THE EFFECT OF PLANT DENSITY AND "RECTANGULARITY" ON ACHENE YIELD IN LONG AND SHORT STEMMED SUNFLOWER CULTIVARS

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Sunflower breeders, often motivated by requests from growers, are steadily more concerned to make use of the truly dwarf hybrids developed through research. This requires a careful evaluation of the response of these plants under normal agronomical conditions (2,5). Plant density is one of the most important factors influencing yield (1,6,7), together with plant height (4) and the spatial relationship between plants (often referred to today as "rectangularity" (3) meaning the ratio of the distance between rows to that between plants). For these reasons we decided to carry out a number of trials, beginning in 1984, in a suitable location on the Tuscan coast near Pisa (central Italy). The present paper reports on trials in 1986, the climate of which is reported in fig. 1. Soil type was a naturally fertile clay and the agronomical techniques known to be the most suitable in this environment were employed. Seeding took place on 2/5/1986 in split plots with three replications. Primary treatment A was given in the plots, secondary treatment B in the sub-plots B and tertiary treatment C in sub-sub-plots. Each replication extended over a total area of roughly 1000 m^2. Treatments were as follows: A - two sunflower hybrids were used, one tall ("Stromboli"), the other short ("Cucciolo"); B - six densities (2-4-6-8-10 and 12 plants per m^2); C - four rectangularities (1-2-3- and 4). At hoeing time densities were corrected manually. The independent variable considered was achene yield expressed in ql/ha. In order to evaluate the effect of treatments on this variable, values measured were statistically elaborated using various degrees of polynomial equations to find the one which best expressed the pattern s investigated (highest R2). The result was quadratic equations which always managed to fit our experiments.

Discussion of Results

The achene yield character, examined under the "density x hybrid" interaction (which proved to be statistically significant) gave a curved graph for both hybrids tested (fig. 2). Long stem sunflower showed a marked improvement in yield between 2p/m^2 (11.1 q /ha) and 8p/m^2 (45 q /ha) - the latter of which gave maximum yields. Beyond this mark yield fell quite sharply (33 q /ha for 12p/m^2) which could be due to a progressive decrease in unit seed weight and calatid diameter, both of which decrease with increasing densities. Short stemmed hybrids on the contrary showed best yields at 10p/m^2 (44q /ha) but there was no

appreciable decrease in yield even at maximum density tested (42 q /ha with 12 p/m^2). This indicates that the short-stemmed variety is less affected by competition than the long-stemmed.
The other interaction which proved to be statistically significant, i.e. "rectangularity x hybrid", as revealed by achene yield, also gave an analogous curved graph for both hybrids but with a few variations which are worth mentioning. The tall hybrid gave best achene yield at rectangularity 2 (35 q /ha) but in the dwarf variety rectangularities three and four were the best (35.8 and 36 q /ha respectively (fig.3).

Conclusions

The following conclusions may be drawn from our results:
- along the coast near Pisa optimal density for tall hybrids is 8 p/m^2 but to obtain similar results in dwarf hybrids it must be raised to 10 p/m^2. When density is above the optimal, yield in tall hybrids falls abruptly but in short-stemmed plants the difference is hardly appreciable.
- seeds must be placed according to a carefully drawn geometrical plan. Best rectangularity proved to be 2 (twice the distance between rows as between plants on each row) in tall hybrids but in the dwarf variety both three and four rectangularities (three and four times the distance between rows as that between plants) gave almost identical results.

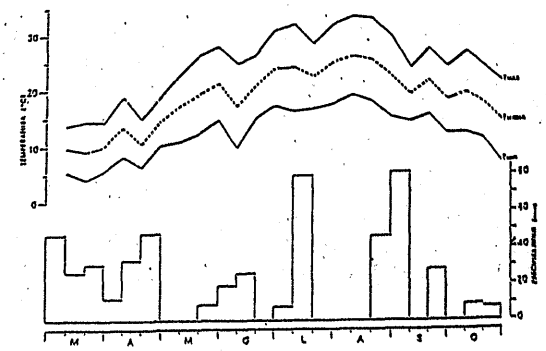
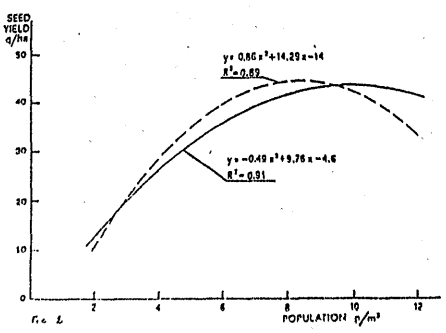
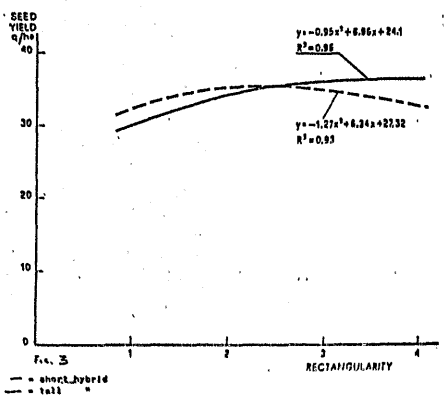


FIG. 1





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