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HETEROTIC STUDIES IN YELLOW MAIZE DIALLEL HYBRIDS

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ABSTRACT

Ten yellow kernel maize inbred lines were crossed during spring season 2019, in a complete diallel fashion to developed 90 F₁ hybrids at Cereal Crops Research Institute (CCRI), Pirsabak - Nowshera, Khyber Pakhtunkhwa, Pakistan. During subsequent summer season 2019, ten parental inbred lines, 90 F₁ hybrids along with two commercial checks (commercial hybrid CS-2420 and commercial OPV-2011Y) were grown in a randomized complete design with two replications. The objectives of the research were to study the mean performance of F₁ hybrids in comparison to parental inbred lines and check genotypes, various categories of heterosis. Highly significant variations were recorded among the genotypes for all the studied traits except anthesis silking interval. The F₁ hybrid exhibited less days to 50% tasseling, anthesis and silking i.e., 53.50, 56.00 and 59.00 days, respectively. Maximum primary leaf area was observed in F₁ hybrid (659.34 cm²) while less days to physiological maturity were recorded in F₁ hybrid. The F₁ hybrids showed maximum values for kernels per row (42.50), and grain yield (8392.78 kg ha⁻¹). Results obtained could be used for the development of early maturing and high yielding maize genotypes in future breeding programs.

KEYWORDS: Diallel crosses, Heterosis, Earliness traits, Grain yield

INTRODUCTION

Maize (*Zea mays* L.) is ranked as the third essential cereal crop after wheat and rice in term of growing area, production and grain yield (Hussain *et al.*, 2011; Ali, 2015). It is grown in the different regions of the world, which includes temperate, tropical and subtropical regions (Iqbal, 2009). Usually, maize is cultivated up to 3300 meters above sea level, 50⁰ N to 40⁰S latitude in the majority of the areas worldwide (Iqbal *et al.*, 2010). Maize is adapted to variety of soils, however, soil with 6.5 to 7.5 pH is most suitable for its best growth. Pollen shedding is usually accelerated by hot dry weather (Poehlman, 1977; Ali *et al.*, 2017). Biochemical analysis of maize revealed that its kernel contains vital components i.e., starch (70-75%), oil (4-5%), and protein (8-10%) (Hallauer and Miranda, 2000).

In world's economy, the major contributions are made by maize crop and its byproducts and thus have a crucial part in the economic sector and are an indispensable component in food industry (Homayoun, 2011; Nyombayire *et al.*, 2018). Maize is a multipurpose crop and has eminent economic importance because of its vast number of industrial uses. During 2018-19 in Pakistan, maize covered an area of 1.381 m ha, which produced 6.309 m tonnes with an average yield of 4787 kg ha⁻¹ (Anonymous, 2018-19). As compared to 2017-18, the maize and wheat crops showed positive growth at the rate of 6.9% and 0.5%, respectively. However, negative growth was observed for sugarcane (-19.4%), cotton (-17.5%) and rice (-3.3%) crops (Pak. Economic Survey, 2018-19). Utilization of maize grain in the form of food and feed has further enhanced its demand in relation to the relative increase of human population (Masood *et al.*, 2020)

In maize breeding, the main objectives are to improve the agronomic traits and ensure the sustainability in harsh abiotic and biotic conditions through hybridization (Khan *et al.*, 2018). The breeders are facing many problems during the production of hybrids through selection of potential parental genotypes and their crosses. Sometimes, the maize hybrids perform very well and sometime not (Ali *et al.*, 2019). Therefore, it is very necessary to consistently screen the advanced maize populations over diverse environments. It will help the breeders to be updated about the potential combiners and their desirable cross combinations which can be isolated as new recombinant or to exploit heterosis. Therefore, the plant breeders need to plan some strategies under diverse environments to achieve these objectives.

Heterosis refers to the increase in vigor and productivity of F₁ hybrids over mid and better parental cultivars (Shull, 1952). In majority of the crops, heterosis works as a vital tool for improvement in production of F₁ hybrids (Duvick, 1999). In recent decades, the term heterosis was mostly used because it plays a vital role in selection procedure in enhancing the productivity of maize, wheat, cotton and other cereal crops (Onejeme *et al.*, 2020). An intensive research work has been conducted on heterosis in many crops, but so far the causes which contribute to heterosis are not too much clear (Coors and Pandey, 1999). In cross pollinated crops, heterosis is of great significance in meeting food demand of the world (Abebe *et al.*, 2020). Selection of parental genotypes is the most important stage in the breeding programs in order to develop new hybrids having desirable characters. Therefore, heterosis can be explored and used as an important tool for getting increased and desirable productivity through F₁ hybrids. Heterosis is a biological phenomenon observed in F₁ hybrids manifesting rapid growth and development, and high productivity (Fayed *et al.*, 2019). Heterosis works as a basic tool for improved production of maize in the form of F₁ hybrids, and heterosis over better parent (heterobeltiosis) can be useful for determining true heterotic effects in cross combinations (Singh, 2014). Therefore, heterotic studies can provide the basis

for the exploitation of valuable hybrid combinations and their commercial utilization in future breeding programs (Keimeso *et al.*, 2020).

Identification of superior maize genotypes is the most important aim of the plant breeder in a mixed or base populations (Khan *et al.*, 2004).

MATERIALS AND METHODS

Breeding material, design and procedure

Ten elite yellow kernel maize inbred lines (PSLY-1, PSLY-2, PSLY-3, PSLY-4, PSLY-5, PSLY-6, PSLY-7, PSLY-8, PSLY-9 and PSLY-10) were sown in a non-replicated crossing block by dibbling in a seedbed during spring season 2019 at Cereal Crops Research Institute (CCRI), Pirsabak - Nowshera, Khyber Pakhtunkhwa, Pakistan. Every parental lines was sown in two rows, 5 m long, spaced 25 and 75 cm between the plants and rows, respectively, to ensure easy and careful crossing and handling of the breeding material. The ten distinct yellow maize inbred lines were crossed in a 10 × 10 complete diallel fashion to produce the 90 F₁ hybrids.

At flowering stage, before pollen shedding, silks were trimmed to get uniform silk brush for uniform grain setting. Shoots were covered by bagging them with shoot bags. The plant tassels were then covered with tassel bags by placing them over the tassels and stapled. As soon as the silks became receptive, shoot bags were removed and they were pollinated with pollen grains collected from the specific parent. Maximum plants were hand pollinated to get the desired amount of seed for further evaluation of F₁ hybrids. At maturity, all the crosses were harvested, threshed, packed, labeled separately and stored in the laboratory for further field evaluation.

During summer season 2019, the seeds of parental inbred lines, their 90 F₁ hybrids (including direct and reciprocal crosses) and two commercial checks i.e., commercial hybrid (CS-2420) and commercial OPV (2011Y) were seeded in a randomized complete block design (RCBD) with two replications (Table 1). Two rows were assigned for every treatment having 5 m row length. Plant-Plant and Row-Row spacing were kept 25 and 75 cm, respectively. To restrain the maximum probable involvement of environmental factors, all the cultural practices and input were uniformly opted and applied in accordance with recommendation for maize's production, whilst maintaining unvarying agronomic situations to get sufficient maximum achievable yield. Fertilizers at the rate of 170:70 kg NP ha⁻¹ were applied. Whole P₂O₅ and ½ N were applied at the time of land preparation and planting time in the form of DAP and Urea, respectively. However, the remaining ½ N were applied as side dressing in the form of

Table 1. Parental inbreds and 10 × 10 F₁ diallel hybrids used in the study

| Inbred lines | | | |
|------------------------|--------------------------|---------------------------|---|
| S. No. | Parents | S. No. | Parents |
| 1 | PSLY-1 | 6 | PSLY-6 |
| 2 | PSLY-2 | 7 | PSLY-7 |
| 3 | PSLY-3 | 8 | PSLY-8 |
| 4 | PSLY-4 | 9 | PSLY-9 |
| 5 | PSLY-5 | 10 | PSLY-10 |
| Check genotypes | | | |
| 11 | Commercial Hybrid-CS2420 | | |
| 12 | Commercial OPV-2011Y | | |
| S. No. | Direct Crosses | Reciprocal Crosses | S. No. Direct Crosses Reciprocal Crosses |

| | | | No. | | | |
|----|------------------|------------------|-----|------------------|------------------|--|
| 1 | PSLY-1 × PSLY-2 | PSLY-2 × PSLY-1 | 24 | PSLY-3 × PSLY-10 | PSLY-10 × PSLY-3 | |
| 2 | PSLY-1 × PSLY-3 | PSLY-3 × PSLY-1 | 25 | PSLY-4 × PSLY-5 | PSLY-5 × PSLY-4 | |
| 3 | PSLY-1 × PSLY-4 | PSLY-4 × PSLY-1 | 26 | PSLY-4 × PSLY-6 | PSLY-6 × PSLY-4 | |
| 4 | PSLY-1 × PSLY-5 | PSLY-5 × PSLY-1 | 27 | PSLY-4 × PSLY-7 | PSLY-7 × PSLY-4 | |
| 5 | PSLY-1 × PSLY-6 | PSLY-6 × PSLY-1 | 28 | PSLY-4 × PSLY-8 | PSLY-8 × PSLY-4 | |
| 6 | PSLY-1 × PSLY-7 | PSLY-7 × PSLY-1 | 29 | PSLY-4 × PSLY-9 | PSLY-9 × PSLY-4 | |
| 7 | PSLY-1 × PSLY-8 | PSLY-8 × PSLY-1 | 30 | PSLY-4 × PSLY-10 | PSLY-10 × PSLY-4 | |
| 8 | PSLY-1 × PSLY-9 | PSLY-9 × PSLY-1 | 31 | PSLY-5 × PSLY-6 | PSLY-6 × PSLY-5 | |
| 9 | PSLY-1 × PSLY-10 | PSLY-10 × PSLY-1 | 32 | PSLY-5 × PSLY-7 | PSLY-7 × PSLY-5 | |
| 10 | PSLY-2 × PSLY-3 | PSLY-3 × PSLY-2 | 33 | PSLY-5 × PSLY-8 | PSLY-8 × PSLY-5 | |
| 11 | PSLY-2 × PSLY-4 | PSLY-4 × PSLY-2 | 34 | PSLY-5 × PSLY-9 | PSLY-9 × PSLY-5 | |
| 12 | PSLY-2 × PSLY-5 | PSLY-5 × PSLY-2 | 35 | PSLY-5 × PSLY-10 | PSLY-10 × PSLY-5 | |
| 13 | PSLY-2 × PSLY-6 | PSLY-6 × PSLY-2 | 36 | PSLY-6 × PSLY-7 | PSLY-7 × PSLY-6 | |
| 14 | PSLY-2 × PSLY-7 | PSLY-7 × PSLY-2 | 37 | PSLY-6 × PSLY-8 | PSLY-8 × PSLY-6 | |
| 15 | PSLY-2 × PSLY-8 | PSLY-8 × PSLY-2 | 38 | PSLY-6 × PSLY-9 | PSLY-9 × PSLY-6 | |
| 16 | PSLY-2 × PSLY-9 | PSLY-9 × PSLY-2 | 39 | PSLY-6 × PSLY-10 | PSLY-10 × PSLY-6 | |
| 17 | PSLY-2 × PSLY-10 | PSLY-10 × PSLY-2 | 40 | PSLY-7 × PSLY-8 | PSLY-8 × PSLY-7 | |
| 18 | PSLY-3 × PSLY-4 | PSLY-4 × PSLY-3 | 41 | PSLY-7 × PSLY-9 | PSLY-9 × PSLY-7 | |
| 19 | PSLY-3 × PSLY-5 | PSLY-5 × PSLY-3 | 42 | PSLY-7 × PSLY-10 | PSLY-10 × PSLY-7 | |
| 20 | PSLY-3 × PSLY-6 | PSLY-6 × PSLY-3 | 43 | PSLY-8 × PSLY-9 | PSLY-9 × PSLY-8 | |
| 21 | PSLY-3 × PSLY-7 | PSLY-7 × PSLY-3 | 44 | PSLY-8 × PSLY-10 | PSLY-10 × PSLY-8 | |
| 22 | PSLY-3 × PSLY-8 | PSLY-8 × PSLY-3 | 45 | PSLY-9 × PSLY-10 | PSLY-10 × PSLY-9 | |
| 23 | PSLY-3 × PSLY-9 | PSLY-9 × PSLY-3 | - | - | - | |

Urea about five weeks after emergence and before earthing-off. Weeds were controlled by pre-emergence application of Primextra gold at the rate 2500 ml ha⁻¹. Insects control was carried out through seed treatment with Confidor before planting and with the application of Furadon granules in the whirls after one month of planting. Hand weeding and earthing-off operations were carried out for weed control in later stage and after six weeks of emergence. The crop was irrigated, as and when required, till one week before maturity.

Traits measurement

Data on ten randomly selected plants were documented (on individual plant basis) for below mentioned parameters.

Days to 50% tasseling

Data regarding days to 50% tasseling was recorded by counting the days from sowing to the day when 50% of plants produced tassels in subplots.

Days to 50% anthesis

In each subplot, data for number of days from planting to 50% anthesis was recorded when pollen shedding started after dehiscence of anthers on central branch of the tassel on 50% plants in a subplot (Ihsan *et al.*, 2005).

Days to 50% silking

Silking data was recorded as the number of days from sowing until 50% of the plants in each subplot showed silks (Hinze and Lamkey, 2003; Khan *et al.*, 2004).

Plant height (cm)

Plant height was recorded by measuring the height from the ground level to the base of the tassel of plant in each entry with the help of meter rod in centimeters at physiological maturity and then their average was calculated (John, 1991; Guzman and Lamkey, 2000).

Ear length (cm)

Ear length was measured in centimeters by measuring the length of ten randomly selected cobs for each subplot and averaged (John, 1991)

Kernels per row

Average of ten randomly selected ears for each entry was recorded for number of kernels per row.

Grain yield (kg ha⁻¹)

Grain yield (kg ha⁻¹) for each entry was calculated by using the following formula:

$$\text{Grain yield (kg ha}^{-1}\text{)} = \frac{\text{FW (kg plot}^{-1}\text{)} \times (100\text{-MC)} \times \text{S} \times 10,000}{(100\text{-15)} \times \text{area harvested (plot size)}}$$

Where,

FW = fresh ear weight at harvest in kg plot⁻¹

MC = grains moisture content at harvest time

S = Shelling coefficient = 0.8

1 hectare = 10,000 m²

100-15 = Required grain moisture for storage

Area to be harvested (plot size) = 7.5 m²

Statistical analyses

Table 2. Analysis of variance in maize

| Source of Variation (S.O.V.) | D.F. | Mean (M.S.) | Square Calculated F-Value |
|------------------------------|-------------|-------------|---------------------------|
| Replication (R) | (R-1) | RMS | - |
| Genotypes (G) | (G-1) | GMS | GMS / EMS |
| Error | (R-1) (G-1) | EMS | - |
| Total | RG-1 | - | - |

Heterosis

Mid parent heterosis was computed in term of percent increase (+) or decrease (-) of F₁ hybrids over its mid parent value as suggested by Fehr (1987).

$$\text{Heterosis (\%)} = \frac{\overline{F_1} - \overline{MP}}{\overline{MP}} \times 100$$

Heterobeltiosis as coined by Fonseca (1965) was estimated in term of percent increase or decrease of the F₁ hybrid over its better parent.

$$\text{Heterobeltiosis (\%)} = \frac{\overline{F_1} - \overline{BP}}{\overline{BP}} \times 100$$

Economics heterosis was also calculated by comparison of F₁ hybrids with existing commercial variety 'OPV 2011Y' using the following formula.

$$\text{Economics Heterosis (\%)} = \frac{\overline{F_1} - \overline{CV}}{\overline{CV}} \times 100$$

Commercial heterosis was also estimated with the help of following formula using commercial hybrid (CH) 'CS-2420' in comparison.

$$\text{Commercial Heterosis (\%)} = \frac{\overline{F_1} - \overline{CH}}{\overline{CH}} \times 100$$

Heterosis value for all the four categories of heterosis were further subjected to 't' test to determine that whether F_1 hybrid means are statistically different from their mid and better parents, check cultivar and hybrid. The 't' values were computed by the following formulas used by Wynne *et al.* (1970).

't' for mid parent heterosis

$$t = \frac{F_1 - MP}{\sqrt{\frac{3}{2r}} (EMS)} \times 100$$

't' for better parent heterosis

$$t = \frac{F_1 - BP}{\sqrt{\frac{2}{r}} (EMS)} \times 100$$

Where

MP = Mid parent value of the particular F_1 cross

BP = Better parent value in the particular F_1 cross

EMS = Error mean square

The 't' value for economics and commercial heterosis was calculated by the formulas used by Falconer and Mackey (1996).

t (Economic heterosis) = SH/SE(d)

t (Commercial heterosis) = CH/SE(d)

SE(d) for EH or CH = $\pm t = \sqrt{2Me/r}$

Where

SE(d) = Standard error

Me = Error mean square

r = Number of replications

t = Obtained value will test against the tabulated t-value at error degree of freedom

RESULTS AND DISCUSSION

Success of maize breeding program is predominantly based on the choice and use of promising parental inbred lines for hybridization, followed by selection for favorable gene combinations in homozygous lines under diverse environments. Therefore, information regarding genetic variability and heterotic effects provides dependable tools to the breeder for crop improvement. Such type of information is also useful for hybrid development in maize.

To achieve these objectives, the present studies were carried out in ten yellow kernel maize parental inbred lines, 90 F_1 hybrids and two check genotypes for earliness, morphological and yield related traits at Cereal Crops Research Institute (CCRI), Pirsabak - Nowshera, Khyber Pakhtunkhwa, Pakistan.

The present study embodies Genetic variability and Heterosis.

Genetic variability and heterotic studies

According to analysis of variance, significant ($P \leq 0.01$) variations were recorded among the genotype for almost all the traits (Table 3). Significant differences were reported among the genotypes for majority of the morphological and yield traits except anthesis silking interval while studying heterosis and combining ability in highland adopted maize genotypes (Keimeso *et al.*, 2020). Previous studies showed significant differences for majority of traits while studying genetic variability, heritability, heterosis and combining ability in diverse maize genotypes (Gheeta *et al.*, 2019; Bharat *et al.*, 2020).

Days to 50% tasseling

Maize breeders are usually interested in producing early maturity maize genotypes. In parental lines and F_1 hybrids, the days to 50% tasseling ranged from 55.00 to 58.00 days and 51.50 to 59.00 days, respectively (Table 4). Overall, F_1 hybrids took less days to 50% tasseling (55.49 days) compared to parental genotypes (56.60 days) and commercial checks (55.50 days). Two F_1 hybrids PSLY-4 \times PSLY-6 (51.50 days) and PSLY-5 \times PSLY-9 (51.50 days) showed minimum and equal number of days to 50% tasseling and these populations were found at par with five other F_1 hybrids i.e., PSLY-1 \times PSLY-7, PSLY-3 \times PSLY-9, PSLY-4 \times PSLY-7, PSLY-8 \times PSLY-9, and PSLY-9 \times PSLY-10 ranged from 53.00 to 53.50 days. The hybrid PSLY-3 \times PSLY-1 (59.00 days) manifested maximum days to 50% tasseling, and was found at par with four other inbred lines i.e., PSLY-4, PSLY-10, PSLY-3, PSLY-5, and five F_1 hybrids PSLY-2 \times PSLY-8, PSLY-2 \times PSLY-3, PSLY-3 \times PSLY-4, PSLY-6 \times PSLY-4, and PSLY-7 \times PSLY-6 ranging from 57.00 to 58.00 days. However, the remaining genotypes exhibited medium number of days to 50% tasseling. Past studies reported significant differences among the maize inbred lines and their hybrids for earliness traits under normal and water stress conditions (Zafar *et al.*, 2026; Ilyas *et al.*, 2019).

Days to 50% tasseling are one of the important factors which contribute to maturity in maize. For days to 50% tasseling, negative heterosis over mid parent was ranging from -0.44% (PSLY-1 \times PSLY-2, PSLY-8 \times PSLY-1) to -9.25% (PSLY-4 \times PSLY-6, PSLY-5 \times PSLY-9) (Table 4). The 66 F_1 hybrids showed negative mid parent heterosis, out of which 24 achieved the level of significance. Later promising F_1 hybrids were followed by two other F_1 hybrids i.e., PSLY-10 \times PSLY-5 (-6.96%) and PSLY-9 \times PSLY-10 (-6.55%). The 63 F_1 hybrids exhibited negative better parent heterosis, in which 24 reached to the level of significance. The range for negative better parent heterosis was -4.35% (PSLY-4 \times PSLY-3) to -8.85% (PSLY-5 \times PSLY-9). Later promising F_1 hybrid was closely followed by F_1 hybrid PSLY-4 \times PSLY-6 (-7.21%). For economic heterosis, 39 F_1 hybrids exhibited negative heterosis, varied from -0.90% to -7.21%, and two F_1 hybrids met the significance level. The highest and significantly negative economic heterosis was recorded in two F_1 hybrids i.e., PSLY-4 \times PSLY-6 and PSLY-5 \times PSLY-9 with same value (-7.21%). For commercial heterosis, 22 F_1 hybrids exhibited negative heterotic values, ranged from -0.92% (PSLY-1 \times PSLY-5, PSLY-2 \times PSLY-10) to -5.50% (PSLY-4 \times PSLY-6, PSLY-5 \times PSLY-9) and two F_1 hybrids reached to the level of significance. For days to 50% tasseling, the negative heterosis is favored because it leads to earliness and associated with days to physiological maturity. Past studies reported negative heterotic values with varied magnitudes as mid, better parent, and standard heterosis in maize F_1 hybrids (Kumar *et al.*, 2014; Masood *et al.*, 2020). Greater genetic variability and desirable negative mid, better parent and commercial heterotic values were reported in maize F_1 hybrids (Singh *et al.*, 2012; Izhar and Chakraborty, 2013).

Days to 50% anthesis

Days to 50% anthesis days is also an important factor which contribute to maturity in maize. In parental lines, days to 50% anthesis varied from 57.50 to 64.00 days while in F₁ hybrids the said range was 56.50 to 62.50 days (Table 5). The differences in parental inbred lines regarding days to anthesis also caused variations in their hybrids. Overall, F₁ hybrids took less days to 50% anthesis (58.67 days) compared to parental genotypes (60.05 days) and commercial checks (59.50 days). The hybrid PSLY-5 × PSLY-7 (56.00 days) was observed with minimum days to 50% pollen shedding. However, the said inbred line was found equal in performance with four other F₁ hybrids i.e., PSLY-1 × PSLY-5, PSLY-8 × PSLY-1, PSLY-9 × PSLY-1, PSLY-1 × PSLY-10 and PSLY-9 × PSLY-5 ranging from 56.50 to 57.50 days. The inbred line PSLY-9 (64.00) consumed maximum days to 50% anthesis. Significant differences were noticed among maize parental lines and their hybrids for various earliness traits including days to 50% silking, morphological and yield traits (Ilyas *et al.*, 2019).

For days to 50% anthesis, negative heterosis over mid parent was ranging from -0.83% (PSLY-2 × PSLY-10) to -8.87% (PSLY-9 × PSLY-5) (Table 5). The 66 F₁ hybrids showed negative mid parent heterosis, out of which 45 achieved the level of significance. The range for negative mid parent heterosis was -0.83% (PSLY-2 × PSLY-10) to -8.87% (PSLY-9 × PSLY-5). Later promising F₁ hybrid was followed by two other F₁ hybrids i.e., PSLY-9 × PSLY-1 and PSLY-9 × P SLY-3 with same value (-7.73%). The 54 F₁ hybrids exhibited negative heterosis over better parent, ranged from -0.83% (PSLY-5 × PSLY-5) to -5.83 % (PSLY-9 × PSLY-5) and 24 F₁ hybrids exhibited significant negative heterosis over better parent. For economic heterosis, 76 F₁ hybrids exhibited negative heterosis, varied from -0.83% (PSLY-1 × PSLY-4, PSLY-3 × PSLY-1 and PSLY-4 × PSLY-1) to -6.67% (PSLY-5 × PSLY-7), and 34 F₁ reached the significance level. Negative commercial heterosis was ranging from -0.85% (PSLY-1 × PSLY-2, PSLY-2 × PSLY-1, PSLY-1 × PSLY-3 and PSLY-2 × PSLY-7) to -5.08% (PSLY-5 × PSLY-7). The 55 F₁ hybrids showed negative heterosis, in which 10 F₁ hybrids reached the significance level. Present consequences regarding mid and better parent heterosis were parallel with past findings which reported negative heterotic effects for days to 50% anthesis and other earliness traits in maize (Kara, 2001; Malik *et al.*, 2004; Ali *et al.*, 2013; Fayed *et al.*, 2019; Masood *et al.*, 2020).

Days to 50% silking

Vegetative growth is also determined by days to silking and less time to silking after tasseling is desirable to have a good synchronization of pollen and silks. Days to 50% silking ranged from 59.50 to 64.00 days in parental inbred lines while 59.00 to 63.50 days in F₁ hybrids ranged (Table 6). On average, the F₁ populations took minimum days to silking (60.73 days) as compared to parental lines (62.15 days) and commercial checks (62.25 days). The hybrid PSLY-5 × PSLY-7 (59.00 days) exhibited minimum days to 50% silking. However, it was alike with two inbred lines PSLY-7 (59.50 days), PSLY-6 (60.50 days) and five other hybrids i.e., PSLY-10 × PSLY-9 (59.50 days), PSLY-10 × PSLY-8 (60.00 days), PSLY-8 × PSLY-9 (60.00 days), PSLY-1 × PSLY-2 (60.50 days) and PSLY-2 × PSLY-1 (60.50 days). The inbred line PSLY-9 (65.50 days) took maximum days to 50% silking (65.50 days). All other genotypes exhibited medium values for days to 50% silking. Ilyas *et al.* (2019) mentioned significant variations among the inbred lines and their F₁ hybrids for days to 50% silking which might be due genotypic differences among maize genotypes used under diverse environments. Previous studies identified less mean values for 21 maize F₁ hybrids as compared to seven parental lines for earliness traits in line × tester studies (Murtadha *et al.*, 2016; Lay and Razdan, 2017; Masood *et al.*, 2020).

For days to 50% silking, negative heterosis over mid parent was ranging from -0.40% (PSLY-9 × PSLY-3) to -7.39% (PSLY-9 × PSLY-3) (Table 6). The 74 F₁ hybrids exhibited negative mid parent heterosis, in which seven F₁ hybrids achieved significance level for days to 50% silking. Three F₁ hybrids i.e., PSLY-10 × PSLY-9, PSLY-9 × PSLY-5 and PSLY-9 × PSLY-4 also revealed the significantly highest and negative mid parent heterosis -7.03, -6.67 and -6.56%, respectively. In view of better parent heterosis, 48 F₁ crosses exhibited negative better parent heterosis, varied from -0.40% (PSLY-4 × PSLY-6) to -5.56% (PSLY-9 × PSLY-3), and 17 F₁ hybrids reached to the significance level. In case of economic heterosis, 79 F₁ hybrids revealed negative heterosis, ranged from -0.80% (PSLY-2 × PSLY-8, PSLY-4 × PSLY-6 and PSLY-4 × PSLY-9) to -5.60% (PSLY-5 × PSLY-7), and 54 F₁ hybrids met the significance level. For commercial heterosis, 74 F₁ hybrids revealed negative heterosis, ranged from -0.81% (PSLY-2 × PSLY-4, PSLY-8 × PSLY-2, PSLY-8 × PSLY-3 and PSLY-6 × PSLY-10) to -4.84% (PSLY-5 × PSLY-7) and 35 F₁ hybrids attained significance level for days to 50% silking. These results were in corroboration with the past findings who also observed varying magnitudes of mid, better parent and standard heterosis with negative effects in F₁ hybrids for days to silking and other earliness traits in maize (Elmyhum, 2013; Izhar and Chakraborty, 2013; Kumar *et al.*, 2014; Abebe *et al.*, 2020).

Plant height

Moderate plant height has a good impact on yield, and have a positive correlation and that is why it is of more concern to maize breeders. Plants having optimum height and having ear placement at center or near to center are more resistance to lodging, thus, contribute significantly to grain yield. Parental inbred lines ranged 130.14 to 165.70 cm while F₁ hybrids ranged from 121.72 to 204.56 cm for plant height (Table 7). The overall mean performance showed that F₁ hybrids (161.75 cm) produced maximum plant height as compared to parental lines (142.12 cm) while minimum than commercial checks (165.55 cm). Maximum plant height was exhibited by hybrid PSLY-3 × PSLY-3 (204.60 cm), followed by five other hybrids i.e., PSLY-4 × PSLY-2, PSLY-4 × PSLY-5, PSLY-4 × PSLY-3, PSLY-5 × PSLY-4 and PSLY-2 × PSLY-8 ranging from 170.60 to 184.40 cm. All other genotypes showed medium value for plant height. Past studies identified better performance of F₁ populations over their parents in maize (Saleh *et al.*, 2002; Zare *et al.*, 2010; Onejeme *et al.*, 2020).

For plant height, positive heterosis over mid parent ranged from 0.11% (PSLY-10 × PSLY-1) to 39.02% (PSLY-3 × PSLY-4) (Table 7). The 71 F₁ hybrids exhibited positive mid parent heterosis, in which 61 F₁ hybrids attained the significance level. Later promising F₁ hybrid was followed by three other F₁ hybrids i.e., PSLY-9 × PSLY-4 (29.33%), PSLY-9 × PSLY-3 (28.02%) and PSLY-4 × PSLY-9 (26.48%). Positive heterosis over better parent varied from 0.79% (PSLY-2 × PSLY-10) to 38.89% (PSLY-3 × PSLY-4). The 81 F₁ hybrids manifested positive heterotic values in which 52 achieved significance level. Positive economic heterosis varied from 0.05% (PSLY-1 × PSLY-9) to 34.30% (PSLY-3 × PSLY-4). The 69 F₁ hybrids showed positive heterosis in which 20 F₁ hybrids were significant. Later promising F₁ hybrid was followed by hybrid PSLY-4 × PSLY-1 (21.09%). In commercial heterosis, 5 F₁ hybrids revealed positive heterosis for plant height, in which no hybrid attained significance. Majority of the F₁ hybrids exhibited negative values for plant height, indicating that these hybrids were dwarf than commercial check hybrid. Present results about mid and better parent heterosis were in line with the previous findings which reported high level of positive heterosis for plant height in F₁ hybrids of maize (Frascaroli *et al.*, 2007; Singh and Gupta, 2009; Amanullah *et al.*, 2011; Rafique *et al.*, 2011; and; Ilyas *et al.*, 2020; Masood *et al.*, 2020).

Ear Length

Ear length ranged from 10.50 to 18.50 cm in parental inbred lines while in F₁ hybrids the said range was 13.00 to 20.75 cm (Table 8). On average, maximum mean value for ear length was observed in F₁ hybrids (16.52 cm) as compared to parental lines (14.54 cm) and commercial checks (13.82 cm). The two hybrids PSLY-1 × PSLY-3 and PSLY-2 × PSLY-1 with same value (20.75 cm) exhibited maximum ear length. The inbred line PSLY-8 (10.50 cm) revealed minimum value for ear length, followed by one other F₁ hybrid PSLY-10 × PSLY-1 (13.00 cm). In past studies, greater and significant genetic variation was observed among different maize genotypes for ear length (Bartaula *et al.*, 2019; Ahmed *et al.*, 2020; Masood *et al.*, 2020).

Positive heterosis over mid parent was ranging from 0.72% (PSLY-3 × PSLY-6) to 56.00% (PSLY-1 × PSLY-8) (Table 8). The 78 F₁ hybrids exhibited positive mid parent heterosis out of which 34 F₁ hybrids met significance level. Later promising F₁ hybrid was followed by three other F₁ hybrids i.e., PSLY-2 × PSLY-8 (54.00%), PSLY-8 × PSLY-2 (51.00%) and PSLY-10 × PSLY-8 (46.88%). Positive heterosis over better parent was ranging from 1.54% (PSLY-3 × PSLY-10) to 43.10% (PSLY-2 × PSLY-1). The 58 F₁ hybrids showed positive heterosis over better parent in which 23 F₁ hybrids were significant. Later promising F₁ hybrid was followed by three other F₁ hybrids i.e., PSLY-4 × PSLY-2 (37.07%), PSLY-10 × PSLY-4 (36.61%) and PSLY-1 × PSLY-8 (34.48%). For standard heterosis, 50 F₁ hybrids revealed significant positive standard heterosis, ranged from 20.56% (PSLY-10 × PSLY-9) to 55.14% (PSLY-2 × PSLY-1 and PSLY-1 × PSLY-3). Two other F₁ hybrids i.e., PSLY-4 × PSLY-2 (48.60%) and PSLY-2 × PSLY-5 (45.79%) also exhibited significantly highest standard heterosis. Positive commercial heterosis varied from 0.88% (PSLY-9 × PSLY-1) to 45.61% (PSLY-2 × PSLY-1). The 85 F₁ hybrids exhibited positive commercial heterosis, in which 33 hybrids attained the significance level. Past studies documented positive heterotic values for mid and better parent with high genetic variation in maize F₁ populations (Gorgulho and Filho, 2001; Suba *et al.*, 2001; Ali *et al.*, 2013; Fayed *et al.*, 2019; Masood *et al.*, 2020).

Kernels per row

Variation among maize genotypes for kernels per row indicating adequate genetic variability in the parental lines and their respective F₁ hybrids. In parental lines and F₁ hybrids, the kernels per row varied from 23.83 to 36.83 and 23.83 to 45.33, respectively (Table 9). Overall, the F₁ populations revealed maximum mean value for kernels per row (35.22) than the parental inbred lines (30.62) and commercial checks (34.00). The two F₁ hybrids PSLY-1 × PSLY-8 (45.33) and PSLY-2 × PSLY-5 (45.16) exhibited maximum kernels per rows. However, these genotypes were found similar in performance with one other F₁ hybrid PSLY-6 × PSLY-5 (43.67). Past studies reported significant contribution of grains per row towards grain yield, and maize genotypes were observed with significant differences regarding kernels per row (Ilyas *et al.*, 2019; Masood *et al.*, 2020). Varied responses were reported in maize parental lines and their F₁ hybrids for said trait and F₁ hybrids were more prominent as compared to parental lines (Maria *et al.*, 2026; Aswin *et al.*, 2020).

For the kernels per row, 78 F₁ crosses exhibited positive mid parent heterosis, varied from 1.23% (PSLY-1 × PSLY-5) to 65.58% (PSLY-10 × PSLY-9), and in which 66 F₁ hybrids obtained significance (Table 9). Later promising F₁ hybrid was also followed by two other hybrids PSLY-1 × PSLY-8 (54.99%) and PSLY-8 × PSLY-9 (53.49%) for kernels per row. Regarding better parent heterosis, 57 F₁ hybrids showed positive better parent heterosis, varied from 0.90% (PSLY-7 × PSLY-4) to 54.55% (PSLY-10 × PSLY-9), and 44 F₁ hybrids

attained the significant. Later promising F₁ hybrid was also followed by three other F₁ hybrids i.e., PSLY-8 × PSLY-9 (46.20%), PSLY-10 × PSLY-4 (41.21%) and PSLY-1 × PSLY-8 (40.93%) for kernels per row. Regarding standard heterosis, 71 F₁ hybrids revealed positive heterosis, ranged from 0.52% (PSLY-9 × PSLY-6, PSLY-1 × PSLY-6) to 41.67% (PSLY-2 × PSLY-5), and 52 hybrids showed significance. Positive commercial heterosis was ranging from 0.46% (PSLY-1 × PSLY-6) to 25.93% (PSLY-1 × PSLY-8). The 41 F₁ hybrids manifested positive heterosis, out of which 22 hybrids were significant for kernels per row. Parallel results were reported for mid and better parent heterosis while studying the heterotic effect in maize hybrids for yield related traits (Abuali *et al.*, 2012; Anyanwu, 2013; Kumar *et al.*, 2014; Rajesh *et al.*, 2014; Ilyas *et al.*, 2020; Masood *et al.*, 2020).

Grain yield

Parental inbred lines ranged 5840.63 to 9871.06 kg ha⁻¹ while F₁ hybrids ranged from 3272.89 to 11514.98 kg ha⁻¹ for grain yield (Table 10). Overall mean performance showed that F₁ hybrids (8758.94 kg ha⁻¹) produced maximum grain yield as compared to parental lines (7274.43 kg ha⁻¹) and commercial checks (7104.26 kg ha⁻¹). The hybrid PSLY-2 × PSLY-1 exhibited maximum value for grain yield (11514.98 kg ha⁻¹). However, it was found at par with one inbred line PSLY-6 and five other F₁ hybrids i.e., PSLY-3 × PSLY-4, PSLY-3 × PSLY-1, PSLY-5 × PSLY-2, PSLY-4 × PSLY-10 and PSLY-1 × PSLY-7 ranging 9271.22 to 11050.04 kg ha⁻¹. The F₁ hybrid PSLY-9 × PSLY-1 revealed minimum value for grain yield (3272.89 kg ha⁻¹) and it was found at par with three other F₁ hybrids i.e., PSLY-9 × PSLY-10, PSLY-10 × PSLY-8 and PSLY-6 × PSLY-8 ranging from 4777.38 to 5164.73 kg ha⁻¹. The remaining genotypes showed moderate values for grain yield. Highly significant differences were recorded among maize F₁ hybrids and their parental lines for grain yield, indicating greater genetic variability (Ilyas *et al.*, 2019; ELmyhun *et al.*, 2020). Similarly, significant variations were also reported in different maize hybrids derived from diverse parental lines (Terasawa *et al.*, 2008; Karadavut and Akili, 2012). See Table 5 for Mean performance and heterotic effects of 10 × 10 yellow maize F₁ diallel hybrids for days to 50% tasseling

For grain yield, 77 F₁ hybrids revealed positive mid parent heterosis, ranged from 2.47% to 78.7%, and in which 32 hybrids attained the significance level (Table 10). The highest and significantly positive mid parent heterosis was recorded in F₁ hybrid PSLY-5 × PSLY-4 (78.71%). Two other F₁ hybrids i.e. PSLY-8 × PSLY-5 and PSLY-3 × PSLY-4 also revealed maximum and significant positive mid parent heterotic values i.e., 68.59% and 65.23% respectively for grain yield. In view of better parent heterosis, 66 F₁ crosses presumed positive better parent heterosis, varied from 0.53% (PSLY-6 × PSLY-1) to 72.06% (PSLY-5 × PSLY-4) and 23 F₁ hybrids reached to significance level. Positive economic heterosis was ranging from 7.02% to 92.33%. The 85 F₁ hybrids revealed positive heterosis, in which 56 F₁ hybrids met the significance level for grain yield. The highest and significantly positive economic heterosis was recorded in F₁ hybrid PSLY-2 × PSLY-1 (92.33%). In commercial heterosis, 64 F₁ hybrids revealed positive heterosis for grain yield, ranged from 0.02% (PSLY-3 × PSLY-8) to 34.41% (PSLY-3 × PSLY-4) and eight F₁ hybrids attained significance level. Corresponding results were reported for mid and better parent heterosis revealing heterotic effects of varying magnitudes for grain yield and yield contributing traits F₁ hybrids of maize (Amanullah *et al.*, 2011; Ikramullah *et al.*, 2011; Abuali *et al.*, 2012; Ali *et al.*, 2013; Singh, 2015; Fayed *et al.*, 2019; Masood *et al.*, 2020). Table 6 shows Mean performance and heterotic effects of 10 × 10 yellow maize F₁ diallel hybrids for days to 50% anthesis.

Table 3. Mean squares for various traits in 10 × 10 F₁ diallel hybrids of yellow maize.

| Parameters | Replications (df = 1) | Genotypes (df = 101) | Error (df = 101) | CV % |
|-----------------------|--------------------------|-------------------------|---------------------|---------|
| Days to 50% tasseling | 1.25 | 4.09** | 1.39 | 2.12 |
| Days to 50% anthesis | 1.10 | 3.56** | 0.59 | 1.31 |
| Days to 50% silking | 2.59 | 4.16** | 0.67 | 1.35 |
| Plant height | 1.14 | 416.07** | 22.04 | 4.60 |
| Ear length | 0.93 | 6.55** | 1.83 | 8.14 |
| Kernel rows per ear | 0.24 | 3.82** | 1.56 | 9.13 |
| Grain yield | 3141871.23 | 4464835.85** | 1379814.42 | 13.69 |

** , * = Significant at P≤0.01 and at P≤0.05, respectively

Table 4. Mean performance and heterotic effects of 10 × 10 yellow maize F₁ diallel hybrids for days to 50% tasseling.

| Parental Inbred lines | Days to 50% tasseling | MPH (%) | BPH (%) | SH (%) | CH (%) |
|------------------------------|-----------------------|---------|---------|--------|--------|
| PSLY-1 | 56.50 | | | | |
| PSLY-2 | 56.00 | | | | |
| PSLY-3 | 57.50 | | | | |
| PSLY-4 | 58.00 | | | | |
| PSLY-5 | 57.00 | | | | |
| PSLY-6 | 55.50 | | | | |
| PSLY-7 | 55.00 | | | | |
| PSLY-8 | 56.00 | | | | |
| PSLY-9 | 56.50 | | | | |
| PSLY-10 | 58.00 | | | | |
| Mean | 56.60 | | | | |
| Check genotypes | | | | | |
| Hybrid CS-2420 | 54.50 | | | | |
| OPV-2011Y | 55.50 | | | | |
| Mean | 55.00 | | | | |
| F₁ Hybrids | | | | | |
| PSLY-1 × PSLY-2 | 56.00 | -0.44 | 0.00 | 0.90 | 2.75 |
| PSLY-1 × PSLY-3 | 56.50 | -0.88 | 0.00 | 1.80 | 3.67 |
| PSLY-1 × PSLY-4 | 56.50 | -1.31 | 0.00 | 1.80 | 3.67 |
| PSLY-1 × PSLY-5 | 54.00 | -4.85** | -4.42* | -2.70 | -0.92 |
| PSLY-1 × PSLY-6 | 57.50 | 2.68 | 3.60 | 3.60 | 5.50* |
| PSLY-1 × PSLY-7 | 53.50 | -4.04* | -2.73 | -3.60 | -1.83 |
| PSLY-1 × PSLY-8 | 54.00 | -4.00* | -3.57 | -2.70 | -0.92 |
| PSLY-1 × PSLY-9 | 55.50 | -1.77 | -1.77 | 0.00 | 1.83 |
| PSLY-1 × PSLY-10 | 55.00 | -3.93* | -2.65 | -0.90 | 0.92 |

| | | | | | |
|------------------|-------|---------|---------|---------|--------|
| PSLY-2 × PSLY-1 | 56.00 | -0.45 | 0.00 | 0.90 | 2.75 |
| PSLY-2 × PSLY-3 | 58.00 | 2.20 | 3.57 | 4.50 | 6.42** |
| PSLY-2 × PSLY-4 | 57.00 | 0.00 | 1.79 | 2.70 | 4.59* |
| PSLY-2 × PSLY-5 | 57.50 | 1.77 | 2.68 | 3.60 | 5.50* |
| PSLY-2 × PSLY-6 | 56.00 | 0.45 | 0.90 | 0.90 | 2.75 |
| PSLY-2 × PSLY-7 | 56.00 | 0.90 | 1.82 | 0.90 | 2.75 |
| PSLY-2 × PSLY-8 | 58.50 | 4.46* | 4.46* | 5.41* | 7.34** |
| PSLY-2 × PSLY-9 | 55.50 | -1.33 | -0.89 | 0.00 | 1.83 |
| PSLY-2 × PSLY-10 | 54.00 | -5.26* | -3.57 | -2.70 | -0.92 |
| PSLY-3 × PSLY-1 | 59.00 | 3.51 | 4.42 | 6.31** | 8.26** |
| PSLY-3 × PSLY-2 | 58.50 | 3.08 | 4.46* | 5.41* | 7.34** |
| PSLY-3 × PSLY-4 | 58.00 | 0.43 | 0.87 | 4.50* | 6.42** |
| PSLY-3 × PSLY-5 | 56.00 | -2.18 | -1.75 | 0.90 | 2.75 |
| PSLY-3 × PSLY-6 | 55.50 | -1.77 | 0.00 | 0.00 | 1.83 |
| PSLY-3 × PSLY-7 | 57.00 | 1.33 | 3.64 | 0.00 | 4.59* |
| PSLY-3 × PSLY-8 | 55.00 | -3.08 | -1.79 | -0.90 | 0.92 |
| PSLY-3 × PSLY-9 | 53.50 | -6.14** | -5.31* | -3.60 | -1.83 |
| PSLY-3 × PSLY-10 | 56.00 | -3.03 | -2.61 | 0.90 | 2.75 |
| PSLY-4 × PSLY-1 | 56.50 | -1.31 | 0.00 | 1.80 | 3.67 |
| PSLY-4 × PSLY-2 | 56.50 | -0.88 | 0.89 | 1.80 | 3.67 |
| PSLY-4 × PSLY-3 | 55.00 | -4.76* | -4.35* | -0.90 | 0.92 |
| PSLY-4 × PSLY-5 | 54.50 | -5.22** | -4.39* | -1.80 | 0.00 |
| PSLY-4 × PSLY-6 | 51.50 | -9.25** | -7.21** | -7.21** | -5.50* |
| PSLY-4 × PSLY-7 | 53.50 | -5.31 | -2.73 | -3.60 | -1.83 |
| PSLY-4 × PSLY-8 | 55.00 | -3.51 | -1.79 | -0.90 | 0.92 |
| PSLY-4 × PSLY-9 | 56.00 | -2.18 | -0.88 | 0.90 | 2.75 |
| PSLY-4 × PSLY-10 | 55.00 | -5.17** | -5.17* | -0.90 | 0.92 |
| PSLY-5 × PSLY-1 | 55.00 | -3.08 | -2.65 | -0.90 | 0.92 |
| PSLY-5 × PSLY-2 | 54.00 | -4.42* | -3.57 | -2.70 | -0.92 |
| PSLY-5 × PSLY-3 | 55.50 | -3.06 | -2.63 | 0.00 | 1.83 |
| PSLY-5 × PSLY-4 | 56.00 | -2.61 | -1.75 | 0.90 | 2.75 |
| PSLY-5 × PSLY-6 | 55.00 | -2.22 | -0.90 | -0.90 | 0.92 |
| PSLY-5 × PSLY-7 | 53.50 | -4.46* | -2.73 | -3.60 | -1.83 |
| PSLY-5 × PSLY-8 | 55.00 | -2.65 | -1.79 | -0.90 | 0.92 |
| PSLY-5 × PSLY-9 | 51.50 | -9.25** | -8.85** | -7.21** | -5.50 |
| PSLY-5 × PSLY-10 | 55.00 | -4.35* | -3.51 | -0.90 | 0.92 |
| PSLY-6 × PSLY-1 | 55.50 | -0.89 | 0.00 | 0.00 | 1.83 |
| PSLY-6 × PSLY-2 | 57.50 | 3.14 | 3.60 | 3.60 | 5.50* |
| PSLY-6 × PSLY-3 | 56.00 | -0.88 | 0.90 | 0.90 | 2.75 |
| PSLY-6 × PSLY-4 | 58.00 | 2.20 | 4.50 | 4.50 | 6.42 |
| PSLY-6 × PSLY-5 | 56.50 | 0.44 | 1.80 | 1.80 | -1.83 |
| PSLY-6 × PSLY-7 | 56.00 | 1.36 | 1.82 | 0.90 | 2.75 |
| PSLY-6 × PSLY-8 | 57.50 | 3.14 | 3.60 | 3.60 | 5.50 |
| PSLY-6 × PSLY-9 | 54.00 | -3.57 | -2.70 | -2.70 | -0.92 |
| PSLY-6 × PSLY-10 | 54.50 | -3.96* | -1.80 | -1.80 | 0.00 |
| PSLY-7 × PSLY-1 | 54.50 | -2.24 | -0.91 | -1.80 | 0.00 |
| PSLY-7 × PSLY-2 | 55.50 | 0.00 | 0.91 | 0.00 | 1.83 |

| | | | | | |
|---------------------|-------|--|---------|-------|-------|
| PSLY-7 × PSLY-3 | 55.00 | -2.22 | 0.00 | -0.90 | 0.92 |
| PSLY-7 × PSLY-4 | 56.50 | 0.00 | 2.73 | 1.80 | 3.67 |
| PSLY-7 × PSLY-5 | 54.50 | -2.68 | -0.91 | -1.80 | 0.00 |
| PSLY-7 × PSLY-6 | 57.00 | 3.17 | 3.64 | 2.70 | 4.59* |
| PSLY-7 × PSLY-8 | 54.00 | -2.70 | -1.82 | -2.70 | -0.92 |
| PSLY-7 × PSLY-9 | 56.00 | 0.45 | 1.82 | 0.90 | 2.75 |
| PSLY-7 × PSLY-10 | 54.50 | -3.54 | -0.91 | -1.80 | 0.00 |
| PSLY-8 × PSLY-1 | 56.00 | -0.44 | 0.00 | 0.90 | 2.75 |
| PSLY-8 × PSLY-2 | 56.00 | 0.00 | 0.00 | 0.90 | 2.75 |
| PSLY-8 × PSLY-3 | 57.00 | 0.44 | 1.79 | 2.70 | 4.59* |
| PSLY-8 × PSLY-4 | 55.00 | -3.51 | -1.79 | -0.90 | 0.92 |
| PSLY-8 × PSLY-5 | 56.00 | -0.88 | 0.00 | 0.90 | 2.75 |
| PSLY-8 × PSLY-6 | 56.50 | 1.35 | 1.80 | 1.80 | 3.67 |
| PSLY-8 × PSLY-7 | 54.00 | -2.70 | -1.82 | -2.70 | -0.92 |
| PSLY-8 × PSLY-9 | 53.50 | -4.89** | -4.46* | -3.60 | -1.83 |
| PSLY-8 × PSLY-10 | 54.00 | -5.26* | -3.57 | -2.70 | -0.92 |
| PSLY-9 × PSLY-1 | 55.50 | -1.77 | -1.77 | 0.00 | 1.83 |
| PSLY-9 × PSLY-2 | 54.50 | -3.11 | -2.68 | -1.80 | 0.00 |
| PSLY-9 × PSLY-3 | 56.00 | -1.75 | -0.88 | 0.90 | 2.75 |
| PSLY-9 × PSLY-4 | 55.00 | -3.93* | -2.65 | -0.90 | 0.92 |
| PSLY-9 × PSLY-5 | 54.00 | -4.85** | -4.42* | -2.70 | -0.92 |
| PSLY-9 × PSLY-6 | 54.00 | -3.57 | -2.70 | -2.70 | -0.92 |
| PSLY-9 × PSLY-7 | 56.00 | 0.45 | 1.82 | 0.90 | 2.75 |
| PSLY-9 × PSLY-8 | 54.00 | -4.00** | -3.57 | -2.70 | -0.92 |
| PSLY-9 × PSLY-10 | 53.50 | -6.55** | -5.31* | -3.60 | -1.83 |
| PSLY-10 × PSLY-1 | 56.00 | -2.18 | -0.88 | 0.90 | 2.75 |
| PSLY-10 × PSLY-2 | 56.50 | -0.88 | 0.89 | 1.80 | 3.67 |
| PSLY-10 × PSLY-3 | 56.00 | -3.03 | -2.61 | 0.90 | 2.75 |
| PSLY-10 × PSLY-4 | 56.00 | -3.45 | -3.45 | 0.90 | 2.75 |
| PSLY-10 × PSLY-5 | 53.50 | -6.96** | -6.14** | -3.60 | -1.83 |
| PSLY-10 × PSLY-6 | 56.50 | -0.44 | 1.80 | 1.80 | 3.67 |
| PSLY-10 × PSLY-7 | 54.00 | -4.42* | -1.82 | -2.70 | -0.92 |
| PSLY-10 × PSLY-8 | 56.00 | -1.75 | 0.00 | 0.90 | 2.75 |
| PSLY-10 × PSLY-9 | 56.50 | -1.31 | 0.00 | 1.80 | 3.67 |
| Hybrids mean | 55.49 | **, * = Significant at P≤0.01 and at P≤0.05, respectively, MPH: Mid-parent heterosis, BPH: Better-parent heterosis, SH: Standard heterosis, CH: Commercial heterosis | | | |
| LSD _{0.05} | 2.34 | | | | |

Table 5. Mean performance and heterotic effects of 10 × 10 yellow maize F₁ diallel hybrids for days to 50% anthesis.

| Parental Inbred lines | Days to 50% anthesis | MPH (%) | BPH (%) | SH (%) | CH (%) |
|-----------------------|----------------------|---------|---------|--------|--------|
| PSLY-1 | 60.50 | | | | |
| PSLY-2 | 59.50 | | | | |
| PSLY-3 | 60.50 | | | | |
| PSLY-4 | 61.00 | | | | |
| PSLY-5 | 60.00 | | | | |

| | |
|---------|-------|
| PSLY-6 | 58.50 |
| PSLY-7 | 57.50 |
| PSLY-8 | 58.50 |
| PSLY-9 | 64.00 |
| PSLY-10 | 60.50 |
| Mean | 60.05 |

Check genotypes

| | |
|----------------|-------|
| Hybrid CS-2420 | 59.00 |
| OPV-2011Y | 60.00 |
| Mean | 59.50 |

F₁ Hybrids

| | | | | | |
|------------------|-------|---------|---------|---------|---------|
| PSLY-1 × PSLY-2 | 58.50 | -2.50* | -1.68 | -2.50 | -0.85 |
| PSLY-1 × PSLY-3 | 58.50 | -3.31** | -3.31* | -2.50 | -0.85 |
| PSLY-1 × PSLY-4 | 59.50 | -2.06 | -1.65 | -0.83 | 0.85 |
| PSLY-1 × PSLY-5 | 57.50 | -4.56** | -4.17 | -4.17** | -2.54 |
| PSLY-1 × PSLY-6 | 58.50 | -1.68 | 0.00 | -2.50 | -0.85 |
| PSLY-1 × PSLY-7 | 59.00 | 0.00 | 2.61 | -1.67 | 0.00 |
| PSLY-1 × PSLY-8 | 56.50 | -5.04** | -3.42* | -5.83** | -4.24** |
| PSLY-1 × PSLY-9 | 58.00 | -6.83** | -4.13 | -3.33* | -1.69 |
| PSLY-1 × PSLY-10 | 57.50 | -4.96** | -4.96** | -4.17** | -2.54 |
| PSLY-2 × PSLY-1 | 58.50 | -2.56* | -1.68 | -2.50 | -0.85 |
| PSLY-2 × PSLY-3 | 61.00 | 1.67 | 2.52 | 1.67* | 3.39* |
| PSLY-2 × PSLY-4 | 59.50 | -1.24 | 0.00 | -0.83 | 0.85 |
| PSLY-2 × PSLY-5 | 60.00 | 0.42 | 0.00 | 0.00 | 1.69 |
| PSLY-2 × PSLY-6 | 59.00 | 0.00 | 0.85 | -1.67 | 0.00 |
| PSLY-2 × PSLY-7 | 58.50 | 0.00 | 1.74 | -2.50 | -0.85 |
| PSLY-2 × PSLY-8 | 60.50 | 2.54** | 3.42* | 0.83 | 2.54 |
| PSLY-2 × PSLY-9 | 58.00 | -6.07** | -2.52 | -3.33* | -1.69 |
| PSLY-2 × PSLY-10 | 59.50 | -0.83 | -1.65 | -0.83 | 0.85 |
| PSLY-3 × PSLY-1 | 59.50 | -1.65 | -1.65 | -0.83 | 0.85 |
| PSLY-3 × PSLY-2 | 60.50 | 0.83 | 1.68 | 0.83 | 2.54 |
| PSLY-3 × PSLY-4 | 61.00 | 0.41 | 0.83 | 1.67 | 3.39* |
| PSLY-3 × PSLY-5 | 58.00 | -3.73** | -3.33* | -3.33* | -1.69 |
| PSLY-3 × PSLY-6 | 58.00 | -2.52* | -0.85 | -3.33* | -1.69 |
| PSLY-3 × PSLY-7 | 59.00 | 0.00 | 2.61 | -3.33 | 0.00 |
| PSLY-3 × PSLY-8 | 58.00 | -2.52* | -0.85 | -3.33* | -1.69 |
| PSLY-3 × PSLY-9 | 58.50 | -6.02** | -3.31* | -2.50 | -0.85 |
| PSLY-3 × PSLY-10 | 58.50 | -3.31** | -3.31* | -2.50 | -0.85 |
| PSLY-4 × PSLY-1 | 59.50 | -2.06 | -1.65 | -0.83 | 0.85 |
| PSLY-4 × PSLY-2 | 59.50 | -1.24 | 0.00 | -0.83 | 0.85 |
| PSLY-4 × PSLY-3 | 61.50 | 1.23 | 1.65 | 2.50 | 4.24** |
| PSLY-4 × PSLY-5 | 58.00 | -4.13** | -3.33** | -3.33* | -1.69 |
| PSLY-4 × PSLY-6 | 60.50 | 1.26 | 3.42* | 0.83 | 2.54 |
| PSLY-4 × PSLY-7 | 57.00 | -3.80** | -0.87 | -5.00** | -3.39* |
| PSLY-4 × PSLY-8 | 57.50 | -3.77** | -1.71 | -4.17** | -2.54 |
| PSLY-4 × PSLY-9 | 59.50 | -4.80** | -2.46 | -0.83 | 0.85 |
| PSLY-4 × PSLY-10 | 58.00 | -4.53** | -4.13** | -3.33* | -1.69 |

| | | | | | |
|------------------|-------|---------|---------|---------|---------|
| PSLY-5 × PSLY-1 | 58.00 | -3.73** | -3.33** | -3.33* | -1.69 |
| PSLY-5 × PSLY-2 | 57.50 | -3.77** | -4.17** | -4.17** | -2.54 |
| PSLY-5 × PSLY-3 | 59.00 | -2.07 | -1.67 | -1.67 | 0.00 |
| PSLY-5 × PSLY-4 | 59.50 | -1.65 | -0.83 | -0.83 | 0.85 |
| PSLY-5 × PSLY-6 | 58.50 | -1.27 | -2.50* | -2.50 | -0.85 |
| PSLY-5 × PSLY-7 | 56.00 | -4.68** | -2.61 | -6.67** | -5.08** |
| PSLY-5 × PSLY-8 | 57.50 | -2.95** | -4.17** | -4.17** | -2.54 |
| PSLY-5 × PSLY-9 | 57.50 | -7.26** | -4.17** | -4.17** | -2.54 |
| PSLY-5 × PSLY-10 | 58.00 | -3.73** | -3.33* | -3.33* | -1.69 |
| PSLY-6 × PSLY-1 | 60.50 | 1.68 | 3.42* | 0.83 | 2.54 |
| PSLY-6 × PSLY-2 | 60.50 | 2.54* | 1.68* | 0.83 | 2.54 |
| PSLY-6 × PSLY-3 | 58.50 | -1.68 | 0.00 | -2.50 | -0.85 |
| PSLY-6 × PSLY-4 | 60.00 | 0.42 | 2.56 | 0.00 | 1.70 |
| PSLY-6 × PSLY-5 | 59.00 | -0.42 | -1.67 | -1.67 | 0.00 |
| PSLY-6 × PSLY-7 | 58.00 | 0.00 | 0.87 | -1.66 | -1.69 |
| PSLY-6 × PSLY-8 | 60.50 | 3.42** | 3.42 | 0.83 | 2.54 |
| PSLY-6 × PSLY-9 | 57.50 | -6.12** | -1.71 | -4.17** | -2.54 |
| PSLY-6 × PSLY-10 | 59.50 | 0.00 | 1.71 | -0.83 | 0.85 |
| PSLY-7 × PSLY-1 | 56.50 | -4.24** | -1.74** | -5.83** | -4.24** |
| PSLY-7 × PSLY-2 | 58.50 | 0.00 | 1.74 | -2.50 | -0.85 |
| PSLY-7 × PSLY-3 | 57.50 | -2.54* | 0.00 | -4.17** | -2.54 |
| PSLY-7 × PSLY-4 | 58.50 | -1.27 | 1.74 | -2.50 | -0.85 |
| PSLY-7 × PSLY-5 | 57.00 | -2.98** | -0.87 | -5.00** | -3.39* |
| PSLY-7 × PSLY-6 | 60.50 | 4.31** | 5.22** | 0.83 | 2.54 |
| PSLY-7 × PSLY-8 | 57.00 | -1.72 | -0.87 | -5.00 | -3.39* |
| PSLY-7 × PSLY-9 | 58.50 | -3.70** | 1.74 | -2.50 | -0.85 |
| PSLY-7 × PSLY-10 | 57.50 | -2.54* | 0.00 | -4.17** | -2.54 |
| PSLY-8 × PSLY-1 | 57.50 | -3.36** | -1.71 | -4.17** | -2.54 |
| PSLY-8 × PSLY-2 | 59.00 | 0.00 | 0.85 | -1.67 | 0.00 |
| PSLY-8 × PSLY-3 | 59.50 | 0.00 | 1.71 | -0.83 | 0.85 |
| PSLY-8 × PSLY-4 | 59.00 | -1.26 | 0.85 | -1.67 | -2.54 |
| PSLY-8 × PSLY-5 | 58.00 | -2.11 | -3.33* | -3.33* | -1.69 |
| PSLY-8 × PSLY-6 | 58.50 | 0.00 | 0.00 | -2.50 | -0.85 |
| PSLY-8 × PSLY-7 | 57.50 | -0.86 | 0.00 | -4.17** | -2.54 |
| PSLY-8 × PSLY-9 | 57.50 | -6.12** | -1.71 | -4.17** | -2.54 |
| PSLY-8 × PSLY-10 | 58.50 | -1.68 | 0.00 | -2.50 | -0.85 |
| PSLY-9 × PSLY-1 | 57.50 | -7.63** | -4.96** | -4.17** | -2.54 |
| PSLY-9 × PSLY-2 | 57.50 | -6.88** | -3.36* | -4.17** | -2.54 |
| PSLY-9 × PSLY-3 | 57.50 | -7.63** | -4.96** | -4.17** | -2.54 |
| PSLY-9 × PSLY-4 | 58.00 | -7.20** | -4.92** | -3.33* | -1.69 |
| PSLY-9 × PSLY-5 | 56.50 | -8.87** | -5.83** | -5.83** | -4.24** |
| PSLY-9 × PSLY-6 | 57.00 | -6.94** | -2.56 | -5.00** | -3.39* |
| PSLY-9 × PSLY-7 | 57.00 | -6.17** | -0.87 | -5.00** | -3.39* |
| PSLY-9 × PSLY-8 | 58.00 | -5.31** | -0.85 | -3.33* | -1.69 |
| PSLY-9 × PSLY-10 | 59.00 | -5.22** | -2.48 | -1.67 | 0.00 |
| PSLY-10 × PSLY-1 | 59.50 | -1.65 | -1.65 | -0.83 | 0.85 |
| PSLY-10 × PSLY-2 | 61.00 | 1.67 | 2.58 | 1.67 | 3.39* |

| | | | | | |
|---------------------|-------|--|---------|---------|--------|
| PSLY-10 × PSLY-3 | 59.50 | -1.65 | -1.65 | -0.83 | 0.85 |
| PSLY-10 × PSLY-4 | 59.00 | -2.88** | -2.48 | -1.67 | 0.00 |
| PSLY-10 × PSLY-5 | 57.00 | -5.39** | -5.00** | -5.00** | -3.39* |
| PSLY-10 × PSLY-6 | 60.50 | 1.68 | 3.42* | 0.83 | 2.54 |
| PSLY-10 × PSLY-7 | 57.50 | -2.54* | 0.00 | -4.17** | -2.54 |
| PSLY-10 × PSLY-8 | 59.00 | -0.84 | 0.85 | -1.67 | 0.00 |
| PSLY-10 × PSLY-9 | 58.00 | -6.83** | -4.13** | -3.33* | -1.69 |
| Hybrids mean | 58.57 | **, * = Significant at P≤0.01 and at P≤0.05, respectively, MPH: Mid-parent heterosis, BPH: Better parent heterosis, SH: Standard heterosis, CH: Commercial heterosis | | | |
| LSD _{0.05} | 1.52 | | | | |

Table 6. Mean performance and heterotic effects of 10 × 10 yellow maize F₁ diallel hybrids for days to 50% silking.

| Parental Inbred lines | Days to 50% silking | MPH (%) | BPH (%) | SH (%) | CH (%) |
|------------------------------|---------------------|---------|---------|---------|--------|
| PSLY-1 | 62.50 | | | | |
| PSLY-2 | 61.00 | | | | |
| PSLY-3 | 63.00 | | | | |
| PSLY-4 | 64.00 | | | | |
| PSLY-5 | 62.00 | | | | |
| PSLY-6 | 60.50 | | | | |
| PSLY-7 | 59.50 | | | | |
| PSLY-8 | 61.00 | | | | |
| PSLY-9 | 65.50 | | | | |
| PSLY-10 | 62.50 | | | | |
| Mean | 62.15 | | | | |
| Check genotypes | | | | | |
| Hybrid CS-2420 | 62.00 | | | | |
| OPV-2011Y | 62.50 | | | | |
| Mean | 62.25 | | | | |
| F₁ Hybrids | | | | | |
| PSLY-1 × PSLY-2 | 56.00 | -2.02 | -0.82 | -3.20* | -2.42 |
| PSLY-1 × PSLY-3 | 56.50 | -2.79* | -2.40 | -2.40 | -1.61 |
| PSLY-1 × PSLY-4 | 56.50 | -1.19 | 0.00 | 0.00 | 0.81 |
| PSLY-1 × PSLY-5 | 54.00 | -3.61** | -4.00** | -4.00 | -3.23* |
| PSLY-1 × PSLY-6 | 57.50 | -1.63 | 0.00 | -3.20 | -2.42 |
| PSLY-1 × PSLY-7 | 53.50 | -0.82 | 1.68 | -3.20* | -2.42 |
| PSLY-1 × PSLY-8 | 54.00 | -3.64** | -2.46 | -4.80** | -4.03 |
| PSLY-1 × PSLY-9 | 55.50 | -6.25** | -4.00** | -4.00** | -3.23* |
| PSLY-1 × PSLY-10 | 55.00 | -3.20** | -3.20* | -3.20* | -2.42 |
| PSLY-2 × PSLY-1 | 56.00 | -2.07 | -0.82 | -3.20* | -2.42 |
| PSLY-2 × PSLY-3 | 58.00 | 2.42* | 4.10** | 1.60 | 2.42 |
| PSLY-2 × PSLY-4 | 57.00 | -1.60 | 0.82 | -1.60 | -0.81 |
| PSLY-2 × PSLY-5 | 57.50 | 0.81 | 1.64 | -0.80 | 0.00 |
| PSLY-2 × PSLY-6 | 56.00 | -1.23 | -1.64 | -4.00** | -3.23* |
| PSLY-2 × PSLY-7 | 56.00 | 0.41 | 1.68 | -3.20* | -2.42 |
| PSLY-2 × PSLY-8 | 58.50 | 1.64 | 1.64 | -0.80 | 0.00 |
| PSLY-2 × PSLY-9 | 55.50 | -5.14** | -1.64 | -4.00** | -3.23* |

| | | | | | |
|------------------|-------|---------|---------|---------|---------|
| PSLY-2 × PSLY-10 | 54.00 | -1.21 | 0.00 | -2.40 | -1.61 |
| PSLY-3 × PSLY-1 | 59.00 | -3.59** | -3.20* | -3.20* | -2.42 |
| PSLY-3 × PSLY-2 | 58.50 | 0.00 | 1.64 | -0.80 | 0.00 |
| PSLY-3 × PSLY-4 | 58.00 | -0.79 | 0.00 | 0.80 | 1.61 |
| PSLY-3 × PSLY-5 | 56.00 | -3.20** | -2.42 | -3.20* | -2.42 |
| PSLY-3 × PSLY-6 | 55.50 | -3.64** | -1.65 | -4.80** | -4.03** |
| PSLY-3 × PSLY-7 | 57.00 | -2.04 | 0.84 | -4.80** | -3.23* |
| PSLY-3 × PSLY-8 | 55.00 | -3.23** | -1.64 | -4.00** | -3.23* |
| PSLY-3 × PSLY-9 | 53.50 | -5.06** | -3.17* | -2.40 | -1.61 |
| PSLY-3 × PSLY-10 | 56.00 | -2.79* | -2.40 | -2.40 | -1.61 |
| PSLY-4 × PSLY-1 | 56.50 | -3.56** | -2.40 | -2.40 | -1.61 |
| PSLY-4 × PSLY-2 | 56.50 | 0.00 | 2.46 | 0.00 | 0.81 |
| PSLY-4 × PSLY-3 | 55.00 | 0.00 | 0.79 | 1.60 | 2.42 |
| PSLY-4 × PSLY-5 | 54.50 | -3.97** | -2.42** | -3.20* | -2.42 |
| PSLY-4 × PSLY-6 | 51.50 | -0.40 | 2.48 | -0.80 | 0.00 |
| PSLY-4 × PSLY-7 | 53.50 | -3.64** | 0.00 | -4.80** | -4.03** |
| PSLY-4 × PSLY-8 | 55.00 | -4.00** | -1.64 | -4.00** | -3.23 |
| PSLY-4 × PSLY-9 | 56.00 | -4.25** | -3.13* | -0.80 | 0.00 |
| PSLY-4 × PSLY-10 | 55.00 | -5.14** | -4.00** | -4.00** | -3.23 |
| PSLY-5 × PSLY-1 | 55.00 | -3.61** | -3.22* | -4.00 | -3.23* |
| PSLY-5 × PSLY-2 | 59.50 | -3.25** | -2.46 | -4.80** | -4.03** |
| PSLY-5 × PSLY-3 | 60.50 | -3.20** | -2.42 | -3.20* | -2.42 |
| PSLY-5 × PSLY-4 | 61.00 | -3.17** | -1.61 | -2.40 | -1.61 |
| PSLY-5 × PSLY-6 | 61.00 | -0.41 | 0.83 | -2.40 | -1.61 |
| PSLY-5 × PSLY-7 | 59.00 | -2.88* | -0.84 | -5.60** | -4.84** |
| PSLY-5 × PSLY-8 | 60.00 | -2.44* | -1.64 | -4.00** | -3.23* |
| PSLY-5 × PSLY-9 | 60.00 | -5.88** | -3.23* | -4.00** | -3.23* |
| PSLY-5 × PSLY-10 | 60.50 | -2.81* | -2.42 | -3.20 | -2.42 |
| PSLY-6 × PSLY-1 | 63.00 | 2.44* | 4.13** | 0.80 | 1.61 |
| PSLY-6 × PSLY-2 | 63.00 | 3.70** | 3.28* | 0.80 | 1.61 |
| PSLY-6 × PSLY-3 | 60.50 | -2.02 | 0.00 | -3.20* | -2.42 |
| PSLY-6 × PSLY-4 | 61.50 | -1.20 | 1.65 | -1.60 | -4.03** |
| PSLY-6 × PSLY-5 | 61.00 | -0.41 | 0.83 | -2.40 | -4.84** |
| PSLY-6 × PSLY-7 | 61.00 | 1.67 | 2.52 | -2.40 | -1.61 |
| PSLY-6 × PSLY-8 | 62.50 | 2.88 | 3.31* | 0.00 | 0.81 |
| PSLY-6 × PSLY-9 | 60.00 | -4.76** | -0.83 | -4.00** | -3.23* |
| PSLY-6 × PSLY-10 | 61.50 | 0.00 | 1.65 | -1.60 | -0.81 |
| PSLY-7 × PSLY-1 | 60.00 | -1.64 | 0.84 | -4.00** | -3.23* |
| PSLY-7 × PSLY-2 | 60.50 | 0.41 | 1.68 | -3.20* | -2.42 |
| PSLY-7 × PSLY-3 | 60.50 | -1.22 | 1.68 | -3.20* | -2.42 |
| PSLY-7 × PSLY-4 | 60.00 | -2.83* | 0.84 | -4.00** | -3.23* |
| PSLY-7 × PSLY-5 | 59.50 | -2.06 | 0.00 | -4.80** | -4.03 |
| PSLY-7 × PSLY-6 | 62.00 | 3.33 | 4.20** | -0.80 | 0.00 |
| PSLY-7 × PSLY-8 | 60.00 | -0.41 | 0.84 | -4.00** | -3.23* |
| PSLY-7 × PSLY-9 | 60.50 | -3.20** | 1.68 | -3.20* | -2.42 |
| PSLY-7 × PSLY-10 | 59.50 | -2.46** | 0.00 | -4.80** | -4.03** |
| PSLY-8 × PSLY-1 | 60.00 | -2.83* | -1.64 | -4.00** | -3.23* |

| | | | | | |
|------------------|-------|---------|---------|---------|---------|
| PSLY-8 × PSLY-2 | 61.50 | 0.82 | 0.82 | -1.60 | -0.81 |
| PSLY-8 × PSLY-3 | 61.50 | -0.81 | 0.82 | -1.60 | -0.81 |
| PSLY-8 × PSLY-4 | 61.00 | -2.40* | 0.00 | -2.40 | -3.23* |
| PSLY-8 × PSLY-5 | 59.50 | -3.25** | -2.46 | -4.80 | -4.03** |
| PSLY-8 × PSLY-6 | 60.50 | -0.41 | 0.00 | -3.20 | -2.42 |
| PSLY-8 × PSLY-7 | 61.00 | 1.24 | 2.52 | -2.40 | -1.61 |
| PSLY-8 × PSLY-9 | 60.00 | -5.14** | -1.64 | -4.00** | -3.23** |
| PSLY-8 × PSLY-10 | 60.50 | -2.02 | -0.82 | -3.20* | -2.42 |
| PSLY-9 × PSLY-1 | 60.00 | -6.25** | -4.00** | -4.00** | -3.23* |
| PSLY-9 × PSLY-2 | 60.00 | -5.14** | -1.64 | -4.00** | -3.23* |
| PSLY-9 × PSLY-3 | 59.50 | -7.39** | -5.56** | -4.80** | -4.03** |
| PSLY-9 × PSLY-4 | 60.50 | -6.56** | -5.47** | -3.20** | -2.42 |
| PSLY-9 × PSLY-5 | 59.50 | -6.67** | -4.03** | -4.80** | -4.03** |
| PSLY-9 × PSLY-6 | 60.00 | -4.76** | -0.83 | -4.00** | -3.23* |
| PSLY-9 × PSLY-7 | 60.00 | -4.00** | 0.84 | -4.00** | -3.23* |
| PSLY-9 × PSLY-8 | 59.50 | -5.93** | -2.46 | -4.80** | -4.03** |
| PSLY-9 × PSLY-10 | 61.00 | -4.69** | -2.40 | -2.40 | -1.61 |
| PSLY-10 × PSLY-1 | 60.50 | -3.20** | -3.20* | -3.20* | -2.42 |
| PSLY-10 × PSLY-2 | 62.50 | 1.21 | 2.46* | 0.00 | 0.81 |
| PSLY-10 × PSLY-3 | 61.00 | -2.79* | -2.40 | -2.40 | -1.61 |
| PSLY-10 × PSLY-4 | 61.00 | -3.56** | -2.40 | -2.40 | -1.61 |
| PSLY-10 × PSLY-5 | 59.50 | -4.42** | -4.03** | -4.80** | -4.03 |
| PSLY-10 × PSLY-6 | 63.50 | 3.25** | 4.96** | 1.60 | 2.42 |
| PSLY-10 × PSLY-7 | 60.50 | -0.82 | 1.68 | -3.20* | -2.42 |
| PSLY-10 × PSLY-8 | 60.00 | -2.83* | -1.64 | -4.00** | -3.23* |
| PSLY-10 × PSLY-9 | 59.50 | -7.03** | -4.80** | -4.80** | -4.03** |

Hybrids mean 60.73
 LSD_{0.05} 1.64
 **, * = Significant at P≤0.01 and at P≤0.05, respectively, MPH: Mid-parent heterosis, BPH: Better-parent heterosis, SH: Standard heterosis, CH: Commercial heterosis

Table 7. Mean performance and heterotic effects of 10 × 10 yellow maize F₁ diallel hybrids for plant height (cm).

| Parental Inbred lines | Plant height (cm) | MPH (%) | BPH (%) | SH (%) | CH (%) |
|------------------------|-------------------|---------|---------|--------|--------|
| PSLY-1 | 165.70 | | | | |
| PSLY-2 | 147.34 | | | | |
| PSLY-3 | 147.28 | | | | |
| PSLY-4 | 147.00 | | | | |
| PSLY-5 | 146.16 | | | | |
| PSLY-6 | 138.38 | | | | |
| PSLY-7 | 134.08 | | | | |
| PSLY-8 | 133.50 | | | | |
| PSLY-9 | 131.58 | | | | |
| PSLY-10 | 130.14 | | | | |
| Mean | 142.12 | | | | |
| Check genotypes | | | | | |
| Hybrid CS-2420 | 178.78 | | | | |
| OPV-2011Y | 152.32 | | | | |

| Mean | 165.55 | | | | |
|------------------------------|--------|---------|----------|----------|----------|
| F₁ Hybrids | | | | | |
| PSLY-1 × PSLY-2 | 153.70 | -1.80 | 4.32 | 0.91 | -14.03** |
| PSLY-1 × PSLY-3 | 172.36 | 10.14* | 4.02 | 13.16** | -3.59 |
| PSLY-1 × PSLY-4 | 170.12 | 8.81* | 15.73* | 11.69* | -4.84 |
| PSLY-1 × PSLY-5 | 160.88 | 3.17 | -2.91 | 5.62 | -10.01* |
| PSLY-1 × PSLY-6 | 154.12 | 1.37 | 11.37* | 1.18 | -13.79** |
| PSLY-1 × PSLY-7 | 139.60 | -6.87 | 4.12 | -8.35 | -21.92** |
| PSLY-1 × PSLY-8 | 133.62 | -10.68 | -19.36** | -12.28* | -25.26** |
| PSLY-1 × PSLY-9 | 152.40 | 2.53 | 15.82** | 0.05 | -14.76** |
| PSLY-1 × PSLY-10 | 151.66 | 2.53 | 16.54** | -0.43 | -15.17** |
| PSLY-2 × PSLY-1 | 163.50 | 4.27 | 10.97** | 7.34 | -8.55* |
| PSLY-2 × PSLY-3 | 160.14 | 8.71 | 8.73 | 5.13 | -10.43* |
| PSLY-2 × PSLY-4 | 178.94 | 21.59 | 21.73** | 17.48** | 0.09 |
| PSLY-2 × PSLY-5 | 159.70 | 8.82* | 9.26 | 4.85 | -10.67** |
| PSLY-2 × PSLY-6 | 164.40 | 15.08** | 18.80** | 7.93 | -8.04 |
| PSLY-2 × PSLY-7 | 148.24 | 5.35 | 10.56 | -2.68 | -17.08** |
| PSLY-2 × PSLY-8 | 170.56 | 21.46** | 15.76** | 11.97* | -4.60 |
| PSLY-2 × PSLY-9 | 167.60 | 20.18** | 13.75** | 10.03* | -6.25 |
| PSLY-2 × PSLY-10 | 148.50 | 7.03 | 0.79 | -2.51 | -16.94** |
| PSLY-3 × PSLY-1 | 174.78 | 11.69** | 18.67** | 14.75** | -2.24 |
| PSLY-3 × PSLY-2 | 156.26 | 6.08 | 6.10 | 2.59 | -12.60** |
| PSLY-3 × PSLY-4 | 204.56 | 39.02** | 38.89** | 34.30** | 14.42** |
| PSLY-3 × PSLY-5 | 169.52 | 15.54* | 15.98** | 11.29* | -5.18 |
| PSLY-3 × PSLY-6 | 159.96 | 11.99** | 8.61 | 5.02 | -10.53* |
| PSLY-3 × PSLY-7 | 154.30 | 9.68* | 4.77 | 5.02 | -13.69** |
| PSLY-3 × PSLY-8 | 171.02 | 21.82** | 16.12** | 12.28* | -4.34 |
| PSLY-3 × PSLY-9 | 165.24 | 18.51** | 12.19* | 8.48 | -7.57 |
| PSLY-3 × PSLY-10 | 162.60 | 17.22** | 10.40* | 6.75 | -9.05* |
| PSLY-4 × PSLY-1 | 169.26 | 8.26** | 15.14* | 11.12* | -5.32 |
| PSLY-4 × PSLY-2 | 184.44 | 25.32 | 25.47** | 21.09** | 3.17 |
| PSLY-4 × PSLY-3 | 182.16 | 23.80** | 23.68** | 19.59** | 1.89 |
| PSLY-4 × PSLY-5 | 183.62 | 25.27** | 25.63** | 20.55** | 2.71 |
| PSLY-4 × PSLY-6 | 167.30 | 17.25** | 13.81** | 9.83* | -6.42 |
| PSLY-4 × PSLY-7 | 153.30 | 9.08* | 4.29 | 0.64 | -14.25** |
| PSLY-4 × PSLY-8 | 154.72 | 10.32* | 5.25 | 1.58 | -13.46** |
| PSLY-4 × PSLY-9 | 176.18 | 26.48** | 19.85** | 15.66 | -1.45 |
| PSLY-4 × PSLY-10 | 160.50 | 15.83** | 9.18 | 5.37** | -10.22 |
| PSLY-5 × PSLY-1 | 154.04 | -1.21 | 5.39 | 1.13 | -13.84** |
| PSLY-5 × PSLY-2 | 160.28 | 9.22* | 9.66 | 5.23 | -10.35* |
| PSLY-5 × PSLY-3 | 154.74 | 5.47 | 5.87 | 1.59 | -13.45** |
| PSLY-5 × PSLY-4 | 181.00 | 23.48** | 23.84** | 18.83** | 1.24 |
| PSLY-5 × PSLY-6 | 162.24 | 14.04** | 11.00* | 6.51 | -9.25* |
| PSLY-5 × PSLY-7 | 132.50 | -5.44 | -9.35 | -13.01** | -25.89* |
| PSLY-5 × PSLY-8 | 159.34 | 13.95** | 9.02 | 4.61 | -10.87** |
| PSLY-5 × PSLY-9 | 165.62 | 19.26** | 13.31** | 8.73 | -7.36 |
| PSLY-5 × PSLY-10 | 161.30 | 16.76** | 10.36* | 5.90 | -9.78* |

| | | | | | |
|------------------|--------|---------|----------|----------|----------|
| PSLY-6 × PSLY-1 | 160.00 | 5.24 | -3.44** | 5.04 | -10.50* |
| PSLY-6 × PSLY-2 | 156.08 | 9.25* | 5.93 | 2.47 | -12.70** |
| PSLY-6 × PSLY-3 | 157.46 | 10.24* | 6.91 | 3.37 | -11.93** |
| PSLY-6 × PSLY-4 | 171.20 | 19.98** | 16.46** | 12.39* | -14.25** |
| PSLY-6 × PSLY-5 | 163.66 | 15.03** | 11.97* | 7.44 | -8.45* |
| PSLY-6 × PSLY-7 | 155.46 | 14.12** | 12.34** | 2.06 | -13.04** |
| PSLY-6 × PSLY-8 | 153.90 | 13.21** | 11.22* | 1.04 | -13.92** |
| PSLY-6 × PSLY-9 | 156.82 | 16.18** | 13.33* | 2.95 | -12.28** |
| PSLY-6 × PSLY-10 | 159.12 | 18.52** | 14.99** | 4.46 | -11.00** |
| PSLY-7 × PSLY-1 | 138.90 | -7.33 | 3.59** | -8.81 | -22.31** |
| PSLY-7 × PSLY-2 | 154.72 | 9.96* | 15.39** | 1.58 | -13.46** |
| PSLY-7 × PSLY-3 | 159.20 | 13.16** | 8.09 | 4.52 | -10.95** |
| PSLY-7 × PSLY-4 | 153.46 | 9.19* | 4.39 | 0.75 | -14.16** |
| PSLY-7 × PSLY-5 | 131.20 | -6.37 | -10.24* | -13.87** | -26.61** |
| PSLY-7 × PSLY-6 | 146.60 | 7.61 | 9.34 | -3.76 | -18.00** |
| PSLY-7 × PSLY-8 | 121.72 | -9.02 | -9.22 | -20.09** | -31.92** |
| PSLY-7 × PSLY-9 | 145.82 | 9.78 | 8.76 | -4.27 | -18.44** |
| PSLY-7 × PSLY-10 | 128.12 | -3.02 | -4.45 | -15.89** | -28.34** |
| PSLY-8 × PSLY-1 | 144.76 | -3.24 | -12.64** | -4.96 | -19.03** |
| PSLY-8 × PSLY-2 | 157.54 | 12.19** | 6.92 | 3.43 | -11.88** |
| PSLY-8 × PSLY-3 | 172.44 | 22.83** | 17.08** | 13.21** | -3.55 |
| PSLY-8 × PSLY-4 | 152.70 | 8.88 | 3.88 | 0.25 | -13.46** |
| PSLY-8 × PSLY-5 | 164.66 | 17.76** | 12.66* | 8.10 | -7.90 |
| PSLY-8 × PSLY-6 | 154.50 | 13.65** | 11.65* | 1.43 | -13.58** |
| PSLY-8 × PSLY-7 | 124.14 | -7.21 | -7.41 | -18.50** | -30.56** |
| PSLY-8 × PSLY-9 | 152.66 | 15.18** | 14.35** | 0.22 | -14.61** |
| PSLY-8 × PSLY-10 | 145.48 | 10.36* | 8.97 | -4.49 | -18.63** |
| PSLY-9 × PSLY-1 | 143.44 | -3.50 | 9.01 | -5.83 | -19.77** |
| PSLY-9 × PSLY-2 | 166.04 | 19.06** | 12.69* | 9.01 | -7.13 |
| PSLY-9 × PSLY-3 | 178.50 | 28.02** | 21.20** | 17.19** | -0.16 |
| PSLY-9 × PSLY-4 | 180.14 | 29.33** | 22.54** | 18.26 | 0.76 |
| PSLY-9 × PSLY-5 | 141.52 | 1.91 | -3.17 | -7.09 | -20.84** |
| PSLY-9 × PSLY-6 | 165.62 | 22.70** | 19.68** | 8.73 | -7.36 |
| PSLY-9 × PSLY-7 | 156.18 | 17.58** | 16.48** | 2.53 | -12.64** |
| PSLY-9 × PSLY-8 | 155.70 | 17.47** | 18.33** | 2.22 | -12.91** |
| PSLY-9 × PSLY-10 | 142.72 | 9.06 | 8.47 | -6.30 | -20.17** |
| PSLY-10 × PSLY-1 | 148.08 | 0.11 | 13.79* | -2.78 | -17.17** |
| PSLY-10 × PSLY-2 | 155.70 | 12.22** | 5.67 | 2.22 | -12.91** |
| PSLY-10 × PSLY-3 | 159.30 | 14.84** | 8.16 | 4.58 | -10.90** |
| PSLY-10 × PSLY-4 | 167.12 | 20.60** | 28.42** | 9.72* | -6.52 |
| PSLY-10 × PSLY-5 | 156.80 | 13.50** | 7.28 | 2.94 | -12.29** |
| PSLY-10 × PSLY-6 | 156.80 | 16.79** | 13.31* | 2.94 | -12.29** |
| PSLY-10 × PSLY-7 | 139.02 | 5.23 | 3.68 | -8.73 | -22.24** |
| PSLY-10 × PSLY-8 | 144.84 | 9.88 | 11.30* | -4.91 | -18.98** |
| PSLY-10 × PSLY-9 | 155.76 | 19.03** | 18.38** | 2.26 | -12.88** |

Hybrids mean 161.75
 LSD_{0.05} 14.29
 **, * = Significant at P≤0.01 and at P≤0.05, respectively, MPH: Mid-parent heterosis,

BPH: Better-parent heterosis, SH: Standard heterosis, CH: Commercial heterosis

Table 8. Mean performance and heterotic effects of 10 × 10 yellow maize F₁ diallel hybrids for ear length (cm).

| Parental Inbred lines | Ear length (cm) | MPH (%) | BPH (%) | SH (%) | CH (%) |
|------------------------------|-----------------|---------|----------|---------|---------|
| PSLY-1 | 14.50 | | | | |
| PSLY-2 | 14.50 | | | | |
| PSLY-3 | 16.25 | | | | |
| PSLY-4 | 14.00 | | | | |
| PSLY-5 | 13.75 | | | | |
| PSLY-6 | 18.50 | | | | |
| PSLY-7 | 16.00 | | | | |
| PSLY-8 | 10.50 | | | | |
| PSLY-9 | 13.88 | | | | |
| PSLY-10 | 13.50 | | | | |
| Mean | 14.54 | | | | |
| Check genotypes | | | | | |
| Hybrid CS-2420 | 14.25 | | | | |
| OPV-2011Y | 13.38 | | | | |
| Mean | 13.82 | | | | |
| F₁ Hybrids | | | | | |
| PSLY-1 × PSLY-2 | 15.40 | 6.21 | 6.21 | 15.14 | 8.07 |
| PSLY-1 × PSLY-3 | 20.75 | 34.96** | 27.69** | 55.14** | 45.61** |
| PSLY-1 × PSLY-4 | 17.50 | 22.81** | 20.69* | 30.84** | 22.81* |
| PSLY-1 × PSLY-5 | 16.50 | 16.81* | 13.79 | 23.36* | 15.79 |
| PSLY-1 × PSLY-6 | 13.50 | -18.18* | -27.03** | 0.93 | -5.26 |
| PSLY-1 × PSLY-7 | 16.50 | 8.20 | 3.13 | 23.36* | 15.79 |
| PSLY-1 × PSLY-8 | 19.50 | 56.00** | 34.48** | 45.79** | 36.84** |
| PSLY-1 × PSLY-9 | 15.25 | 7.49 | 5.17 | 14.02 | 7.02 |
| PSLY-1 × PSLY-10 | 14.88 | 6.25 | 2.59 | 11.21 | 4.39 |
| PSLY-2 × PSLY-1 | 20.75 | 30.12** | 43.10** | 55.14** | 45.61** |
| PSLY-2 × PSLY-3 | 15.50 | 0.81 | -4.62 | 15.89 | 8.77 |
| PSLY-2 × PSLY-4 | 18.13 | 27.19** | 25.00** | 35.51** | 27.19** |
| PSLY-2 × PSLY-5 | 19.50 | 38.05** | 34.48** | 45.79** | 36.84** |
| PSLY-2 × PSLY-6 | 16.50 | 0.00 | -10.81 | 23.36* | 15.79 |
| PSLY-2 × PSLY-7 | 17.75 | 16.39* | 10.94 | 32.71** | 24.56* |
| PSLY-2 × PSLY-8 | 19.25 | 54.00** | 32.76** | 43.93** | 35.09** |
| PSLY-2 × PSLY-9 | 18.00 | 26.87** | 24.14* | 34.58** | 26.32** |
| PSLY-2 × PSLY-10 | 19.00 | 35.71** | 31.03** | 42.06** | 33.33** |
| PSLY-3 × PSLY-1 | 17.00 | 10.57* | 4.62 | 27.10** | 19.30* |
| PSLY-3 × PSLY-2 | 16.00 | 4.07 | -1.54 | 19.63 | 12.28 |
| PSLY-3 × PSLY-4 | 17.25 | 14.05 | 6.15 | 28.97** | 21.05* |
| PSLY-3 × PSLY-5 | 14.75 | -1.67 | -9.23 | 10.28 | 3.51 |
| PSLY-3 × PSLY-6 | 17.50 | 0.72 | -5.41 | 30.84** | 22.81** |
| PSLY-3 × PSLY-7 | 16.13 | 0.00 | -0.77 | 30.84* | 13.16 |
| PSLY-3 × PSLY-8 | 17.50 | 30.84** | 7.69 | 30.84** | 22.81* |
| PSLY-3 × PSLY-9 | 15.00 | -0.41 | -7.69 | 12.15 | 5.26 |

| | | | | | |
|------------------|-------|---------|----------|---------|---------|
| PSLY-3 × PSLY-10 | 17.00 | 14.29 | 4.62 | 27.10** | 19.30* |
| PSLY-4 × PSLY-1 | 18.63 | 30.70** | 28.45** | 39.25** | 30.70** |
| PSLY-4 × PSLY-2 | 19.88 | 39.47** | 37.07** | 48.60** | 39.47** |
| PSLY-4 × PSLY-3 | 19.50 | 28.93** | 20.00* | 45.79** | 36.84** |
| PSLY-4 × PSLY-5 | 17.50 | 26.13** | 25.00* | 30.84** | 22.81* |
| PSLY-4 × PSLY-6 | 17.25 | 6.15 | -6.76 | 28.97** | 21.05* |
| PSLY-4 × PSLY-7 | 18.88 | 25.83** | 17.97* | 41.12** | 32.46** |
| PSLY-4 × PSLY-8 | 15.75 | 28.57** | 12.50 | 17.76 | 10.53 |
| PSLY-4 × PSLY-9 | 14.63 | 4.93 | 4.46 | 9.35 | 2.63 |
| PSLY-4 × PSLY-10 | 16.00 | 16.36 | 14.29 | 19.63 | 12.28 |
| PSLY-5 × PSLY-1 | 18.25 | 29.20** | 25.86** | 36.45** | 28.07** |
| PSLY-5 × PSLY-2 | 15.75 | 11.50 | 8.62 | 17.76 | 10.53 |
| PSLY-5 × PSLY-3 | 16.50 | 10.00 | 1.54 | 23.36* | 15.79 |
| PSLY-5 × PSLY-4 | 16.00 | 15.32 | 14.29 | 19.63 | 12.28 |
| PSLY-5 × PSLY-6 | 14.25 | -11.63 | -22.97** | 6.54 | 0.00 |
| PSLY-5 × PSLY-7 | 13.88 | -6.72 | -13.28 | 3.74 | -2.63 |
| PSLY-5 × PSLY-8 | 13.63 | 12.37 | -0.91 | 1.87 | -4.39 |
| PSLY-5 × PSLY-9 | 17.50 | 26.70** | 26.13** | 30.84** | 22.81* |
| PSLY-5 × PSLY-10 | 17.13 | 25.69** | 24.55* | 28.04** | 20.18* |
| PSLY-6 × PSLY-1 | 18.25 | 10.61 | 25.86 | 36.45** | 28.07** |
| PSLY-6 × PSLY-2 | 17.88 | 8.33 | -3.38 | 33.64** | 25.44** |
| PSLY-6 × PSLY-3 | 14.63 | -15.83* | -20.95** | 9.35 | 2.63 |
| PSLY-6 × PSLY-4 | 17.50 | 7.69 | -5.41 | 30.84** | 22.80* |
| PSLY-6 × PSLY-5 | 17.75 | 10.08 | -4.05 | 32.71** | -2.63 |
| PSLY-6 × PSLY-7 | 16.50 | -4.35 | -10.81 | 23.36* | 15.79 |
| PSLY-6 × PSLY-8 | 15.25 | 5.17 | -17.57* | 14.02 | 7.02 |
| PSLY-6 × PSLY-9 | 13.63 | -15.83* | -26.35** | 1.87 | -4.39 |
| PSLY-6 × PSLY-10 | 16.13 | 0.78 | -12.84 | 20.56* | 13.16 |
| PSLY-7 × PSLY-1 | 16.63 | 9.02 | 3.91 | 24.30* | 16.67 |
| PSLY-7 × PSLY-2 | 15.88 | 4.10 | -0.78 | 18.69 | 11.40 |
| PSLY-7 × PSLY-3 | 16.63 | 3.10 | 2.31 | 24.30* | 16.67 |
| PSLY-7 × PSLY-4 | 16.88 | 12.50 | 5.47 | 26.17* | 18.42 |
| PSLY-7 × PSLY-5 | 15.00 | 0.84 | -6.25 | 12.15 | 5.26 |
| PSLY-7 × PSLY-6 | 16.50 | -4.35 | -10.81 | 23.36 | 15.79 |
| PSLY-7 × PSLY-8 | 16.00 | 20.75** | 0.00 | 19.63 | 12.28 |
| PSLY-7 × PSLY-9 | 15.63 | 4.60 | -2.34 | 16.82 | 9.65 |
| PSLY-7 × PSLY-10 | 17.00 | 15.25 | 6.25 | 27.10** | 19.30* |
| PSLY-8 × PSLY-1 | 16.38 | 31.00** | 12.93 | 22.43* | 14.91 |
| PSLY-8 × PSLY-2 | 18.88 | 51.00** | 30.17** | 41.12** | 32.46** |
| PSLY-8 × PSLY-3 | 17.00 | 27.10** | 4.62* | 27.10** | 19.30* |
| PSLY-8 × PSLY-4 | 16.88 | 37.76** | 20.54* | 26.17* | 10.53 |
| PSLY-8 × PSLY-5 | 15.00 | 23.71* | 9.09 | 12.15 | 5.26 |
| PSLY-8 × PSLY-6 | 16.25 | 12.07 | -12.16 | 21.50* | 14.04 |
| PSLY-8 × PSLY-7 | 14.50 | 9.43 | -9.38 | 8.41 | 1.75 |
| PSLY-8 × PSLY-9 | 16.38 | 34.36** | 18.02 | 22.43* | 14.91 |
| PSLY-8 × PSLY-10 | 16.25 | 35.42** | 20.37* | 21.50* | 14.04 |
| PSLY-9 × PSLY-1 | 14.38 | 1.32 | -0.86 | 7.48 | 0.88 |

| | | | | | |
|---------------------|-------|--|----------|---------|---------|
| PSLY-9 × PSLY-2 | 16.75 | 18.06* | 15.52 | 25.23 | 17.54 |
| PSLY-9 × PSLY-3 | 16.50 | 9.54 | 1.54 | 23.36* | 15.79 |
| PSLY-9 × PSLY-4 | 16.25 | 16.59 | 16.07 | 21.50 | 14.04 |
| PSLY-9 × PSLY-5 | 14.25 | 3.17 | 2.70 | 6.54 | 0.00 |
| PSLY-9 × PSLY-6 | 14.63 | -9.65 | -20.95** | 9.35 | 2.63 |
| PSLY-9 × PSLY-7 | 15.63 | 4.60 | -2.34 | 16.82 | 9.65 |
| PSLY-9 × PSLY-8 | 14.50 | 18.97 | 4.50 | 8.41 | 1.75 |
| PSLY-9 × PSLY-10 | 15.00 | 9.59 | 8.11 | 12.15 | 5.26 |
| PSLY-10 × PSLY-1 | 13.00 | -7.14 | -10.34 | -2.80 | -8.77 |
| PSLY-10 × PSLY-2 | 16.00 | 14.29 | 10.34 | 19.63 | 12.28 |
| PSLY-10 × PSLY-3 | 15.88 | 6.72 | -2.31 | 18.69 | 11.40 |
| PSLY-10 × PSLY-4 | 19.13 | 39.09** | 36.61** | 42.99** | 34.21** |
| PSLY-10 × PSLY-5 | 16.00 | 17.43* | 16.36 | 19.63 | 12.28 |
| PSLY-10 × PSLY-6 | 15.00 | -6.25 | -18.92* | 12.15 | 5.26 |
| PSLY-10 × PSLY-7 | 16.00 | 8.47 | 0.00 | 19.63 | 12.28 |
| PSLY-10 × PSLY-8 | 17.63 | 46.88** | 30.56** | 31.78* | 23.68* |
| PSLY-10 × PSLY-9 | 16.13 | 17.81* | 16.22 | 20.56* | 13.16 |
| Hybrids mean | 16.52 | **, * = Significant at P≤0.01 and at P≤0.05, respectively, MPH: Mid-parent heterosis, BPH: Better-parent heterosis, SH: Standard heterosis, CH: Commercial heterosis | | | |
| LSD _{0.05} | 2.68 | | | | |

Table 9. Mean performance and heterotic effects of 10 × 10 yellow maize F₁ diallel hybrids for kernels per row.

| Parental Inbred lines | Kernels row ⁻¹ | MPH (%) | BPH (%) | SH (%) | CH (%) |
|------------------------------|---------------------------|----------|----------|----------|----------|
| PSLY-1 | 32.17 | | | | |
| PSLY-2 | 29.17 | | | | |
| PSLY-3 | 33.33 | | | | |
| PSLY-4 | 27.00 | | | | |
| PSLY-5 | 35.33 | | | | |
| PSLY-6 | 34.67 | | | | |
| PSLY-7 | 36.83 | | | | |
| PSLY-8 | 26.33 | | | | |
| PSLY-9 | 23.83 | | | | |
| PSLY-10 | 27.50 | | | | |
| Mean | 30.62 | | | | |
| Check genotypes | | | | | |
| Hybrid CS-2420 | 36.00 | | | | |
| OPV-2011Y | 32.00 | | | | |
| Mean | 34.00 | | | | |
| F₁ Hybrids | | | | | |
| PSLY-1 × PSLY-2 | 38.17 | 24.46** | 18.65** | 19.27** | 6.02 |
| PSLY-1 × PSLY-3 | 38.50 | 17.56** | 15.50** | 20.31** | 6.94* |
| PSLY-1 × PSLY-4 | 31.50 | 6.48 | -2.07** | -1.56 | -12.50** |
| PSLY-1 × PSLY-5 | 34.17 | 1.23 | -3.30 | 6.77 | -5.09 |
| PSLY-1 × PSLY-6 | 36.17 | 8.23** | 4.33 | 13.02** | 0.46 |
| PSLY-1 × PSLY-7 | 25.00 | -27.54** | -32.13** | -21.88** | -30.56** |
| PSLY-1 × PSLY-8 | 45.33 | 54.99** | 40.93** | 41.67** | 25.93** |

| | | | | | |
|------------------|-------|----------|----------|----------|----------|
| PSLY-1 × PSLY-9 | 32.17 | 14.88** | 0.00 | 0.52 | -10.65** |
| PSLY-1 × PSLY-10 | 31.83 | 6.70 | -1.04 | -0.52 | -11.57** |
| PSLY-2 × PSLY-1 | 34.83 | 11.96** | 8.29* | 8.85 | -3.24 |
| PSLY-2 × PSLY-3 | 28.67 | -8.27* | -14.00** | -10.42** | -20.37** |
| PSLY-2 × PSLY-4 | 37.50 | 33.53** | 28.57** | 17.19** | 4.17 |
| PSLY-2 × PSLY-5 | 45.17 | 40.05** | 27.83** | 41.15** | 25.46** |
| PSLY-2 × PSLY-6 | 35.17 | 10.18** | 1.44 | 9.90* | -2.31 |
| PSLY-2 × PSLY-7 | 35.17 | 6.57* | -4.52 | 9.90* | -2.31 |
| PSLY-2 × PSLY-8 | 40.17 | 44.74** | 37.71** | 25.52** | 11.57** |
| PSLY-2 × PSLY-9 | 33.33 | 25.79** | 14.29** | 4.17 | -7.41* |
| PSLY-2 × PSLY-10 | 36.17 | 27.65** | 24.00** | 13.02** | 0.46 |
| PSLY-3 × PSLY-1 | 37.00 | 12.98** | 11.00** | 15.63** | 2.78 |
| PSLY-3 × PSLY-2 | 37.50 | 20.00** | 12.50** | 17.19** | 4.17 |
| PSLY-3 × PSLY-4 | 32.50 | 7.73* | -2.50 | 1.56 | -9.72** |
| PSLY-3 × PSLY-5 | 41.17 | 19.90** | 16.51** | 28.65** | 14.35** |
| PSLY-3 × PSLY-6 | 38.50 | 13.24** | 11.06** | 20.31** | 6.94** |
| PSLY-3 × PSLY-7 | 39.83 | 13.54** | 8.14* | 20.31** | 10.65** |
| PSLY-3 × PSLY-8 | 40.50 | 35.75** | 21.50** | 26.56** | 12.50** |
| PSLY-3 × PSLY-9 | 30.50 | 6.71 | -8.50* | -4.69 | -15.28** |
| PSLY-3 × PSLY-10 | 33.67 | 10.68** | 1.00** | 5.21 | -6.48 |
| PSLY-4 × PSLY-1 | 36.67 | 23.94** | 13.99** | 14.58** | 1.85 |
| PSLY-4 × PSLY-2 | 36.17 | 28.78** | 24.00** | 13.02** | 0.46 |
| PSLY-4 × PSLY-3 | 36.00 | 19.34 | 8.00* | 12.50** | 0.00 |
| PSLY-4 × PSLY-5 | 30.83 | -1.07 | -12.74* | -3.65 | -14.35** |
| PSLY-4 × PSLY-6 | 32.17 | 4.32 | -7.21* | 0.52 | -10.65** |
| PSLY-4 × PSLY-7 | 34.83 | 9.14* | -5.43 | 8.85* | -3.24 |
| PSLY-4 × PSLY-8 | 35.00 | 31.25** | 29.63** | 9.38* | -2.78** |
| PSLY-4 × PSLY-9 | 27.17 | 6.89 | 0.62 | -15.10** | -24.54** |
| PSLY-4 × PSLY-10 | 29.50 | 8.26* | 7.27 | -7.81* | -18.06** |
| PSLY-5 × PSLY-1 | 40.67 | 20.49** | 15.09** | 27.08** | 12.96** |
| PSLY-5 × PSLY-2 | 40.33 | 25.06** | 14.15** | 26.04** | 12.04** |
| PSLY-5 × PSLY-3 | 30.50 | -11.17** | -13.68** | -4.69 | -15.28** |
| PSLY-5 × PSLY-4 | 36.33 | 16.58** | 2.83 | 13.54** | 0.93 |
| PSLY-5 × PSLY-6 | 34.00 | -2.86 | -3.77 | 6.25 | -5.56 |
| PSLY-5 × PSLY-7 | 29.33 | -18.71** | -20.36** | -8.33* | -18.52** |
| PSLY-5 × PSLY-8 | 42.17 | 36.76** | 19.34** | 31.77** | 17.13** |
| PSLY-5 × PSLY-9 | 32.33 | 9.30** | -8.49 | 1.04 | -10.19** |
| PSLY-5 × PSLY-10 | 32.50 | 3.45 | -8.02 | 1.56 | -9.72** |
| PSLY-6 × PSLY-1 | 39.67 | 18.70** | 23.32** | 23.96** | 10.19** |
| PSLY-6 × PSLY-2 | 29.83 | -6.53* | -13.94** | -6.77 | -17.13** |
| PSLY-6 × PSLY-3 | 30.00 | -11.76** | -13.46** | -6.25 | -16.67** |
| PSLY-6 × PSLY-4 | 23.83 | -22.70 | -31.25** | -25.52** | -3.24** |
| PSLY-6 × PSLY-5 | 43.67 | 24.76** | 23.58** | 36.46** | -18.52** |
| PSLY-6 × PSLY-7 | 38.50 | 7.69** | 4.52 | 20.31** | 6.94* |
| PSLY-6 × PSLY-8 | 38.50 | 26.23** | 11.06** | 20.31** | 6.94 |
| PSLY-6 × PSLY-9 | 32.33 | 10.54** | -6.73* | 1.04 | -10.19** |
| PSLY-6 × PSLY-10 | 32.50 | 4.56 | -6.25 | 1.56 | -9.72** |

| | | | | | |
|---------------------|-------|--|----------|----------|----------|
| PSLY-7 × PSLY-1 | 39.83 | 15.46** | 8.14** | 24.48** | 10.65** |
| PSLY-7 × PSLY-2 | 38.83 | 17.68** | 5.43 | 21.35** | 7.87* |
| PSLY-7 × PSLY-3 | 39.33 | 12.11** | 6.79* | 22.92** | 9.26** |
| PSLY-7 × PSLY-4 | 37.17 | 16.45** | 0.90 | 16.15** | 3.24 |
| PSLY-7 × PSLY-5 | 36.83 | 2.08 | 0.00 | 15.10** | 2.31 |
| PSLY-7 × PSLY-6 | 28.33 | -20.75** | -23.08** | -11.46** | -21.30* |
| PSLY-7 × PSLY-8 | 37.17 | 17.68** | 0.90 | 16.15** | 3.24 |
| PSLY-7 × PSLY-9 | 36.50 | 20.33** | -0.90 | 14.06** | 1.39 |
| PSLY-7 × PSLY-10 | 40.83 | 26.94** | 10.86 | 27.60** | 13.43** |
| PSLY-8 × PSLY-1 | 33.17 | 13.39** | 3.11 | 3.65 | -7.87** |
| PSLY-8 × PSLY-2 | 38.33 | 38.14** | 31.43** | 19.79** | 6.48 |
| PSLY-8 × PSLY-3 | 27.83 | -6.70 | -16.50** | -13.02** | -22.69** |
| PSLY-8 × PSLY-4 | 32.50 | 21.88** | 20.37** | 1.56 | -2.78** |
| PSLY-8 × PSLY-5 | 38.67 | 25.41** | 9.43** | 20.83** | 7.41* |
| PSLY-8 × PSLY-6 | 34.00 | 11.48** | -1.92 | 6.25 | -5.56 |
| PSLY-8 × PSLY-7 | 34.00 | 7.65* | -7.69* | 6.25 | -5.56 |
| PSLY-8 × PSLY-9 | 38.50 | 53.49** | 46.20** | 20.31** | 6.94* |
| PSLY-8 × PSLY-10 | 34.33 | 27.55** | 24.85** | 7.29 | -4.63 |
| PSLY-9 × PSLY-1 | 31.83 | 13.69** | -1.04 | -0.52 | -11.57** |
| PSLY-9 × PSLY-2 | 30.33 | 14.47** | 4.00 | -5.21 | -15.74** |
| PSLY-9 × PSLY-3 | 39.00 | 36.44** | 17.00** | 21.88** | 8.33** |
| PSLY-9 × PSLY-4 | 32.33 | 27.21** | 19.75** | 1.04* | -10.19** |
| PSLY-9 × PSLY-5 | 29.50 | -0.28 | -16.51** | -7.81* | -18.06** |
| PSLY-9 × PSLY-6 | 32.17 | 9.97** | -7.21* | 0.52 | -10.65** |
| PSLY-9 × PSLY-7 | 34.83 | 14.84** | -5.43 | 8.85* | -3.24 |
| PSLY-9 × PSLY-8 | 35.17 | 40.20** | 33.54** | 9.90* | -2.31 |
| PSLY-9 × PSLY-10 | 38.33 | 49.35** | 39.39** | 19.79** | 6.48 |
| PSLY-10 × PSLY-1 | 36.83 | 23.46** | 14.51** | 15.10** | 2.31 |
| PSLY-10 × PSLY-2 | 33.67 | 18.82** | 15.43** | 5.21 | -6.48 |
| PSLY-10 × PSLY-3 | 37.00 | 21.64** | 34.55** | 15.63** | 2.78 |
| PSLY-10 × PSLY-4 | 38.83 | 42.51** | 41.21** | 21.35** | 7.87* |
| PSLY-10 × PSLY-5 | 31.83 | 1.33 | -9.91** | -0.52 | -11.57** |
| PSLY-10 × PSLY-6 | 32.00 | 2.95 | -7.69* | 0.00 | -11.11** |
| PSLY-10 × PSLY-7 | 37.83 | 17.62** | 2.71 | 18.23** | 5.09 |
| PSLY-10 × PSLY-8 | 34.50 | 28.17** | 25.45** | 7.81* | -4.17 |
| PSLY-10 × PSLY-9 | 42.50 | 65.58** | 54.55** | 32.8**1 | 18.06** |
| Hybrids mean | 35.22 | **, * = Significant at P≤0.01 and at P≤0.05, respectively, MPH: Mid-parent heterosis, BPH: Better-parent heterosis, SH: Standard heterosis, CH: Commercial heterosis | | | |
| LSD _{0.05} | 2.32 | | | | |

Table 10. Mean performance and heterotic effects of 10 × 10 yellow maize F₁ diallel hybrids for grain yield.

| Parental Inbred lines | Grain yield (kg ha ⁻¹) | MPH (%) | BPH (%) | SH (%) | CH (%) |
|-----------------------|------------------------------------|---------|---------|--------|--------|
| PSLY-1 | 7018.86 | | | | |
| PSLY-2 | 6721.34 | | | | |
| PSLY-3 | 7065.17 | | | | |

| | | | | | |
|------------------------------|----------|---------|---------|---------|---------|
| PSLY-4 | 6309.77 | | | | |
| PSLY-5 | 5840.63 | | | | |
| PSLY-6 | 9871.06 | | | | |
| PSLY-7 | 8172.83 | | | | |
| PSLY-8 | 6776.00 | | | | |
| PSLY-9 | 7220.56 | | | | |
| PSLY-10 | 7748.06 | | | | |
| Mean | 7274.43 | | | | |
| Check genotypes | | | | | |
| Hybrid CS-2420 | 8221.44 | | | | |
| OPV-2011Y | 5987.09 | | | | |
| Mean | 7104.26 | | | | |
| F₁ Hybrids | | | | | |
| PSLY-1 × PSLY-2 | 8033.00 | 16.93 | 14.45 | 34.17 | -2.29 |
| PSLY-1 × PSLY-3 | 9828.71 | 39.57** | 39.11* | 64.17** | 19.55 |
| PSLY-1 × PSLY-4 | 10578.51 | 58.73** | 50.72** | 76.69** | 28.67* |
| PSLY-1 × PSLY-5 | 8252.86 | 28.35 | 17.58 | 37.84 | 0.38 |
| PSLY-1 × PSLY-6 | 11032.76 | 30.64* | 11.77 | 84.28** | 34.19* |
| PSLY-1 × PSLY-7 | 9271.22 | 22.06 | 13.44 | 54.85** | 12.77 |
| PSLY-1 × PSLY-8 | 10876.24 | 57.69** | 54.96** | 81.66** | 32.29* |
| PSLY-1 × PSLY-9 | 9530.27 | 33.86* | 31.99 | 59.18** | 15.92 |
| PSLY-1 × PSLY-10 | 8840.78 | 19.74 | 14.10 | 47.66* | 7.53 |
| PSLY-2 × PSLY-1 | 11514.98 | 40.34** | 64.06** | 92.33** | 40.06** |
| PSLY-2 × PSLY-3 | 8054.59 | 16.85 | 14.00 | 34.53 | -2.03 |
| PSLY-2 × PSLY-4 | 9938.82 | 52.54** | 47.87** | 66.00** | 20.89 |
| PSLY-2 × PSLY-5 | 6819.99 | 8.58 | 1.47 | 13.91 | -17.05 |
| PSLY-2 × PSLY-6 | 9832.16 | 18.51 | -0.39 | 64.22** | 19.59 |
| PSLY-2 × PSLY-7 | 8927.37 | 19.88 | 9.23 | 49.11* | 8.59 |
| PSLY-2 × PSLY-8 | 9957.53 | 47.55** | 48.15** | 66.32** | 21.12 |
| PSLY-2 × PSLY-9 | 8766.63 | 25.76 | 21.41 | 46.43* | 6.63 |
| PSLY-2 × PSLY-10 | 9559.22 | 32.13* | 23.38 | 59.66** | 16.27 |
| PSLY-3 × PSLY-1 | 8392.78 | 19.18 | 18.79 | 40.18 | 2.08 |
| PSLY-3 × PSLY-2 | 8273.41 | 20.02 | 17.10 | 38.19 | 0.63 |
| PSLY-3 × PSLY-4 | 11050.04 | 65.23** | 56.40** | 84.56** | 34.41* |
| PSLY-3 × PSLY-5 | 7814.21 | 21.10 | 10.60 | 30.52 | -4.95 |
| PSLY-3 × PSLY-6 | 9361.57 | 10.55 | -5.16 | 56.36** | 13.87 |
| PSLY-3 × PSLY-7 | 8794.35 | 15.43 | 7.60 | 56.36** | 6.97 |
| PSLY-3 × PSLY-8 | 8223.02 | 18.82 | 16.39 | 37.35 | 0.02 |
| PSLY-3 × PSLY-9 | 8977.57 | 25.69 | 24.33 | 49.95* | 9.20 |
| PSLY-3 × PSLY-10 | 8239.06 | 11.24 | 6.34 | 37.61 | 0.21 |
| PSLY-4 × PSLY-1 | 9707.61 | 45.67** | 38.31* | 62.14** | 18.08 |
| PSLY-4 × PSLY-2 | 7066.35 | 8.45 | 5.13 | 18.03 | -14.05 |
| PSLY-4 × PSLY-3 | 9712.94 | 45.24** | 37.48* | 62.23** | 18.14 |
| PSLY-4 × PSLY-5 | 8220.98 | 35.32* | 30.29* | 37.31 | -0.01 |
| PSLY-4 × PSLY-6 | 9433.30 | 16.60 | -4.43 | 57.56** | 14.74 |
| PSLY-4 × PSLY-7 | 9335.22 | 28.92* | 14.22 | 55.92** | 13.55 |
| PSLY-4 × PSLY-8 | 9371.61 | 43.23** | 38.31* | 56.53* | 13.99 |

| | | | | | |
|------------------|---------|---------|--------|---------|-------|
| PSLY-4 × PSLY-9 | 9832.16 | 45.34** | 36.17* | 64.22** | 19.59 |
| PSLY-4 × PSLY-10 | 9294.43 | 32.23* | 19.96 | 55.24** | 13.05 |
| PSLY-5 × PSLY-1 | 8499.99 | 32.20* | 21.10* | 41.97 | 3.39 |

| F₁ hybrids | Grain yield (kg ha⁻¹) | MPH (%) | BPH (%) | SH (%) | CH (%) |
|------------------------------|---|----------------|----------------|---------------|---------------|
| PSLY-5 × PSLY-2 | 9300.71 | 48.08** | 38.38* | 55.35** | 13.13 |
| PSLY-5 × PSLY-3 | 7651.76 | 18.58 | 8.30 | 27.80 | -6.93 |
| PSLY-5 × PSLY-4 | 10856.78 | 78.71** | 72.06** | 81.34** | 32.05* |
| PSLY-5 × PSLY-6 | 9021.12 | 14.83 | -8.61 | 50.68* | 9.73 |
| PSLY-5 × PSLY-7 | 8057.10 | 14.99 | -1.42 | 34.57 | -2.00 |
| PSLY-5 × PSLY-8 | 10147.14 | 60.85** | 49.75** | 69.48** | 23.42 |
| PSLY-5 × PSLY-9 | 8512.00 | 30.34 | 17.89 | 42.17* | 3.53 |
| PSLY-5 × PSLY-10 | 9360.31 | 37.77* | 20.81 | 56.34** | 13.85 |
| PSLY-6 × PSLY-1 | 9923.45 | 17.51 | 0.53 | 65.75** | 20.70 |
| PSLY-6 × PSLY-2 | 8939.29 | 7.75 | 9.38 | 49.31* | 8.73 |
| PSLY-6 × PSLY-3 | 7215.55 | -14.79 | -26.90* | 20.52 | -12.23 |
| PSLY-6 × PSLY-4 | 9770.62 | 20.77 | -1.02 | 63.19** | 13.55 |
| PSLY-6 × PSLY-5 | 9029.65 | 14.94 | -8.52 | 50.82* | -2.00 |
| PSLY-6 × PSLY-7 | 7936.00 | -12.04 | -19.60 | 32.55 | -3.47 |
| PSLY-6 × PSLY-8 | 5164.73 | -37.95** | -47.68** | -13.74 | -37.18 |
| PSLY-6 × PSLY-9 | 8357.02 | -2.21 | -15.34 | 39.58* | 1.65 |
| PSLY-6 × PSLY-10 | 9743.69 | 10.60 | -1.29 | 62.75** | 18.52 |
| PSLY-7 × PSLY-1 | 8316.86 | 9.49 | 1.76 | 38.91 | 1.16 |
| PSLY-7 × PSLY-2 | 7024.48 | -5.67 | -14.05 | 17.33 | -14.56 |
| PSLY-7 × PSLY-3 | 10177.88 | 33.59* | 24.53 | 70.00 | 23.80 |
| PSLY-7 × PSLY-4 | 8971.92 | 23.90 | 9.78 | 49.85* | 9.13 |
| PSLY-7 × PSLY-5 | 8603.29 | 22.79 | 5.27 | 43.70* | 4.64 |
| PSLY-7 × PSLY-6 | 9504.00 | 5.34 | -3.72 | 58.74** | 15.60 |
| PSLY-7 × PSLY-8 | 6407.20 | -14.28 | -21.60 | 7.02 | -22.07 |
| PSLY-7 × PSLY-9 | 8110.95 | 5.38 | -0.76 | 35.47 | -1.34 |
| PSLY-7 × PSLY-10 | 8604.24 | 8.09 | 5.28 | 43.71* | 4.66 |
| PSLY-8 × PSLY-1 | 10742.90 | 55.75** | 53.06** | 79.43** | 30.67* |
| PSLY-8 × PSLY-2 | 9738.04 | 44.30** | 44.88* | 62.65** | 18.45 |
| PSLY-8 × PSLY-3 | 8539.32 | 23.39 | 20.87 | 42.63* | 3.87 |
| PSLY-8 × PSLY-4 | 9620.71 | 47.04** | 41.98* | 60.69** | 13.99 |
| PSLY-8 × PSLY-5 | 10635.29 | 68.59** | 56.96** | 77.64** | 29.36* |
| PSLY-8 × PSLY-6 | 6422.03 | -22.84 | -34.94** | 7.26 | -21.89 |
| PSLY-8 × PSLY-7 | 5723.29 | -23.43 | -29.97* | -4.41 | -30.39* |
| PSLY-8 × PSLY-9 | 8303.69 | 18.65 | 15.00 | 38.69 | 1.00 |
| PSLY-8 × PSLY-10 | 8213.33 | 13.10 | 6.00 | 37.18 | -0.10 |
| PSLY-9 × PSLY-1 | 3272.89 | -54.03** | -54.67** | -45.33* | -60.19** |
| PSLY-9 × PSLY-2 | 8248.07 | 18.32 | 14.23 | 37.76 | 0.32 |
| PSLY-9 × PSLY-3 | 9590.90 | 34.27* | 2.83* | 60.19** | 16.66 |
| PSLY-9 × PSLY-4 | 10116.87 | 49.54** | 40.11* | 68.98** | 23.05 |
| PSLY-9 × PSLY-5 | 7402.67 | 13.35 | 2.52 | 23.64 | -9.96 |
| PSLY-9 × PSLY-6 | 10089.41 | 18.06 | 2.21 | 68.52** | 22.72 |

| | | | | | |
|---------------------|----------|--|---------|---------|----------|
| PSLY-9 × PSLY-7 | 10230.27 | 32.92* | 25.17 | 70.87** | 24.43 |
| PSLY-9 × PSLY-8 | 9857.25 | 40.85** | 36.52* | 64.64** | 19.90 |
| PSLY-9 × PSLY-10 | 4777.38 | -36.17** | -38.34* | -20.21 | -41.89** |
| PSLY-10 × PSLY-1 | 7324.86 | -0.79 | -6.03 | 22.34 | -10.91 |
| PSLY-10 × PSLY-2 | 9600.00 | 32.69* | 23.90 | 60.35** | 16.77 |
| PSLY-10 × PSLY-3 | 8843.29 | 19.40 | 14.14 | 47.71* | 7.56 |
| PSLY-10 × PSLY-4 | 7326.60 | 4.24 | -5.44 | 22.37 | -10.88 |
| PSLY-10 × PSLY-5 | 9340.86 | 37.48* | 20.56 | 56.02** | 13.62 |
| PSLY-10 × PSLY-6 | 9128.47 | 3.62 | -7.52 | 52.47** | 11.03 |
| PSLY-10 × PSLY-7 | 8156.86 | 2.47 | -0.20 | 36.24 | -0.79 |
| PSLY-10 × PSLY-8 | 5105.01 | -29.70* | -34.11* | -14.73 | -37.91** |
| PSLY-10 × PSLY-9 | 8030.75 | 7.30 | 3.65 | 34.13 | -2.32 |
| Hybrids mean | 8758.94 | **, * = Significant at P≤0.01 and at P≤0.05, respectively, MPH: Mid-parent heterosis, BPH: Better-parent heterosis, SH: Standard heterosis, CH: Commercial heterosis | | | |
| LSD _{0.05} | 2330.52 | | | | |

CONCLUSIONS AND RECOMMENDATIONS

Majority of F₁ hybrids exhibited the highest and significant negative mid, better parent, standard and commercial heterosis by performing better than parental inbred lines and check genotypes for earliness traits and maturity, while the highest and significantly positive mid, better parent, standard and commercial heterosis for morphological and yield related traits. The superior F₁ hybrids showing significant positive heterosis for grain yield and desirable agronomic traits should be further evaluated across multiple locations and seasons to confirm their yield stability. These promising hybrids may be utilized in future maize breeding programs for the development of high-yielding and early maturing cultivars.

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