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Evaluation of sweet corn (*Zea mays* L. *Saccharata*) cv Sugar 75 for livelihood security in mid central table land zone of Odisha

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Abstract
The study was carried out through front line demonstrations during *rabi* season of 2017-18 in mid central table land zone of Odisha with an objective to evaluate the performances of hybrid sweet corn variety (Sugar 75) as compared to the farmer's practice (common maize) for livelihood security. The sweet corn (Sugar 75) recorded higher plant height (152.4 cm), no of cobs plant^{-1}(1.35), grains cob^{-1}(450.6) and weight of cob (295.6 g) than common maize. The same also produced green cob yield (152.5 q ha^{-1}), green fodder yield (190.3 q ha^{-1}), harvest index (44.5%) and grain yield 48.3 q ha^{-1} which is 36.1% higher than common maize. Sweet corn (Sugar 75) gave higher gross return Rs. 132450.0 ha^{-1} with a benefit-cost ratio 2.81, profitability (Rs.232.7 ha^{-1} day^{-1}) and additional net return Rs. 64382.5 ha^{-1} as compared to farmers practice and the study showed that horizontal spread of area from 0.8 to 12.0 hectare under improved technology with technological gap, extension gap and technology index; 41.7 q ha^{-1}, 12.8 q ha^{-1}, 46.3% respectively. Thus, the existing common maize can be replaced by sweet corn (Sugar 75) for higher productivity, profitability and livelihood security.

Keywords: Economics, extension gap, front line demonstration, sweet corn, technology gap, technology index

Introduction
The agriculture is the back bone of the country with more than 65 per cent population of country directly or indirectly depends on agriculture for their livelihood. In most of the tribal areas of the country, traditional agricultural practices with old crops or cropping system are being practiced in order to fulfill the needs of the family. The farmers grow low value crops after paddy in *rabi* season. Therefore, to enhance the production and income per unit area, it is very essential to grow high value short duration crops like sweet corn, which will not only increase awareness about this crop but also meet requirement of good quality fodder for their milch animal which will result in an increased milk production and thus, enhance the income of farmer [1] Agriculture systems require an economically viable, socially acceptable and sustainable approach to improve lively hood of the farming community ensuring food and nutritional security as well as financial power, the sweet corn (*Zea mays saccharata* Strut.) in this context seems vital and alternative crop to meliorate the situation [2]. Corn (*Zea mays* L.) is a versatile crop, which finds a place in the human food, animal feed, fodder and industrial raw material. Recently specialty corns such as baby corn and sweet corn have emerged as alternative food sources, especially for the affluent society. Sweetcorn is used as a human food in the soft dough stage with succulent grain. Sweet corn is gaining popularity both in rural and urban areas because of its high sugar and low starch content. It has a great market potential and high market value in India [3]. Hence, the present study was conducted with an objective to evaluate the performances of hybrid sweet corn variety (Sugar 75) as compared to the farmer's practice (common maize) for higher productivity, profitability and livelihood security.

2. Materials and Methods
2.1. Experimental site, year and climate
The study was carried out through front line demonstrations in farmers field during *rabi* season of 2017-18 in *Talagarh* village of Angul district in mid central table land zone of Odisha with an objective to evaluate the performances of sweet corn cv. Sugar 75 as compared to the farmer's practice (common maize). The study site lies in 85^0 13′ 32′′ E longitude and 20^0 42′54'' N latitude and average elevation of 300 m above sea level. The mean maximum and mean minimum temperature registered in the year was 31.2^0 C and 16.4^0 C respectively with total of 29.7 mm rainfall received during the cropping period.

2.2. Initial soil status
The soil of the study area was acidic in reaction (pH-5.7), red loam medium texture, medium in organic carbon (0.53%), potassium (203.4 kg ha^{-1}) and low in nitrogen (220.6 kg ha^{-1}), phosphorus (13.5 kg ha^{-1}) content [4].

2.3. Procedures
Five different farmers cultivated the sweet corn cv. Sugar 75 with recommended package of practices in 0.8 hectare of land. They were supplied with sweet corn seed (Sugar 75) and fertilizers. Besides farmers practice of common maize was selected as local check. The crops were sown during 4th week of November and harvested during 4th week of February. Observations on different growth and yield parameters were taken and economic analysis was done by calculating cost of cultivation, gross return, net return and B: C ratio. Final crop yield were recorded and the gross return were calculated on the basis of market price of the produce. For the introduction of the technology, different extension approaches through regular field visit, farmers training programmes & interpersonal communication were made. Trainings on farmers and farm women were conducted for the awareness among the farmers and field days were celebrated for the horizontal spread of technology.

Also leaflets and pamphlets on improved package of practices of sweet corn cultivation were distributed among the farmers in the village.

Details of Technology: Sugar-75 is a hybrid variety of sweet corn possessing cylinder shape, big tender ear with sweet and good taste. It has yellow colour kernels with good tip filling. Plant height: 150-180 cm. Maturity: 78-85 days.50% silking: 53-55 days. Population ha^{-1}:55000-60000. Ear length: 21.25 cm. Ear diameter: 4.5 cm. No of rows: 14-16 of kernels. Sugar %:15-16 Brix. Keeping all these in view the variety "Sugar-75" has been recommended for cultivation in Odisha

2.4 Calculations
Further study on technology gap, extension gap and technology index were calculated by the following formula [5].

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield-Farmers yield

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

Profitability of the system was calculated by dividing the net return ha^{-1} by 365 days. The production efficiency value was calculated by dividing the total grain production ha^{-1} with total duration of crop [6].

2.5 Statistical analysis
Tabular analysis involving simple statistical tools like mean was done by standard formula to analyze the data and draw conclusions and implications [7].

3. Results and Discussion
3.1 Plant height, no of cobs plant, grains cob^{-1}, weight of cob
The improved practice (sweet corn cv. Sugar 75) showed (Table 1) higher plant height (152.4 cm), cobs $plant^{-1}$(1.35), grains cob^{-1} (450.6) and weight of cob (295.6 g) as compared to farmers practice (common maize) which was attributed to their genetic variability and varietal difference [8].

3.2. Green cob yield, green fodder yield, harvest index, grain yield and production efficiency
Sweet corn (Sugar 75) produced (Table 1) higher green cob yield (152.5 q ha^{-1}), green fodder yield (190.3 q ha^{-1}) and harvest index (44.5%) in compared to common maize [15]. Sweet corn (Sugar 75) also produced grain yield 48.3 q ha^{-1} which is 36.1% higher than common maize with production efficiency (56.8 kg ha^{-1} day^{-1}). This might be due to the production of higher number of cobs $plant^{-1}$ and grains cob^{-1} [10].

Table 1: Effect of frontline demonstration on plant height, cobs $plant^{-1}$, grains cob^{-1}, weight of cob, grain yield, production efficiency, green cob yield, and green fodder yield and harvest index

Mean value	Improved practice (Sweet corn cv. Sugar 75)	Farmer's practice (Common maize)
Plant height(cm)	152.4	145.6
No of cobs $plant^{-1}$	1.35	1.27
No of grains cob^{-1}	450.6	340.3
Weight of cob(g)	295.6	130.2
Grain yield (q ha^{-1})	48.3	35.5
% of increase in grain yield over local check	36.1	
Production efficiency (Kg $ha^{-1}day^{-1}$)	56.8	41.8
Green cob yield (q ha^{-1})	152.5	91.6
Green fodder yield (q ha^{-1})	190.3	145.2
Harvest index (%)	44.5	38.7

3.3. Economics
An analysis on economics (Table 2) revealed that sweet corn hybrid variety (Sugar 75) gave higher gross return Rs. 132450 ha^{-1} with a benefit-cost ratio 2.81, profitability (Rs. 232.7 ha^{-1} day^{-1}) and additional net return Rs.64382.5 ha^{-1} as compared to farmers practice [2, 11]. The advantages of growing sweet corn variety over the common maize with higher return, the variation in net return and benefit-cost ratio may be attributed to the variation in the price of Agri inputs and produce [12].

Table 2: Effect of frontline demonstration on cost of cultivation, gross return, net return, B:C ratio and profitability

Mean value	Improved practice (Sweet corn cv. Sugar 75)	Farmer's practice (Common maize)
Cost of cultivation (Rs ha^{-1})	47150	30020
Gross return (Rs ha^{-1})	132450.0	50587.5
Net return (Rs ha^{-1})	84950	20567.5
B:C ratio	2.81	1.68
Profitability (Rs ha^{-1} day^{-1})	232.7	56.3

3.4. Technology gap, extension gap and technology index

Technology gap: The demonstrations recorded (Table 3) technology gap of 41.7 q ha^{-1} may be attributed to the differential soil fertility status and variable climatic conditions [13]. Technology gap indicated the needs to create awareness among the farmers through various extension means for adoption of sweet corn for reducing the gap.

Extension gap: Extension gap (12.8 q ha^{-1}) was found may be due to higher yield of sweet corn variety in demonstration plots. More and more use of latest production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap.

Technology index: The Technology index was 46.3% which showed the higher feasibility of the demonstrated technology of sweet corn in Farmers field.

3.5. Technology transferred

For varietal introduction, different extension approaches were made. The variety sweet corn (Sugar75) could successfully out yield the common maize and recorded eye-catching higher yield. The area under sweet corn expanded horizontally to 18 hectares during rabi' 2018-19 (Table 3) from a mere 0.8 hectare demonstration during first year (2017-18) of introduction and adopted by 45 farmers in 12 villages. Due to efforts of KVK, scientists field visit, interpersonal communication and individual efforts of the farmers, the variety Sugar 75 could spread in the district. Thus the FLD might have a positive impact on farming community in the district over local check [1]. Front line demonstration also produced significant positive results and provided the extension functionaries an opportunity to demonstrate the productivity potential and profitability of sweet corn and latest production technology under actual farming situations. FLD programmes are very effective in changing attitude, skill and knowledge of improved package of practices of new varieties [14].

Table 3: Effect of front line demonstration on technology gap, extension gap, technology index and transfer of technology

Technology gap (q ha^{-1})	41.7
Extension gap (q ha^{-1})	12.8
Technology index (%)	46.3
No of villages adopted	10
No of farmers adopted	45
Area (ha)	12

3.6. Farmers feedback

The hybrid sweet corn (Sugar-75) produced higher yield and profitability. Overall, the performance of FLD results suggested that it has the potential for increase knowledge of the farmer as well as showed high level at satisfaction about technology.

4. Conclusion

Thus, existing farmer's practice of common maize can be replaced with cultivation of sweet corn for livelihood security point of view in rainfed upland situation for higher remuneration and sustainability.

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