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BEHAVIOUR OF SOME AGRONOMIC CHARACTERS IN F_1 OF A CROSS BETWEEN A KENYA VARIETY AND VNIIMK 8931, AN INTRODUCED RUSSIAN VARIETY OF SUNFLOWER

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One of the most popular variety of sunflower in the highlands of Kenya and neighbouring countries is "Kenya White". Its main agronomic merits consists in a reasonable seed yield, good adaptability to the various local soils and climates and a fair resistance to several diseases. However, for an improvement programme of vegetable seed oil, as it is envisaged by the local Ministry of Agriculture and regarding the total amount of oil per hectare, this variety and all the local ones are not satisfactory.

The oil content of the seed is not more than 28 - 30 %. The stem of the K.W. plants is rather tall, attaining some 430 - 450 cm high, favouring the lodging of the plant during and after flowering.

Over the last ten years several sunflower cultivars, especially from Russia, have been introduced and tested in this country. None of them has shown any remarkable yield, and in most cases the total oil production per hectare was far below the local varieties. Starting from 1969, a series of testcrosses between local and diverse origin varieties, has been carried out in several localities of this country. In some cases a great increase in seed yield over the two parent varieties has been noticed.

With the aim of improving the knowledge of the performance for commercial production of these F_1, an experiment to compare some agronomic traits of the parent varieties and the F_1 has been made in 1971 rainy season, in Trans Nzoia region of Kenya.

The Russian variety, VNIIMK 8931, used in this experiment as female, possesses quite different feature from the local ones, because it has selected in a diverse environment. The oil percentage of the kernel is very high, reaching 45 - 48 % in the original seed. Besides it has a shorter stem and shows more resistance to lodging. It matures about 40 days earlier than the Kenya White.

A gene for male sterility (ms ms) has been incorporated in this variety by backcrossing, therefore the present population is segregating 1 : 1 pollen sterile versus pollen fertile. To ensure complete

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crossbreeding, only male sterile plants have been pollinated with pollen from K. White as male.

Diagrams 1 to 6 illustrate the various performance of the F_1 and its parents for five different characters, according to different levels of phosphate and plant population. In this experiment nitrogen has not shown any significant response.

In fig. 1 the seed yield, a most important trait, has significantly increased in F_1 over both its parents, displaying overdominance. Again this confirms what has been ascertained in the previous evaluation trials for this particular cross. However, although the increase in seed yield determines ultimately an increase in total oil yield per hectare, it appears that the high oil percentage in the kernel of the Russian variety is not inherited at all in F_1.

Table 1 gives the results of the crude fat analysis of the seed of the three entries, at harvest.

Table 1 - Crude fat percentage of the total seed weight in D.M.

Average of 40 samples per each entry.

	Entry	Crude fat %	
P_1	(VNIIMK 8931)	44.6	
P_2	(K. White)	28.9	
F_1	(VNIIMK 8931 x K. White)	30.1	L.S.D. 05 2.37

A non significant difference in the oil content of the seed between K. White and the F_1 emphasizes the recessiveness of this character. In fig. 1, although the regression coefficient S, for different level of plant density, does not show any significant variation in yield, the regression curve chosen for each entry is given with the population exhibiting the highest yield. Noticeable is the increasing response in the seed yield by increasing the level of application of phosphate at planting time. Both regression curves of F_1 and P_2 do not indicate any sign of decrease in yield at the highest level of phosphate, i. e. 189 kg of P_2O_5 per ha.

A second character associated with hybrid vigour or seed productivity (**) is the head diameter. In F_1 this trait is higher than both contributing parents and reveals, as in seed yield, an overdominance. The phosphate effect is positive both in linear P and quadratic PP response in the test of significance of the regression coefficient, substantiating even here the possibility of close correlation between seed yield and head diameter.

However, the following three traits of the F_1 are all intermediate in behaviour.

The lodging percentage of the plants observed in F_1 reveals an incomplete or intermediate dominance over the same character of both parents.

The length of the growing period, which here is evaluated with the number of days from sowing to 50 % flowering, is also intermediate in F_1 compared to its parent varieties.

Finally even the stem height, often associated with lateness and the percentage of lodging, is intermediate in F_1 as shown in fig. 5. The analysis of the regression coefficient of the phosphate levels

(**) R.E. BURNS - Head size of sunflower as indicator of plot yield. Agron. Journal 1970 - 62 - 112.

indicates a significant positive of negative response in linear or quadratic in most of the cases.

In fig. 6 the effect of different levels of plant density on the percentage of plant lodging has been studied to compare the individual behaviour of the three genotypes : F_1, P_1, P_2.

Surprisingly no significant response appears to reduce or increase the percentage of plant lodging by varying the plant density.

From the results of this experiment three main points of interest are emerging :

1) The significant increase in seed yield of this particular cross over the parent average (95,7 %) ;

2) The reduction in height ;

3) The decrease in lodging percentage in F_1 compared with K. White.

All these traits represent a clear improvement upon the local available varieties. The reduction in growing period of this F_1 is also an advantage, especially in the areas where the length of the rainy season is shorter.

For the commercial production of this hybrid it should be noted that the male sterile gene, incorporated in the VNIIMK 8931, is linged to a marker gene which permits the elimination of the fertile plants even during the young vegetative stages. At present more than six generations of this variety, with genetic male sterility, have been grown in Kenya without any noticeable changes in behaviour. Therefore the production of large scale hybrid seed in this country will be possible in the near future.

Nowadays, apart from Kenya, other countries are interested in the improvement of the domestic vegetable oils, by expanding particularly the crop of sunflower. Some of them are faced with the problem of adapting high oil yielding varieties to their specific environment.

Besides due to increasing demands for edible oils the period required to improve the total oil per hectare is rather short. The immediate use of the first generation of a cross between local and imported high oil yielding varieties, which shows an increase in the total oil yield, could be a better choice than a long term method of plant selection.

However, if the observed increase in the seed yield can compensate for the low oil percentage of the seed in F_1, a more consistent improvement in the local vegetable oil production could be achieved by the isolation of high oil genes dominant or intermediate in inheritance when crossed with low oil varieties.

Fig. 1 - Effect of phosphate on seed yield of the F_1 and its parents.

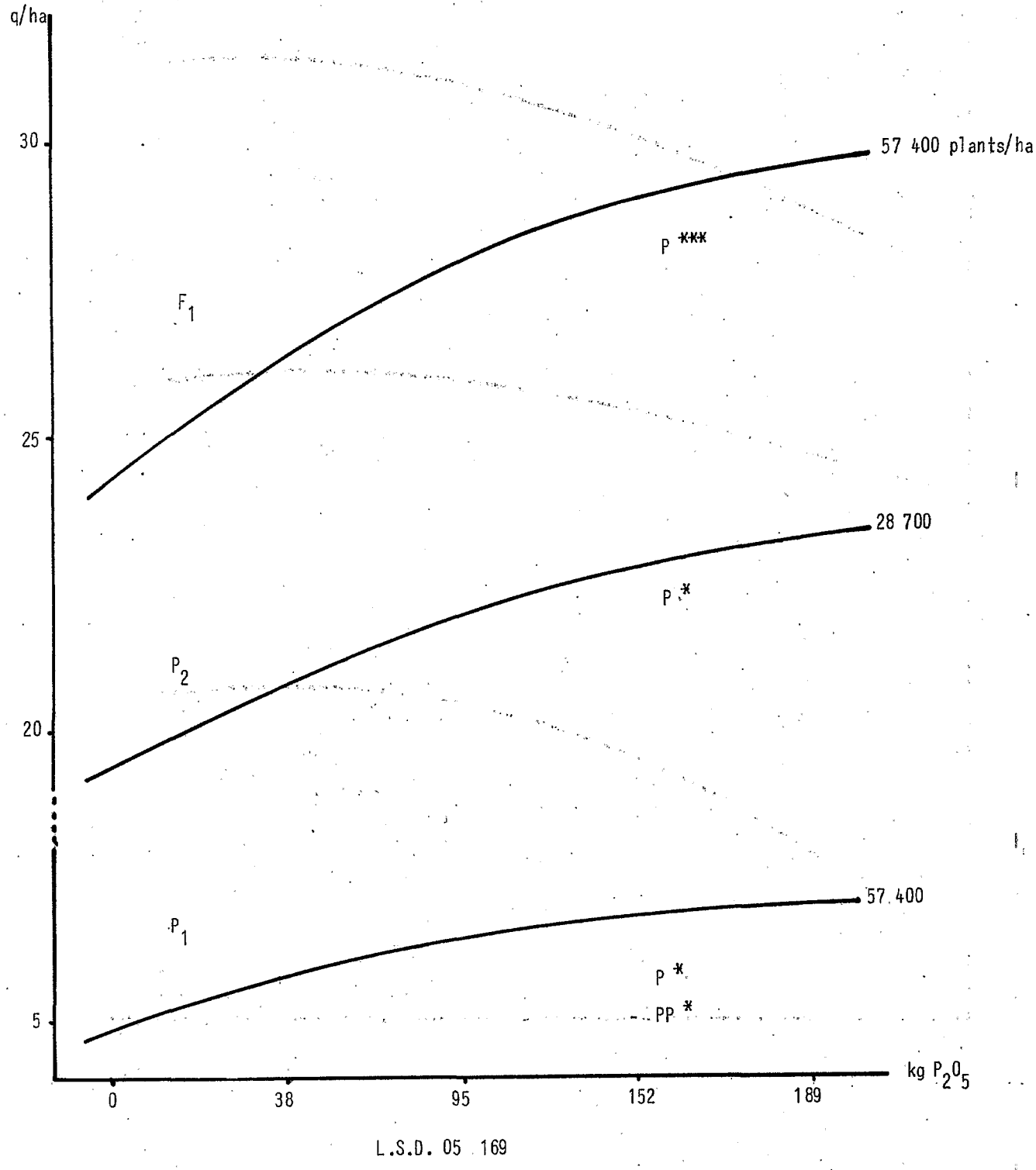

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Fig. 2 - Effect of phosphate on the head diameter of the F_1 and its parents

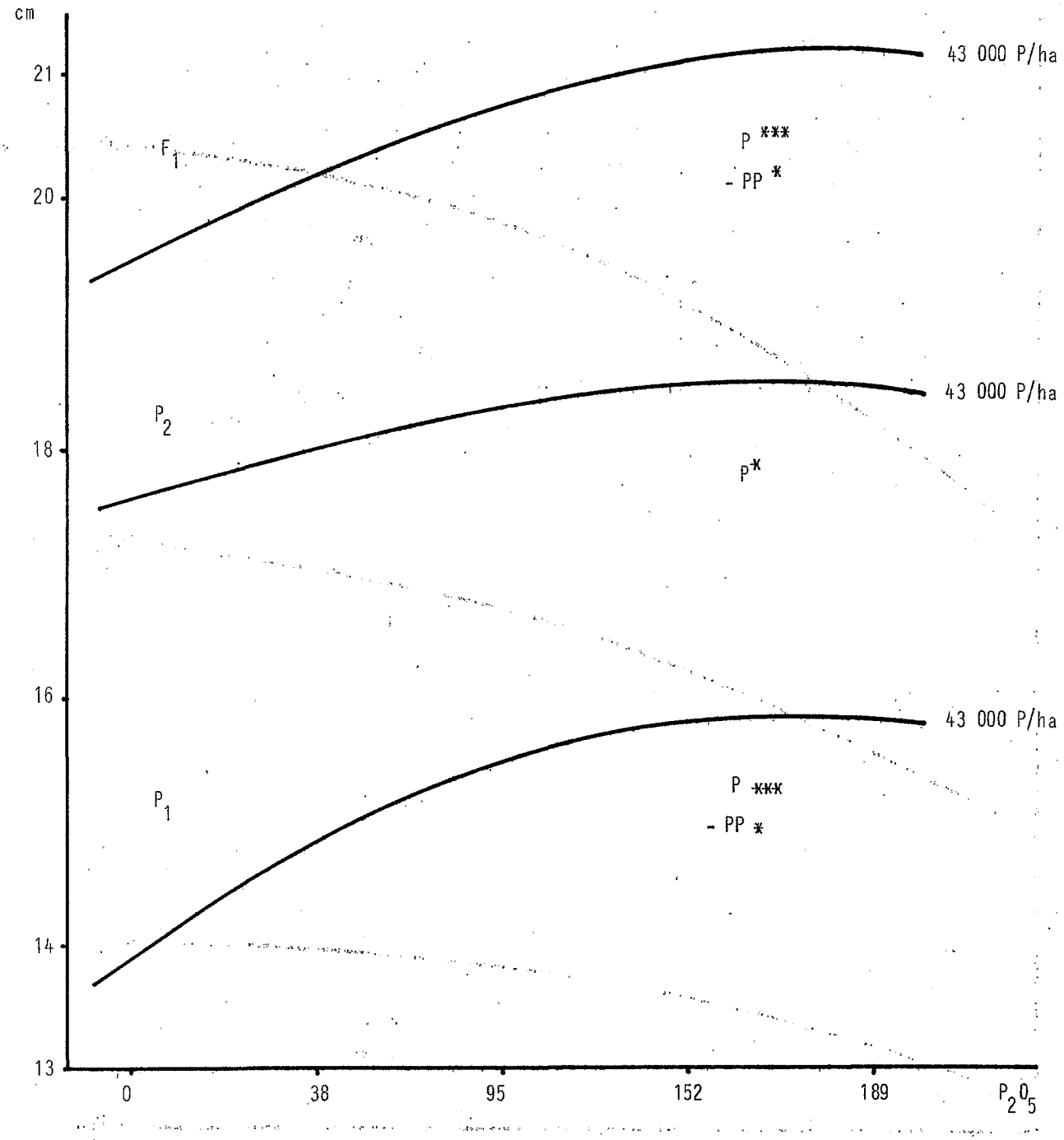

Fig. 3 - Phosphate effect on lodging % of the F_1 and its parent (43 000 plant density).

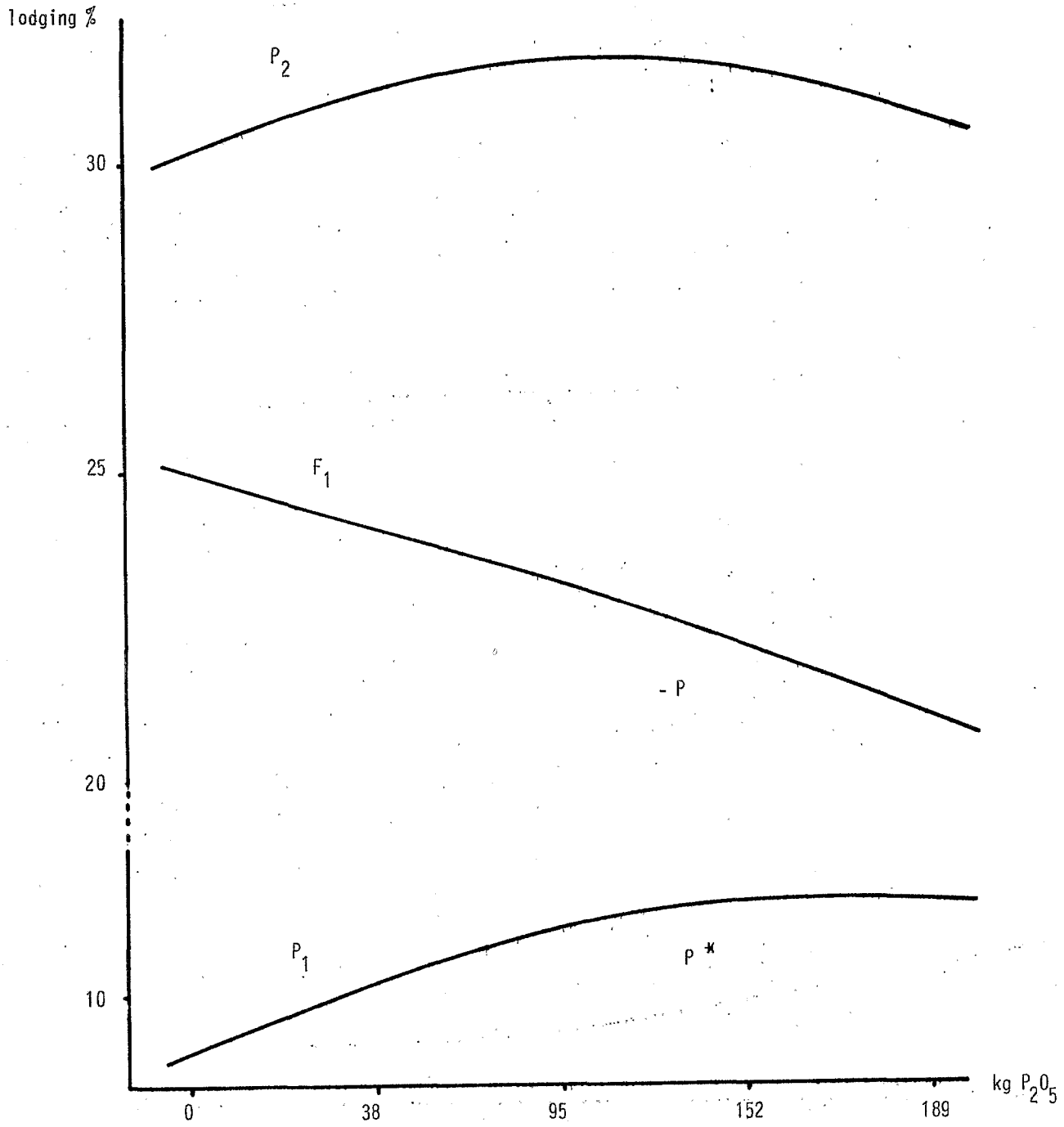

Fig. 4 - Phosphate effect on number of days from planting to 50 % to flowering of F_1 and its parents.

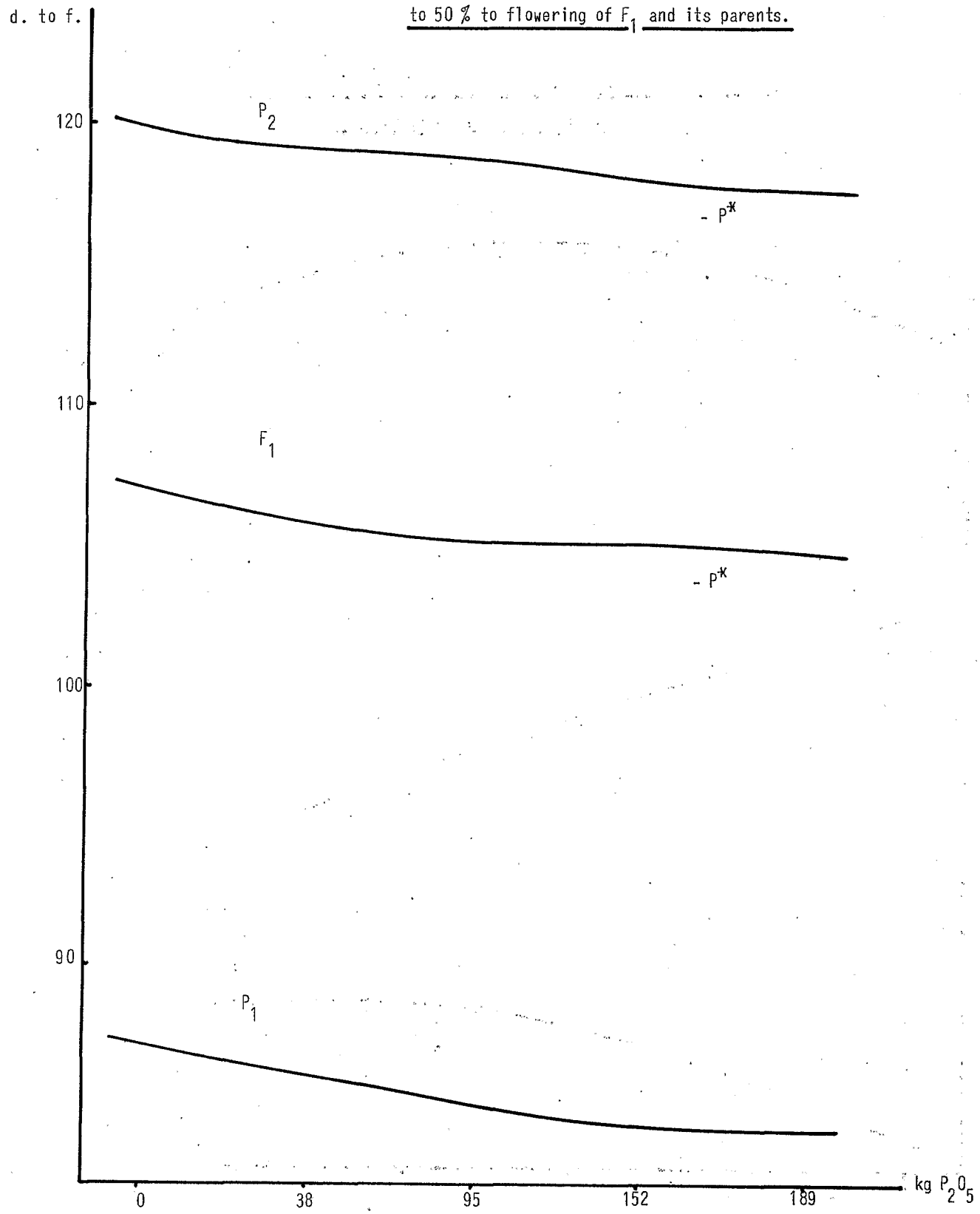

Fig. 5 - Phosphate effect on the height of the F_1 and its parents.

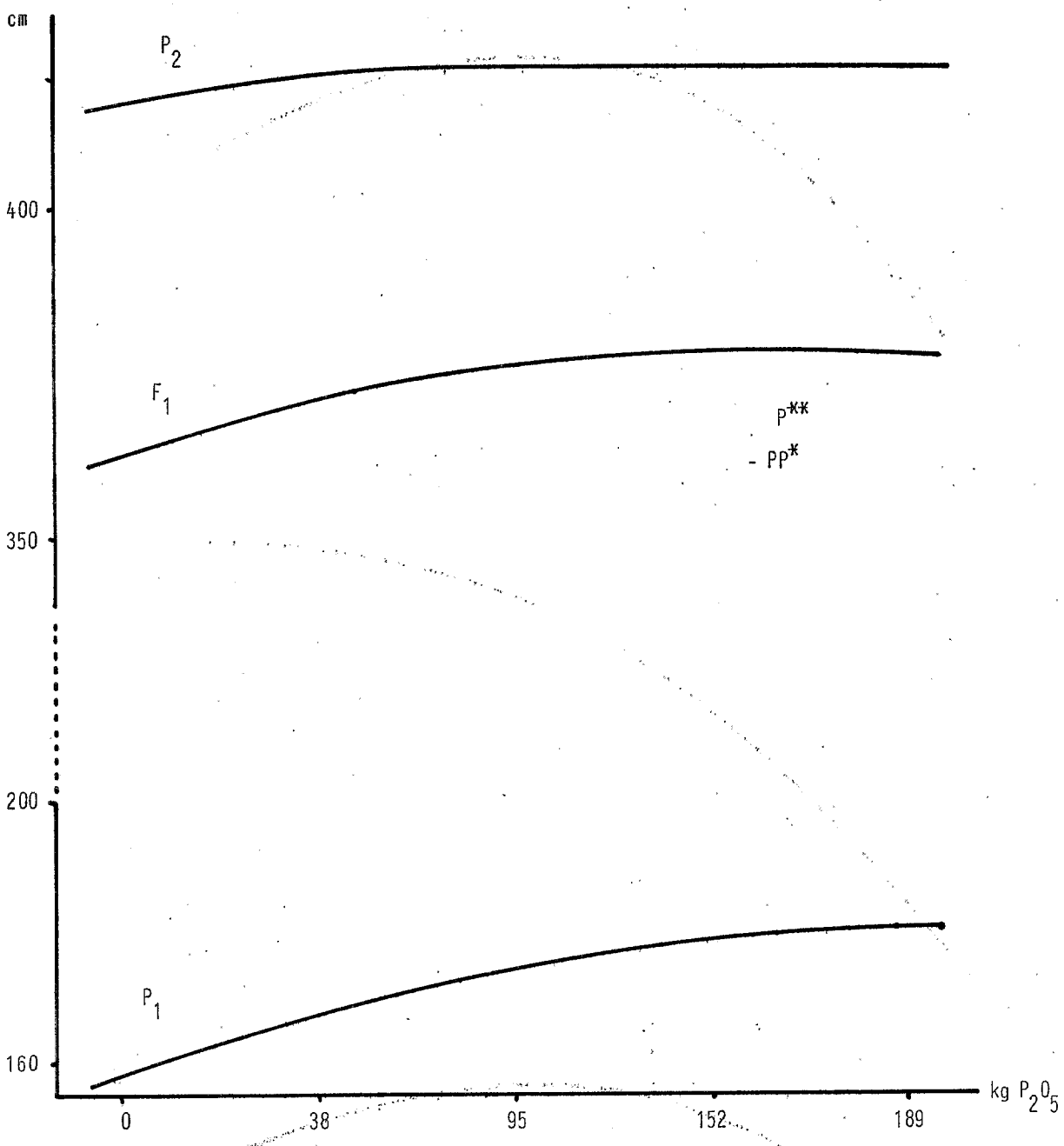

Fig. 6 - Percentage of lodging plants at different population density of F_1 and its parents.