THE VITAMIN B_1 CONTENT OF DUTCH WHEAT AND THE FACTORS WHICH DETERMINE THIS CONTENT [1]

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SUMMARY

The vitamin B_1 content of a number of Dutch wheat varieties grown on different kinds of soil, was determined colorimetrically after diazotization. It was found that the vitamin B_1 content is, in the first instance, dependent on the variety. Amongst the summer varieties Van Hoek has a decidedly high, Carma a low content. Of the winter varieties Alba has a high content and Carstens V a low one.

The kind of soil on which the wheat is grown influences the vitamin B_1 content in this respect, that a higher content is always found on sea-clay than on sandy soil.

Weather conditions also have an influence. A higher content was found in the warm summer of 1947 than in the poorer summers of 1946 and 1948. This difference is greatest in the case of summer wheat, viz. 30 to 50 per cent, in the case of winter wheat it is only 0 to 20 per cent.

INTRODUCTION

In recent years rather much has been published in other countries about the vitamin B_1 content of wheat and of the influence exercised on it by different factors.

The investigations were chiefly concerned with wheat varieties grown in different parts of the United States and Canada. Harvests of different years, grown in the same experimental fields, were also compared.

As a rule it was found that the hard varieties contain more vitamin B_1 than the soft ones, while the summer varieties have a higher content than the winter varieties (HOFFMAN (1940), DOWNS (1941), NORDGREN (1941), CONNER (1941)).

The influence of the soil was investigated by HOFFER (1944) who showed that wheat from Alberta has, on an average, a lower content than wheat from Saskatchewan and Manitoba, while DOWNS (1941) established that wheat from 47 different districts in Kansas was influenced by the locality.

HOFFER (1944) discovered that weather conditions also influence the vitamin B_1 content, from investigations of wheat from the provinces of Alberta, Manitoba and Saskatchewan in the years 1940 (average content 3.93 μg per gram wheat), 1941 (average 4.56 μg per gram) and 1942 (average 3.45 μg per gram).

O'DONNEL and BAYFIELD (1947), in their investigations also found a difference in vitamin B_1 content in different years. In the wet year of 1941 they found that wheat from Kansas had an average content of vitamin B_1 of 3.7 μg per gram and in the harvest of 1942 with comparatively good weather a content of 4.2 μg per gram, thus 15 per cent more.

In West Canada, WHITESIDE and JACKSON (1943) compared six hard summer varieties in the years 1939 and 1940. They found no difference between the two years, but established that a high vitamin B_1 content is, in the first instance, a varietal character.

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1) Partly adapted from the thesis of the first author (1951).

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Thus all investigators come to the conclusion that the vitamin B_1 content is influenced by genetic circumstances as well as by external conditions.

Contrary to what is known of foreign varieties, nothing is known about the vitamin B_1 content of the different Dutch wheat varieties.

Through the agency of the Central Institute of Agricultural Research, we were able to investigate a number of samples of Dutch wheat. Our investigations were concerned with summer and winter wheats grown on different kinds of soil in the experimental fields of the Institute and harvested in the years 1946, 1947 and 1948. The influence of seeding-time was traced in the case of some varieties. Details of the experimental fields are set forth in some publications of the Agricultural Extension Service (CENTRAAL INSTITUUT VOOR LANDBOUWKUNDIG ONDERZOEK, 1946, 1947, 1948).

Before the analysis the samples of wheat were ground in a laboratory mill with a sieve of 0.8 mm. The determinations were carried out according to the method of L. P. VAN DER MIJLL DEKKER (1947). All determinations were carried out in duplicate, moisture contents not being taken into account.

INVESTIGATION OF SUMMER WHEAT

The following varieties were examined in the investigation: Atle (1948), Blanka (1946, 1947, 1948), Carma (1946), Chanteclair (1946), Chanteclair × Jong (1946), Hera (1947, 1948), Van Hoek (1946, 1947, 1948), Van Hoek × Carstens (1948), Koga (1946, 1947, 1948), Mansholt Witte (1946, 1948).

The results obtained can be summarized in two tables (Tables 1 and 2).

Table 1. Average vitamin B_1 content (μg per gram) of the separate summer wheat varieties from the collective experimental fields. The standard deviations were calculated on the basis of variance analysis.

Variety	1946	1947	1948
Mansholt Witte	4.1 [1]	–	3.2 ± 0.12
Van Hoek	3.4 ± 0.116	5.1 ± 0.075	3.2 ± 0.12
Chanteclair × Jong	3.4 ± 0.116	–	–
Hera	–	4.4 ± 0.080	3.4 ± 0.12
Van Hoek × Carstens	–	–	3.3 ± 0.12
Chanteclair	3.1 [1]	–	–
Blanka	2.9 ± 0.116	4.0 ± 0.075	3.4 ± 0.12
Atle	–	–	2.9 ± 0.12
Carma	2.7 ± 0.116	–	–
Koga	2.7 ± 0.116	3.6 ± 0.075	2.8 ± 0.12

[1]) Samples from only one experimental field.

The following conclusions can be drawn from these tables.

1 *Varietal differences*

There were very decided differences amongst the varieties in 1946, 1947, as well as in 1948.

A wheat variety with a relatively high vitamin content (e.g. Van Hoek) in one year, has also a high content in other years, while a low content (Koga) is likewise maintained.

It is thus apparent that the vitamin B_1 content is determined by genetic factors.

2 *Influence of soil*

Table 2 shows that summer wheat varieties grown on sea clay or sandy sea silt soils have a higher vitamin B_1 content than the same varieties grown on river clay or sandy soil. This applies to the three years in which the investigations took place. Thus the kind of soil also influences the vitamin B_1 content.

Table 2. Average vitamin B_1 content (μg per gram) of the separate summer wheat varieties grown on different soils.

Type of soil	Year of harvest	Variety								Average
		Atle	Blanka	Carma	Chanteclair × Jong	Hera	Van Hoek	Van Hoek × Carstens	Koga	
Sea clay	1946	–	2.9	3.2	3.8	–	3.7	–	3.4	3.4 ± 0.116
	1947	–	4.1	–	–	4.6	5.5	–	3.7	4.5 ± 0.053
	1948	3.1	3.5	–	–	3.4	3.3	3.4	3.1	3.3 ± 0.076
Sandy sea silt . . .	1946	–	3.3	3.1	3.8	–	3.1	–	2.8	3.2 ± 0.116
	1947	–	4.0	–	–	4.4	4.6	–	3.6	4.2 ± 0.075
	1948	–	–	–	–	–	–	–	–	–
River clay	1946	–	–	–	–	–	–	–	–	–
	1947	–	3.6	–	–	3.7	4.5	–	3.4	3.8 ± 0.146
	1948	–	–	–	–	–	–	–	–	–
Sand	1946	–	2.7	2.3	3.1	–	3.4	–	2.5	2.8 ± 0.068
	1947	–	3.8	–	–	4.0	4.3	–	3.4	3.9 ± 0.103
	1948	2.6	3.3	–	–	3.2	(3.0)	3.1	2.3	2.9 ± 0.076

3 *Influence of weather conditions*

As Tables 1 and 2 show, the vitamin B_1 content of a wheat variety can change in different years. The average content of a number of varieties also differs from year to year. The changeable weather conditions are very probably responsible for this.

All the varieties investigated had a higher content of vitamin B_1 in the warm dry summer of 1947 than in 1946 and 1948.

4 *Influence of seeding time*

The vitamin B_1 content of wheat also depends on the seeding time, a higher content being generally found with a late seeding time. This influence was found in all the varieties investigated in 1946, not always in 1947. It is apparent, however, that in both cases a significant difference exists in the average value, see Table 3.

Table 3. Average vitamin B_1 content of the summer wheat varieties listed in Table 2 at different seeding dates. Standard deviations calculated on the basis of variance analyses.

Seeding date	1946 μg vitamin B_1 per gram	Seeding date	1947 μg vitamin B_1 per gram
16/3	2.64 ± 0.116	18/4	4.3 ± 0.06
4/4	3.06 ± 0.116	28/4	4.5 ± 0.06
Difference	0.42 ± 0.164	Difference	0.2 ± 0.08

A distinction can be made in the winter wheat varieties between those which are hardy and those which are less so. Of the winter-hardy varieties the following were investigated: Astra (1946), Carstens V (1946, 1947, 1948), Claudius (1948), Criewener (1946), Lovink (1946) and Titan (1947, 1948).

The less winter-hardy varieties investigated were: Alba (1946, 1947, 1948), Juliana (1946, 1947, 1948), Staring (1946, 1947, 1948) and Demeter (1948).

The results found for the winter varieties can also be summarized in a table (Table 4).

Table 4. Average vitamin B_1 content (μg per gram) of a few separate winter wheat varieties grown on different kinds of soil in three different years.

Soil	Year of harvest	Variety			Average
		Alba	Carstens V	Juliana	
Sea clay	1946	4.1	3.7	3.7	3.8 ± 0.09
	1947	4.4	4.0	4.6	4.3 ± 0.10
	1948	4.1	3.5	4.1	3.9 ± 0.11
Sandy sea silt soil	1946	4.2	4.1	3.6	4.0 ± 0.14
	1947	3.6	3.8	3.9	3.8 ± 0.10
	1948	3.8	3.6	4.1	3.8 ± 0.09
River clay, sand or loess	1946	–	3.1	3.2	3.2 ± 0.20
	1947	3.6	3.8	4.0	3.8 ± 0.16
	1948	4.2	3.1	3.8	3.7 ± 0.27

Some conclusions can be drawn from this table as was done in the case of the summer varieties.

1 *Varietal differences*

As in the case of the summer varieties, some of those here have a significantly higher vitamin B_1 content than others, thus in 1946 Alba had a decidedly higher content than Carstens V.

2 *Influence of soil*

Here also a difference can be seen between the average of the varieties due to the influence of the soil. Clay always gave a higher content than sandy soil.

3 *Influence of weather conditions*

Here, as in the case of summer wheat, an influence of weather conditions is found, though less strong. Higher contents of vitamin B_1 were found in 1947 than in 1946, but, however, not on silt soil.

4 *Influence of seeding time*

In 1946—1947 some varieties were sown at different times. In contrast to the summer varieties, no influence of seeding date was found.

Literature

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