

Nutrient Management & Developed Technologies for Nutrient Management in Maize Crop: A Review

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Abstract- Maize is regarded as an all season crop in most parts of India because of its better growth habits and withstanding abilities. As humans require nutrients to survive, plants too need the essential nutrients for better growth and development which ultimately fulfills the production desires of a farmer. The physiological development of maize completely depends on the required amount of nutrients that is made available.

I. INTRODUCTION

Maize may not be the staple food of India but its need in the Indian diet puts it in the most wanted and desired crop in India. Its production in India stands at the 3rd position after to wheat and rice. The utilization of maize has been significantly increasing with the improvement of new and high yield varieties of the crop since years. In most parts of India, maize is cultivated throughout the agricultural year and this is considered as the most advantage of this crop. Even with less or optimum application of nutrients, it responds well to the un favorable soil conditions and grows giving an optimum yield. Nutrient management in maize crop is most essential as the practice of following the recommended dose has been outdated with the varying environmental and soil conditions in this modern era. With the practice of traditional or recommended doses of fertilizers the maize output remains to be flattened in the recent years. To feed the hunger of increasing population in the country, researches on many different nutrient management practices are most important in determining the alternative and most suitable practices for the crop. A research was carried out by scientist Satyanarayana and his team in the year 2013 and it was reported that the average use of N, P₂O₅, and K₂O by farmers was reduced by 17, 56, and 58 respectively, than the RDF suggestions. An experiment carried out by scientist Vijay pooniya and his team on nutrient expert assisted Site specific nutrient management in the South-Asian Indo-Gangetic Plains Region (IGPR) in the year 2015 revealed that site specific nutrient management combined with farm yard manure (SSNM + FYM) resulted in increased root length, higher nitrogen efficiency and phosphorous, high bulk density, increased soil physiological and biological properties, as well as high nutrient efficiencies, highest root surface and root density increased productivity and also high amounts of N, K and soil carbon was found in soil than the recommended dosage which was more than the application of fertilizer (RDF). Whereas SSNM- Nutrient expert assisted also led to the similar results with the application of SSNM + FYM in the crop output." These unexpected but

increased output proved that combinational usage of nutrients can be more beneficial in increasing the yield and productivity of maize rather than the practice of recommended doses of fertilizer inputs.

II. CHEMICAL FERTILIZER

Till today the whole agricultural production in the country is dependent on the only first green revolution initiated in the 1960's. The production has seen a drastic increase with the usage of different chemical fertilizers but the changes in soil properties and plant conditions have increased the worry of farmers in the future output from their farms. Chemical fertilizers play the most vital role in providing the plants and soil with all required and essential nutrients and elements like nitrogen, phosphorous, zinc, potassium and many more. Inclusion of chemical fertilizers into the soil enriches the physical and chemical properties of soil, helping the plants thriving well to different soil conditions. Doses of chemicals are prescribed on plants based on the tests and researches done taking an average estimate of the requirements for the crops. Many new testing methodologies and researches like STCR and SSNM and many more have been utilized in the field of agriculture to get the correct fertilizer requirement doses for the crop.

III. NITROGEN

Nitrogen is considered to be one of the most essential and primary nutrient for its effect on the growth and development of maize crop. The physiological growth of plants is completely dependent on the amount of nitrogen they receive. For a plant to get proper and full vegetative growth it requires the accurate amount of nitrogen. To determine the quantity of nitrogen that has to be furnished, the nitrogen sources needs to be determined well. For better growth of the crop a dose of 100 – 150 kg/ha of N can be suggested for application to the crop in 3 split doses. Nitrogen requirement doses for maize crop also varies based on its growing season, physiological appearances and many more factors related to its timely growth. The amount of application of nitrogen source for maize crop may be high, optimum or low based its growth ability and growing time and physiological appearances. A test called as pre-side dress soil nitrogen test (PSNT) can be done to determine if the soil contains sufficient amount of nitrogen for getting the desired yield of maize. The pre-side dress soil nitrogen

test (PSNT) provides a way to determine if there will be sufficient nitrogen in the soil for maximum economic yields corn. For application of fertilizer a farmer should consider 4 things on priority. Right time, Right place, Right source and Right dose are the four most important things have to be considered for the maize crop. According to scientist Yousaf and team in the year 2016, "The sustainable crop production of maize crop completely depends on the regular soil fertility enhancement by maintaining the balance between nitrogen requirement and its supply." Similarly in another research carried out by Scientist jiban shreshta and team in the year 2018, it was reported that smaller doses of nitrogen resulted in maximum grain yield of maize, under low plant densities but as the plant density increased, the dosage requirement also were needed to be increased to maximize the yield. It was also observed that the tasseling and silking days in maize were also affected with the nitrogen levels."

IV. PHOSPHORUS

For maize crop, Phosphorous is as important as Nitrogen. The stem growth and strength to the plant increases with phosphorous application. Phosphorous being the primary nutrient plays a very vital and major role in the growth and standing of maize crop. Phosphorous is highly essential for maize crop for a better and early growth and for proper filled grains. During germination and initial growth stages, phosphorous application is most essential for plant stand and growth. It is highly necessary for carrying out the physiological and biological processes in maize plants.

V. POTASSIUM

The third most required nutrients for the internal and external functions in maize is potassium. It plays major role in the growth of plant cells and organs. Crops uptake more amount of potassium from the soil and deficiency of it can lead to many disorders in the plant growth system leading to damage of the crop and weaker stems. "According to a research carried out by scientist Muhammad and his team in the year 2012 on Potassium use efficiency of maize hybrid and was published in the Journal of Animal and Plant Sciences, it was noted that the phosphorous application affected the physiological maturity of maize crop. With the foliar application of potassium at 92 days the physiological maturity was increases in the crop. In two years it was observed that the physiological maturity of maize crop increased to 50% more than the control." According to many researchers conducted on the potassium uptake in maize plant it was found that the uptake of potassium by tubers, leaves, petioles was much higher with the recommended application of K rich fertilizer sources and when given in split does.

VI. MICRONUTRIENTS

Maize is a versatile crop under various agro - climatic conditions. But the abiotic and biotic stress has lead to decrease in the yield less than its potential yield. Micro nutrients are very essential in full filling the essential nutrient needs of the maize crop. The yield gaps can be covered up with the timely and precise

application of accurate amount of micronutrients to the crop. Manganese, iron and zinc play a vital role for maize plant. Many physiological, biochemical and biological processes are carried out by zinc, manganese and iron application in the maize crop. These micronutrients help in carrying out the chemical functions in the maize crop and many deficiency symptoms also overcome with the timely application of these micro nutrients in the maize crop. It also helps in carrying out the photosynthesis and respiration processes in the maize plants. Micronutrients may not be considered as essential elements but these can be essential in certain stages for the maize crop due to invariability of season, topography or other adverse factors.

VII. ORGANIC MANURES

India saw a unbelievable upliftment in the production, productivity and yield with the implementation and adaption of green revolution from 1960's. But at the present time, it does not seem to be a good option being opted with regard to the soil and human health and in consideration with the pollution levels. Many researchers around the world are now getting back into the age old traditional method of organic practices to retain and improve the soil structure and health and to improve the quality of food production. Many organic ways are being practiced on different crops to test its efficiency of production and yield. A research was done by scientist "Sadiq Naveed and his team in the year 2018, on efficiency check of organic manures on maize crop and It was noted that when FYM, press mud, fisheries manure and slaughter house manure was added in combination with zinc to the soil then the grain yield was found to have increased about 67% and nutrient uptake and soil nutrient status was also recorded to be higher prior to the harvesting stage of the maize crop."

VIII. INTEGRATED NUTRIENT MANAGEMENT

Just like the human taste buds, plants too deserve a mixed and varied nutrient status for increasing their growth efficiency. Integrated nutrient management practice is one of the most useful and efficient tactics for providing a better nourishment to the maize crop. After a thorough review of many research articles it can be understood that the growth, development, nutrient use efficiency, production, productivity per m², nutrient uptake efficiency of the crop and yield of maize was recorded to have given an enhanced output than the practice of a traditional use of single source of fertilizer resources. Inclusion of integrated resources of nutrients into the main crop has been proven to increase the yield and production capacity of maize crop in a long run. It not only helps in nutrition retention but also increases the nutrient uptake capacity of the soil and plants. "In an experiment carried in 2010 by scientist Joshi and team, during kharif season in the Rajasthan college of Agriculture, Udaipur, the effect of integrated nutrient management on growth and productivity and economics on maize was studied. It was noted that integrated use of recommended dosage of fertilizer (120:60:30 kg/ha) along with FYM (10 t/ha) resulted in maximum dry matter production, increased leaf area index and maximum plant height and the overall data was more than 95% in comparison to the control plot. The soil quality also increases with the integrated application of

nutrient rich resources which ultimately decreases the environmental and farm pollutions. So an integrated application of chemical, organic and bio fertilizers will result in enhancement of yield, productivity and nutrient status of soils in maize crop.

IX. LEAF COLOR CHART

It is one of the most innovative things that have been developed for estimating the time of application and quantity of application of fertilizer in crop fields. With a on field comparison of color of the leaves of the plant with a scientifically developed card, the fertilizer application can be accurately estimated. The color indicates the growth stage of the plant and it creates a link with the nutrient requirement of the crop. With different types of LCC it becomes predictable for a farmer to estimate the right time of application of nutrient sources in the maize crop. LCC is very useful in maize for application of fertilizers in the critical growth stages of the crop. LCC use helps farmer in reducing their expenditure on Nitrogen applications which also serves in controlling the soil health and thereby decreasing the environmental pollution.

X. SITE SPECIFIC NUTRIENT MANAGEMENT

Site specific nutrient management (SSNM) is one of the wonderful approaches of maintaining the balance of application of fertilizers to the crop fields. SSNM focuses on the proper timely application and accurate place of application of fertilizers during the crop growth. In many researches based on SSNM in maize it was observed that the utilization, input and output of N,P,K was much higher than the regular practices of fertilizer applications. According to a research conducted by scientist Julie Mae Pasuquin and her team on a new site-specific nutrient management approach for maize in the favorable tropical environments of Southeast Asia, International Plant Nutrition Institute, Southeast Asia Program 2016, it was observed that with SSNM practices the grain yield, agronomic efficiency, NPK efficiency, gross return was much more than the normal practices of fertilizer applications in the maize crop. The application doses of N, P, K and other essential elements can be better estimated with SSNM practice. The targeted and potential yield becomes much favorable with the adoption of SSNM practices in the crop fields. SSNM has to be followed with 4 principles of right dose, right place, right time and right method for getting a better output of the maize crop.

XI. FUTURE SCOPE OF RESEARCH

Maize is regarded as the queen of cereals because of its greater use in cuisine and Indian diet. Being the staple food of Mexicans it has also gained most utilization in Indian diets. Looking at the present development of food demands and the rising population, the potential and targeted yield of maize needs an ample increase of production to meet all the demands. Various researches on maize are being done on to test its ability and increase its productivity and profitability and yield. To meet the production demand by 2050 and get an 25% extra output from now to 2050, there requires many researches to be carried out in future on the nutrient management of maize. There needs to be many

tests to be done on getting out different and alternative techniques of nutrient resource uses to achieve the targeted yield of the crop. SSNM, PNM practices, nutrient expert approaches, soil testing and crop response approaches and use of LCC based and SPAD meters are to be encouraged to make the farmers efficient and help them to increase their production and productivity and yield in the future. Much emphasis has to be given on the eastern regions of India where the soil health is of super quality till now and the farmers and researchers need to be encouraged to take risks with different tests on Maize crop and verities and check their efficiency and output forgetting a good output of the crop.

XII. CONCLUSION

Maize is the most successfully growing crops in various agro climatic zones in all seasons of the agricultural year so to maintain its demands and quality, there has been many varieties being developed and released by many research and educational institutions from whole over the country. To maintain a high level quality of the crop and keep its production available whole year maize production needs to be increased until its targeted yield and potential yield is achieved. Maize contributes to a major proportion of diet and nutrients in the health table of human body. Keeping a view on the future requirements, maize production needs to be increased along with sustaining the naturally available farm resources. India needs to develop the farming practices and include the use of latest technologies and farming techniques to increase the efficiency and yield of maize crop.

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