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# MODE OF INHERITANCE OF COB WEIGHT AND GRAIN YIELD IN MAIZE

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***Summary:*** The aim of this paper was to investigate maize inbred lines and their hybrids for the genetic variability and mode of inheritance of plant height, cob weight and grain yield.

Twelve inbred lines (eight domestic and four US ones) were used to analyze genetic variability and mode of inheritance. Statistical date analysis showed that there was genetic variability among the inbreds lines for each of the traits analyzed. The results of the study comfirmed that superdominance is the mode of inheritance of all three traits studied.

***Key words:*** maize, genetic analysis, inheritance, plant height, cob weight, grain yield

## Introduction

Maize (*Zea mays* L.) is one of the most important field crops in the world. It is a major crop for livestock feed and human nutrition in a number of developed and developing countries. One of the top breakthroughs in modern agriculture came with the discovery of heterosis, and this phenomenon is considered one of the main reasons behind successful industrial production of maize (Malik et al., 2004).

The main goal of any maize breeding program is to obtain new inbreds and hybrids that will outperform the existing hybrids with respect to a number of traits. In working towards this goal, particular attention is paid to grain yield as the most important agronomic characteristic. A great deal of attention is also paid to the components of yield, as grain yield is a complex character that depends on a number of factors.

The objective of this paper was to determine genetic variability and the mode of inheritance for plant height, cob weight, and grain yield in inbred lines and their hybrids.

## Material and Methods

In the present study we evaluated 12 inbred lines and their hybrids. Eight of the inbreds (62/IV, 137/IV, 212 A, 75/IV, 54/IV, 9/IV, NS L 1000 and NS L 1001) came from the domestic germplasm stock, while four (B 73 L, B 73 Ht, B 37 and N 152) were from the U.S.A. During 2001, the parental lines and their hybrids were evaluated in field experiments in a single location (Rimski Sancevi) using a complete block design with three replications. Each plot consisted of one 5 m

long row. The spacing was 0.70 m between the plots and 0.25 m between the plants. The standard maize growing technique was used and harvesting was done by hand.

The data for plant height, cob weight and grain yield per plant were recorded on 30 randomly taken competitive plants.

The data were subjected to the standard statistical technique for the analysis of variance in order to establish the level of significance among genotypes. The arithmetic mean ($\bar{x}$), standard deviation ( ), standard error ($S_{\bar{x}}$) and coefficient of variation (V) were determinated according to Singh and Chaudhary (1985).

In the evaluation of the mode of inheritance, the LSD test of the mean value of the F1 generation was used relatave to the parental average (Hadživuković, 1973).

## Results and Discussion

### *Plant height*

Plant height is a highly important character not only for describing new maize varietes but for green and dry matter production and even grain yield as well (Zsubori et al., 2002).

The highest mean value of plant height was obtained in the line NS L 1001 and the lowest in 75/IV. Highly significant differences were observed between the inbred line with the maximum mean value and all the other lines with the exception of B 73 Ht and N 152. The line 75/IV exhibited significant differences relative to B 73 Ht, B 37 and N 152. Significant differences were also found between the line N 152 on the one hand and NS L 1000, 9/IV, 54/IV, 212 A, 137/IV, 62/IV and B 73 L on the other.

The highest variation according to standard deviation was recorded in the line NS L 1000 and the lowest in 9/IV (Tab. 1).

Among the hybrids, the highest mean value of plant height was observed in the combination B 73 Ht × 54/IV. This value was significantly different from the values found in B37 × 137/IV and NS L 1000 × B 73 Ht as well as highly significant different from those recorded in 73 L × 137/IV and B 73 Ht × 212 A (Tab. 1). The hybrid combination B 73 L × 137/IV had the lowest mean value and was significantly different from the hybrid combination NS L 1001 × N 152.

The highest variability by standard deviation was observed in the hybrid B 73 × 137/IV and the lowest in NS L 1000 × N 152.

In the inbreds, the coefficients of variation for plant height ranged from 1.4% (9/IV) to 7.9% (NS L 1000), while in the hybrid combinations the variation was from 0.2% (NS L 1000 × N 152) to 7.7% (B 73 L×137/IV).

All of the hybrid combinations studied had positive heterosis as the mode of inheritance of plant height (Tab. 1). The results obtained in this paper are in accordance with those obtained by Edwards and Lamkey (2002) and Alvi et al. (2003) and partially similar to the findings of Sujiprihati (1996), who obtained full dominance and overdominance as the mode of inheritance of this trait. Our results are contrary to those obtained by Lu et al (2003), who reported partial dominance as the mode of inheritance of plant height.

*Tab. 1. Averages, index of variation and mode of inheritance of plant height (cm)*

| Lines and hybrids | $\bar{X}\pm S_{\bar{X}}$ | S | V (%) | Mode of inheritance |
|---|---|---|---|---|
| B 73 L | 194.5±2.7 | 3.5 | 1.8 | |
| B 73 Ht | 206.5±3.4 | 5.9 | 2.9 | |
| B 37 | 202.0±2.6 | 4.5 | 2.2 | |
| 62/IV | 180.7±8.1 | 14.0 | 7.8 | |
| 137/ IV | 177.3±2.4 | 4.2 | 2.3 | |
| 212 A | 173.7±4.8 | 8.4 | 4.8 | |
| 75/IV | 170.7±4.1 | 7.1 | 4.2 | |
| 54/IV | 195.5±8.6 | 15.0 | 7.7 | |
| 9/IV | 179.2±1.4 | 2.5 | 1.4 | |
| NS L 1000 | 193.8±8.8 | 15.3 | 7.9 | |
| N 152 | 229.0±3.6 | 6.2 | 2.7 | |
| NS L 1001 | 239.7±6.4 | 11.2 | 4.7 | |
| B 73 L × 137/IV | 277.5±12.3 | 21.4 | 7.7 | s.d. |
| B 37 × 137/IV | 285.0±1.5 | 2.6 | 0.9 | s.d. |
| B 73 Ht × 212 A | 279.0±3.5 | 6.1 | 2.2 | s.d. |
| 62/IV × 75/IV | 299.3±6.5 | 11.3 | 3.8 | s.d. |
| B 73 Ht × 54/IV | 319.2±0.7 | 1.3 | 0.4 | s.d. |
| B 37 × 9/IV | 294.8±1.2 | 2.1 | 0.7 | s.d. |
| NS L 1000 × N 152 | 302.8±0.3 | 0.6 | 0.2 | s.d. |
| NS L 1000 × B 73 Ht | 289.2±4.9 | 8.5 | 2.9 | s.d. |
| NS L 1001 × N 152 | 312.2±7.8 | 13.6 | 4.3 | s.d. |
| LSD 0.05 | 28.11 | | | |
| LSD 0.01 | 37.41 | | | |

### *Cob weight*

The average values, index of variation and mode of inheritance for cob weight are shown in Table 2.

The highest mean value of cob weight was found in the inbred line B 73 L. This mean was highly significantly different from those found in the lines 62/IV, 75/IV, 54/IV and 9/IV. The lowest mean value was recorded in the line 75/IV, with a highly signicant difference relative to the lines B 73 L, B 37, NS L 1000, N 152 and NS L 1001.

The highest cob weight variation was observed in the line N 152 and the lowest in 9/IV.

The hybrid combination B 37 × 137/IV had the highest mean value of cob weight, while NS L 1001 × N 152 had the lowest. The test for determining the significance of differences among means did not reveal any significant differences among the hybrids.

The highest variation was found in the combination B 37 × 137/IV and the lowest in 62/IV × 75/IV.

The coefficient of variation ranged from 2.94 % (B 37) to 17.95% (N 152) in the inbred lines and from 3.93% (62/IV × 75/IV) to 14.05% (NS L 1001 × N 152) in the hybrids.

In all the hybrid combinations, the mode of inheritance of cob weight was superdominance, which is in accordance with the results obtained by Bocanski (1988), Suba et al. (2001), Geetha and Jayaraman (2001), Bocanski et al. (2004a), and Bocanski et al. (2005).

*Tab. 2. Averages, index of variation and mode of inheritance of cob weight (g)*

| Lines and hybrids | $\bar{X}\pm S_{\bar{X}}$ | s | V (%) | Mode of inheritance |
|---|---|---|---|---|
| B 73 L | 32.02±1.57 | 2.73 | 8.52 | |
| B 73 Ht | 21.28±1.49 | 2.58 | 12.12 | |
| B 37 | 29.89±0.51 | 0.88 | 2.94 | |
| 62/IV | 19.88±1.01 | 1.75 | 8.80 | |
| 137/ IV | 21.22±0.74 | 1.28 | 6.03 | |
| 212 A | 22.62±1.12 | 1.94 | 8.57 | |
| 75/IV | 16.48±1.37 | 2.37 | 14.38 | |
| 54/IV | 19.77±0.76 | 1.31 | 6.63 | |
| 9/IV | 18.44±0.51 | 0.88 | 4.77 | |
| NS L 1000 | 27.67±0.85 | 1.48 | 5.35 | |
| N 152 | 26.68±2.77 | 4.79 | 17.95 | |
| NS L 1001 | 29.41±1.95 | 3.38 | 11.49 | |
| B 73 L × 137/IV | 50.49±1.83 | 3.17 | 6.27 | s.d. |
| B 37 × 137/IV | 51.74±3.87 | 6.70 | 12.94 | s.d. |
| B 73 Ht × 212 A | 36.82±1.67 | 2.88 | 7.82 | s.d. |
| 62/IV × 75/IV | 38.71±0.87 | 1.52 | 3.93 | s.d. |
| B 73 Ht × 54/IV | 46.60±3.15 | 5.45 | 11.70 | s.d. |
| B 37 × 9/IV | 42.60±2.84 | 4.91 | 11.52 | s.d. |
| NS L 1000 × N 152 | 44.67±2.07 | 3.58 | 8.01 | s.d. |
| NS L 1000 × B 73 Ht | 43.73±2.30 | 3.98 | 9.10 | s.d. |
| NS L 1001 × N 152 | 34.01±2.76 | 4.78 | 14.05 | s.d. |
| LSD 0.05<br>LSD 0.01 | 5.608<br>7.504 | | | |

### *Grain yield per plant*

Among the inbreds, the highest mean value was found in the inbred line NS L 1001 and the lowest in the line 137/IV (Tab.3). The inbred line with the highest mean value (NS L 1001) was significantly different in this respect from the lines B 73 L, B 73 Ht, B 37, 137/IV, 212 A, 75/IV, 54/IV and 9/IV. The mean value of grain yield per plant recorded in the line 137/IV was significantly lower than the averages found in the lines B 73 L, 62/IV, NS L 1000, N 152 and NS L 1001. No significant differences were observed between the lines NS L 1000 and N 152, but the mean values of these two lines were significantly different from those of B 73 Ht, B37, 75/IV and 9/IV.

The highest variation of grain yield per plant by standard deviation was found in the line NS L 1001 and the lowest in B 37.

Among the hybrids, the highest mean value of the studied trait was recorded in the combination NS L 1001×N 152 and the lowest in NS L 1000 × B 73 Ht (Tab.3). Significant differences were found only between the hybrid combination with the highest mean (NS L 1001 × N 152) and that with the lowest (NSL 1000 × B 73Ht).

In hybrids, the highest variation of grain yield per plant according to standard deviation was found the combination NS L 1001 × N 152, wshile 62/IV × 75/IV had the lowest (Tab.3).

The coefficient of variation ranged from 2.95 (N 152) to 16.09% (B 73 Ht) in the inbreds and from 2.52 (62/IV × 75/IV) to 12.71% (NS L 1001 × N 152) in the hybrids.

All the hybrid combinations had superdominance as the mode of inheritance of grain yield. The results of our study are supported by the findings of many other authors (Bocanski, 1988; Bocanski et al., 1999, Wolf et al., 2000; Vales et al, 2001; Edwards and Lamkey, 2002; Michelson et al., 2002; Lu et al., 2003; Soengas et al., 2003; Bocanski et al, 2004 a, b; Tollernaar et al., 2004; Unay et al., 2004; Bocanski et al, 2005), who also found superdominance as mode of inheritance of grain yield in their studies.

*Tab. 3. Averages, index of variation and mode of inheritance of grain yield (g)*

| Lines and hybrids | $\bar{X}\pm S_{\bar{X}}$ | s | V (%) | Mode of inheritance |
|---|---|---|---|---|
| B 73 L | 115.18±9.08 | 15.73 | 13.66 | |
| B 73 Ht | 83.28±7.74 | 13.40 | 16.09 | |
| B 37 | 94.55±1.93 | 3.34 | 3.53 | |
| 62/IV | 121.89±7.32 | 12.69 | 10.41 | |
| 137/ IV | 69.64±5.45 | 9.44 | 13.56 | |
| 212 A | 105.96±3.24 | 5.61 | 5.29 | |
| 75/IV | 89.80±5.60 | 9.69 | 10.79 | |
| 54/IV | 105.41±3.99 | 6.91 | 6.55 | |
| 9/IV | 87.56±3.67 | 6.35 | 7.25 | |
| NS L 1000 | 139.67±9.01 | 15.60 | 11.17 | |
| N 152 | 148.59±2.53 | 4.38 | 2.95 | |
| NS L 1001 | 175.80±9.55 | 16.55 | 9.41 | |
| B 73 L × 137/IV | 251.46±12.26 | 21.23 | 8.44 | s.d. |
| B 37 × 137/IV | 236.99±10.98 | 19.02 | 8.44 | s.d. |
| B 73 Ht × 212 A | 230.03±7.91 | 13.75 | 5.98 | s.d. |
| 62/IV × 75/IV | 249.96±3.64 | 6.31 | 2.52 | s.d, |
| B 73 Ht × 54/IV | 252.29±16.25 | 28.14 | 11.15 | s.d. |
| B 37 × 9/IV | 243.87±13.52 | 23.43 | 9.61 | s.d. |
| NS L 1000 × N 152 | 218.67±10.86 | 18.81 | 8.60 | s.d. |
| NS L 1000 × B 73 | 200.55±6.91 | 11.97 | 5.97 | s.d. |
| NS L 1001 × N 152 | 255.26±18.73 | 32.44 | 12.71 | s.d. |
| LSD 0.05<br>LSD 0.01 | 25.46<br>34.07 | | | |

## Conclusion

The inbred line NS L 1001 had the highest mean value of plant height. The same line also had the highest mean value of grain yield per plant, while the highest mean value of cob weight was produced by the inbred line B 73 L. The lowest mean values of plant height and cob weight were found in the line 75/IV. The line 137/IV had the lowest average grain yield.

The inbred line B 73 Ht in combination with the line 54/IV (B 73 Ht × 54/IV) had the highest mean value of plant height, while the combination of the same line with 137/IV (B 73 Ht × 137/IV) produced the lowest mean value of this trait. The highest mean value of cob weight was found in the combination B 37 × 137/IV and the lowest in NS L 1001×N 152. For grain yield, the highest value was found in NS L 1001×N 152, and the lowest in NS L 1000×B 73.

Super dominance was the mode of inheritance of the three studied traits.

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