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PHOTOSYNTHETIC PRODUCTIVITY IN RELATION TO HETEROSIS EFFECT IN SUNFLOWER

The present paper presents the results of determining photosynthetic productivity of 3 sunflower hybrids and their parent lines obtained in Romania.

The plants were cultivated under irrigation conditions on the experimental field of the Research Institute for Cereals and Technical Plants at Fundulea.

The following physiological indices were studied starting with the 4 leaves growth-stage: leaf-area dynamics; average photosynthetic productivity; photosynthesis and respiration intensity (according to Katnuski); the leaf pigments content variation (Mettstein, 1957) and the dry-matter accumulation (Beghishev, 1953). The respective data were processed according to the method of balanced, sliding means (Urmantsev, 1967).

The climatic conditions in the two experiment years were marked by high temperature during the flowering period and at the beginning of the seed-formation stage, thus influencing the kernel-filling and the subsequent seed yield.

Fig.1 records leaf-area dynamics. The strongest heterosis effect, as compared to the initial parental lines was obtained at the Sorem 80 hybrid, which had the highest leaf area index: 4.4 (the ratio between the leaf area and the occupied land area).

The leaf area index ranged within the two experiments years between 3.6 and 4.4 for the hybrids, and between 2.6 and 3.4 for the parental lines. It has been also ascertained that the leaf system formation rate is faster at hybrids as compared to the parental lines, especially for Sorem 80. Specifically, the mean values of the total leaf area duration over the two experi-

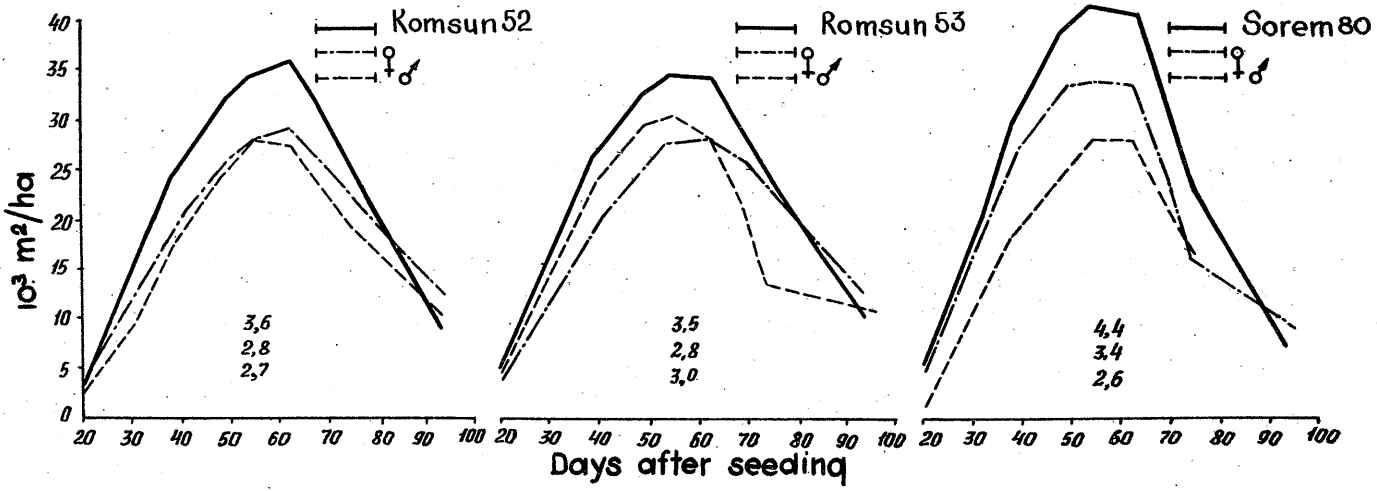

Fig. 1. Total leaf area ($10^3 m^2$/ha) and area index (L.A.I.)

ment years range between 546.1 x 10^3 sq m/days/ha for the father line of Sorem 80, and 930 x 10^3 sq m/days/ha for the hybrid Sorem 80 itself. Following fecundation, the heterosis effect of this physiological index is higher as compared to the pre-fecundation period but, in all cases, the hybrids values are higher than those of the parental ones.

The contribution of each leaf from the middle section of the stem (i. e. 5-15) to the photosynthesis process was the highest and similar both in hybrids and in parental lines.

We did not find the heterosis effect in the intensity of photosynthesis per unit of area. At the same time the hybrids have a higher photosynthetic activity (Fig. 2).

Respiration intensity ranged within broad limits, with very low values in certain cases, such as for Sorem 80. In most cases, however, the respiration of the hybrid plants recorded the average value of parental lines.

The leaf pigments content increased with the plants age, reaching the maximum after flowering. We found that the respective lines have a higher chlorophyll content per square surface unit than the hybrid forms, except for Romsun 53. However, the hybrids are superior to the parental lines in what concerns the chlorophyll content per whole plant (Fig. 3, a, b, c).

The dry matter accumulation rate was not much different for the forms studied; however, the total dry matter accumulation per hectare varied over the two years between 80 c/ha (father line of Romsun 53) and 114.7 c/ha (Romsun 52).

Fig. 4 shows changes in the dry matter accumulation in separate plant organs, during the first growth stages it prevails in leaves, but after the head emergence, we find the dry matter accumulation prevailling in the stem, and subsequently in the seeds and leaves. We have found that the decisive factor in the dry

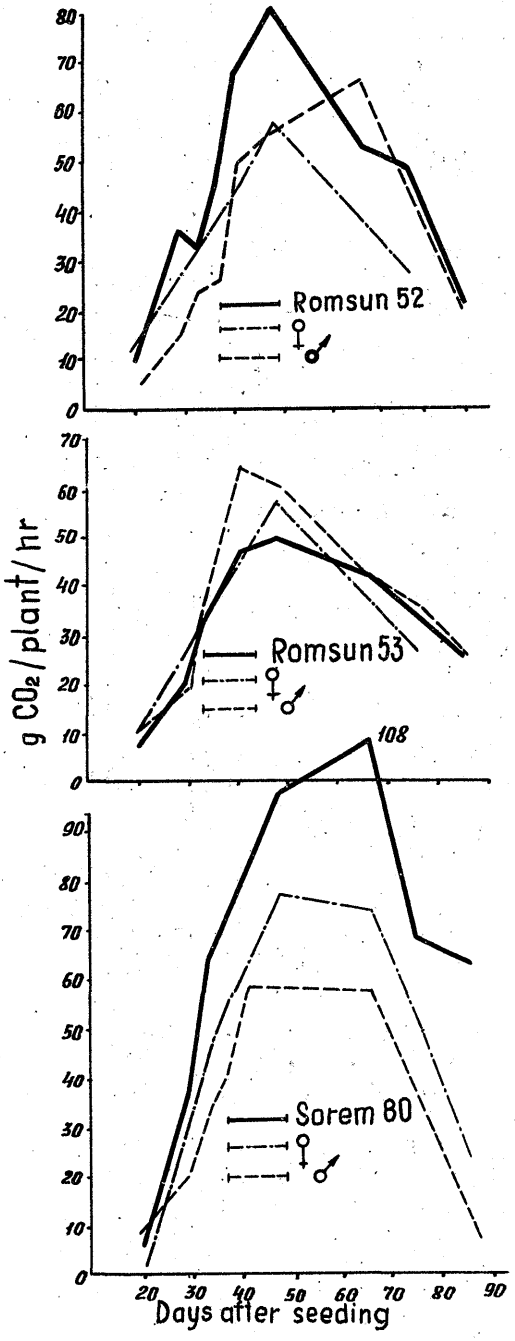

Fig. 2. Photosynthetic rate, g CO_2/plant/hr

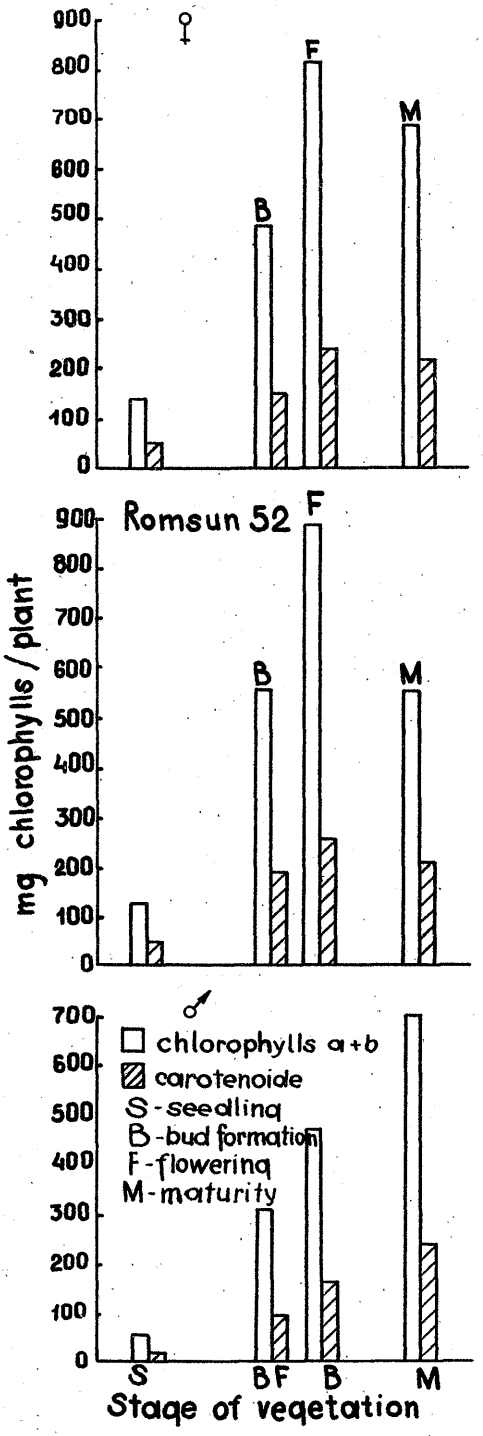

Fig. 3a. Content of chlorophylls, mg/plant

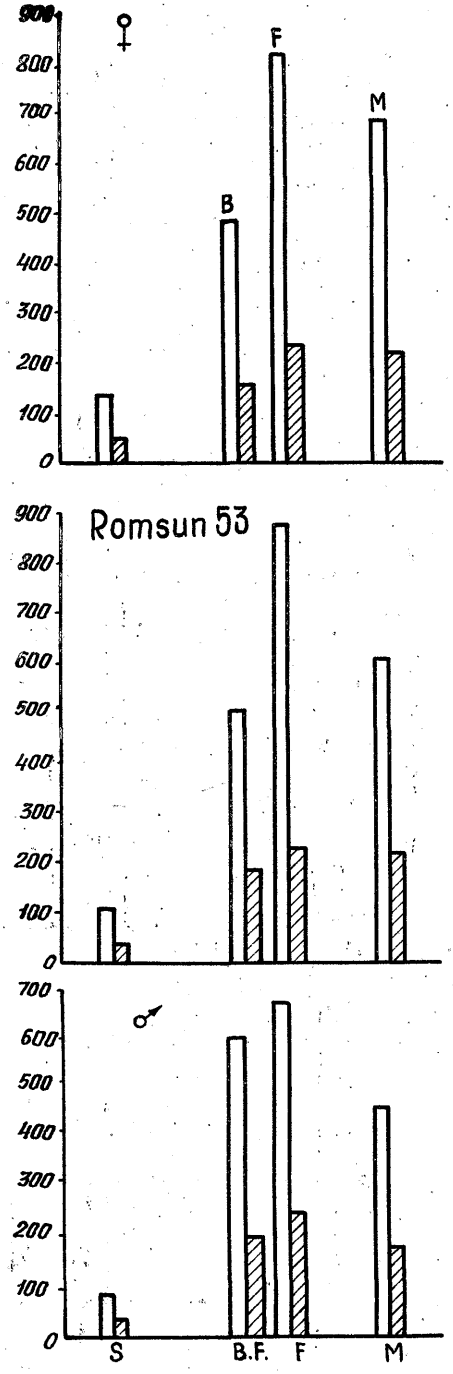

Fig. 3b. Content of chlorophylls, mg/plant

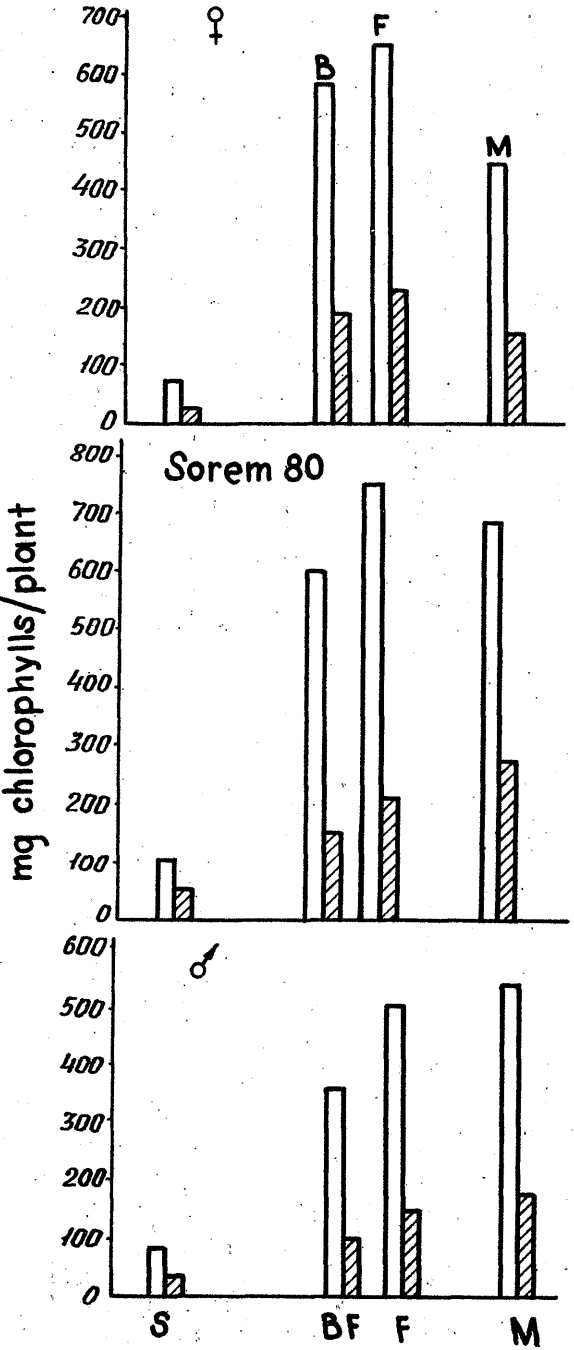

Fig. 3c. Content of chlorophylls, mg/plant

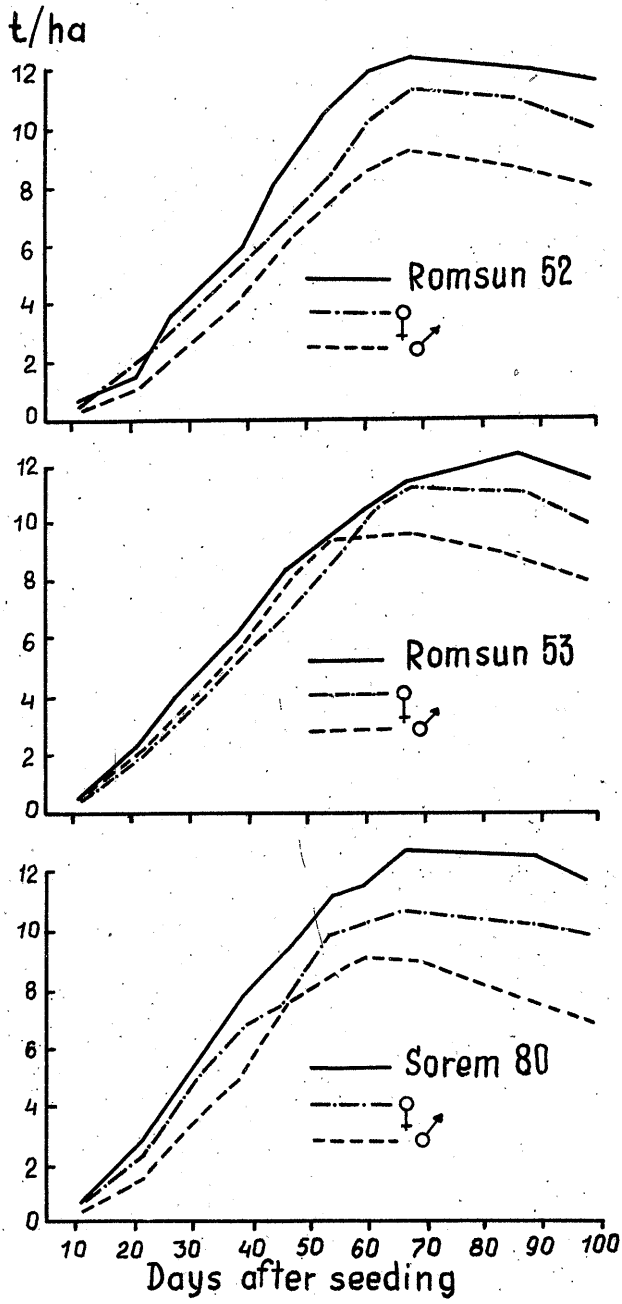

Fig. 4. Drv matter accumulation, t/ha

matter accumulation is the mother line. The positive influence of the mother line can be traced in the formation of the total leaf area before and after fecundation.

Our research suggests the conclusion that the hybrids growth is intensive at the initial stages of the plant's development, during the formation of leaves. Hence this period causes the heterosis effect of the whole plant. The correlation coefficient of the total leaf area with the photosynthetic productivity was 0.7 and with the seed yield 0.8. A very high correlation (0.9) was observed between the seed yield and dry matter accumulation before flowering.

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