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Observations on heterosis in *Zea mays* L. III

Obserwacje nad heterozją u *Zea mays* L. III.

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Based on the selected line with a hereditary fixed vigorous growth (line No. 10), further investigations were performed in 1963 and 1964 in the Department of Genetics of the Warsaw Agricultural University.

Line No. 10, prevailing in its vigorous growth over parental inbred lines and F_1, has been noted for an increased yield only in respect to parental forms, but is distinctly inferior in this trait to F_1 plants.

It became therefore necessary to examine the combining ability of line No. 10. To achive this, it was crossed with inbred lines exhibiting a sufficient degree of fertility. In this purpose the following inbreds were used: U_{26}, U_{221}, $C.O._{151}$, W_{37A}. The inbred lines were selected and kindly supplied by Dr. J. Bojanowski.

In 1963 experiments crosses carried out in 1962 were taken into consideration, namely: $F_1 (U_{26} \times 1. No. 10)$ and $F_1 (U_{221} \times 1. No. 10)$ in 1964 crosses carried out in 1963 were analysed, namely: $F_1 (C.O._{151} \times 1. No. 10)$ and $F_1 (W_{37A} \times 1. No. 10)$, furthermore, for comparison, inbreds W9, WD and $F_1 (WD \times W9)$ were used.

The plants grew in 80×70 cm rows in rich soil. The experimental material consisted of 640 plants. With the beginning of September the height measurements in cm of these plants were taken. After collecting and drying the ears, the kernels shelled out of each ear separately (taking one ear per plant) were weighted.

From the obtained experimental data the arithmetic mean values were computed for individual traits. Table 1 gives the data on the height of plants in the end of vegetation. The upper row plots the arithmetic mean values of the inbred lines and investigated F_1's. The following rows show the differences between the mean values. The significant differences (at $p = 0.05$ level) are denoted with asterisks.

Table 1

Mean height of plants (in cm) at maturity. Comparison of arithmetic mean values of parents and in the progeny of crosses Experiments carried out in 1964

$F_1(C.O._{151} \times l.No10)$	$F_1(W_{37A} \times l.No.10)$	L.No10	$F_1(WD \times W9)$	$C.O._{151}$	W_{37A}	L.W9	L.WD
277. ± 3.66	262. ± 3.60	234. ± 5.66	191.34 ± 2.12	171.7 ± 4.03	165 ± 13.7	156.5 ± 1.93	124.72 ± 2.1
Differences	15.0*	43.0*	85.66*	105.3*	112.0*	120.5*	152.28*
		28.0*	70.66*	90.3*	97.0*	105.5*	137.28*
			42.66*	62.3*	69.0*	77.5*	109.28*
				19.64*	26.34*	34.84*	66.62*
					6.7	15.2*	46.98*
						8.5	40.28*
							31.78*

Table 2

Mean values of ear length and number of rows

		$(U_{221} \times 1.$ No 10)	$(U_{26} \times 1.$ No 10)	(WD × W9)	Line No. 10	$(C.O._{151} \times$ lNo.10)	$(W_{37}A \times$ l.No.10)
Ear length in cm	1963	20.24 ± 0.82	19.87 ± 0.52	16.5 ± 0.46	14.5 ± 0.32		
	1964			16.5 ± 0.24	14.83 ± 0.48	18.58 ± 0.26	18.0 ± 0.46
Number of rows	1963	18.94 ± 0.5	18.0 ± 0.33	15.4 ± 0.54	15.17 ± 0.33		
	1964			14.88 ± 0.67	14.82 ± 0.67	18.0 ± 0.29	17.34 ± 0.46

According to Table 1 all the differences proved to be significant with the exception of the differences between inbreds $C.O._{151}$ and W_{37A} and between W_{37A} and W9. The F_1's of crosses ($C.O._{151} \times$ 1. No. 10) and ($W_{37A} \times$ 1. No. 10) distinctly prevail in height over F_1 (WD$\times$W9) as well as over 1. No. 10. They are more vigorous than the parental forms and have larger ears.

Fig. 1 presents photographs of ears of inbred WD, F_1 (WD$\times$W9), inbred W9 and 1. No. 10 (from left to right).

Fig. 2 shows ears of inbred U_{26}, F_1 ($U_{26} \times$ 1. No. 10), line No. 10, F_1 ($U_{221} \times$ 1. No. 10) and inbred U_{221} (from left to right).

Fig. 3 illustrates ears of inbred $C.O._{151}$, F_1 ($C.O._{151} \times$ 1. No. 10) line No. 10, F_1 ($W_{37A} \times$ 1. No. 10) and inbred W_{37A} (from left to right).

The weight of kernels per ear is conditioned mainly by a greater length of rows and their number per ear. The arithmetic mean values of these traits are presented in Table 2.

Table 3 presents the arithmetic mean values of the kernel weight per ear. The data are obtained from 1963 experiments. The progenies of crosses between inbreds U_{26}, U_{221} and line No. 10 prove to be the best. The differences are significant with the exception of differences between F_1 ($U_{26} \times$ 1. No. 10) and F_1 ($U_{221} \times$ 1. No. 10). The differences between line No. 10 and inbreds U_{221} and U_{26} are not significant. The differences

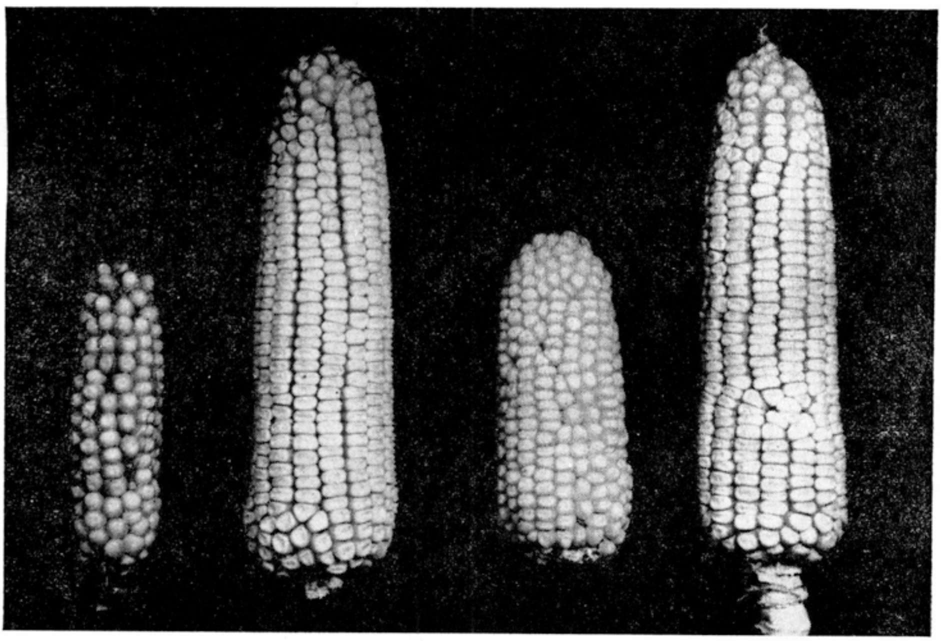

Fig. 1. Presents photographs of ears of inbred WD. F_1 (WD $\times$ W9), inbred W9 and line No. 10 (from left to right)

Table 3

Mean weight of kernels per ear (in g.). Comparison of arithmetic mean values of parents and in the progeny of crosses.
Experiments carried out in 1963

	$F_1(U_{26} \times$ l. No 10)	$F_1(U_{221} \times$ l. No 10	F_1(WD $\times$ W9)	l. No 10	l. U_{221}	l. U_{26}	l. W9	l. WD
	199.7 $\pm$ 7.4	194.34 $\pm$ 8.4	166. $\pm$ 5.05	103.34 $\pm$ 9.4	85. $\pm$ 13.7	71.7 $\pm$ 13.7	68.85 $\pm$ 6.11	41.16 $\pm$ 4.16
Differences		5.36	33.7	96.36	114.7	128.	130.85	158.54
			28.34	91.	109.34	122.64	125.49	153.18
				62.66	81.	94.3	97.15	124.84
					18.34	31.64	34.49	62.18
						13.3	16.15	43.84
							2,85	30.54
								27.69

Table 4

Mean weight of kernels per ear (in g). Comparison of arithmetic mean values of parents and in the progeny of crosses. Experiments carried out in 1964

$F_1(C.O._{151} \times l.No.10)$	$F_1(W_{37A} \times l.No.10)$	$F_1(WD \times W9)$	L.No.10	l.W9	$l.W_{37}A$	$l.C.O._{151}$	l.WD
182.5 ± 6.44	178.33 ± 13.8	167 ± 5.7	113.4 ± 12.33	79.6 ± 18.6	53 ± 5.08	44.39 ± 3.7	37.97 ± 1.57
Differences	4.17	15.5	69.1	102.9	129.5	138.11	144.53
		11.33	54.93	98.73	125.33	133.94	140.36
			53.6	87.4	114	122.61	129.03
				33.8	60.4	69.01	75.43
					26.6	35.21	41.63
						8.61	15.03
							6.42

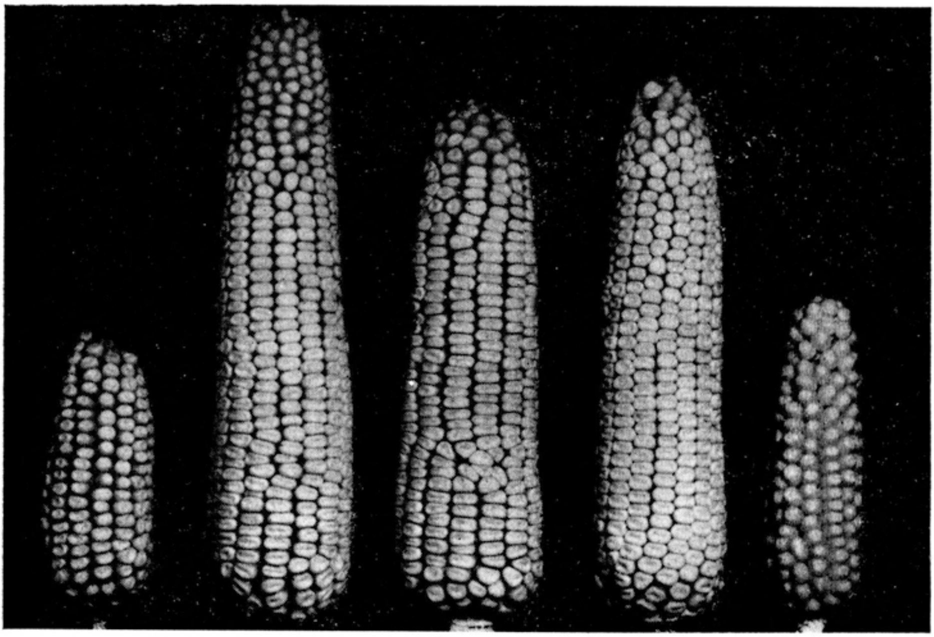

Fig. 2. Shows ears of inbred U26, F_1 (U26 × 1. No. 10), line No. 10, F_1 (U221 × 1. No. 10) and inbred U221 (from left to right)

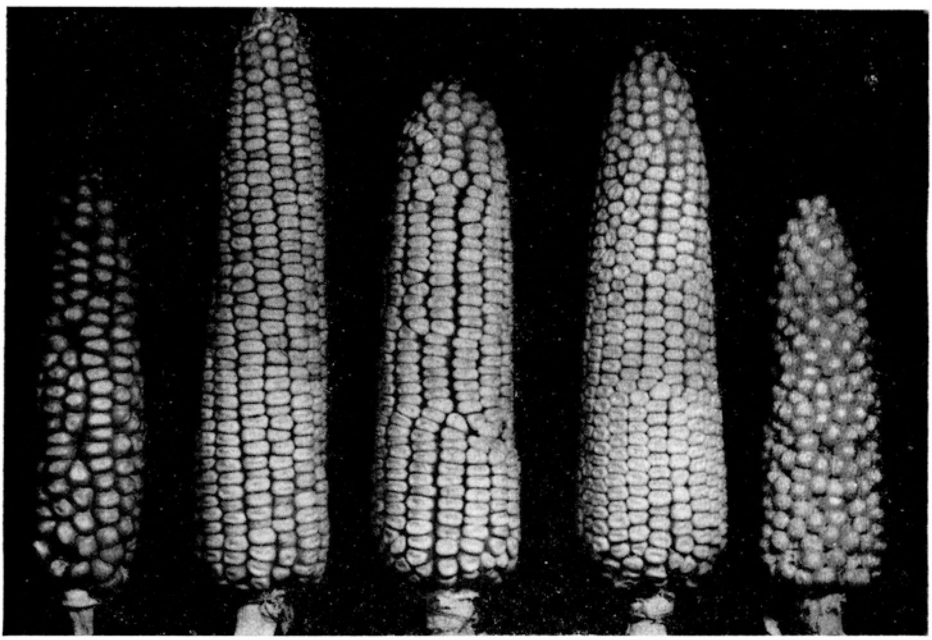

Fig. 3. Presents ears of inbred C.O. 151, F_1 (C.O. 151 × 1. No. 10), line No. 10, F_1 (W37A × 1. No. 10) and inbred W37A (from left to right)

between inbreds U_{221} and inbreds U_{26} and W9 as well as between inbreds U_{26} and W9 are also not significant.

Table 4 presents the arithmetic mean values of the kernel weight per ear. These data belong to 1964 experiments. In this case as well the progeny of crosses between line No. 10 and inbreds $C.O._{151}$ and W_{37A} turned out to be the best.

In general the differences are significant with the exceptions between F_1 ($C.O._{151}$×l. No. 10) and F_1 (W_{37A}×l. No. 10) as well as between inbreds $C.O._{151}$ and W_{37A} and between $C.O._{151}$ and WD.

The experimental data suggest that by selecting suitable inbred lines for crossing with line No. 10 it is possible to increase distinctly the vigour and yield of the hybrids.

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STRESZCZENIE

Linia Nr 10, wyodrębniona w potomstwie krzyżówki WD×W9, wyróżniająca się znacznym stopniem bujności w stosunku do form rodzicielskich i F_1, ustępowała wyraźnie pod względem plonu roślinom pierwszego pokolenia, przewyższając jedynie wyjściowe linie wsobne. Wyłoniło się zagadnienie zbadania zdolności kombinacyjnej linii Nr 10. W związku z tym skrzyżowano ją z liniami wsobnymi, wyróżniającymi się dostatecznym stopniem płodności, mianowicie z liniami: U_{26}, U_{221}, $C.O._{151}$ i W_{37A}. Materiał eksperymentalny obejmował 640 roślin. Doświadczenie przeprowadzono w latach 1963—1964 na terenie Ursynowa, w Zakładzie Genetyki S.G.G.W.

W badaniach uwzględniono cechę wysokości roślin w końcowym okresie wegetacji oraz ciężar ziarn z jednej normalnie wykształconej kolby na roślinie. Po opracowaniu danych eksperymentalnych zestawiono je w postaci tabel. Na podstawie przeprowadzonych doświadczeń można było stwierdzić, że mieszańce pierwszego pokolenia uzyskane z krzyżówek z linią Nr 10 były najbardziej bujne i plenne. Dane eksperymentalne wskazują na możność znacznego zwiększenia plonu mieszańców pierwszego pokolenia na drodze dobierania odpowiednich komponentów do krzyżowania z linią Nr 10.

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