

$\underline{g} \underline{p} \underline{s}^{\text{sk}} / \underline{g} \underline{p} \underline{s}$ .

The last two individuals were produced from the cross of plants  $\underline{G} \underline{p} \underline{s}^{\text{st}} \underline{M}^{\text{st}} / \underline{G} \underline{P} \underline{s} \underline{m}^{\text{st}} \underline{K}$  and  $\underline{g} \underline{p} \underline{s}^{\text{sk}} / \underline{G} \underline{P} \underline{s} \underline{K}$ , respectively, with a  $\underline{g} \underline{p} \underline{s} \underline{m}^{\text{st}} / \underline{g} \underline{p} \underline{s} \underline{m}^{\text{st}}$  line. Plants with a similar genotype could occur following  $\underline{p}$  back mutation, intralocus recombination and gene conversion. While a distinction between the last two possibilities seems not feasible at the moment, the first possibility can be discarded on the ground that no  $\underline{P}$  back mutants were previously observed in extensive experiments (Stadler 1952). In addition, we analyzed more than 14,000 gametes produced from homozygous  $\underline{p}/\underline{p}$  plants without recovering a single case of  $\underline{P}$  back mutation.

Whatever the mechanism leading to a  $\underline{P} \underline{s}^{\text{st}}$  (or  $\underline{P} \underline{s}^{\text{sk}}$ ) recombinant, its occurrence is here considered sufficient positive evidence in favour of the hypothesis of the compound nature of  $\underline{R}^{\text{st}}$  and  $\underline{R}^{\text{sk}}$ .

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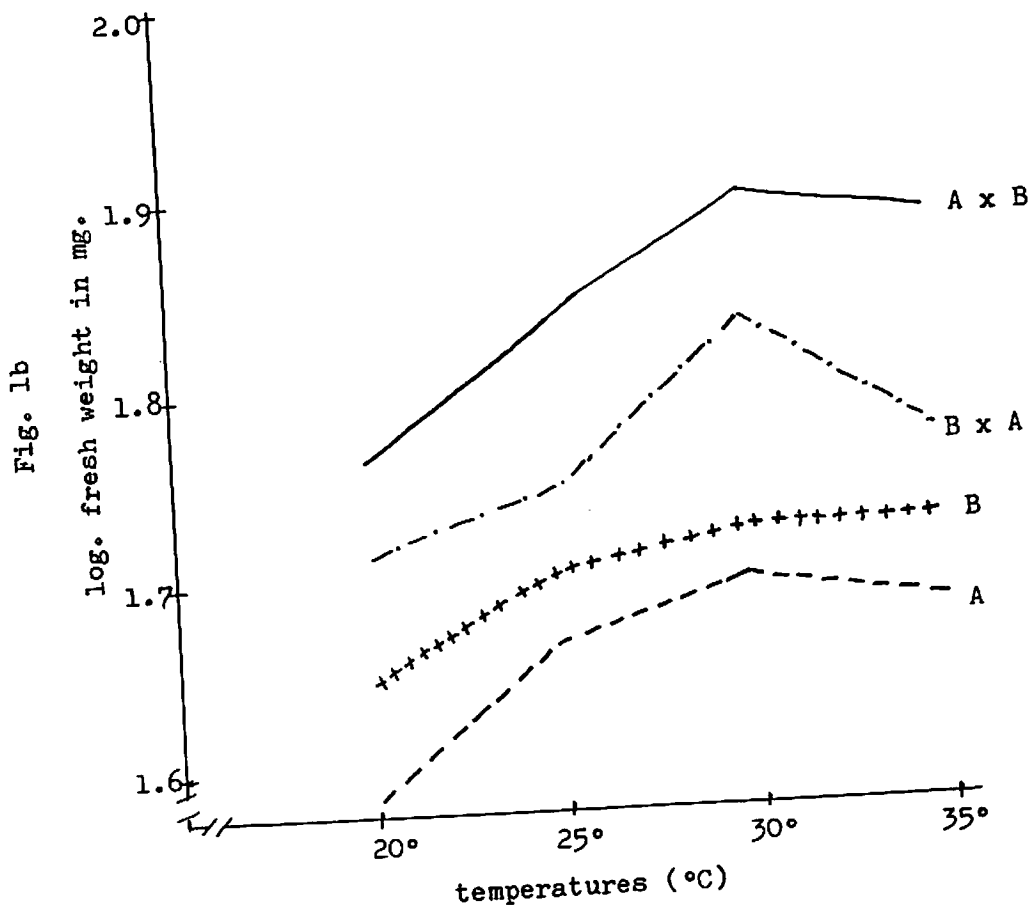
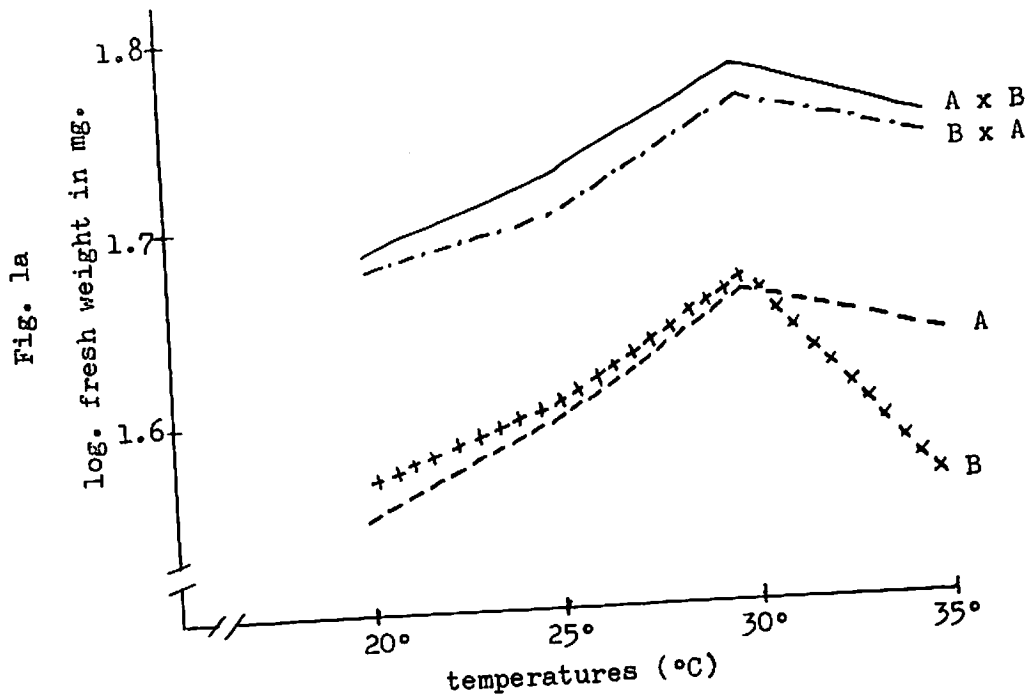
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### 3. In vitro growth rate of maize root tips: heterozygote superiority and environmental variations.

One of the features of heterozygote advantage is that its degree might vary according to several environmental factors. In the case of temperature it has been shown that an increase of temperature above the optimal value may result in an increase of heterosis. This effect is interpretable in terms of the higher developmental stability of the heterozygous versus corresponding homozygous individuals.

Langridge (1962) interpreted this effect (in Drosophila and Arabidopsis) as the result of a complementation among temperature non-sensitive alleles of different genes.

In this experiment growth rate of maize root tips at different temperatures was used as a means to analyze the heterotic advantage. The validity of this system has been discussed in previous papers (Ottaviano e Zannini, 1965; Ottaviano 1966). In this research two inbred lines, W 22 and 33-16, and their reciprocal crosses were employed. In the context they will be referred to as A, B, A x B, and B x A, respectively. W 22 is a monoploid-derived line, kindly furnished by Dr. S. Chase. Four levels of temperature were used, namely, 20, 25, 30 and 35° C. Pilot experiments proved that the optimal temperature for growth is around 25° C.



The basic medium (M1) consisted of mineral salts, agar, sugar and vitamin B<sub>1</sub> (Ottaviano e Zannini, 1965). The possibility exists that the high temperature damage is due to the inhibition of synthesis of some important cellular metabolite. Accordingly the experiment was performed also in an enriched medium (M2) carrying as additional components casein hydrolysate, pyridoxine and nicotinamide.

Single root tips were grown in testtubes. The experiment was arranged in randomized blocks, with ten replications for each genotype-temperature-medium combination. Growth was allowed to proceed for ten days. In each case the temperature was kept at 25° C for the first two days. Growth was measured as fresh weight at the end of this period.

Table 1

Genotypes	Medium	Temperatures			
		20°	25°	30°	35°
A	M <sub>1</sub>	1.5536	1.6010	1.6681	1.6407
	M <sub>2</sub>	1.5971	1.6711	1.7067	1.6907
B	M <sub>1</sub>	1.5707	1.6052	1.6755	1.5642
	M <sub>2</sub>	1.6575	1.7106	1.7304	1.7351
A x B	M <sub>1</sub>	1.6894	1.7263	1.7820	1.7544
	M <sub>2</sub>	1.7731	1.8497	1.9065	1.8990
B x A	M <sub>1</sub>	1.6815	1.7097	1.7698	1.7431
	M <sub>2</sub>	1.7200	1.7598	1.8444	1.7816

The results obtained, expressed in log mg. of fresh weight (Table 1, Figures 1a and 1b), have been analyzed statistically (factorial analysis of variance). The main findings can be summarized as follows: the growth response to temperature variations is not the same for all the material considered. Above 30° C and on minimal medium (M1), W 22 shows a reduction in growth, while the other line and the two hybrids have constant growth. The addition of casein, pyridoxine, and nicotinamide (M2)

repairs completely the temperature effect observed on the thermosensitive line (W 22) and brings out differences between reciprocals which are not observable with the minimal medium.

On the whole these results fit the model of the contribution of temperature-sensitive alleles to the heterotic advantage exhibited at high temperatures. However, in this case the role played by the cytoplasm should also be considered. Furthermore, it is not possible at the moment to exclude the involvement of ontogenetic processes that are temperature sensitive in this phenomenon.

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1. A ring-of-20 chromosomes.

An association of 20 chromosomes at diakinesis was observed by John Stout in  $F_1$  plants of a cross between two multiple interchange stocks. One multiple interchange parent was a 6-3-2-4-8 homozygote, the other was from semisterile plants selected from (5-7-1-9-10 x 8-10) backcrossed to 5-7-1-9-10. Plants with the crossover in the differential segment of chromosome 10 were expected to be semisterile, i.e. 5-7-1-9-10-8/5-7-1-9-10 heterozygotes. These were crossed on 6-3-2-4-8 and also self-pollinated for increase to establish the 5-7-1-9-10-8 homozygote. Half the plants from the cross were expected to have the ring-of-20. The selfs were grown and the fertiles increased and the test-crosses will be grown this summer to identify the 5-7-1-9-10-8 homozygote.

The Inman scheme (Burnham "Discussions in Cytogenetics," p. 113) will be used to combine the interchanges in one pure stock. A (6-3-2-4-8 x 8-10)  $F_1$  was backcrossed to 6-3-2-4-8, and will be grown this summer. Semisterile plants, which should carry the 6-3-2-4-8-10 crossover, will be increased and also crossed with 5-7-1-9-10-8. Since the 8-10 interchange is common to both parents, one combination from random segregation should combine the two for a 6-3-2-4-8-10-9-1-5-7 multiple interchange stock.