iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** VIII **Month of publication:** August 2019

DOI: http://doi.org/10.22214/ijraset.2019.8067

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VIII, Aug 2019- Available at www.ijraset.com

Maize - The Crop for Tomorrow: A Review

Namitha V V[1], Dr. Rajasree. G[2]
[1]*M.Sc. (Agri) student, Agronomy, College of Agriculture, Kerala Agricultural University, Thrissur, Kerala, India*
[2]*Associate Professor (Agronomy), College of Agriculture, Kerala Agricultural University, Thrissur, Kerala, India*

Abstract: ***World is undergoing large wave of urbanization. According to UNFPA (2015), more than half of the world's population lives in towns and cities and by 2030 this number will increase up to 5 billion. Hence there is an increase in the number of populations who are involved in non-agricultural activities. This resulted in a decline in the farm labour availability. Under this circumstance we have to switch on to other sources which need less labour and easy to produce, at the same time meeting the demand of the growing population. In addition, due to the changing climatic situation, we have to depend on crops that can be incorporated in the existing cropping system. Among the three important staple cereals in the world, the one with the highest productivity and nutritive value can save us from this crisis. Maize is one such crop that can fit very well to our cropping system and is climate resilient.***

Keywords: Urbanization, population, maize, climate resilient

I. INTRODUCTION

Maize (*Zea mays* L) is the third of the most important food crop in the world and together with rice and wheat, provides at least 30 per cent of the food calories to more than 4.5 billion people in about 94 developing countries. Maize in India contributes nearly 9 per cent in the national food basket and can generate more than 100 million-man days (Tariq and Iqbal, 2010). Globally it is an important crop and preferred staple food for more than 1 billion people in Sub-Saharan Africa and Latin America, where animal source of protein is not affordable by the common people. Maize is a C_4 plant. It is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. Globally, maize is known as the "queen of cereals", because it has the highest genetic yield potential among the cereals (Kumar *et al*, 2012). But now there exist a wide gap between the food production and population. In 1798 Malthus proposed the Malthusian theory of population which says that the population grows at exponential rates while the food supply is in arithmetic terms. Even though this theory was proposed in 1798, it is still valid in the present scenario. In order to close these gaps, we have to find an alternative that will provide more output from the available land there by helping to ensure both food and nutritional security.

A. Maize Production State Wise Analysis

In India all the states are producing maize at varied level. The top maize producing states in India include Maharashtra, Madhya Pradesh, Karnataka, Bihar, Telangana, Andhra Pradesh, Uttar Pradesh, Rajasthan, Tamil Nadu, Gujarat. Maharashtra stands first with a production of 3.45 t. Madhya Pradesh and Karnataka comes next and they produce more than 3 t each. Among the 28 states, Kerala is at 27th position having an annual production of 0.07 t. Area is highest in Karnataka (1.37 m ha) followed by Madhya Pradesh (1.2 m ha) and Maharashtra (1.14m ha). While comparing the productivity of maize cultivation Andhra Pradesh (6.612 t ha^{-1}) ranks first. In Kerala, from an area of 70 ha, production of 0.07 t and productivity of (1.04 t ha^{-1}) is reported (India Agristat, 2016).

B. Maize in Cropping Systems

Today, we are facing a decrease in the availability of land. So, we have to increase the productivity from the available land by using suitable crops. Timsina and Conor, (2009) reported that the rice- maize system in south Asia have the highest productivity when compared to the other system like rice-rice and rice- wheat. The commonly used cropping system in south Asia is rice-rice, rice-wheat, and rice- maize (Buresh *et al*., 2010)

Around 850 L water is used for per kg grain production (with 2-4 irrigations) which is lesser when compared with rice which utilize 3,000 L per kg grain (with 20-35 irrigations). Since we are facing water scarcity problem instead of taking two crops of rice, the summer rice fallows can be utilized effectively for maize cultivation in Kerala. Archana and Bai (2016) reported that the summer rice fallows of Kerala can be utilized for raising baby corn and found that all the varieties have same yield (G 5414, CO 6 and NSC 1009 B).

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The crop is highly responsive to nutrient management practices. Mavarkar (2016) suggested nutrient scheduling of 135:65:45 kg NPK ha^{-1} as split application for baby corn intercropped in coconut garden of which the basal application half N, full P, K and another half N at 25 DAS produced higher cob yield and B:C ratio

To popularize maize crop among small farmers of Ernakulam district of Kerala, Krishi Vigyan Kendra, ICAR (Central Marine Fisheries Research Institute) organized 25 demonstrations during 2012-13 to 2014-15 on traditional farmer's field. Maize cultivars Pratap-4 and Pratap-5 were used for demonstration. Results of demonstration revealed that Pratap-4, Pratap-5 and local variety produced 33.70, 30.7 and 23.4 q ha^{-1} respectively. Average income generated by the crop range starts from Rs. 36840 to Rs. 40440 and local variety Rs. 30240 (Meena *et al*., 2015). The agriculture system that is practiced by most of the farmers is based upon mixed farming in which two major enterprises are crops and livestock. Maize not only supplied food but also ensure green fodder to the livestock. The crude protein content of maize was found to be similar to that of guinea grass, hybrid napier and was devoid of antinutritional factors.

In a study conducted by George (1981) on the fodder production potential of maize- legume mixture observed that maize- black gram mixture produced superior yield and the calcium content was also found to be higher.

C. Maize In Adverse Climatic Conditions

1) *Maize Under Drought Situation:* Scientists from CIMMYT showed that drought tolerant maize varieties can provide farming families in Zimbabwe an extra 9 months of food. As climate change problems like variable rainfall and drought continue to impact the southern African nation at an increasing rate, these varieties could provide a valuable safety net for farmers and consumers. Adoption of drought tolerant maize varieties by farmers is crucial for maintaining food security in the region. The people who has adopted hybrid maize cultivation has got a yield of 680.5 kg ha^{-1} (Kabir *et al*., 2005). When the temperature goes on increasing the anthesis was found to be high in both rice and maize than in wheat. But the grain filling was maximum for maize than in rice and wheat (Kaur *et al*., 1985).
2) *Maize for low Temperature:* Kaur *et al*., (1985) conducted experiments to evaluate the cold tolerant capacity of S_1 lines of Pratap and that of the local variety. In Punjab the winter is severe and the temperature may go beyond 10^0c. The experiment was conducted in open field. The S_1 lines of Pratap showed superior agronomic character than the local variety. There are maize variety which can to provide food security under low temperature condition.
3) Maize for Nutrition: Protein-calorie malnutrition is a widespread and serious public health problem in Africa. Zambia is one of the most severely affected countries in Africa and levels of protein-calorie malnutrition is high. Due to the adoption of hybrid maize like SR52, ZH1, SR11, ZCA, and SR13, there is an increase in the nutritive value like energy, protein, fat, carbohydrate, calcium, iron, thiamine, riboflavin (Kumar, 1994). Muzhingi *et al.* (2011) reported that by the adoption of β carotene enriched maize helps to overcome vitamin A deficiency and they found the same level of vitamin A content in blood of those who have the retinol supplement. The zinc absorption was also higher when the young rural Zambian children were fed with zinc biofortified maize (Chomba *et al*., 2015).

Singh and Chandra (2009) reported that with the adoption of quality protein maize in Bihar, there was an increase in the height up to 0.63cm $month^{-1}$ and weight up to 166 g $month^{-1}$ in the children and weight of children who consumed wheat have only 0.55cm $month^{-1}$ of height and 142 g $month^{-1}$ of weight.

Maize flour can be utilised as substite for rice and wheat flours in different proportions in different food items like traditional foods (Idli, Dosa, Puttu and Adai), convenience foods (Papad and Noodles), bakery (Cookies and Bread) and snacks (Vada and Pakoda) which was organoleptically evaluated using nine point hedonic scale and all products scored maximum acceptability. This enhance food and nutritional security as they are rich source of micronutrients and can eradicate hunger and poverty (Subbulakshmi and Amutha, 2013).

D. How to Popularize Maize Cultivation

1) Value added corn products: Maize is already a part of our breakfast in the form of corn flakes, one of the components in the multigrain atta used for making chapatti and baby food items. Other value added products are corn soups, corn syrup, corn starch, corn flour and corn meal. It can also be included in our diet by making of Idli, Puttu, Vada, Dosa, Ada, Papad etc.
2) Through public distribution system: Under the present situation only rice and wheat are included in the public distribution system. Even though maize has minimum support price, the government is not able to sell it due to the lack of proper channels in the public distribution system. Compared with rice and wheat it has got the lowest minimum support price.

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3) Packed animal food: There are corn based packed animal foods like corn feed pellet, yellow seed corn, etc. In Karnataka they are having industries to make feeds from corn. This can also be practiced in Kerala so that the farmers will be having better income security.

4) Popularisation of speciality corn: The speciality corns that are having higher nutritive value like baby corn and sweet corn can be added in our diet either by direct use or by means of value addition. Sweet corn can be used in wine industry and Baby corn to prepare salads, pickles, chutney etc.

II. CONCLUSION

Maize is a potential crop that can address issues like food scarcity, undernutrition, climate change and water scarcity. In India maize is mainly used as cattle feed and less amount is used for human consumption. So that there exists pressure toward rice and wheat to produce more to meet the demand. Since we are facing land and water scarcity, maize is one of the best alternative sources that can adapt to various agro ecological situation and have high genetic yield potential. Rin addition to that several value added products can also be made from maize.

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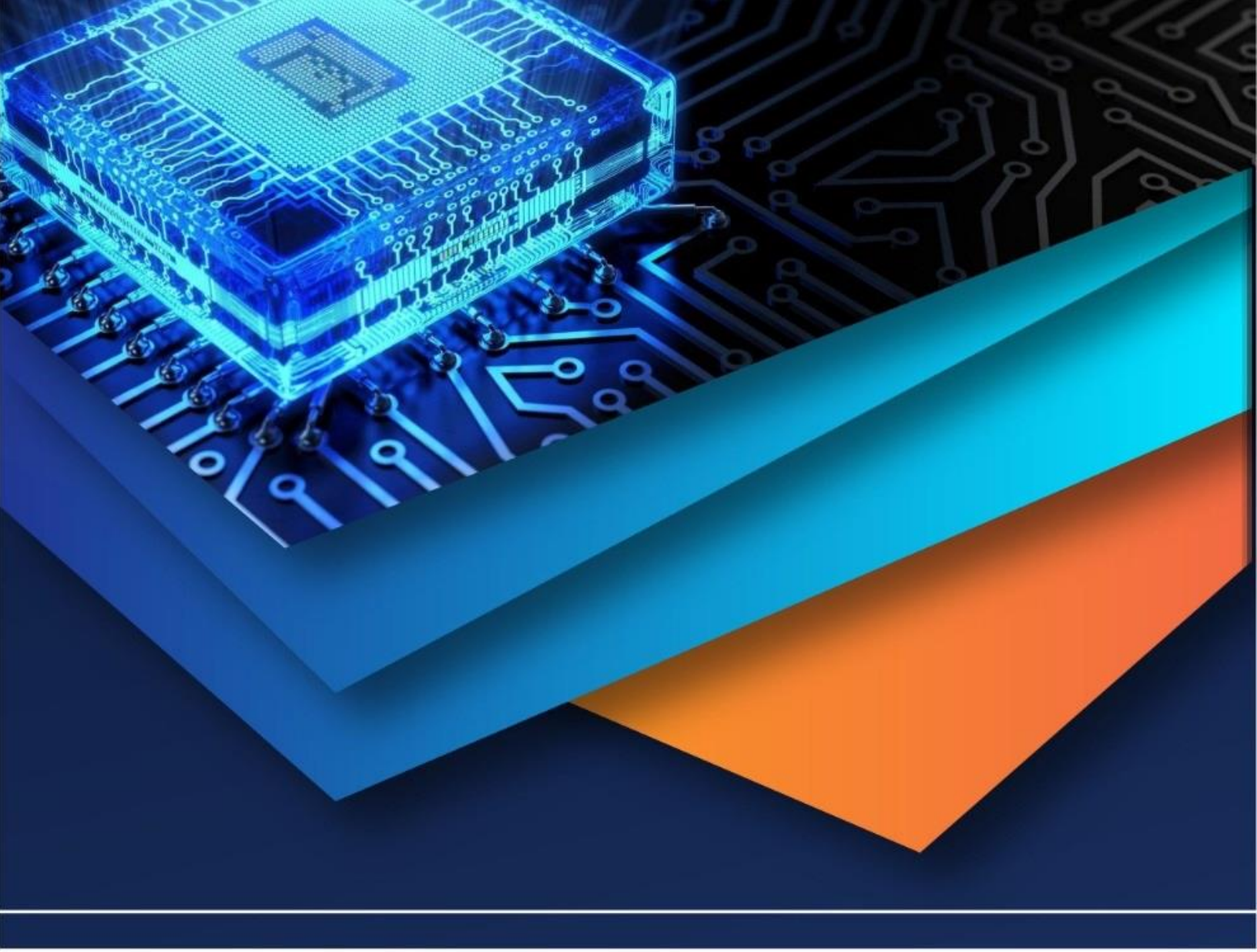

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