

TECHNICAL BULLETIN

No. 16, 2021

Cultivating White Maize for Human Consumption in Bangladesh

Bangladesh, although is self-sufficient in rice production, has to import more than six million tons of wheat to maintain food security. Being a C4 crop, Maize is more productive than the C3 crop rice or wheat. Growing white Maize, thus, may be a viable option to enhance and sustain food and nutritional security in the country. Modern white Maize hybrids produce softer kernels and can be used to prepare diverse food items which are more tasty, finer and softer than those made from yellow Maize. Researchers of the Sher-e-Bangla Agricultural University conducted research on white Maize during the years 2015-18 in different regions of Bangladesh with the objectives of evaluating different varieties of white Maize and developing appropriate agronomic practices for its production.



Methodology



The project was implemented jointly by three institutions: Sher-e-Bangla Agricultural University (SAU), Dhaka; Bangladesh Wheat and Maize Research Institute (BWMRI), Dinajpur in both research plots (SAU and BWMRI) and farmers' fields of six districts. Forty-nine white Maize varieties suitable for human consumption were collected from home and abroad and from among them, the most productive and adapted ones were selected. Areas suitable for white Maize production were also delineated by GIS techniques.

Agronomic practices such as, planting configuration, fertilizer doses and application schedules, etc. were tested and perfected for white Maize production. Also, the use of white Maize for preparing various delicacies was tested.



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Results and Outputs

Varieties

Varieties which performed best in at least for more than one year were selected for the specific sites which are presented below.

Rabi season

- SAU, Dhaka: The varieties PSC-121, Changnuo-1, Q-Xiangnuo-1, Changnuo-6 and Yangnuo-3 performed best across the years showing seed yields ranging from slightly greater higher than 7 to over 12 t ha⁻¹. The local varieties which had comparatively lower seed yields (1.14-3.89 t ha⁻¹).
- Dhamrai, Dhaka: Changnuo-6 (9.129 t ha⁻¹), ch1 and PSC-121 yielded (seed) over 8 t ha⁻¹. Yangnuo-7 had the lowest (6.04 t ha⁻¹).
- Rangpur: Changnuo-1 performed significantly showing seed yield range of 6.35-12.17 t ha⁻¹). The variety PSC and KS-510 had lower seed yields (4.54-4.57 t ha⁻¹)
- Bandarban: PSC-121 and the CIMMYT line 15008 showed good performance for more than two years showing yield up to over 13 t ha⁻¹. Farmers earned Tk. 66,132 ha⁻¹ at Bandarban selling fresh cobs.
- Dinajpur: PSC-121 in 2015-16 and 2016-17 (5.57 t ha⁻¹); in 2017-18: PSC-121 matured in 120 days yielding 6.94 t ha⁻¹ while yellow Maize matured in 112-134 days yielding 5.34-8.38 t ha⁻¹.
- BWMRI: PSC-121, Yangnuo-3 and Changnuo-6 proved to be better giving yield up to 11.75 t ha⁻¹.



Kharif season

- SAU, Dhaka: Yangnuo-3000 and PSC-121 were consistent showing seed yield of 5.35-5.92 t ha⁻¹ in 2016 and 2017.
- Bandarban: PSC-121 gave considerably high seed yields, even higher than that of the national level (7.00 t ha⁻¹).

Planting configuration

Rabi season

SAU: The optimum plant spacing varied with maize variety. Across the years, the variety KS-510 at a planting spacing of 50x25 cm, Changnuo-6 at 60x25 cm, PSC-121 and Changnuoat 50x20 cm gave the highest seed yield (9.2-14.9 t ha⁻¹).

Dhamrai: PSC at 50x20-25 cm gave the best seed yield across the years (9.15-10.84 t ha⁻¹).

Rangpur: Irrespective of variety or year, the spacing 50x20-25 cm gave the highest seed yields (13.50-14.09 t ha⁻¹).

Bandarban: Across the variety and years the spacing 50x25 cm was the optimum giving the highest seed yield (9.56-10.61 t ha⁻¹); across the years the variety PSC-121 at 50x25 and paired rows gave higher seed yield (10.40-10.61 t ha⁻¹).

BWMRI: Across the varieties and years the spacing 50x20-25 cm gave higher seed yields (9.55-9.63 t ha⁻¹); across the years PSC-121 with 50x20 cm spacing gave significantly higher seed yield (10.65 t ha⁻¹).

Kharif season

SAU, Dhaka: Yangnuo-30 at 40x25 (6.497 t ha⁻¹); 40x25 and 50x25 cm (6.06-6.93 t ha⁻¹).

Soil moisture regime

- Irrigating four times coupled with polythene mulching brought about a two-fold increase in seed yield
- The most drought tolerant variety was Yangnuo-3000
- Using rice straw and rice husk at the rate of 5 t ha⁻¹ for mulching increased the seed yield of white maize over 100%
- Application of anti-transpirant kaolin at the vegetative stage or at the tasseling stage was found to be a good moisture conservation measure.

Fertilizer doses, weed control and cropping pattern

Irrespective of season, variety or location, balanced fertilizer doses at the rates of 100-125% of the recommended rates gave the highest seed yield of white Maize. Integrated nutrient management with cowdung compost @ 2.5 t ha⁻¹ + 50% of the recommended doses of chemical fertilizers and a close plant spacing (60x20 cm) gave the best result in terms of seed yield.

Hand weeding 60 days after sowing was good enough.

Pre-emergence application of the herbicide Panida 1.5 was also found to be effective in weed control.

Rice equivalent yield and relative yield total (RYT) were higher in the rice-maize system (1.57 and 1.14, respectively) at Bandarban which were higher than those for the traditional jhum system. However, the traditional jhum system generated a higher income than did sole maize.



Food product development

Various food items such as, ruti (hand-baked bread), parota (buttered ruti), pakora (stuffed fritter), sweet pua (pancake), cornball, jhalpua (chili-spiced pancake), corn salad, jilapi (sweets), firmi (sweet porridge), etc were prepared from white Maize.

Benefits and Outcomes

In field days and training programs, farmers showed keen interest in growing white Maize and they expected easy and profitable marketing of white

Maize. Campaigns to popularize food items prepared from white Maize generated curiosity among the local populations about white Maize as a delicious and nutritious food source.

Expected Impacts

As a C4 plant with higher productivity, white Maize may be a food source supplementing the staple food crop, rice and contributing to food security for the burgeoning population of Bangladesh. Also, white Maize possesses quite a bit of climate resilience which is an added advantage for this crop given Bangladesh's vulnerability to climate change adversities. This research-and-demo project created a positive impact among farmers and consumers regarding the suitability of white Maize as a nutritious cereal which may be used to prepare various delicacies suiting the Bangladeshi palate. Since white Maize is more productive than Wheat

and food items prepared with white Maize flour are as nutritious as those made with Wheat flour, it may, to a great extent, replace wheat as the second staple cereal in Bangladesh reducing Wheat imports and saving foreign exchange.

Recommendations

- ❖ Follow-up research-and demo work needs to be extended to other districts of the country to introduce white Maize to the farmers and consumers;
- ❖ The white Maize varieties selected in this project may not be suitable for growing in other areas of Bangladesh, massive multi-location trials should be conducted to recommend white Maize varieties suitable for various AEZs of the country;
- ❖ In Bangladesh, Maize competes with Boro rice, Wheat and other Rabi crops for space, so it should be planted as a late Rabi crop especially after harvesting post-transplant Aman rice crop(s) such as, Potato, etc. However, Maize sown in the late Rabi season may suffer from summer storms (Kalboishakhi) at the vegetative or grain fill stage. So, Maize breeders need to develop dwarf early-maturing varieties;
- ❖ Consumer acceptable food products from white Maize need to be developed and manufactured commercially with the help of nutritionists, food scientists, business entrepreneurs, etc.

This technical bulletin has been prepared on the basis of technical information available from a completed CGP project of KGF, the details of which are given below:

Project Code and Title: TF 16-WM/15. Collection, evaluation and introduction of white Maize for human consumption in Bangladesh

Principal Investigator: Prof. Dr. Md. Jafar Ullah, Department of Agronomy, Sher-e-Bangla Agricultural University (SAU), Dhaka; **Project Duration:** March 2015 to June 2018

Published by:

Krishi Gobeshona Foundation, AIC Building, 3rd Floor, BARC Campus, Farmgate, Dhaka-1215, Bangladesh, Telephone: 880-2-9111041, Fax: 880-2-58150270, Website: www.kgf.org.bd, E-mail: kgf-bd@live.com