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THE SOLIDITY OF THE CAULIFLOWER CURD

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With 7 figures

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ABSTRACT

Research has been carried out on the inheritance of the solidity of the cauliflower curd. Assuming that this character depends on a number of polygenic factors, the occurring segregations could be explained. Plants with the same solidity may be of a highly different genetic nature, and in propagation may segregate very differently.

During selection proper attention should be paid to the solidity of the curds, the more so as loose plants propagate more rapidly.

INTRODUCTION

One of the factors determining the quality of the curd is its solidity. The consumer demands a solid curd. Solidity partly depends on the time of harvesting. Curds will grow loose after some time, and will then bolt and flower. This mostly starts at the periphery. The curds should be harvested just before this becomes visible.

The various varieties and strains also show differences in solidity which depend on the texture of the curd. In many cases these differences are already distinguishable the moment the plants are coming into curd (fig. 5, 6, 7). Research has been carried out on the mode of inheritance of this solidity. Some preliminary results have been published by JENSMA (1).

TRIALS

In 1953 and 1954 seed was obtained from a number of early varieties by selfing some plants with loose and solid curds. This was done by bagging some flower stalks of each plant in cheesecloth. The progenies were judged for solidity in 1954 and 1955. Two loose curds were taken from a progeny with loose curds, two solid curds from a progeny with solid curds. With these, two crosses solid × loose were made. The F_1's were judged in 1956. Of both F_1's seed was grown from a number of loose and solid plants, again by selfing. In addition some flower stalks of each plant were allowed to flower without being isolated. In 1956 seed was again produced in these two ways, but using plants of other varieties. Furthermore reciprocal crosses were then made between plants with solid and loose curds. The 1956 seed was judged in 1958.

From 1955 onwards the seed was sown under glass in late September or early October. Transplanting in the field occurred the following spring. The plants matured in June. Part of the material propagated in 1953 was sown under glass in February 1954. These plants were set out in the field in April and ripened in July.

Judging took place as soon as the curds were ripe for harvesting. For solidity they were scored on a scale of 1 (very loose) to 7 (very solid).

Results

The results are presented in some histograms. The horizontal axis shows the solidity classes, the vertical axis the number of plants in each class. Fig. 1 gives the solidity of the progenies of 7 solid and 14 loose parents. The frequency distributions in the F_1's and the F_2's of the hybrid populations made in 1955, as well as those of the populations from which the parents had been derived, are depicted in fig. 2 a and b; those of the F_1's made in 1956 with the populations from which their parents had been derived are shown in fig. 3.

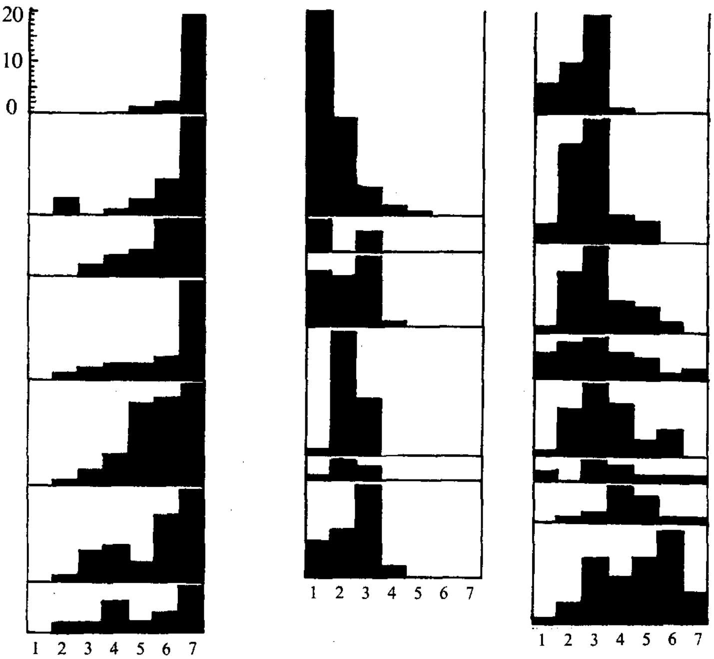

FIG. 1. FREQUENCY DISTRIBUTIONS OF SOLIDITY IN PROGENIES OF 7 SOLID (LEFT) AND 14 LOOSE PARENTS (MIDDLE AND RIGHT)

Discussion

Solid plants on an average give more solid progenies than loose plants, which can only be attributed to genetical differences.

From fig. 1 it will be seen that all forms of frequency distributions occur. Peaks occur in nearly all classes, but more particularly in the outer classes of the scale. This may be due to the scale-graduation chosen. The occurring continuous variation leads to the assumption that we are concerned here with a case of quantitative inheritance.

When studying characters that are inherited quantitatively it appears to be a problem to find the most suitable scale. The ideal genetic scale has a graduation with the contribution of one gene as a unit. On such a scale a progeny segregating for one or more non-linked polygenic factor pairs gives a binomial frequency distribution, apart from modifying conditions. If the inheritance of the factors is intermediate the

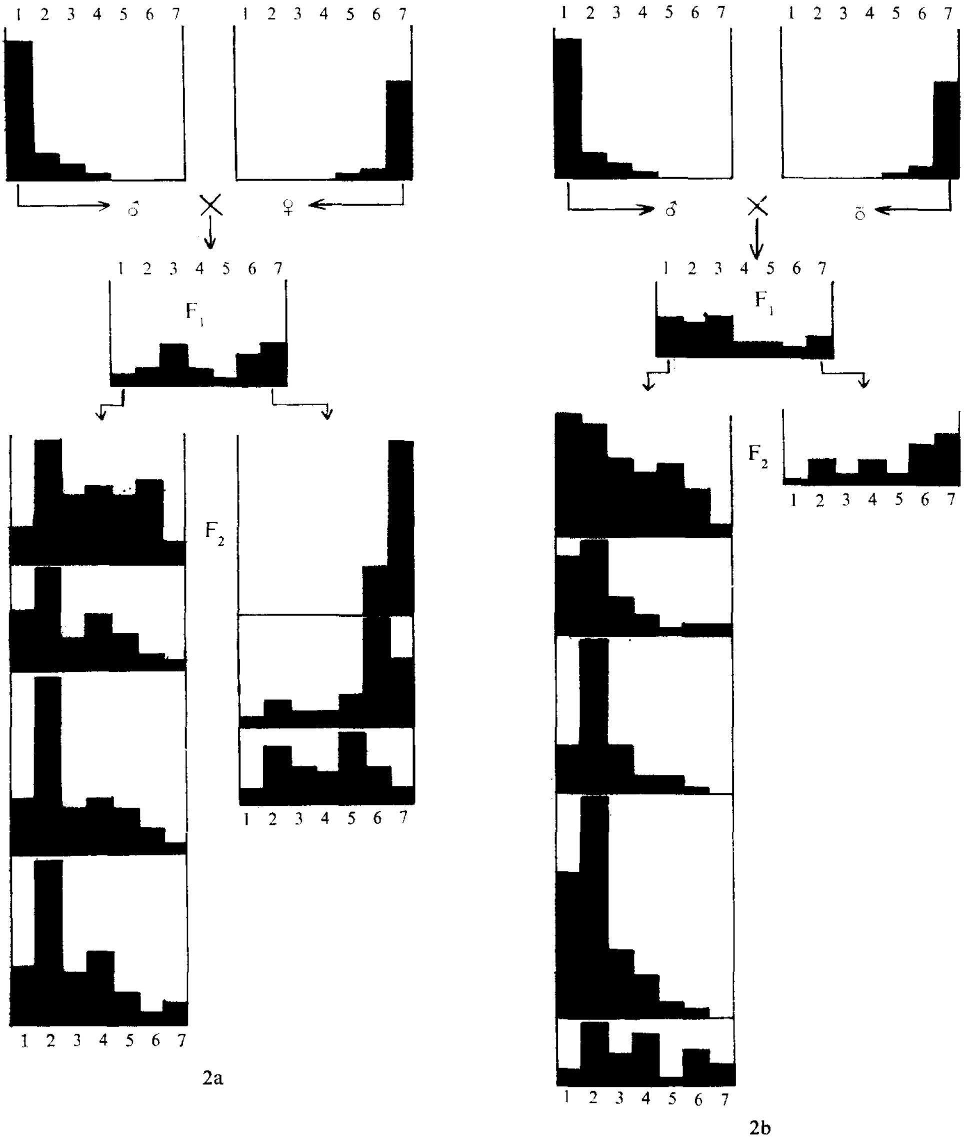

FIG. 2a. FREQUENCY DISTRIBUTIONS OF SOLIDITY IN P, F_1 AND F_2 OF HYBRID POPULATION 1

FIG. 2b. FREQUENCY DISTRIBUTIONS OF SOLIDITY IN P, F_1 AND F_2 OF HYBRID POPULATION 2

frequency distribution becomes symmetric, if the inheritance depends on dominant-recessive factors this distribution becomes approximately symmetric if many factors segregate. Oblique frequency distributions may occur when the outer classes of the scale comprise more classes of the ideal genetic scale than the centre classes.

Assuming that the solidity of the cauliflower curd is also largely governed by a number of polygenic factors, the oblique frequency distributions with peaks in the solidity classes 1 and 7 can be explained in this manner. Here, too, the outer classes

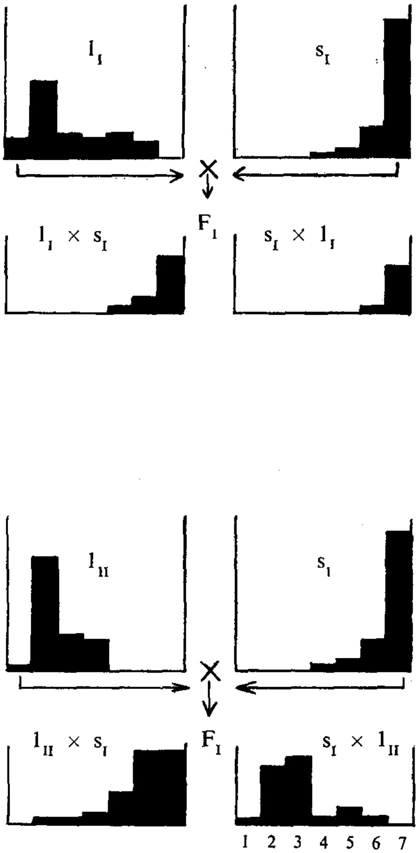

FIG. 3. FREQUENCY DISTRIBUTION OF SOLIDITY IN P AND F_1 OF HYBRID POPULATION

of the visual scale apparently comprise more classes of the genetical scale than the centre classes. In this way very solid curds may segregate very differently as they are genotypically not alike. The same holds good of loose curds. This situation is represented schematically in fig. 4.

From fig. 2 a and b it appears that the F_1's resulting from crosses between solid and loose parent plants show a great variation in solidity without there being a pronounced peak. This variation indicates that the parents were to a large extent heterozygous.

In the one reciprocal cross made in 1956 all plants of the F_1 had solid curds. Such a result may be expected when a homozygously very solid plant is crossed with a loose plant that was genetically located near the upper limit of class 1. The great similarity between the reciprocal F_1's leads to the assumption that plasmatic factors do not play a part. This assumption is confirmed by the second crossing, made in 1956, in which the cross loose × solid was on an average even more solid than the cross solid × loose. In both cases the same loose parent was used for this second crossing, but not the same solid parent.

The progenies of the F_1 plants deviate from those of the plants of the commercial varieties in that they segregated more markedly, probably due to their more heterozygous nature.

visual scale

genetical scale

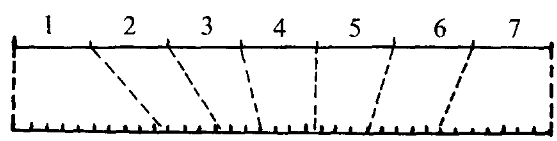

FIG. 4. SCHEMATIC REPRESENTATION OF VISUAL AND GENETICAL SCALE

So all observations can be explained by assuming that solidity is governed by a number of polygenic factors. For a more profound study of these factors it is desirable to analyse the solidity concept into a number of distinctly measurable factors, e.g. the number of ramifications of the flower stalks, their length and thickness and the angle they make with the main axis.

Modifications

In addition to heritable variation there may be variation in solidity caused by environmental factors. An impression of this latter variation can be gained from table 1 which shows data on the solidity of some numbers tested both in 1954 and in 1955.

Table 1. Solidity of the progenies of solid and loose plants in 2 successive years

Parents	Number	Year	Number of plants judged	Distribution among solidity classes in %						
				1	2	3	4	5	6	7
Loose	5	1954	96	14	17	20	10	15	20	4
	5	1955	176	18	27	31	13	7	3	1
Solid	3	1954	52	–	6	6	10	15	17	46
	3	1955	94	1	2	9	11	15	27	34

The 3 solid plants gave in both years nearly the same results. In the progenies of the loose plants the differences between the two years were greater. Possibly an initially loose curd is more modifiable than a solid one.

Manner of pollination

In figures 2 a and b the F_2 progenies of the selfed and open-pollinated selected plants have been added together. In both categories the frequency distributions were very much the same, as will be seen from table 2.

Table 2. Solidity of the selfed and open-pollinated progenies of 9 loose plants

Pollination	Number of plants judged	Distribution among the solidity classes in %						
		1	2	3	4	5	6	7
Selfed	271	26	35	11	13	8	5	2
Open-pollinated .	391	14	36	15	13	9	9	4

It appeared that selfing had no effect on the growth of the progenies, as previously indicated by Jensma (1). Therefore changes in vigour are not likely to influence solidity.

Selection for solidity

It will always be necessary to select for solidity. Also with continuous selection one should reckon with the segregation of a number of plants with loose curds. In populations with mainly loose curds solidity by selection can probably only be increased to a certain level. Another point is that a plant with a loose curd multiplies more rapidly than a plant with a solid curd, as it bolts earlier and forms more flower stalks.

JENSMA found that 89 plants with solid curds on the average yielded 9.4 grammes of seed per plant, and that 83 plants with loose curds on the average gave 15.6 grammes per plant (1). Consequently natural selection moves in a negative direction, owing to which solidity, if not receiving proper attention, will decline.

SAMENVATTING

De vastheid van de krop bij bloemkool

De overerving van de vastheid van de krop bij bloemkool is in onderzoek genomen.

Door aan te nemen dat deze eigenschap bepaald wordt door een aantal polygene factoren, konden alle optredende verschijnselen verklaard worden. Planten met eenzelfde vastheid kunnen genotypisch nog weer zeer verschillen en bij vermeerdering zeer ongelijk uitsplitsen.

Bij de selectie zal voortdurend op de vastheid gelet moeten worden, temeer omdat planten met een losse krop zich sneller vermeerderen.

REFERENCE

1. JENSMA, J. R., Teelt en veredeling van bloemkool *(Growing and breeding of cauliflower)*. Meded. Instituut voor de Veredeling van Tuinbouwgewassen, Wageningen, **96** (1957): 40–42.

FIG. 5. EXAMPLE OF A LOOSE CURD

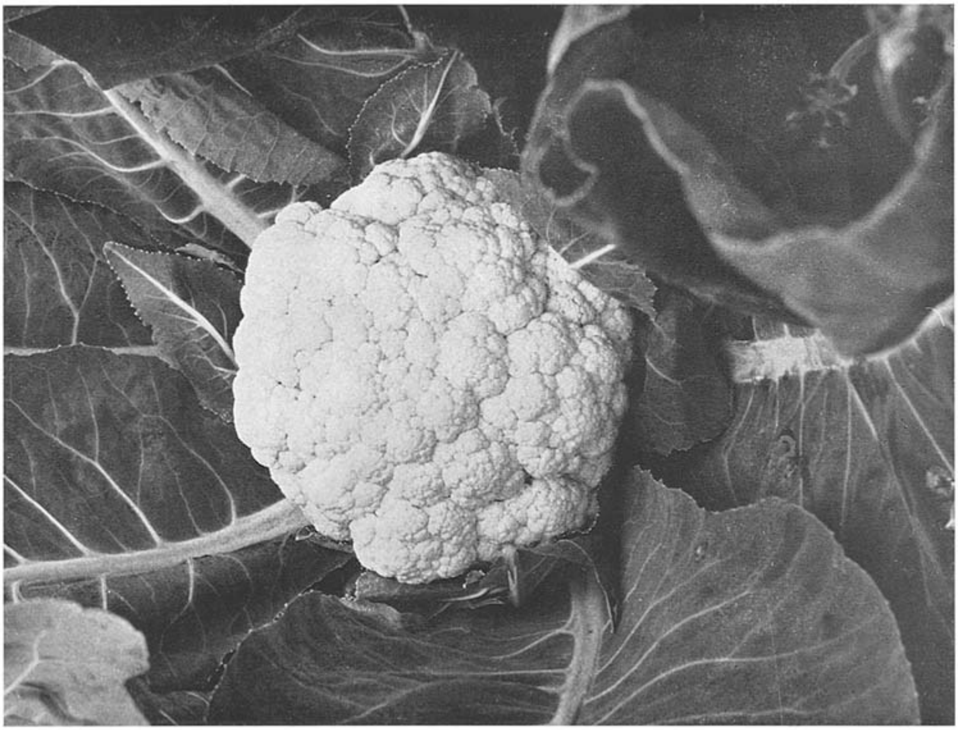

FIG. 6. EXAMPLE OF A SOLID CURD

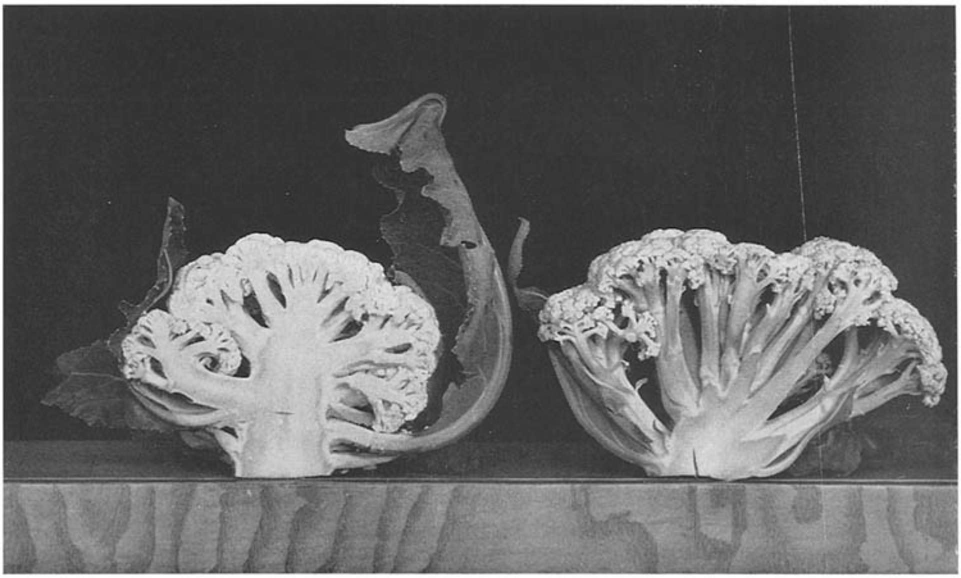

FIG. 7. CROSS SECTION OF A SOLID CURD (LEFT) AND A LOOSE CURD (RIGHT)