
May	5057	758	221	2097	282	730
June	12421	1705	164	5627	148	1308
Total	91037	13510	3372	40506	1982	13928

Field Experiments

KHARIF- 2020

Effect of Foliar Application of Nutrients on Growth and Yield of Bt. Cotton

The experiment was conducted with the objective to evaluate the impact of Foliar Application of Nutrients (zinc sulphate, magnesium sulphate, urea) on Growth and Yield of Bt. Cotton. The results indicated that highest seed cotton yield (2945 kg/ha in cotton zone) was obtained in T₆ treatment where 250-125-100 and DAP 2% spray was applied. Overall the foliar application of DAP proved the best.

Effect of Sulphur on Yield of Bt. Cotton Crop

The studies were conducted in order to evaluate the impacts of Sulphur on the yield of Bt. Cotton. NPK was applied to all treatments @ 250-125-100 kg/ha alongwith sulphur at varying rates (i.e 0, 10, 15, 20, 25 and 30 kg/ha). The highest cotton yield (3238 kg/ha in cotton zone) was obtained in T₅ (i.e sulphur @ 25 kg/ha (Figure 1).

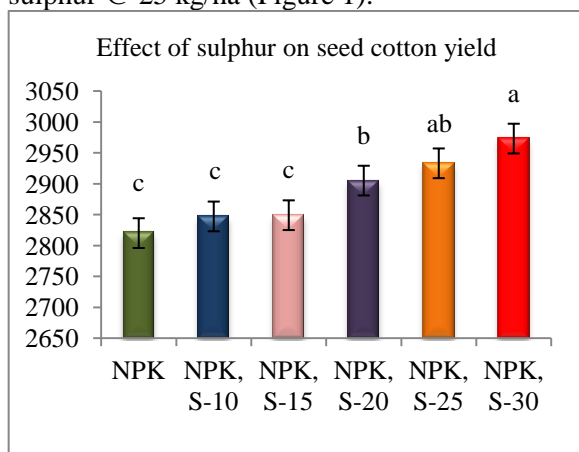


Fig.1. Effect of sulphur on seed cotton yield

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

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 (2738 kg/ha) on overall basis was obtained where Urea was used along with DAP.

Fertilizer Response Curve Studies on Bt. Cotton (April/May Sown)

To formulate fertilizer recommendations for Bt. cotton, experiment was conducted at thirty two locations in Central, Cotton and Thal zones. The

data revealed that maximum seed cotton yield (3028 kg/ha) was harvested from T₈ where N-P₂O₅-K₂O were applied @ 250-189-100 kg/ha on overall basis from thirty sites.

Response of Bt. Cotton (April/May Sown) to Cu, Fe and Mn

Studies, reported herein, were conducted with the objective to assess the response of Bt. cotton to Cu, Fe and Mn application. The results showed that maximum seed cotton yield (3114 kg/ha) was obtained in cotton zone from T₅ where Zn, B, Cu, Fe and Mn were applied @ 5,1,5,15,10 & 10 kg/ha respectively.

To Study the Response of Bt. Cotton to Phosphorus Fertilization

This study was conducted with the objective to evaluate the impact of phosphorus fertilization on Bt. Cotton. Phosphorus treatments were T₁=125 kg/ha at sowing, T₂=125 kg/ha after germination, T₃, T₄, T₅ were 125, 100, 75 kg/ha through fertigation 30 DAS, T₆=75 kg/ha 30 DAS, T₇=50 kg/ha at flowering. From the results it is evident that the phosphorus Fertilization @ 75 kg/ha P through Fertilization (Drum) 30 DAS + 50 kg/ha P at flowering through Fertilization exhibited maximum seed cotton yield (i.e. 3252 kg/ha) (Figure 2).

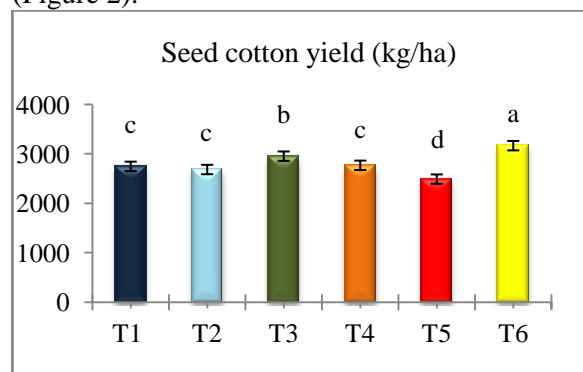


Fig.2. Effect of phosphorus fertilization on seed cotton yield.

Effect of zinc application on BT Cotton

This study was conducted with the objective to evaluate the dose of zinc for Bt cotton. The levels of zinc applied were 5, 10, 15, and 20 kg/ha. Zinc @ 10 and 20 kg/ha gave higher significant yield i.e. 2860 and 2571 kg/ha respectively.

Evaluation of zinc (liquid) fertilization to Bt. Cotton (April/May sown)

These experiments were conducted in agro-ecological zones of Punjab to compare the efficiency of zinc (liquid) with conventional zinc sources (dust & spray) on Bt. Cotton crop. It was observed that liquid zinc (10%) gave maximum yield (2574 kg/ha) with 16 litre per hectare of dose.

Impact Evaluation of Leguminous Crop in Rice-Wheat Cropping System to Improve Soil Fertility (Kharif and Rabi Seasons)

The major objective of this experiment was to evaluate the impact of inclusion of legume crop on soil fertility and crop yield in rice-wheat cropping system. The highest paddy yield of basmati (5323 kg/ha) was obtained from the treatment (T₁) where N-P₂O₅-K₂O were applied @ 135-90-60 kg/ha with no Jantar incorporation into soil in Rice zone. Contrary to that in central and cotton zone T₂ (i.e 135-90-60 kg/ha N-P₂O₅-K₂O with Jantar incorporation) gave maximum yield of 4930 and 4459 kg/ha respectively than in T₁ (N-P₂O₅-K₂O were applied @ 135-90-60 kg/ha with no Jantar incorporation) where the yield was 4680 and 4203 kg/ha. In old sites, half fertilizer with Sesbania was equal to full fertilizer without Sesbania. In Rabi season, on overall basis, wheat yield was not affected by decreasing fertilizer dose because of inclusion of legume. However, in cotton zone wheat yield decreased in plots where fertilizer dose to rice was decreased. This showed the carry over effect of fertilizer dose from previous crop.

Response of Fine Rice to Variable Nitrogen Doses

The said experiment was conducted at seven sites. It was found that maximum yield of 4601 kg/ha, 4822 kg/ha and 5741 kg/ha was obtained from T₈ in rice zone, central zone and cotton zone respectively where nitrogen was applied @ 168 kg/ha (Figure 3). Tested levels were from 0 to 168 kg/ha.

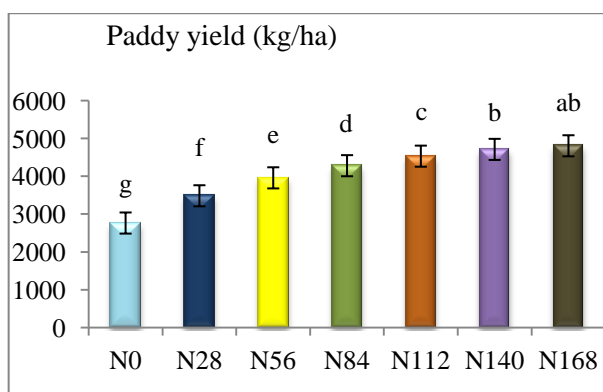


Fig.3. Effect of nitrogen levels on paddy yield

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 overall highest paddy yield of 4985 kg/ha and 5006 kg/ha where phosphorus was applied @ 135 kg/ha in rice zone and central zones, respectively.

To Explore the Best NP Ratio for Coarse Rice within Limits of Present Farmer Budget for Fertilizer

To explore the most economical NP fertilizer ratio for coarse rice within the limits of present farmer budget for fertilizer was the main purpose of study. The highest paddy yield (5667 kg/ha) was found with recommended dose of fertilizer.

Fertilizer Response Curve Studies on Coarse Rice

To formulate the fertilizer recommendations for coarse rice, studies reported herein were conducted at four sites in rice zone and one site in central zone. The results envisaged that maximum paddy yield (5206 kg/ha) was harvested from T₈ where NPK were applied @ 261-104-80 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 (4944 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 (0.2%) and zinc (0.1%) was done twice on coarse and fine rice varieties. Foliar spray improved zinc and iron contents in all varieties. In PK-1121, zinc contents increased from 22.9 ppm to 31.8 ppm and iron contents increased from 11.8 to 17.1 ppm. Similar results were achieved for other varieties also (Figures 4 and 5). Broken bars show grain Fe contents and plane bars depict Zn contents.

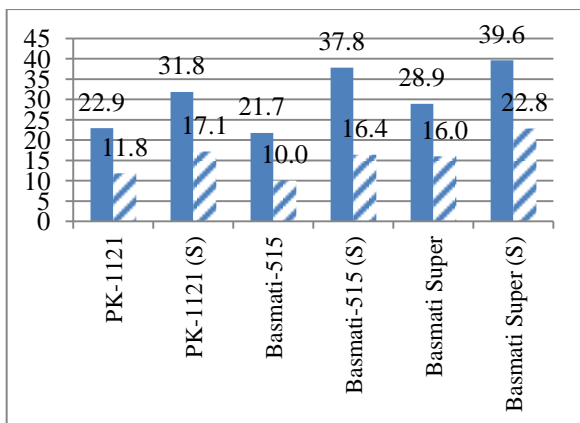


Fig.4. Effect of foliar sprays on grain zinc and iron contents (ppm)

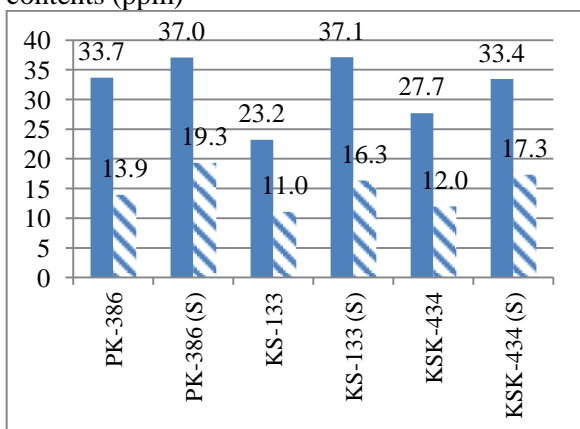


Fig.5. Effect of foliar sprays on grain zinc and iron contents (ppm)

Effect of split application of potash on rice crop

The objective of studies was to ascertain the effect of split application of potash on Basmati rice. Treatments were T₁ 135-90-0, T₂ 135-90-60 all K at sowing, T₃ 135-90-30 all K at sowing T₄ 135-90-60 half K at sowing+half K at 30-35 days after transplanting. The treatments with and without splitting of recommended dose were statistically similar (5099 vs 5086 kg/ha) showing no extra advantage of splitting of potash (Figure 6).

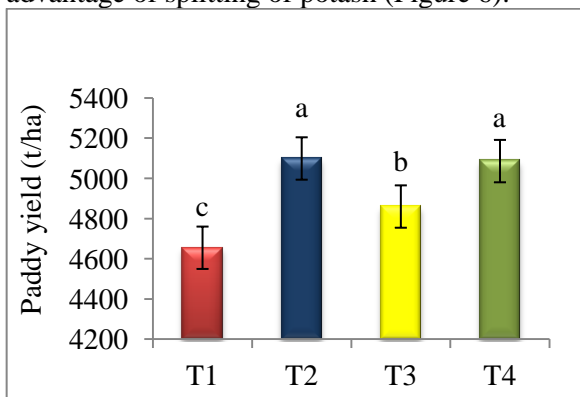


Fig.6. Effect of split application of K on basmati rice

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 @ 10⁶ GFU⁻¹ Soil and in the burnt portion of field, it was 2047 @ 10⁶ GFU⁻¹.

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 was recorded with fertilizer dose of NPK@195-60-30 kg/ha in all agro-ecological zones and on overall it yielded 52.64 t/ha maize fodder yield.

Developing and Testing Fertilizer Prediction Model for major crops

The main objective of study was to testing and validation of fertilizer prediction models for 5 major crops. Testing and validation for wheat, sugarcane, basmati rice, cotton and spring maize are in progress during kharif.

Effect of Different Sources of Sulphur on Maize Cob Yield

The experiment was conducted to evaluate efficiency of different sources of sulphur i.e. elemental sulphur, bentonite and gypsum. Doses were 22, 22 and 169 kg/ha respectively. All sulphur sources increased the maize grain yield with 22kg/ha of sulphur ingredient (Figure 7).

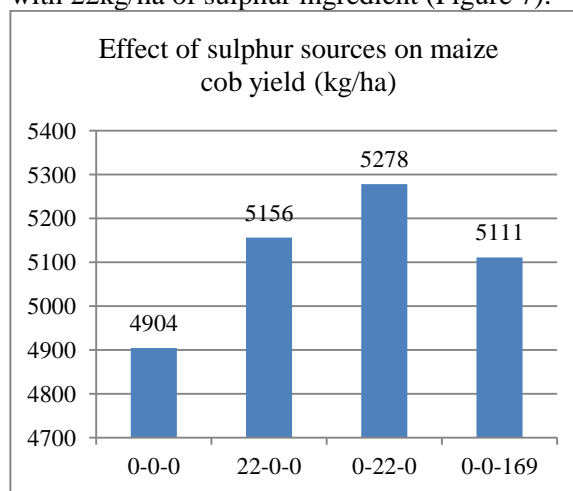


Fig.7. Effect of S sources on maize cob yield

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. At Faisalabad, cane yields with DAP and Phosphoric acid as phosphorus sources were 112 vs 113 t/ha respectively and at par with each other with recommended level of NPK.

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 yields (51.51 t/ha) were observed with @ 120-60-30 kg/ha. This was at par with 51.49 t/ha with 80-90-30 kg/ha of fertilizer.

Fertilizer Response Curve Studies on New Varieties of Groundnut

Experiment reported herein was conducted at one location in Barani zone. The highest pod yield (2315 kg/ha) was obtained where NPK were applied @ 69-58-30 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 nine sites. The highest sesamum yield (1103 kg/ha) was obtained where NPK were applied @ 60-90-30 kg/ha.

Fertilizer Response Curve Studies on Cauliflower

The said studies were conducted at three sites to formulate fertilizer recommendations. The highest yield (49.76 t/ha) was obtained where NPK were applied @ 120-100-100 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 (51.18 t/ha) was obtained from where N-P₂O₅-K₂O was applied @ 180-160-80 kg/ha (Figure 8).

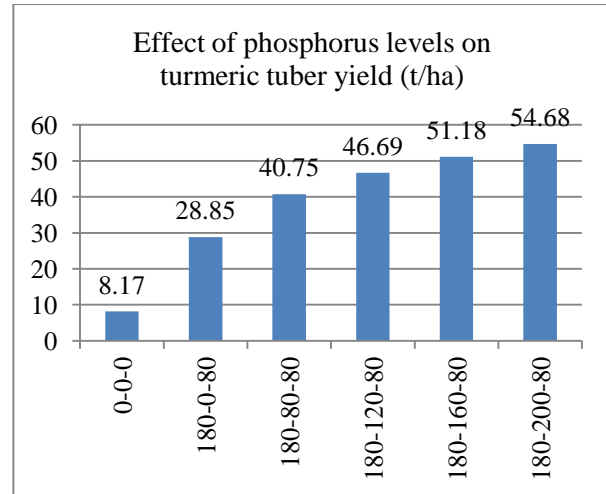


Fig.8. Effect of phosphorus levels on turmeric tuber yield (t/ha)

Mung Response to Potassium

The experiment was conducted at ten locations in Rice, Cotton and Thal zones to observe response of Mung to K. The yield data envisaged that maximum yield (1353 kg/ha) was harvested from T5 where K₂O was applied @50 kg/ha.

RABI 2019-20 Wheat

Fertilizer Response Curve Studies on Wheat in Irrigated Areas

These experiments were conducted in various agro-ecological zones of Punjab with eleven treatments. Maximum wheat grain yield of 4783 kg/ha was obtained with NPK@160-171-60 kg/ha of fertilizer which was followed by 160-114-60 kg/ha with grain yield of 4400 kg/ha.

Fertilizer Response Curve Studies on Wheat under Rainfed Conditions

These experiments were conducted in Rawalpindi and Attock barani areas with different levels of N, P and K in a single experimental plan of eleven treatments. On an average, highest wheat grain yield (4560 kg/ha) was obtained from T9 where NPK were applied @ 90-135-60 kg/ha. The recommended dose of 90-90-60 produced 4254 kg/ha of wheat grain.

Effect of Burning of Rice Crop Residues on Bacterial Population in Rice-Wheat System

Soil samples were collected from burnt and unburned portions of rice fields from 60 sites of Sargodha, Jhang and Faisalabad Districts. 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, December 2019 and January 2020,

Total Organic Carbon (%)		Microbial Population @ 106 CFU G-1 Soil	
Un-Burnt	Burnt	Un-Burnt	Burnt
0.46	0.38	3.77	2.80

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. On overall basis, Urea+DAP and Nitrophos+CAN combinations gave similar yields. However, Urea+SSP gave comparatively lower yield (Figure 9, 10).

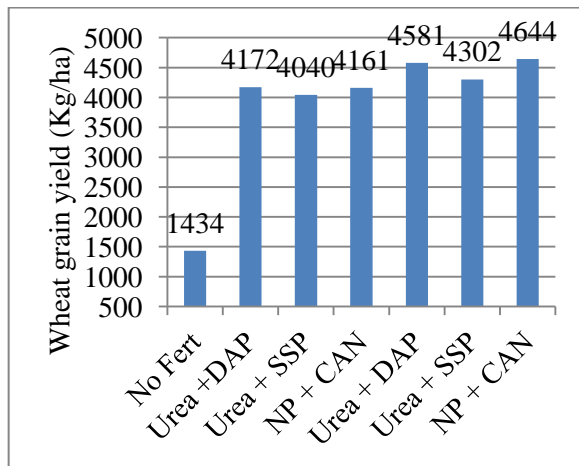


Fig.9. Effect of fertilizer combinations on grain yield of wheat



Fig.10. Effect of fertilizer combinations (5-3-2020)

Field evaluation of IPNI-Nutrient Expert Fertilizer Model for Wheat

Experiment was conducted at 14 sites in Punjab to ascertain the performance of IPNI model. Fertilizer

treatments were: T1=No Fertilizer, T2=Farmer Practice, T3=80-57-30 N-P₂O₅-K₂O kg/ha, T4=Recommended (160-114-60), T5=Nutrient Expert dose. Results showed that wheat grain yield from IPNI model was higher than Farmers Practice viz. 4090 vs 4518 kg/ha (Figure 11). However, on overall basis, it was almost equal to recommended dose of fertilizer (Recommended=4621 vs IPNI=4518 in Kg/ha).

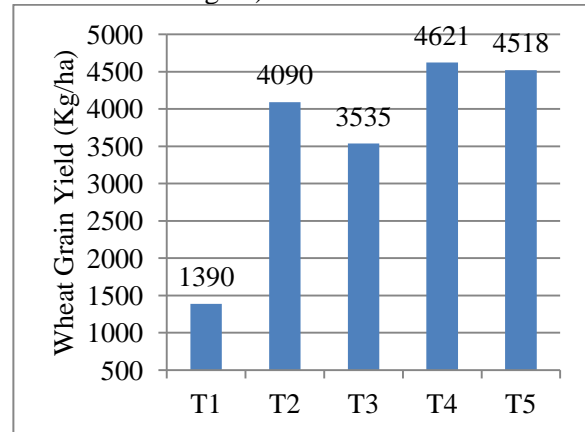


Fig.11. Comparison of grain yield under different fertilizer recommendations

Fertilizer and Micronutrient Requirements of Wheat advance lines

Two separate experiments were conducted on fertilizer and micronutrient requirements of wheat advance line (Line-14154). Maximum grain yield of 4923 kg/ha with 160-171-60 kg/ha of fertilizer followed by 4706 kg/ha was obtained by application of recommended fertilizer of 160-114-60 kg/ha. Application of Zn alone and in combination with B/Fe/Mn increased wheat grain yield to 4793 and 4863 kg/ha respectively.

Bio-fortification of Wheat Grains with Zn and Fe

Field experiments were conducted for bio-fortification of wheat grains. With application of two foliar sprays of 0.3% Zn and three foliar sprays of Fe between booting and milking stages increased zinc and iron contents of wheat grains during previous years. However, analysis of these elements during current year is under progress.

RABI 2018-19 Other Crops

The results of other crops which were processed after the compilation of previous report are as under.

Fertilizer Response Curve Studies on Potato

Results collected from 12 sites showed that indicated that NPK @300-225-150 and 300-150-225 kg/ha gave highest potato tuber yield (29.03 and 28.08 t/ha).

Fertilizer response curve studies on Peas

Various levels of N, P and K were tested in eleven treatment combination. NPK@114-36-25 and 46-54-25 kg/ha produced statistically equal yields of 6020 and 6364 kg/ha respectively. This was first year of experiments with 5 sites. So more experimentation in needed to reach at conclusive results.

Fertilizer requirements of Ispaghol.

The experiments were carried out in eleven treatment design and NPK@75-25-30 and 50-37.5-30 kg/ha of fertilizer produced 843 and 970 kg/ha of ispaghol yield respectively.

Response of Mango to Zinc and Boron application

Experiments were started on zinc and boron requirements of mango. Maximum yield of mango was observed to be 150 kg/plant with 1500-1000-750-150 grams/plant of N-P-K-Zn. Experiments on boron are also at initial stage.

Best Combination of NPK for Grapes

The experiment was conducted in Hazro District Attock with variety Kings Ruby (Figure 12). Higher doses of fertilizer T2, T3 gave higher but almost similar grape yields of 42.48 and 43.20 kg/plant where NPK were applied @ 360-120-300 and 480-120-400 grams/plant (Figure 13).



Fig.12. Fertilizer application to grapes

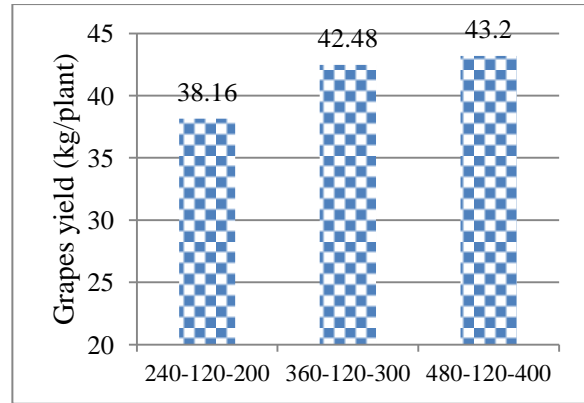


Fig.13. Effect of fertilizer dose on grapes yield

Micronutrients Management and Demonstration for Citrus Orchards

Field trials (40) were conducted at farmers' fields in four districts namely Toba Tek Singh, Sahiwal, Bhakkar and Layyah to ascertain the response of macro and micronutrients on citrus yield and disease incidence. NPK@1000-500-500 grams/plant was applied. Mostly the variety was Kinnow. Balanced use of fertilizer increased citrus yield. While comparing micronutrients soil and foliar applications, foliar applications proved better for lower disease incidence. In another experiment, two and three sprays of micronutrients were also compared under farmer practice and recommended fertilizer. Here the results indicated that application of three sprays gave the highest yield (Figure 14, 15,16).

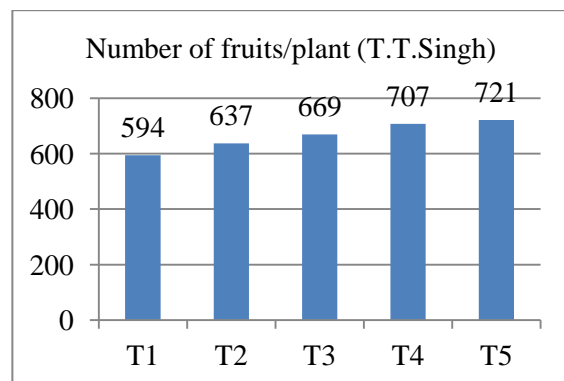


Fig.14. Number of fruits per plant in District Toba Tek Singh

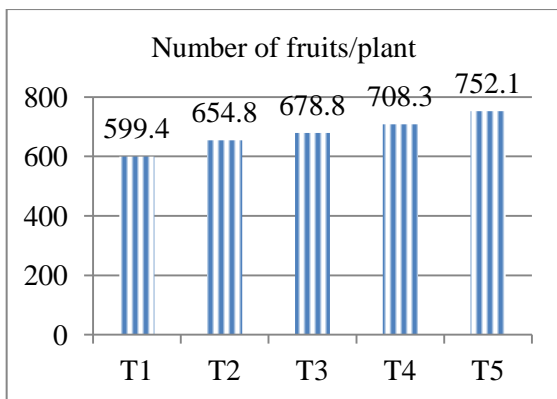


Fig.15. Number of citrus fruits per plant in District Bhakkar



Fig.16. Citrus yield data collection in Darya Khan

Comparative Efficiency of Different Sources of Nitrogen for Citrus Orchards

Comparative efficiency of different sources of nitrogen was assessed for citrus orchard. Urea, ammonium sulphate, nitrophos and calcium ammonium nitrate was applied in various treatments. Number of fruits per plant was not affected by different sources of nitrogen. However, nitrophos and calcium ammonium nitrate fertilizers produced slightly higher weight of fruits as compared to urea and ammonium sulphate as sources of nitrogen. The results are presented in Figure 17.

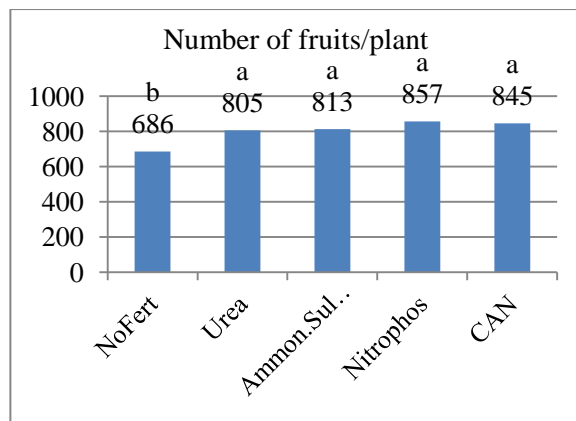


Fig.17. Effect of sources of fertilizer on Citrus

Fertilizer response curve studies on Spring Maize.

The experiments were conducted at 12 sites on spring maize for varying nitrogen, phosphorus and potash levels. Fertilizer doses of NPK@225-150-125 and 225-150-62.5 kg/ha produced grain yields of 9296 and 9156 kg/ha which were statistically similar.

Fertilizer response curve studies on Sugarcane advance lines (2019-20)

Experiment was conducted with eleven treatments in research area of AARI having varying doses of nitrogen, phosphorus and potash. Maximum cane yield of 91.67 t/ha was obtained with application of 250-175-125 kg/ha of NPK using variety S-2005-US-54. Application of NPK above this dose did not result in significant increase in yield.

Effect of Copper sulphate application on Sugarcane new variety

Copper sulphate was applied to sugarcane crop @ 0, 4, 5 and 6 kg/ha at sowing. Results indicated that its application increased the cane yield (Figure 18).

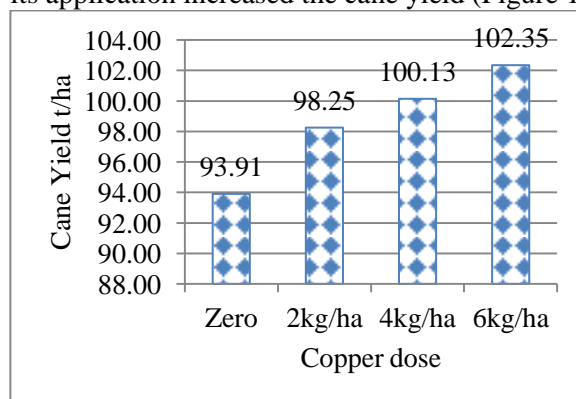


Fig.18. Effect of copper sulphate application on cane yield

Effect of Different Sources of Sulphur on the Sugarcane Yield.

Sulphur (22kg/ha) was applied to sugarcane as elemental sulphur and bentonite at sowing of sugarcane. Final cane yield showed that there was no significant increase in yield which was perhaps due to the reason that solubility of sulphur is low and it may take considerable time for its dissolution (Figure 19).



Fig.19. Data collection of sugarcane

Fertilizer Response Curve Studies on Sugarcane New Variety (CPF-246)

Phosphorus was applied to sugarcane from 125 to 350 kg/ha with uniform dose of 250-125 kg/ha of nitrogen and potash respectively. Results showed the increase of cane yield to 102.78 t/ha with application of 250 kg/ha of phosphorus. Further increase of phosphorus did not increase yield.

Fertilizer Requirements of Rye Grass

Trial was conducted in Muridke to determine fertilizer requirement of rye grass. Fertilizer dose of 200-60-30 kg/ha of N-P₂O₅-K₂O produced the highest fresh fodder yield (64.0 t/ha) of rye grass.

Fertilizer Requirements of Onion

Field experiments were conducted at 26 sites in Punjab to determine nutrient requirements of onion. In second stage of study, phosphorus was tested from 160 to 310 kg/ha alongwith fixed dose of 100 kg/ha each of nitrogen and potash. On overall basis, P₂O₅@310 kg/ha produced highest yield of 19.90 t/ha of onion (Figure 20).

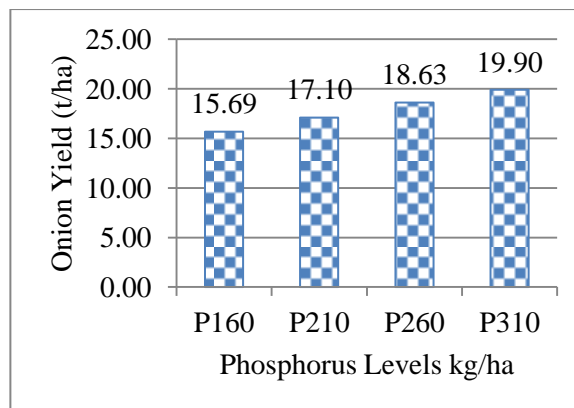


Fig.20. Onion yield with various levels of P

To Study and Demonstrate the Impact of Micronutrients Application on Vegetable in Tunnels

Effect of micronutrients was assessed on tunnel vegetables' yield in Gujranwala, Okara and Sahiwal. Micronutrients were applied at sowing or first irrigation (Zn, Cu, Fe, Mn and B @5, 1.5, 10, 6 and 1.0 kg/ha respectively). Yield of cucumber, Shimla mirch and tomato was increased with application of micronutrients. The results are presented in Figure 21.

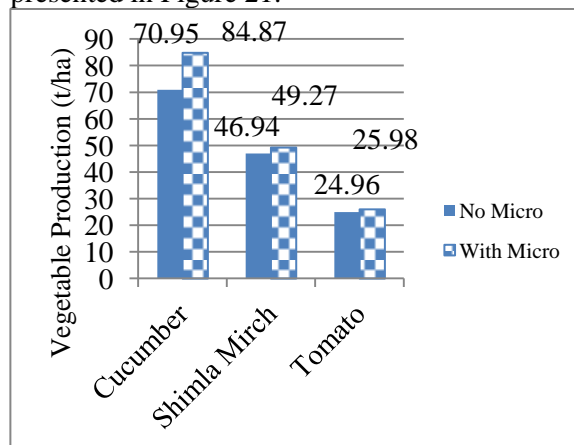


Fig.21. Effect of micronutrients on yield of tunnel vegetables

Fertilizer Requirements of Tomato

Field experiments on tomato were conducted at 26 sites in Punjab to determine nutrient requirements of tomato. In confirmatory stage of study, phosphorus application varied from 170 to 320 kg/ha along with fixed dose of 150 and 100 kg/ha of nitrogen and potash respectively. On overall basis, increasing dose of phosphorus increased tomato yield to 37.52 t/ha with 320 of P₂O₅ kg/ha.

MISCELLANEOUS ACTIVITIES

Regulatory Samples

Regulatory Samples / heavy metal samples.

Fertilizer Regulatory: 2019-20

Total samples analysed: 5470

Soil & Water Samples under Advisory Services 2019-20

Soil samples analysed: 91037

Water samples analysed: 13928

Soil & Water Samples of Research Activities 2019-20

Soil samples analysed: 3372

Water samples analysed: 40506

Soil Samples under Extension Services 2.0 2019-20

Total samples analysed: 170782

Trainings Received in FY 2019-20 by Officers

Forty nine scheduled trainings were attended by officers of this institute. These trainings included technical, finance, administration, management and E-Governance etc.

List of Foreign Visits during 2018-19 by Director / Scientists

A conference titled "13th Environmental conference for doctoral students" in Tsinghua University China was attended by Ms Kausar Majid Malik Agri. Officer from 18-19 Oct 2019.

Recognized Publications

The scientists of this institute authored/co-authored 84 publications/book chapters in various journals.

No of Professional Trainings on Citrus

Two trainings of balanced use of fertilizer were conducted for professional staff of Agriculture Extension Department in Layyah and Bhakkar Districts in end of December 2019 27&31th of Dec.

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