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Effect of Integrated Nutrient Management on Baby Corn (*Zea mays* L.) – A Review

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Abstract: ***The cultivation of baby corn in countries like Thailand and Taiwan has proven to be a successful venture. In India, more attention is now given to explore its potentials in order to improve the economic stability of the growing farmers and serve as a source of foreign earning exchange for the country. The baby corn is not different from normal corn, rather its immature cobs of normal corn which are eaten whole unlike mature maize cobs which is too hard to be use rough for human consumption. However, India has to use its great potentials of availability of cheap labour to invest more in its cultivation since its value and market is becoming popular and increasing respectively, both within and outside the country (Ranjan, et al., 2013). One Hundred (100) grams of baby corn are rich in 89.1% moisture, 8.2 mg carbohydrate, 1.9 g protein, 0.06 g ash, 0.2 g fat, 28.0 mg calcium, 86.0 mg phosphorus and 11.0 mg ascorbic acid (Thavaprakaash, et al., 2005). Maximum productivity of baby corn can be achieve or improve through the application of chemical fertilizer but always remember sustainability of growing field for future generation as well as human health is imperative especially due to the continuous increase in country population and world at large. However, substitution of some portion of chemical fertilizers along with either organic manure or biofertilizer will maintain and sustains soil health as well as improving economic stability of farmers.***

Keywords: Baby Corn, Nutrient Management, Urea and Poultry Manure.

1. Introduction

Maize (*Zea mays* L.) is considered as one of the most important world cereals crop which served as staple food more than any of the other cereal crops. Maize was originated from America which was domesticated almost 7000 years ago and it supply nutrients to both human and animal as well as used as a source of raw material for the production of oil, protein, starch, food sweeteners and alcoholic beverages as well as fuel source. It is growing across a wide range of climatic conditions of the world due its wider adaptability (Amanullah, *et al*., 2007 & Chennankrishnan, *et al*., 2012). It's popularly called queen of cereals due to high genetic yield potentials than any other cereals counterpart (Kannan, *et al*., 2013 & Verma, 2011).

The cultivation of baby corn shows a successful result in countries like Thailand and Taiwan despite being a recent development but in India more attention is given by both scientist and farmers in order to find out more about its potentials for obtaining more foreign earning as well as maximum returns to the growers. Baby corn is not genetically dwarf maize as the name implies but it's the immature ear of normally grown maize. Unlike mature maize whose ear are too hard but the whole of baby corn ear are consume by human being as a source vegetable. Since the harvesting and de-husking of this crop are carried out manually by most of the producing countries due to availability of cheap labourers, India being having abundant of labourers whose are very cheap has a greater potential in term of its production and exporting (Ranjan *et al*., 2013, Dadarwal *et al*., 2009 and Kumar *et al*., 2009). Furthermore, the cultivation of baby corn can lead to atleast double return to the farmer unlike normal grain maize (Dass *et al*., 2004). One hundred grams of baby corn are found to be rich in 89.1% Moisture, 1.9 g Protein, 0.2 g Fat, 0.06 g Ash, 8.2 mg Carbohydrate, 28 mg Calcium, 86 mg Phosphorus and 11 mg Ascorbic Acid (Wang, 2009 and Thavaprakaash *et al*., 2005). However the baby corn consumption in Asia is more than any part of the world and its production and markets nowadays are expanding worldwide particularly in Asia, Africa and South America. The leading exporting countries of baby corn in the world include Thailand, Sri Lanka, Taiwan, China, Zimbabwe, Zambia, South Africa, Nicaragua, Costa Rica and Guatamela. However, the major importers of baby corn in the world are U.K., U.S.A., Malaysia, Japan and Australia (Goyal, 2013 and Volker, 2006).

The application of chemical fertilizer may assist in obtaining maximum production of baby corn but keeping in mind that chemical fertilizer may lead to hazardous effect on environmental health beside increasing production cost due to its being expensive, as such the judicious uses of fertilizers from different source on crop or baby corn will maintain the environmental sustainability for generations used without affecting the environmental health (Ranjan *et al*., 2013 Mahajan *et al*., 2007 and Dadarwal *et al*., 2009). However, integrated nutrient management (INM) is a judicious application of fertilizers or manures from different sources to a field in order to maintain the environmental sustainability. The example of chemical fertilizers include Urea, Muriate of Potash, Calcium Ammonium Nitrate, Di-ammonium Phosphate, Zinc Sulphate, and so on and for organic sources include Farm Yard Manure (FYM), Poultry Manure (PM), Compost, Goat Manure, Green Manure, etc. and the example of bio-fertilizers are Phosphate Sulublizing Bacteria, Azolla, Biospirillum, Biopotash and so on. However, the adoption of INM practices on the field will reduce the production cost, thereby increasing the economic yield of the farmers and also increases the supply and availability of soil nutrients to the crop as well as increasing the activity of beneficial soil microorganism due to availability of more organic matter content.

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1.2 Effect of Chemical Fertilizer on Baby Corn

There is no doubt that the application of chemical fertilizers on crop can lead to increase in crop productivity but continuous application of it can pose deleterious effect to soil health as well as loss of some of beneficial micro nutrients and leaving some residual effect to the crop harvest thereby affecting human health too.

a) Growth Parameters

It was reported that application of 120 kg/ha N lead to the emergence of plant with taller height and production of maximum dry matter as well as baby corn yield (baby corn/plant, fresh cob weight as well as length and girth of baby cob) over rest of the treatments used in the trial (Bindhani, *et al*., 2007). Similarly, Jat, *et al*. (2009) reported that maximum plant height of sweet corn was obtained due to the increments of fertilizer doses from 50% (60:30:30 kg NPK per ha) to 100%. The dry matter production was found to be significantly higher under application of 150 kg N/ha compared with the application of 180 kg N/ha (Singh, S.D.S., 2001). Furthermore, Suryavanshi, *et al*. (2008) reported that significance increased in Leaf Area Index (LAI) and dry matter production of maize crop were obtained as a result of the application of 150 kg N/ha over application of either 50 or 100 kg N/ha from inorganic sources.

b) Yield Parameters

Singh *et al*. (2009) revealed that yield parameters of baby corn crop were significantly higher through the application of 100% N from inorganic nutrient sources than integration of either 75% or 50% N along with 25% or 50% FYM respectively. Baby corn cob per plant, number of cobs per plant and girth of baby corn were reported to be significantly increased due to the application of 180: 38.7: 74.7 kg NPK/ha compared with the application of 60:12.9:24.9 kg NPK/ha (Singh, *et al*., 2010). Jaime and Viola (2011) reported that maximum yield of baby corn (cobs) with superior quality was obtained due to basal application of 200 kg N per ha through inorganic sources over integration of both inorganic and compost sources. *Nath et al*. (2009) reported that significance increased of cob girth of sweet corn was obtained due to application of 110 Kg N/ha compared with application of 70 kg N/ha. Lone, *et al*. (2013) reported that significance increased in length of cob was observed due to application of 150% RDF (225:90:60 kg NPK/ha) compared with the rest of treatments used in the trial. Hossain *et al*. (2010) revealed that recommended dose of chemical fertilizer resulted in maximum grain yield of rice crop.

c) Nutrients Uptake

Significance increased in nutrients uptake by maize crop was observed due to application of 180:90:60 kg NPK/ha compared with the application of either 120:60:40 or 60:30:20 kg NPK/ha (Sutaliya and Singh, 2005). Similarly, Kar *et al*. (2006) revealed that application of 80 kg N/ha resulted in significance increased of sweet corn nutrients uptake compare with the rest of the treatments used in the trial.

1.3 Effect of Organic Fertilizer on Baby Corn

The application of Organic manure or fertilizer on soil not only improved the crop productivity but also sustain and maintain the soil productivity and some of beneficial importance of organic manure are viz: reduction in cultivation cost, production of highly nutritious food without residual toxicity which can deteriorate human health and also maintain ecological balance.

a) Growth Parameters

The application of 5 t/ha vermicompost along with 14 and 10 t/ha of poultry manure and FYM resulted in significantly higher leaf area index and dry matter production (Prasad, *et al*., 2003).Maize plant height and dry matter were found to be significantly higher in a field experiment conducted at Salooni and Bangalore through the application of 10 t/ha FYM more than 5 t/ha FYM as well as control treatment (Karki, *et al*., 2005). Similarly, it was reported that application of 20 t/ha FYM resulted in significantly higher maize number of leave as well as dry matter production over 10 t/ha FYM as well as control (Kudtarkar, 2005). Kumar *et al*. (2008) and Jayaprakaash *et al*. (2004) reported that application of 2 t/ha Vermicompost along with 10 t/ha FYM resulted in significantly higher leaf area and leaf area index more than where there is no organic sources of nutrient.

b) Yield Parameters

Khan *et al*. (2008) revealed that the use of organic manure (FYM, poultry manure, green leaf and spray of panchagavya) on sweet corn field resulted in significant increased of yield attributes (grains number per cob, cob length and diameter). Furthermore, application of 3.8 t/ha along with 2.45 t/ha poultry manure resulted in significant increased in wheat crop crude protein content (13.41%) compare with the rest of the treatments used in trial (Channabasanagowda, *et al*., 2008). In a field trial conducted at University of Agriculture Sciences, Dharwad main research field on maize revealed that application of FYM resulted in significantly higher grains and stover yield than vermicompost as well as control (Pattanashetti *et al*., 2002).

1.3 Effect of Integrated Nutrient Management on Baby Corn

a) Growth Parameters

A field study was conducted at Vanavavarayar Institute of Agriculture and the result shows that, integrated nutrient management has positive effect on growth parameters of maize such as leaf area and plant height (Kannan *et al*., 2013). Similarly, a field trial was conducted at University of Agriculture Faisalabad Pakistan in their Agronomic trial field and the result shows that, the combining ability of poultry manure with single super phosphate result in positive increase in growth parameter of maize such as leaf area index and crop growth rate (Ali *et al*., 2012). It was also reported that, the integrated nutrient management has significant effect on growth parameters of maize crop which was found in a field trial conducted at ICAR research field Umiam, Meghalaya (Panwar, 2008). Kumar *et al*. (2008) reported that application of 120 kg N/ha through Urea along with 30 kg N/ha through poultry manure resulted in significance increase in growth attributing parameters in

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maize crop. Haq (2006) conducted a field trial at Shalimar Campus Kashmir and reported that, the combination of FYM and mineral fertilizer significantly increases the growth parameters of maize like plant height, leaf number and Leaf Area Index. Maize crop vigor was observed to be better under integrated nutrient management than sole application of FYM or Urea in a field trial conducted at Makawanpur District of Nepal (Chapagain, 2009, 2010). Similarly, Mahajan *et al*. (2007) conducted a field trial at Kangra district of Himachal Pradesh and reported that, the integrated used of both organic and inorganic manure has positive effect on the total productivity of maize crop than sole used of mineral fertilizer.

b) Yield Parameters

Kannan *et al*. (2013) in their research trial conducted at Vanavavarayar Institute of Agriculture reported that, integrated nutrient management shown the superior result on yield characters of maize like 100 seed weight, number of grain per cob and yield of 4112 Kg/ha due to combined effect of vermicompost and recommended dose of NPK. Ali *et al*. (2012) in their field trial conducted at the University of Agriculture Faisalabad Pakistan in their Agronomic trial field and they reported that, significant increase in yield like 1000 seed weight and maize grain yield was obtained due to integration of both organic and inorganic manure. Ravi *et al*. (2012) in their research trial conducted at agricultural research station Arabhavi of Karnataka and they also confirmed that, the use of 75 per cent RDF with other organic and bio-fertilizer significantly increases the grain yield of quality protein maize. Ashoka *et al*. (2008) reported that integration of RDF (150:75:40 kg NPK per ha) along with 25 kg $ZnSO_4$, 10 kg $FeSO_4$ and 35 kg Vermicompost on baby corn-chickpea sequence resulted in significantly maximum yield and yield attributes namely; ear length, weight of ear, yield (64.43 q/ha) as well as green fodder yield (232.33 q/ha) over sole application of inorganic sources. Lone *et al*. (2013) revealed that integration of 150% RDF (225:90:69 kg NPK/ha) along with 6 t/ha FYM resulted in production of maximum yield of cob without husk (20.60 q/ha). Panwar (2008) conducted a field trial at ICAR research field Umiam, Meghalaya and reported that, the yield parameters of maize show significant increase with the application of 50 per cent N each from FYM and recommended doses of NPK. Furthermore, a field trial was conducted at Konkan region of India and they suggested that substitution of 25 per cent recommended doses of fertilizer with FYM will positively result in better green fodder yield production of maize (Bhagade, *et al*., 2008). Ghaffari *et al*. (2011) conducted a field trial at central Institute of temperate Horticulture regional station Uttarakhand-India and reported that, the grain yield of maize was significantly increased as a result of the application of different sources of nutrients to the maize plant. Thavaprakaash *et al*. (2005 and 2008) conducted a field on baby corn at Tamil Nadu Agricultural University, Combatore and reported that all the yield parameters were significantly increased with the substitution of 50% NPK through either poultry or goat manure along with Azospirillum and Phosphobacteria.

2. Soil Available Nutrients and Nutrients Uptake

Kannan, *et al*. (2013) conducted a field trial at Vanavavarayar Institute of Agriculture and the result shows that, integrated nutrient management significantly influenced the maximum increase in organic carbon as a result of integrated used of vermicompost and recommended dose of NPK. In a field trial conducted at University of Agriculture Faisalabad Pakistan in their Agronomic trial field and the result shows that integrated nutrient management is one of the good approach for nutrients management in the environmental balance (Ali *et al*., 2012). Ghaffari *et al*. (2011) reported that, the nutrients use efficiency was improved up to 11.5% due to combined effect of recommended dose of NPK along with single spray of multi-nutrients. Singh *et al*. (2010) reported that with application of 180Kg N plus 38.7Kg P_2O_5 plus 74.7Kg K_2O per ha and 50% N supplied through FYM resulted in significant increase in available NPK in soil after harvesting baby corn. Sarwar *et al*. (2012) reported that, both organic matter content and nutrients uptake in the soil will be increase if 25 or 50 per cent of N is replace with FYM. Rao *et al*. (2010) also suggested that, the integrated application of nutrients in maize grown under rain fed maintain and sustain soil resources. The nutrients (NPK) uptake was found to be significantly higher due to integration of 50% RDF along with either poultry manure or FYM than sole application of 100% RDF (Thavaprakaash, *et al*., 2007). Shilpashree *et al*. (2012) revealed that, in addition to release of plant nutrients from organic matter, the organic acid produce during decomposition process also release the native nutrients on soil and increases their availability to plant. Ebrahimpour *et al*. (2011) reported that, significance increased of soil nutrients were observed due to use of bio-fertilizer and they concluded that non-chemical sources of crop nutrition provide a reliable alternative to chemical fertilization in organic crop production. Dadarwal *et al*. (2009) reported that, continuous application of FYM enhances the availability of NPK status of soil after harvest of baby corn.

3. Conclusion

Thus, it can be concluded that the integration of different sources of nutrients either from chemical, organic or biofertilizers sources have been proven to be recorded success in different part of the world than sole use of either chemical fertilizers or organic manures and this system is not only improving the total crop productivity but it also maintain and sustains soil health for future generation as well as improving the economic stability of the farmers.

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