PHYSIOLOGICAL REACTION OF SUNFLOWER HYBRIDS TO DIFFERENT PLANTS DENSITIES

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Summary

Three roumanian sunflower hybrids were cultivated in the field conditions at three densities: 41.800, 81.600 and 122.400 plants per hectare. In order to precise physiological reaction of hybrids to different densities were carred aut investigations on: leaf area index (L.A.I.); net assimilation (N.A.); dry matter accumulation; assimilates partitioning; nitrogen and phophorus uptake and metaboli tion; yield production (Kg/ha).

Nitrogen compounds were stored in stem and leaves before the end of flowering and a few part was translocated to achenes at all hybrids and densities.

Phosphorus compounds decreased in sunflower leaves, stem and seeds to densities of 81.600 and 122.400 plants per hectare to Selec and Festiv hybrids and increased to Turbo hybrid.

Introduction

Sunflower, a C_3 type species, presents in comparison with other species belonging to the same group, a high photosynthetic activity (40 mg $CO_2/dm^2/h$) which is limitted in time, being met only with young leaves and being rapidly diminished both at the bottom leaves along with photosynthetic apparatus and at the whole leaf area level after plants flowering (MERRIEN, 1986).

The competition among plants in the case of nutritional area variance, determines variations of the photosynthetic activity and also of source-sink relationship. The present paper aims to underlin from this point of view which is the physiological reaction to the nutrional area variation in 3 sunflower hybrids, cultivated in Romania.

Materials and methods

Sunflower hybrids Turbo, Festiv and Select have been cultiva-

ted under irrigation, in the field, on randomized plots, in three replications, at three densities: D_1=40,800 plants/ha, D_2=81,600 plants/ha and D_3= 122,400 plants/ha.

The following elements were determined in dynamics: dry biomass accumulation, leaf area evolution (dm^2/pl), L.A.I. (leaf area/m^2) net assimilation index (g/ m^2/day), plants content in nitrogen and phosphorus and their migration from the vegetative part into seeds, seed yield and oil content. For the graphical representation of biomass accumulation on organs and the evolution of assimilating area the regression curves of this indices value were used and the number of days since plants emergence.

Results and discussions

The evolution of vegetation stages in the ontogeny of each hybrids was differentiated noticing a delay of plants development with increased densities.

This, at D_2 and D_3 flowering begining was observed after 2-3 days, while full flowering after 6-7 days as compared to D_1, in all studied hybrids.

As concerns the leaf area per plant we noticed that in Turbo hybrid the leaf area reaches the maximum value of 8000 cm^2/plant with the smallest density while in Festiv and Select hybrids for the same density the value is of only 6800 cm^2/plant.

The reduction of the nutritional area by increasing the density from 40,800 to 81,600 determines the reduction of the leaf area from double to simple in the case of Turbo and Festiv hybrids and to its thrird with Select hybrid. By increasing the density to 122,400 pl/ha the assimilating area of Turbo and Festiv hybrids continue to register a slight decrease of approximately 20-25% while with Select hybrid it is of approximately 35% (Fig. 1).

The leaf area index (L.A.I.) ranges with the 3 hybrids, reaching the maximum value with Turbo hybrid at the highest density. The maximum values of the 3 hibrids do not register high differences, the most important phenomenon being the duration of the leaf area(Fig.2). In Turbo hybrid, even in reducing the nutritional area, leaf area is maintained active for a longer period of time, as compared to the other 2 hybrids. The same figure shows the excessive drying of the bottom leaves in Select hybrid.

Refering to the net assimilation (N.A.) we notice a certain

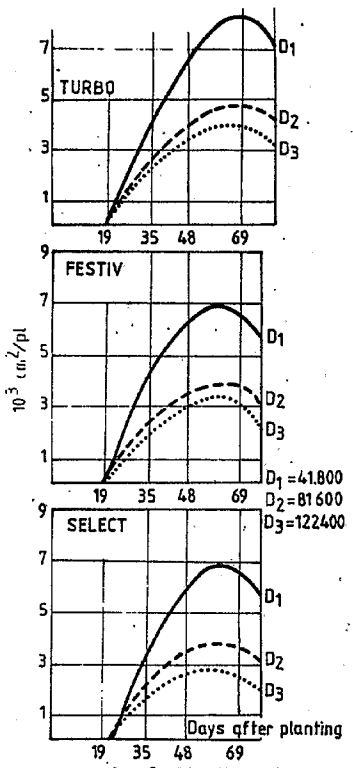

Fig.1 LEAF AREA

uniformity in Turbo hybrid for 3 densities, and decreased of this to the end of the vegetation period in Festiv and Select hibrids (Fig.3). The existence of a constant indice of net assimilation during plants ontogeny in Turbo hybrid may be due to the prolongation of Rubisco enzime (Cavalie, 1988) and after the flowering period fact which can also explain its high productivity.

The interaction between leaf area size and its activity determine the accumulation of biomass and also of useful yield.

The researches carried out by BLANCHET and collab., 1985 show the stressed reduction of both the leaf area and biomass accumulation as a result of the nutritional area. The accumulation of biomass on the organs in these thr. hybrids suffers an evident diminish whit the density growth more stressed in Festiv and Select hybrids as compared to Turbo; for example,

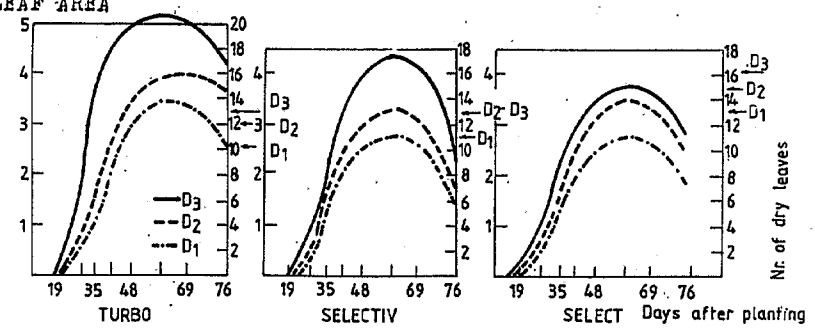

Fig.2 LEAF AREA INDEX

with these two hybrids the biomass accumulation in the head is achi ved only in a 35 percentage in D_3 as compared to D_1.

In the case of Turbo hybrid to seed formation participate both, the assimilates stacked in leaves and stalks till flowering and those synthetized after flowering, by prologing their active period. At Select and Festiv hybrids the leaf area registered an evident decline, seds filling being achieved especially due to the ass. milates in the leaves, stalks and head, formed till flowering (LEFR.

EN, 1983, 1986; BLANCHET, 1982).

The increase of density determines the reduction of plant dry weight (Fig.4. The phenomenon is lower than in the case of Select and Festiv hybrids as compared with Turbo hybrid.

If seeds weight(g/pl) and thousand seeds weight are strongly reduced in the respective hybrids with the density growth from 40,800 to 81,600, over this density the phenomenon does not follow in the same sense (table 1, 2).

Density / Hybrid	D_1	D_2	D_3	SD 5%
Turbo	88,5	26,4	17,3	3,77
Festiv	85,6	25,3	17,5	3,93
Select	85,5	27,3	20,6	6,77

Table 1 Seeds production (g/pl)

Density / Hybrid	D_1	D_2	D_3
Turbo	60	47,3	47,3
Festiv	77	56	55
Select	68,7	56	50

Table 2 1000 seeds weight

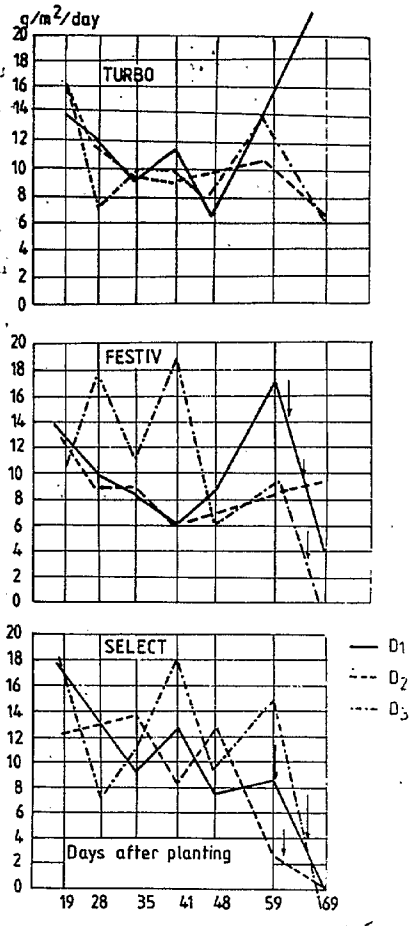

Fig.3 NET ASSIMILATION $g/m^2/d$

The previous researches have led to the same conclusion, that sunflower which is generally a big water and mineral nutrients consumer does not allow high densities, as they cause both the yield reduction and plants lodging (TERREA 1984).

The percentage content in nitrogen along the ontogenetic development of plants with three hybrids register obvious differences during intense growth periods when Turbo hybrid has the lowest content at D_1 and D_2 and the highest at D_3, data confirmed also by MERRIEN (1986). Along with vegetation development, the differences determined by the growth of density are practically negligible with the exception of Turbo hybrid which has an inferiour nitrogen content in seeds at all densities as compared to the other two hybrids (Fig.5).

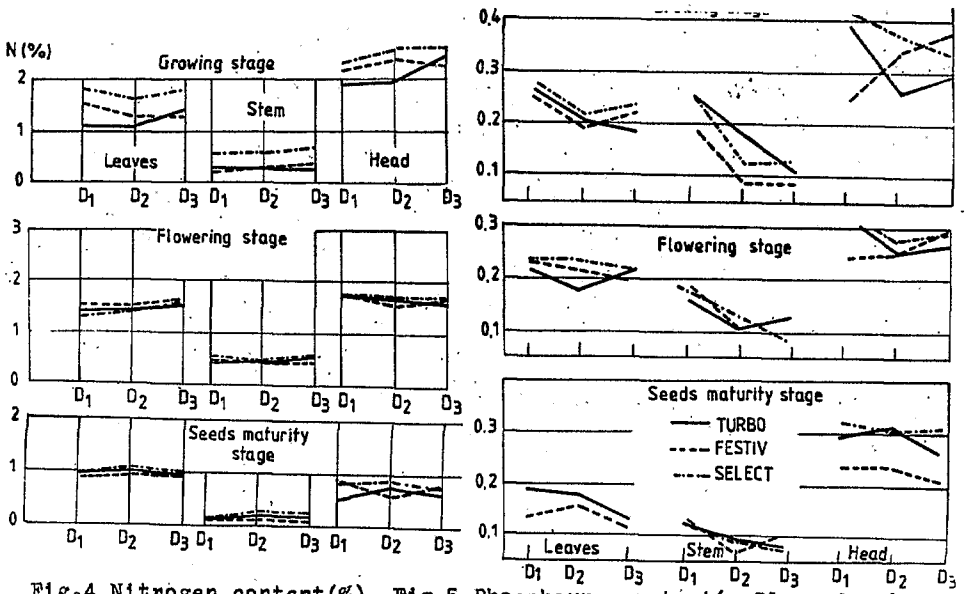

Fig.4 Nitrogen content(%) Fig.5 Phosphorus content(mgPloog d.m.)

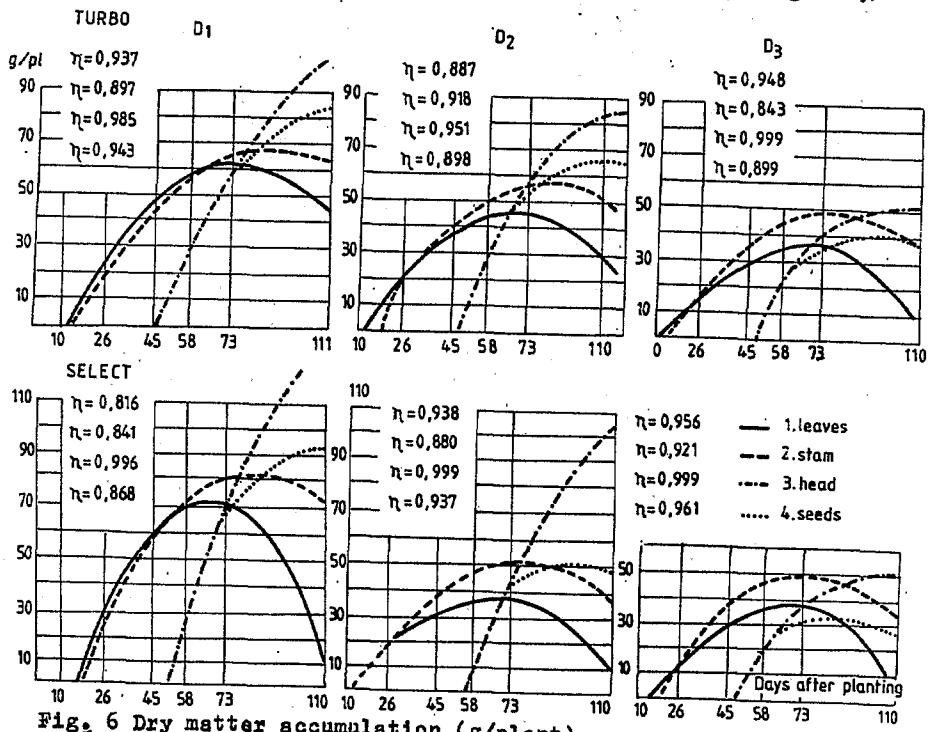

Fig. 6 Dry matter accumulation (g/plant)

This fact is directly connected with the higher oil content probably determined by a higher efficiency and a longer duration of the leaves (MERRIEN 1986.) Nevertheless the phosphorus content registers reductions at D_2 and D_3 in comparison with D_1, almost in all vegetation stages under study (Fig.6).

Conclusions

1. The growth of sunflower plants density from 40,800 to 81,600 and 122,400 determine the decrease of leaf area, seed weight, and seed yield at the all studied hybrids.
2. Turbo hybrid is characterized by the mentainance of the green leaf apparaturs and the prolongation of the CO_2 fixing enzime activity for a longer period after flowering, which determine ,also in the case of maximum density a higher N.A.in comparison with the other two hybrids,as well as a more efficient metabolism of phosphorus.
3. Seeds filling in Select and Festiv hybrids is achieved due to the assimilates stored till flowering in leaves, stalk and head while in Turbo hybrid due also to those synthetized after flowering.
4. Heigh densities of the plants affects the size of leaf apparatus, as well as, as its activity, fact which determines the diminish of assimilates and biomass quantity per plant.

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