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The influence of pre-harvest sprouting on the sowing value of cereals

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Introduction

In 1960 in Holland cereals had to mature and were harvested in a period of high rainfall. Consequently many seed lots were spoiled for sowing purposes, but also in lots that were accepted as seed for sowing pre-harvest sprouting was occasionally prevalent. During the winter 1960/'61 the author performed several experiments for studying the consequences of pre-harvest sprouting of seed when it was sown in soil.
For this purpose it is not sufficient simply to determine the percentage of sprouted kernels in the seed samples, but it is necessary to take into consideration the degree of sprouting of the individual kernels. This is easily done at 10 x magnification. For these experiments several types of sprouted kernels were distinguished :

a. seeds with a minute pericarp crack at their basis,
b. seeds with a crack of one fourth of the germ length,
c. seeds with a crack of half the germ length,
d. seeds with a crack of the full germ length or more.

Moreover in several samples seeds were observed with a pericarp browning over the germ but without sprouting symptoms and these were put aside as group e.
Two types of experiments were conducted. In the first place samples with a high percentage of kernels showing pre-harvest sprouting were sorted according to the degree of sprouting of individual kernels, and afterwards the fractions were compared for their behaviour in soil. In the second place the sprouting percentage of a number of samples was determined, after which the relation between their sprouting percentage and sowing value was studied.
Several simplifications are necessary. As emergence percentage was taken the percentage of full-value seedlings plus half the percentage of slightly underdeveloped seedlings (this underdevelopment may be the consequence of either disease or weakness). As sprouting percentage in the experiment of the second type one fourth of the fractions a and b plus half the fraction c plus the whole fraction d was taken. More-

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over the phytotoxic effect of organic mercurial was studied, and for this purpose the full percentage of heavily injured seedlings plus half the percentage of slightly injured seedlings was accepted as the poisoning percentage.
The soil tests were conducted in light sandy soil in plastic boxes, that were stored in temperature-conditioned rooms illuminated with fluorescent light.

Experiments

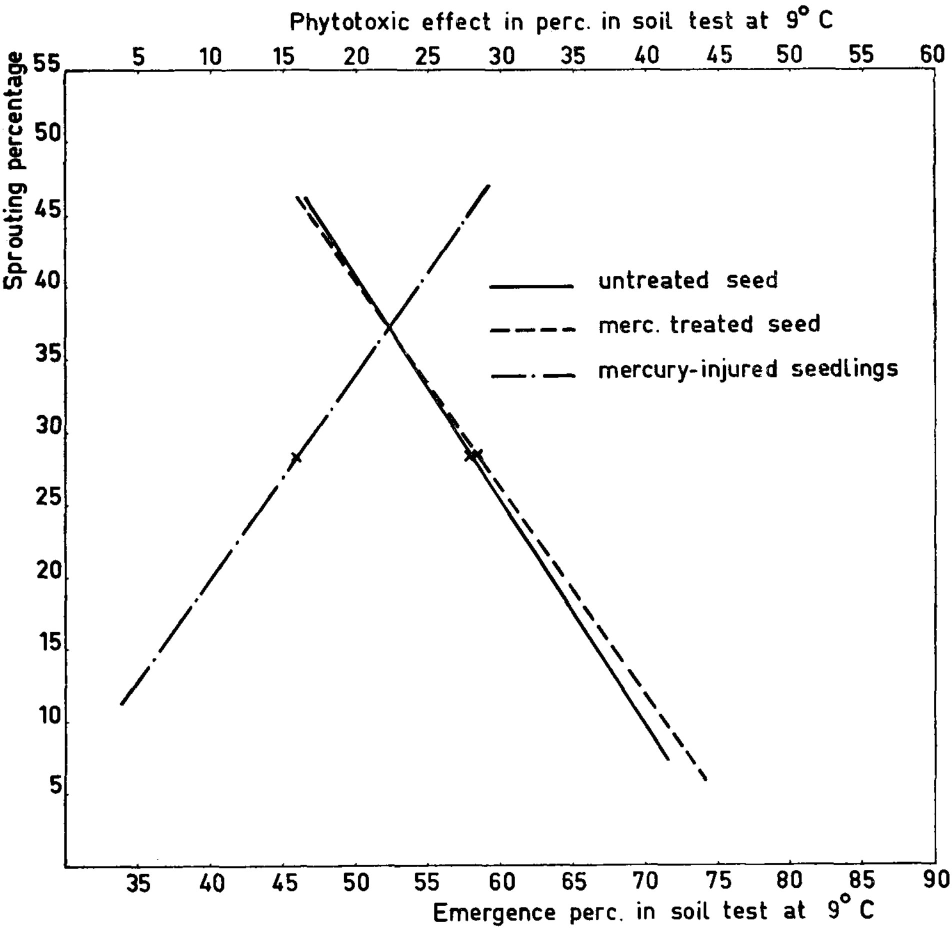
For wheat is was impossible to lay hands on a series of samples with the percentage of pre-harvest sprouting as their only differing characteristic. Some samples, however, showed a sufficient degree of pre-harvest sprouting for sorting under the microscope in fractions as indicated above. Part of each fraction was treated with organic mercurial dust (dosage 0,2 %, 1 day storage at room temperature), and part of each fraction was dusted with thiram (50 % preparation in dosage 0,2 %). They were grown in soil during 3 days at a temperature of 10° C followed by 5 days at 20° C, after which emergence was determined. The results are summarized in TABLE 1 A.
Conditions in this experiment — a loose, light soil and moderate temperature — were certainly favourable for wheat, with the exception of the more or less constant moisture content of the soil that might in the first place favour the activity of semi-parasitic soil fungi. This could be the explanation of the relatively low emergence of the sound seeds.
Pre-harvest sprouting appears to be very injurious, even when scarcely visible at the seed under magnification. Germ browning (which can have different causes) appears to be only slightly injurious in this case.
For emergence of sound kernels mercurial treatment is preferable, but for the sprouted fractions thiram is superior. In case of severe sprouting injury, however, thiram is also insufficient. In this different behaviour towards organic mercury and thiram the greater protectant value of the latter is certainly important, but besides that phytotoxic sensitivity of sprouted kernels might play a role.
Similar results were obtained with a sorted sample of *Carsten's VI* winter wheat.

TABLE 1. Influence of different degrees of pre-harvest sprouting on soil test emergence

Sprouting fraction	Number of seeds	Emergence percentages in soil		
		Untreated	Org. merc.	Thiram
A. Carpo *summer wheat 1960*				
Sound seeds	2 × 50	79½	91½	87
group a	2 × 37	48	58	78
„ b	1 × 22	32	50	63½
„ c	1 × 36	11	21	30½
„ d	2 × 50	1½	3	6
Brown germs e	2 × 50	62½	74½	66
B. Petkus *winter rye 1960*				
Sound seeds	2 × 50	87	90	94½
group a	2 × 50	81½	82	91½
„ b	2 × 50	71½	86	87
„ c	2 × 50	66½	72½	71½
„ d	2 × 50	18½	26	26½
Brown germs e	2 × 50	75½	80	81

PHOTO
Phytotoxic effect of organic mercurial on rye seed: the typical symptoms of injury in cereals are swollen sprouts and short, stubby roots

GRAPH



Conclusions

It may be concluded from these experiments that the injury in consequence of pre-harvest sprouting in wheat and rye is very severe; even when the individual kernels have only slightly sprouted the damage is considerable. Mercurial treatment increases emergence of slightly sprouted kernels but is ineffective in the case of severe sprouting. Thiram offers a somewhat better protection but also fails in the case of severe sprouting. Phytotoxic sensitivity is strongly increased by pre-harvest sprouting.

Of course a decreased emergence caused by pre-harvest sprouting can be more or less compensated by excess tillering of the cereal crop. Yet in any case it will be preferable to sow a smaller quantity of sound seed above sowing a larger quantity of injured seed. The latter offers far greater risks for the farmer.

For producing sound sowing seed the use of varieties with resistance against pre-harvest sprouting, more care in harvesting (for instance by placing the outer bundles of a sheaf upside down), and sharp cleaning of sprouted seed may be advised.