

# Events

November 2016



Group photo of organizers, sponsors and invited guests with Chief Executive Punjab Agricultural Research Board. Photo by authors.

## Significance of Potash Use in Pakistani Agriculture: A Conference Report

Sajid Ali<sup>(1)</sup>, and Abdul Wakeel<sup>(2)\*</sup>

The International Conference on the Significance of Potash Use in Pakistani Agriculture took place from 24-25 November 2016. The conference was organized by the Institute of Agricultural Sciences (IAGS), University of the Punjab, Lahore in collaboration with the International Potash Institute (IPI), Switzerland under the umbrella of the Office of Research Innovation and Commercialization (ORIC), University of the Punjab. Financial support was provided by the University of the Punjab, IPI, Fatima Fertilizer Company (Private) Ltd., Fauji Fertilizer Company (Pvt.) Ltd., and Agrifert Pakistan. Around 200 national participants attended the conference. One of the international speakers, Dr. Muhammad Arshad Javaid (Universiti Teknologi Malaysia), was able to deliver his lecture in person,

whereas Mr. Hillel Magen (IPI, Switzerland) and Prof. Richard Bell (Australia) delivered their lectures through video message.

### The Inaugural Session

The inaugural session began with a recital from The Holy Quran. Sent on behalf of Punjab's Agricultural Minister, Dr. Noor-ul-Islam, Chief Executive of the Punjab Agricultural Research Board (PARB), was the chief guest in the inaugural

<sup>(1)</sup>Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan

<sup>(2)</sup>Institute of Soil and Environmental Sciences, University of Agriculture Faisalabad, Pakistan

\*Corresponding author: [abdulwakeel77@gmail.com](mailto:abdulwakeel77@gmail.com)

session. Other distinguished guests included Prof. Dr. Javed Iqbal Qazi, Dean of the Faculty of Life Sciences, Prof. Dr. Sajid Rasheed Ahmad, Principal of the College of Earth and Environmental Sciences (CEES), and Prof. Dr. Muhammad Saleem Haider, Director of IAGS. Dr. Sajid Ali (Conference Secretary and Assistant Professor at IAGS) briefed conference participants about the objectives of the conference, before Prof. Dr. Haider welcomed the speakers, participants and sponsors. In his welcome address, Prof. Dr. Haider highlighted the importance of crop nutrition, and especially potash, in agricultural production in Pakistan. He also described the importance of holding conferences for sharing and discussing research being carried out in different parts of the country and abroad, and disseminating the research to farming communities. He thanked the participants for attending the event, sponsors for their financial support, and the organizers and volunteers for arranging the conference.

#### **Key Note Address**

##### **Significance and Status of Potash use in Pakistani Agriculture**

*Dr. Muhammad Rashid, General Manager Technical (Ret.), National Fertilizer Marketing (Pvt.) Ltd.*

Dr. Rashid outlined the contribution of the agriculture sector to the national economy stating that it contributes 21.4% to GDP, employs 45% of the country's labor, and provides raw materials to agro-based industries. He said that from 1990 to 2010, the average annual agricultural growth rate was about 4%, with a lower rate of 3% from 2011 to 2016. Dr. Rashid emphasized the importance of balanced use of nitrogenous, phosphatic and potassic fertilizers for meeting the maximum yield potential. In addition to outlining the forms of K in the soil and its role in increasing the productivity of different crops, Dr. Rashid also presented the K uptake of different crops in Pakistan, compared the per hectare yield of these crops with advanced countries, and detailed average retail fertilizer prices, fertilizer use status for the year 2014-15, the main factors contributing to low productivity in Pakistan, and concluded with recommendations regarding the use of potash for increasing agricultural production in Pakistan:

- Supply potash to farmers at subsidized rates. Restart effective agricultural advisory services, particularly training and visiting programs for agricultural extension staff.
- Make effective use of print and electronic media for agricultural advisory programs.
- Enhance soil and plant analysis services provided by agricultural departments.
- Publish results of analysis, particularly regarding potassium (K) in soil and plants, for farmers, agricultural extension staff and research workers.
- Carry out research and development (R&D) work on the response of K fertilizers in Pakistani soils.

- Establish a potash research institute in Punjab to conduct R&D work on various crops and fruits, similar to the Potash Research Institute of India. In this regard, the assistance of IPI and Canada's Potash & Phosphate Institute should be sought.

##### **IPI, its Mission, Activities and Objectives in Pakistan**

*Hillel Magen, Director, IPI, Switzerland*

Mr. Hillel Magen explained that IPI, which was founded in 1952 by German and French potash producers, aims to develop and promote balanced fertilization of crops to produce higher yields and more nutritious food, together with ensuring sustainability of production through the conservation of soil fertility for future generations. Mr. Magen said that IPI is promoting scientific evaluation and demonstration of potash use in Pakistani agriculture. He explained that Pakistan is using huge quantities of nitrogen (N) and phosphorus (P) and alarmingly low quantities of potash. He summarized experiment and research results from different parts of the world under different agro climatic zones which have demonstrated the important role potash plays in plant nutrition:

- Potash increases Nitrogen Use Efficiency (NUE) by about 20%.
- Potash improves the quality of harvested crops, and to get better quality produce we have to go beyond the K levels required for getting high yield.
- Resistance against pests and disease. He elaborated with the example of late blight in potato, which in several experiments was reduced by the application of potash.
- Preservation of soil fertility for agricultural sustainability.

Mr. Magen added that the role of IPI is to sharpen the above-mentioned points in Pakistan to improve the income of farmers and preserve the environment. At the end he thanked the organizers of the conference, particularly Patron in Chief, Prof. Dr. Mujahid Kamran, Prof. Haider and Dr. Abdul Wakeel, IPI coordinator in Pakistan, for organizing such an informative event.

##### **Technical Presentations**

###### **Nutrient Use Efficiency in Plants with Special Reference to Potassium**

*Dr. Muhammad Arshad Javed, Faculty of Biosciences and Medical Engineering (FBME), Universiti Teknologi Malaysia (UTM), Johor Bahru, Malaysia*

Dr. Javed began by outlining the factors affecting sustainable agriculture and agricultural productivity. He then talked about soil and plant based nutrient management and the role of potash in agricultural productivity. Dr. Javed briefed the participants about how the genetic improvement of crops could improve potash use efficiency (KUE) by:

- Optimizing the root architecture (primary root; lateral root; root hair).
- Enhancing K uptake and translocation abilities.
- Coordinating K absorption and translocation with other nutrients like N.
- Exploring the natural variation of KUE in crops.

The speaker concluded by suggesting that the development of new cultivars with higher NUE, coupled with best management practices, will contribute to sustainable agricultural systems that protect and promote soil, water and air quality. Dr. Javed also pointed out that natural variation exists for tolerance to K deficiency, thus improvement of this important trait in field crops is possible.

#### **Foliar Application of $KNO_3$ in Combination with Basal Dose Boost Seed Cotton Yield and Potassium Uptake**

*Dr. Dilbaugh Muhammad, Retired Principal Scientific Officer, Head Agronomy Section, Central Cotton Research Institute (CCRI), Multan*

Dr. Dilbaugh presented one of his many experiments where he worked with potash in cotton. He shared that boll number, weight and seed cotton yield varied significantly with K-application rate and foliar spray. The seed cotton yield and its components were improved with soil applied K, whereas foliar spray further enhanced the efficiency of soil applied K. He concluded his presentation by saying that K application, either through foliar or soil application, is necessary to harvest maximum seed cotton yield. Foliar application alone is not a wise approach to fulfill the K requirement for maximum fruit setting and seed cotton yield. However, K deficiency can be prevented with external K supply supplemented with four foliar sprays of 2%  $KNO_3$  to boost the yield response.

#### **Perspectives of Potassium Solubilizing Microorganisms in Crop Production**

*Dr. Muhammad Naveed, Assistant Professor, Institute of Soil & Environmental Sciences, University of Agriculture, Faisalabad*

Dr. Naveed stated that food shortages are becoming a great danger due to the ever-increasing global population. At the same time, crop yields in many parts of the world are stagnant. Strategies to increase yields must include the introduction of high yielding cultivars, but this leads to nutrient depletion especially K. Then Dr. Naveed threw light on the importance of potash in crop production. He added that the presence of huge reserves of K in the soils developed from Mica minerals may mean that chemical fertilizers do not need to be used, as long as K levels can be managed by adopting efficient strategies.

One strategy, among many, that is adopted to dissolve K minerals, is Efficient Rhizospheric Microbes (ERM) which are effective and economical. Dr. Naveed described the functioning of these

microbes for K-dissolution: organic acid production, lowering of soil pH, chelation, acidolysis, exchange reactions, hydrolysis, biofilm formation, exo-polysaccharides production, tunnels formation by fungi, and complexation. Additionally, Potassium Solubilizing Microorganisms (KSM) adopt a number of other mechanisms which could enhance plant growth, production of growth hormones, N-fixation, P dissolution, siderophore production, Indole Acetic Acid (IAA) production, ACC-deaminase production, enlargement of root systems and antibiotic production. Dr. Naveed stated that the biggest problem in this respect is the commercial propagation of KSMs because the presence of indigenous soil microbes is not high enough to fulfill plant K requirements, so there is need for an inoculum or fertilizer for sustainable development. He concluded that integrated use of biofertilizers could be a better strategy to improve crop production, can be used to reduce the increasing demand of synthetic fertilizers, and can support environment friendly agriculture.

#### **Potassium Management to Decrease Crop Stress Induced by Drought and Frost**

*Dr. Richard Bell, Professor, Department of Food and Agriculture, University of Western Australia, Australia*

Prof. Bell started by stating how K nutrition can be managed to alleviate crop stress by illustrating the forms and physiology of K in soils, its response to crop stress, crops responses, critical K levels, its status in sub-soil, its distribution in soil profiles etc. He then described the physiological roles of K, stating that K is a dominant cation in the cytoplasm consisting of 1-5% plant dry matter (DM) (~200 mM in cytoplasm). Prof. Bell then presented few of the roles ascribed to K in alleviating the stress including:

- Increased rate of photosynthesis.
- Improved translocation of photosynthates.
- Detoxification of reactive oxygen species.
- Osmotic adjustment under low water supply.
- Protection of plant tissues against dehydration/freezing.
- Optimized stomatal control for better water use efficiency.
- Deeper water acquisition and increased soil water storage.

Prof. Bell presented the hypothesis of the study: "Stress in crops due to chilling/frost/drought can be alleviated by higher internal nutrient concentrations than required in non-stressed plants. Higher external (soil test) nutrient levels are required to alleviate crop stress due to chilling/frost/drought". He then described the reasons for selecting K for this particular study, followed by the value of subsoil K and explained it in the light of the Agricultural Production Systems sIMulator (APSIM) model. Prof. Bell then presented some of the published results highlighting the role of K and leaf water potential to photosynthesis, the response of K to crop stress, and the effect of K stress in wheat. He supported his results by comparing photographs of the K stressed and normal seedlings. Prof. Bell showed the results of frost damage in potato

foliage and then described the methodology and treatments used during the study for the years 2015-16. He reported that K reduced frost-induced sterility in both varieties used during the study and concluded that:

- K in soils is commonly low and it can be detected by soil/plant analysis.
- Subsoil K levels down to 50 cm may be important for crop nutrition.
- K improves crop tolerance to drought stress.
- K increases tolerance to frost-induced sterility in wheat.

#### **Role of Potassium in Cotton Production in Pakistan**

*Dr. Niaz Ahmed, Associate Professor, Department of Soil & Environmental Sciences, Bahahuddin Zakariya University, Multan*

Dr. Ahmed described cotton as the economic engine of Pakistan, highlighting its contribution to GDP, foreign exchange earnings, and value addition in agriculture. He outlined the pattern of cotton production for the last six decades in Pakistan and then detailed nutrient use in cotton. Dr. Ahmed stated that the N:K ratio in Pakistan is vestigial (108:1) in comparison with the N:P ratio (3.4:1). He detailed the functions of K and facts about its use in cotton and highlighted the importance of foliar application of K in cotton:

- Mid to late season foliar application of K on cotton can increase yield.
- Foliar K response increased where:
  - soil K is low (low soil test level or fixation);
  - root uptake is compromised;
  - petiole analysis indicates a pending shortage.
- Foliar K begins to enter plant within six hours.
- Maximum uptake occurs between 24 and 48 hours after application (60 to 65% of K).
- Once absorbed, K is translocated to bolls with little delay.

Dr. Ahmad finished his presentation with the following conclusions:

- About two-thirds of soils used to cultivate cotton are deficient in K.
- Soils that have exchangeable-K of less than 80 mg kg<sup>-1</sup> soil should be fertilized with 100 kg K<sub>2</sub>O ha<sup>-1</sup>.
- Three foliar application of 4.1 kg ha<sup>-1</sup> of KNO<sub>3</sub> and balanced use of fertilization for optimum cotton production is beneficial.

#### **Potassium Improves Boll Setting in Early and Mid-Maturing Cotton Cultivars by Primarily Influencing Vegetative Growth Under Both Control and Water-Deficit**

*Dr. Ahmad Naeem Shahzad, Assistant Professor, Department of Agronomy, Bahahuddin Zakariya University, Multan*

Dr. Shahzad stated that cotton is an exhaustive crop and requires NPK in large amounts. Despite high K requirements, K use in cotton production in Pakistan is very limited, probably due to the fact that soils used to be sufficient in this precious resource. He then described the methodology of the presented experiments and said that K application significantly increased plant height in early and late-maturing cultivars, under both control and drought stress conditions. In drought treatment, both 100 and 200 kg K ha<sup>-1</sup> significantly improved the bolls per plant at 135 day after sowing in early and late-maturing cultivars. However, K treatments had no significant effect on boll number in drought-stressed late cultivars.

#### **Effect of NPK Fertilizers and Biofertilizers on Growth and Yield of Mungbean Under Field Conditions**

*Dr. Arshad Javaid, Associate Professor, Institute of Agricultural Sciences, University of the Punjab, Lahore*

Dr. Javaid presented research work carried out on mungbean. He described the methodology of the experiment and shared some of the findings. Dr. Javaid concluded by saying that to boost grain yield of mungbean under field condition, *B. japonicum* TAL-102 should be inoculated in combination with *Glomus mosseae* and the recommended dose of NPK fertilizer should be applied.

#### **Nutrient Regime for Management of Groundnut Root Rot in Punjab, Pakistan**

*Fareeha Jabeen, PhD Research Scholar, Department of Botany, University of the Punjab, Lahore*

Jabeen, a PhD student, shared the results of an experiment on the management of root rot in groundnut by means of nutrient regime management. She began by introducing groundnut, the dangers of root rot and the importance of nutrient management to cope with the disease. Jabeen outlined the methodology and shared some of the results. She concluded that an understanding of disease interactions with each specific nutrient, and the effects on the plant, pathogen and the environment, can be used to enhance disease control, and improve yield competency and crop quality. The effect of mineral nutrient on disease depends on the host plant, the pathogen and other factors. Appropriate modes of fertilizer application, rates and time improve crop productivity and reduce disease incidence.

#### **Importance of Potash and FFC Role in its Promotion**

*Muhammad Zahid Aziz, Senior Executive Marketing, Fauji Fertilizer Company (Pvt.) Ltd., Lahore*

Aziz started by detailing the nutrition sources for crop plants and described the process of translocation of plant food and the deficiency symptoms that appear on the plants due to shortages of these nutrients, in particular K. He then outlined the fertility status of soils and the usage of NPK, and their ratios, in Pakistan. Aziz presented the potash status of Pakistani soils along with the proportion of NPK presently used in Pakistan and stated that these should normally be

used at a ratio of 1:0.5:0.25. He concluded with an overview of the facilities provided by Fauji Fertilizer Company (FFC) to the farming community, including farm advisory centers, models for fertilizer analysis/application and economic models (FFC vs farmer fields).

### Farmers' Session

The International Conference on the Significance of Potash Use in Pakistani Agriculture also brought academia, research and farmers together. Constructive scientific discussions occurred on the first day and the second day was reserved for progressive farmers from different parts of Punjab. During the farmers' session, Dr. Abdul Wakeel, IPI representative in Pakistan, presented the importance of K for balanced fertilizer use in Pakistani agriculture. Afterwards Mr. Naseer Ullah Khan from Fatima Fertilizer Company and Mr. Muhammad Tahir Naeem from FFC presented. As the session was focused on farmers, most of the presentations and discussions were in Urdu.

### Balancing Fertilizers Use with Potassium in Pakistani Agriculture

*Dr. Abdul Wakeel, IPI Consultant, Pakistan*

Dr. Wakeel commenced his presentation with the requirements of plants to live and survive followed by the important roles of K in plants. He then gave a tabulated view of the uptake of nutrients (highlighting K uptake) by different major and important crops of Pakistan. Dr. Wakeel presented a chronological status of K in Punjab soils, showing that more than 40% of Pakistani soils are K deficient. He illustrated graphically the yield trends of wheat, rice and maize for the last three decades, followed by use of fertilizers for five major crops (wheat, rice, maize, cotton, sugarcane) in Pakistan. After providing a chronological overview of the fertilizers offtake in Pakistan for the last 50 years, Dr. Wakeel summed up his presentation by showing the difference between produce grown with and without the application of K.



Photo by authors.

He also threw some light on the importance of K in agricultural production and human health, and its balanced use with N and P to get maximum benefits from applied fertilizer.

### Improving Crop Productivity by Realizing Untapped Crop Potential in Pakistan Through Balanced Use of Fertilizers – Challenges, Prospects and Opportunities

*Mr. Naseer Ullah Khan, Senior Executive Marketing, Fatima Fertilizer Company (Pvt.) Ltd., Lahore*

Mr. Khan stated that with an increasing population rate, land available for food production per person is reducing day by day. He said that in 1960 there was one acre available per person but by 2020 there will only be one acre per 2.7 people. He outlined the production of major crops and fertilizer demand in Pakistan over the next 5-10 years and said that increased production and fertilizer demand is forecasted. Mr. Khan also explained that the contribution of balanced use of fertilizers towards increased yield varies between 30 and 50% in different crop production regions in Pakistan. After presenting the status of plant nutrient and use efficiencies, he reported major crop yields gap analysis and percentage usage in different crops, fertilizers offtake and nutrient wise consumption ( $\text{kg ha}^{-1}$ ), and the consumption of fertilizers for arable land. He compared the fertilizer consumption of Brazil, China, Egypt, India and Pakistan. Mr. Khan revealed that increasing prices of agricultural commodities are contributing towards decreasing input costs. He concluded that untapped potential of crops remains at 57% because the following factors:

- Degradation of soils.
- Nutrient mining.
- Imbalanced use of fertilizers.
- Inefficient use and management of fertilizers and irrigation water.



Photo by authors.

- Primitive nature of farming (low mechanization).
- Negligible availability of quality seeds.
- High post-harvest losses - especially in fruits and vegetables.
- Poor supply chain system for agricultural commodities.

#### Importance of Potassic Fertilizers

Muhammad Tahir Naeem, Senior Executive Marketing, Fauji Fertilizer Company (Pvt.) Ltd., Lahore

Naeem began by describing nutrition sources for crop plants, the process of translocation of plant food, and the deficiency symptoms that appear on plants due to shortage of these nutrients. He briefed the participants about the fertility status of Pakistani soils, the usage of NPK and the ratios being used, the role of macro nutrients i.e. NPK, and provided a brief overview of potash deficiency symptoms in plants and different ways to overcome the nutrient deficiency. Naeem revealed the potash status of Pakistani soils along with the proportion of NPK used, and concluded with an overview of the facilities provided by FFC to farming communities, including farm advisory centers, and soil/plant analysis.

#### Poster Session

Posters from different participants were displayed during the evening of 24.11.2016. Three judges from different institutions (University of the Punjab, Lahore, University of Agriculture, Faisalabad and Bahauddin Zakariya University, Multan) judged the posters on prescribed proforma and the top three posters were awarded with cash prizes and shields.

##### 1<sup>st</sup> Poster Prize (PKR 10,000 and Shield)

Role of Potassium Nutrition in Alleviating the Adverse Effects of Saline Sodic Condition in Rice (*Oryza Sativa* L.) at Different  $EC_w$ :SAR<sub>w</sub> Ratios

Presenters: Alia Munir, Muhammad Moeen-ud-Din, Ghulam Murtaza, Umair Riaz, Humaira Aziz.

##### 2<sup>nd</sup> Poster Prize (PKR 8,000 and Shield)

Relationship Between Soil NPK and Soil-Borne Mycoflora in Wheat-Rice Cropping System of Punjab

Presenters: Ammara Kanwal, Arshad Javaid, Rashid Mahmood and Naureen Akhtar.

##### 3<sup>rd</sup> Poster Prize (PKR 6,000 and Shield)

Effect of Elevated K-Fertilization on Wheat Growth on Saline-Sodic Soil

Presenters: Mehreen Gul, Zafar-ul-Hay and Abdul Wakeel.

#### Concluding Session

The concluding session was started with a recital from The Holy Quran by Dr. Hafiz Azhar Ali Khan, Assistant Professor of IAGS followed by Nasheed for Prophet by Noor-e-Sahar, an IAGS student. Afterwards, the conference secretary, Dr. Sajid Ali, wrapped up the two-day conference and thanked the participants and sponsors. Ch. Afzal Gill, Chairman of the Standing Committee on Agriculture, Government of the Punjab, and Dr. Muhammad Anjum Ali, Director General of Agriculture Extension and Adaptive Research were the guests of honor. Certificates for participants, organizers and sponsors were distributed before Prof. Dr. Muhammad Saleem Haider thanked, the guests, participants, and sponsors, particularly IPI, Fatima Fertilizer Company and FFC for extending their cooperation for the conference. He expressed his hope that these organizations would continue to work for welfare of the farming community and that cooperation among researcher, academia and industry will flourish. He also thanked the organizers for successfully organizing the event.

#### Final Recommendations

- Recent reports on soil analysis confirm that ~40% Pakistani soils are deficient and need potassic fertilizers for better crop production.
- As K is being removed from fields due to the introduction of high yielding crops and intensive agriculture, potassic fertilizers are required for agricultural sustainability.
- To improve the quality of agricultural produce, especially for high value export crops, there is a need to apply extra K fertilization.
- For pest and insect resistance, crops, especially cotton, should be fertilized with K.
- Regarding climate change, K fertilizer should be applied to combat abiotic stresses.
- Agricultural commodity prices are very uncertain in Pakistan; therefore, the government should provide subsidies on agricultural inputs, including potassic fertilizers.
- There is a great need to train extension workers and farmers for balanced use of fertilizers.
- A potash research institute, initially in Punjab, should be established to conduct R&D work on various crops and fruits, similar to the Potash Research Institute of India.

This report also appears on the IPI website at:

[Regional activities/WANA](#)