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HETEROSIS AND PERFORMANCE ANALYSIS OF SWEET CORN HYBRIDS FOR YIELD AND QUALITY CHARACTERS

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ABSTRACT

The present study was conducted to evaluate fourteen sweet corn hybrids along with checks (Mishti, CMVL Sweet Corn 1, ASKH 1 and ASKH 4) for growth, yield, and quality traits under field conditions during the *Kharif,* 2023 season at the Agricultural Research Station, PJTAU, Karimnagar. Observations were recorded on days to 50 % anthesis, days to 50 % silking, plant height (cm), ear height (cm), green cob yield with husk (kg ha^{-1}), green cob yield without husk (kg ha^{-1})and TSS %. Significant variability was found among the hybrids for all traits except TSS, indicating substantial genetic diversity. Hybrids ISH 6-2104, ISH 6-2101 and FSCH 266 recorded superior ear number and ear weight, pointing to their potential for higher productivity. Standard heterosis over the check Mishti for ear weight with and without husk revealed that ISH 6-2104 exhibited the highest positive heterosis (ear weight with husk: 15,367 kg ha^{-1}; +0.78 %; ear weight without husk: 15,532 kg ha^{-1}; +15.08 %) while ISH 6-2101 also showed substantial heterosis for ear weight without husk (+12.99 %, 15,250 kg ha^{-1}). The TSS remained stable across the hybrids (mean ~16 %), indicating uniform sweetness. The results demonstrate considerable variability in the tested hybrids, which can be exploited for selection and improvement in sweet corn breeding programs.

Keywords: Sweet corn, yield, heterosis, standard check, total soluble solids.

Introduction

Sweet corn (*Zea mays L. saccharata Sturt*) is a natural mutant of field maize that accumulates sugars instead of starch in the endosperm due to mutations in one or more recessive genes (e.g., *su1*, *sh2*, *se*). It is highly valued as a vegetable crop for its sweet taste, tenderness, and high nutritional quality (Tracy, 2001). Sweet corn contains 15–20% sugar in the milky stage compared to 3–5% in normal maize (Azanza *et al.,* 1994). The crop is widely grown in tropical and subtropical regions, and its consumption has increased rapidly due to urbanization, dietary diversification, and expansion of the food processing industry.

Evaluation of hybrids is an essential step in identifying superior genotypes that combine desirable agronomic traits, high yield potential, and good quality attributes. Previous studies have reported significant variation among sweet corn genotypes for yield and quality traits (Patil *et al*., 2017 and Pandey *et al*., 2020). The yield and sweetness of sweet corn are influenced by both genetic and environmental factors, including temperature, soil fertility, and moisture availability (Szymanek, 2012). Therefore, multi-trait

evaluation is critical to select hybrids suited to local agro-climatic conditions. In India, the commercial cultivation of sweet corn has expanded substantially due to increasing consumer demand and the establishment of food processing units (Choudhary *et al*., 2021). However, information on the comparative performance of newly developed hybrids under local conditions remains limited. This study aims to evaluate sweet corn hybrids for phenological, growth, yield, and quality parameters to identify high-performing and stable genotypes for cultivation and breeding use.

Materials and Methods

Trial was conducted during *Kharif*, 2023 to evaluate the performance of fourteen sweet corn entries against four checks (CMVL sweet corn 1, Mishti , ASKH 1 and ASKH 4) received from ICAR-IIMR Ludhiana using Randomized Block Design (RBD). Each entry was sown in a plot size of 9.6 m^2 (four rows of 4m with row to row spacing 0.6 m), keeping plant to plant spacing 20 cm with three replications. Data was recorded on traits namely, days to 50% anthesis, days to 50% silking, ear height (cm), plant height (cm), green cob yield with husk (kg/ha), green cob yield without husk (kg/ha) and total soluble sugars (%).The green cobs were harvested at approximately 20 to 23 Days after silking when the cobs reached the milk stage. The following yield-related traits were observed: plant height, as the average height of five plants measured in centimeters by measuring the plant stalk from the ground level to the base of the flag leaf of the matured plant. Ear height was expressed in centimeters by measuring the plant stalk from the ground level to the node of the attachment of the upper most ear. Cob weight with husk calculated on per plot basis in kg/ha by weighing total cobs of plot and Cob weight without husk calculated on per plot basis in kg/ha by weighing total cobs of plot without husk. Total soluble solids (TSS %) measured by brix meter.

Statistical analysis

Analysis of variance (ANOVA) was performed for each trait. Estimates of mean squares, overall mean and experimental coefficient of variation were also calculated for all evaluated traits as per Panse and Sukhatme's (1985) conventional statistical approach. Fischer and Yates (1967) used the numbers from the 'F' table to test the significance.

Treatment means were compared using Tukey's test at a 5% probability level.

Heterosis was calculated using the genotype mean value for each character. The amount of heterosis in relation to standard check (SC) values given by Turner (1953).

Standard heterosis was expressed as per cent increase or decrease observed in F_1 over standard checks.

$$\text{Standard heterosis (\%) } (h_3) = \frac{\overline{F}_1 - \text{Mean of check}}{\text{Mean of check}} \text{x100}$$

Results and Discussion

The analysis of fourteen sweet corn hybrids revealed significant variation for most of the traits studied *i.e.,* days to 50% pollen shed, days to 50% silking, plant height, ear height, and ear yield parameters. Days to 50% pollen shed ranged from 49 (CSCH 18006) to 54 days (APTSKH 1, BSCH 419200, FSCH 218, and Mishti), while days to 50% silking ranged from 52 to 57 days. The mean values for these traits (52 and 54 days, respectively) indicate that most of the hybrids fall in the medium maturity group. Similar findings were reported by Kumar *et al*. (2023) who observed moderate variation in flowering behavior among commercial sweet corn hybrids, emphasizing that early-maturing genotypes are desirable for ensuring better synchronization under variable environments. Plant height among hybrids varied significantly, ranging from 167 cm (BSCH 419200) to 212 cm (FSCH 266), with an overall mean of 188 cm. Ear height ranged from 62 cm to 83 cm, indicating considerable genotypic differences in vegetative vigor and ear placement. Hybrids ISH 6-2104 (197 cm) and FSCH 266 (212 cm) exhibited superior plant stature and ear placement, which may favor higher photosynthetic assimilation and better cob development. According to Prasad *et al.* (2023) and Ramishetty *et al.* (2023), taller plants with moderate ear placement are positively correlated with higher ear weight and grain yield in sweet corn due to enhanced translocation efficiency. The TSS percentage ranged from 16.0% to 16.8%, with a mean of 16.3%. Hybrids BSCH 419200 and FSCH 131 recorded the highest TSS (16.8%), indicating superior sweetness and consumer acceptability. Similar TSS levels were reported by Méndez-Pérez et al. (2024), who found that modern hybrids typically maintain TSS between 15–18% depending on sucrose and Phyto glycogen accumulation. The moderate coefficient of variation (2.16%) and non-significant F-value suggest that TSS was relatively stable across genotypes, in agreement with Wang *et al.* (2023), who highlighted the genetic control and limited environmental influence on sweetness traits. Significant differences were observed for ear yield components. Ear weight with husk ranged from 5484 kg ha^{-1} (ASKH 4) to 15367 kg ha^{-1} (ISH 6-2104), while ear weight without husk ranged from 2321 kg ha^{-1} (ASKH 4) to 15532 kg ha^{-1} (ISH 6-2104). ISH 6-2104, ISH 6-2101, and FSCH 266 recorded the

highest ear yields, surpassing the standard checks Mishti and ASKH 1. The results align with Yadav *et al.* 2024 and Awasthi *et al.* 2023, who reported that yield superiority in sweet corn hybrids is primarily governed by kernel filling duration and husk protection, both influenced by genotype and environmental interaction.

Heterosis: Standard heterosis over the check Mishti (C) was estimated for ear weight with husk and ear weight without husk weight with husk +0.78% and ear weight without husk +15.08%, indicating superior performance relative to the check. ISH 6-2101 also showed substantial heterosis for ear weight without husk (+12.99%) Several entries, including ASKH 4 (C) and ASKH 1 (C), recorded markedly negative heterosis. These results suggest ISH 6-2104 and ISH 6-2101 as promising hybrids. However, statistical significance of the heterosis estimates should be confirmed by ANOVA and pairwise comparisons using the experiment's error variance. The superior performance of ISH 6-2104 and ISH 6-2101 could be attributed to better sink development, cob filling, and possibly enhanced photosynthate partitioning efficiency. Similar results were reported by Kaur *et al.* (2023) and Rani *et al.* (2024)**,** who observed significant heterosis for ear yield in sweet corn hybrids due to heterozygosity and complementary gene action.

Conclusion

The study revealed significant variability among sweet corn hybrids for key agronomic and yield traits. Hybrids ISH 6-2104, ISH 6-2101, and FSCH 266 exhibited superior performance for ear yield and sweetness, making them promising candidates for commercial cultivation and breeding programs aimed at improving productivity and consumer preference.

Table 1: Mean performance for green cob yield, fodder yield and agronomic traits in sweet corn hybrids

S. No	Name of the hybrid	Days to 50% pollen shed	Days to 50% silking	Plant height (cm)	Ear height (cm)	TSS %	Cob weight with husk (kg/ha)	Cob weight without husk (kg/ha)
1	APSKH 1	50	53	183	82	16.2	13396	11085
2	APTSKH 1	54	56	200	77	16	15271	13672
3	BSCH 419200	54	57	167	62	16.8	14538	11092
4	CP GOLDEN	51	54	180	75	16.3	14895	11561
5	CP SWEET KING	52	54	170	73	16.3	15058	12767
6	CSCH 18001	50	52	193	80	16.2	15156	10588
7	CSCH 18006	49	52	185	80	16.6	13480	10625
8	CSCH 19010	50	53	198	83	16.1	13582	11785
9	FSCH 131	50	53	190	72	16.8	13462	12534
10	FSCH 218	54	57	190	77	16.2	13918	13523
11	FSCH 266	53	56	212	83	16.5	15157	13000
12	ISH 6-2101	52	54	190	77	16.3	15077	15250
13	ISH 6-2104	53	56	197	75	16.2	15367	15532
14	ISH 6-2107	52	55	198	80	16.3	14474	13890
15	Mishti (C)	54	57	188	83	16.4	15248	13497
16	ASKH 1 (C)	51	53	170	65	16.1	12487	9979
17	ASKH 4 (C)	51	53	195	75	16.7	5484	2321
18	CMVL Sweet Corn-1	50	52	172	62	16.2	14937	10827
	Location Mean	52	54	188	76	16	13944	11863
	CV (%)	2.14	2.15	4.73	9.53	2.16	7.46	10.36
	F (Prob)	0	0	0	0.01	0.14	0.04	0
	CD (5%)	1.83	1.94	14.7	12	0.57	1794	1902
	CD (1%)	2.46	2.6	19.8	16.1	0.77	2409	2554

Table 2: Standard heterosis over the check for Ear weight without husk and Ear weight with husk in sweet corn hybrids

S.No	Hybrid	Ear weight with husk (kg/ha)	Standard heterosis vs Mishti (%)	Ear weight without husk (kg/ha)	Standard heterosis vs Mishti (%)
1	APSKH 1	13,396	-12.15	11,085	-17.87
2	APTSKH 1	15,271	+0.15	13,672	+1.30
3	BSCH 419200	14,538	-4.66	11,092	-17.82
4	CP GOLDEN	14,895	-2.32	11,561	-14.34
5	CP SWEET KING	15,058	-1.25	12,767	-5.41
6	CSCH 18001	15,156	-0.60	10,588	-21.55
7	CSCH 18006	13,480	-11.59	10,625	-21.28
8	CSCH 19010	13,582	-10.93	11,785	-12.68
9	FSCH 131	13,462	-11.71	12,534	-7.13
10	FSCH 218	13,918	-8.72	13,523	+0.19
11	FSCH 266	15,157	-0.60	13,000	-3.68
12	ISH 6-2101	15,077	-1.12	15,250	+12.99
13	ISH 6-2104	15,367	+0.78	15,532	+15.08
14	ISH 6-2107	14,474	-5.08	13,890	+2.91
15	Mishti (C)	15,248	0.00	13,497	0.00
16	ASKH 1 (C)	12,487	-18.11	9,979	-26.07
17	ASKH 4 (C)	5,484	-64.03	2,321	-82.80
18	CMVL Sweet Corn-1	14,937	-2.04	10,827	-19.78

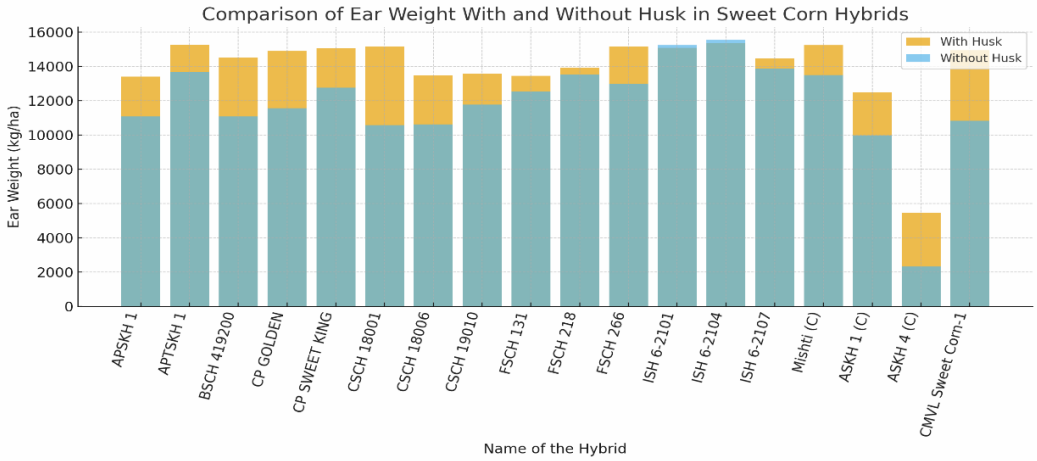

Fig. 1: Comparing ear weight with and without husk across the different sweet corn hybrids.

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