

THESIS

ON

MOISTURE CONTENT AND GERMINATION OF CORN AS AFFECTED BY
ARTIFICIAL DRYING AND PLACE AND METHOD OF STORAGE

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MOISTURE CONTENT AND GERMINATION OF CORN

AS AFFECTED BY

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PART I--MOISTURE AND GERMINATION OF CORN
AS AFFECTED BY ARTIFICIAL DRYING

Introduction

Curing seed corn is a problem with the Willamette Valley corn grower. The comparatively short growing season does not give time for the corn to thoroughly mature and dry on the stalk. This fact, together with the humid weather conditions that prevail from harvest time on through the winter, makes some sort of drying imperative. For the grower who is saving only a small amount of seed, this can be accomplished by hanging the seed ears in a dry, well ventilated place. However, a large percentage of the farmers here grow the crop for silage, depending upon dealers or upon other growers for their supply of seed. This gives opportunity for a few growers to go into seed corn production upon a large enough scale to make kiln drying profitable. In some cases hop or prune dryers are used. These are not entirely satisfactory, but they serve the purpose temporarily. In using these as corn driers, there are a number of questions that come up concerning which there is a dearth of information. Data are available concerning the drying of other grains, however.

Doctor F. Nobbe*, working with wheat, rye, and oats, concluded that wheat and rye may be unhesitatingly dried at temperatures of 40° to 60° C., without suffering injury in regard to germinating power. The water content is thereby reduced to 2 to 3 per cent, which is, however, nearly entirely regained when afterwards exposed to the air. Even at a drying temperature of 80° C., with a reduction in water content to 1 to 2 per cent, the wheat and rye did not suffer serious loss of germination. At 90° C. there was noticeable damage and at 100° C. the germinating power was almost entirely lost. In the case of oats, a temperature of above 40° to 50° C. should not be employed, since a higher temperature will not only retard the germination but may decrease it. The exposure of the seed in an open room after artificial drying, during which exposure the original water content was again nearly reached, did not decrease the germination. In fact, germination seems to be more vigorous after exposure than immediately after drying.

Doctor L. Kiessling**, working chiefly with barley, found no decrease in germination resulting from heating it for one and two hours at 74° C., and only a slight decrease following a drying temperature of 84° C. for one hour. There was a retarding

*Dr. F. Knobbe--Concerning the artificial drying of cereals with reference to their germination. Mitt. Deut. Landw. Gesell., 12 (1897) No. 14 pp. 185-186.

**Dr. L. Kiessling--Investigations on the drying of grain. Vrtljschr. Bayer. Landw. Rat. 11 (1906) No. 1 pp. 13-137.

effect, however. This effect was much less noticeable when the high temperatures were reached gradually. Because of this retarding effect, the results of heating cannot be determined by counting the number of seeds germinating. Doctor Kiessling found that artificial drying improves the germination of immature and poor seeds. He gives a brief outline of previous experiments on the heating of seeds.*

Duvel found that heating wheat to temperatures as high as 158° F. for three and one-half hours in a hot air blast increased its germination slightly.**

Em. Miede gives the results of heating a number of different kinds of seeds at various temperatures and times. Maize had its germination improved by heating at 45° for three, six, twelve, and twenty-four hours, and for three hours at 70°, but for longer periods at this temperature the germination was decreased. He concludes that germination of fresh and hard seeds may be improved by heating.***

Pernot**** of the Oregon Station, in heating oats for the

*Dr. L. Kiessling--Investigations on the Drying of Grain. Vrtljschr. Bayer. Landw. Rat. 11 (1906) No. 1 pp. 13-31.

**J. W. T. Duvel--Garlicky Wheat; B. P. I. Bulletin No. 100, pt. III, pp. 29.

***Em. Miede--Ann. Ecole Nat. Agr. Rennes, 3 (1907).

****E. F. Pernot--Prevention of Smut on Oats; Oregon Station Bulletin No. 63--1900.

prevention of smut, found no marked decrease in germination after heating to 200° F. for ten minutes, although his results show a retarding effect upon the germination. He used one hundred grain samples, and the maximum temperature was maintained for ten minutes in each case. The following data are taken from his report:

<u>Sample Number</u>	<u>Maximum Heating Temperature</u>	<u>Number Ger- minated</u>
1.	132°	94
2.	140.	98
3.	150.	100
4.	160.	100
5.	170.	98
6.	180.	92
7.	190.	99
8.	200.	90
9.	132 in Water. . .	80
10.	Unheated.	100

Because of their importance to the seed corn grower in the Willamette Valley, as well as in other sections, it was deemed worth while to undertake experiments to determine the following points:

- (1) The maximum safe temperature for drying corn without decreasing its germination.
- (2) Whether or not rapid drying injures germination.
- (3) Whether or not a low final water content affects germination adversely.
- (4) The effect of a low initial water content upon the maximum safe drying temperature.
- (5) The effect of the quality of the corn upon the maximum drying temperature.
- (6) The effect of very high temperatures upon germination.
- (7) The change in moisture content when stored after drying, and the consequent effect upon germination.

Procedure

The corn was heated on woven wire shelves in an electric oven provided with an adjustable thermostat. The maximum temperature was reached gradually. Adequate ventilation was provided by vents in the top and bottom of the oven. The aim was to approximate as closely as possible the conditions in the common type of drier in this section. The germination was carried out in a Standard germinating chamber according to the methods of

the Seed Testing Laboratory and the Experiment Station. Both the rag doll and blotters were used. The size of the sample varied from eight to twenty ears, depending upon the amount that could be handled under uniform conditions, the smaller samples being used at the higher temperatures. A Brown-Duvel tester was used in making the moisture determinations.

Three entirely different samples of corn were used, which, for convenience in description, will be designated as Lot I, Lot II, and Lot III. All were of the Minnesota No. 23 variety. They were somewhat below the average in maturity for the 1915 crop.

Lot I. This corn was harvested November 13, 1915, and the samples taken at from one to three weeks later. It was in good condition, though the moisture content was high. At the time of harvesting, the grain contained 28.8 per cent of water and the cob 45.1 per cent. When the experiment began, this had dropped to 27.8 per cent for the grain and 30.6 per cent for the cob. At the time the last sample was taken, the grain contained 21.2 per cent of water and the cob 20.1 per cent. During the interval between harvesting and the conclusion of the experiment, the corn was kept in small lots in the College barn. No attempt was made to prevent the loss of moisture. A water content as high as this would probably be serious to corn under eastern conditions, but due to the mild climate of the Willamette Valley there was little danger of injury from freezing. On the other hand, the weather was cool enough to prevent heating when the corn was

TABLE I--SHOWING MAXIMUM DRYING TEMPERATURE, GERMINATION BEFORE AND AFTER DRYING, AND THE MOISTURE CONTENT OF BOTH GRAIN AND COB BEFORE AND AFTER DRYING

TABLE II--SHOWING MAXIMUM DRYING TEMPERATURE, GERMINATION BEFORE AND AFTER DRYING, AND THE MOISTURE CONTENT OF GRAIN BEFORE AND AFTER DRYING

(Lot I--Table I)

Sample No.	Maximum Drying Temperature		Germination Per Cent		Decrease in Germination	Moisture Content of Grain		Decrease	Moisture Content of Cob		Decrease
	°C	°F	Before Drying	After Drying		Before Drying	After Drying		Before Drying	After Drying	
1	43	109.4	98.0	98.8	-.8	27.0	9.0	18.0	30.6	8.1	22.5
2	45	113.0	99.6	99.2	-.4	25.8	8.6	17.2	28.1	6.4	21.7
3	49	120.2	97.6	98.0	-.4	24.9	8.2	16.7	25.8	6.5	19.3
4	53	127.4	100.0	99.2	-.8	24.5	7.7	16.8	25.0	6.2	18.8
5	55	131.0	99.2	99.6	-.4	25.5	7.5	18.0	26.2	6.3	19.9
6	58	136.4	99.6	97.6	-2.0	23.6	7.0	16.6	24.1	5.9	18.2
7	62	143.6	99.2	96.0	-3.2	23.0	6.6	16.4	23.5	5.1	18.4
8	63	145.4	100.0	94.0	-6.0	23.1	6.2	16.9	22.4	5.0	17.4
9	65	149.0	98.8	89.2	-10.8	22.5	5.1	17.4	21.7	3.8	17.9
10	68	154.4	100.0	92.8	-7.2	21.2	4.8	16.4	20.1	3.7	16.4

(Lot II--Table II)

1	57	134.6	93.8	98.0	-4.2	7.6	4.7	2.9
2	60	140.0	100.0	98.0	-2.0	7.8	4.6	3.2
3	62	143.6	97.9	95.8	-2.1	6.9	3.9	3.0
4	67	152.6	95.8	95.8	-0.0	7.8	3.2	4.6
5	68	154.4	99.5	98.5	-1.0	10.8	4.8	6.0
6	70	158.0	100.0	89.6	-10.4	7.9	3.0	4.9
7	71	159.8	99.5	99.0	-0.5	10.8	4.7	6.1
8	73	163.4	99.5	91.5	-8.0	10.8	4.5	6.3
9	82	179.6	100.0	37.5	-42.5	7.6	2.8	4.8
10	83	181.4	100.0	72.9	-27.1	8.1	3.0	5.1
11	85	185.0	97.9	18.8	-79.1	7.1	2.2	4.9
12	90	194.0	100.0	35.4	-64.6	8.0	2.3	5.7
13	93	199.4	100.0	22.9	-77.1	8.3	2.5	5.8

left in small lots. The experiment was concluded before the corn had been visibly injured by mold. The drying period for this lot was approximately thirty-six hours.

The results in Table I show--(1) That there is practically no difference in germination before and after drying, up to a maximum drying temperature of 55° C. There is only a slight decrease up to 62° C., and no abrupt decrease up to 68°.

(2) That an average loss of 17 per cent of water in thirty-six hours did not decrease the per cent of germination.

(3) A moisture content as low as 7.5 per cent shows no adverse effect upon germination*.

Lot II. These samples were taken from the College stock of seed corn. This lot had been harvested in late November and it had been well dried in a heated basement in which a good circulation of air was maintained by the use of electric fans. The object in heating these samples was to determine the effect of a low initial water content upon the maximum drying temperature. The length of the heating period for each sample of this lot was approximately twenty-four hours.

The results in Table II show--(1) That there was no mark-

*One sample was heated at 35° to 40° C. for five days. The moisture content was reduced to 2 per cent. The germination after drying was 100 per cent.

TABLE III--SHOWING MAXIMUM DRYING TEMPERATURE, GERMINATION BEFORE AND AFTER DRYING, AND THE MOISTURE CONTENT OF BOTH GRAIN AND COB BEFORE AND AFTER DRYING

(Lot III)

Sample No.	Maximum Drying Temperature		Germination Per Cent		Decrease in Germination	Moisture Content of Grain		Decrease	Moisture Content of Cob		Decrease
	Temperature		Before Drying	After Drying		Before Drying	After Drying		Before Drying	After Drying	
	°C	°F									
1	50	122.0	80.0	88.3	- 8.3	19.6	9.2	10.4	18.3	8.1	10.2
2	53	127.4	84.2	76.7	- 7.5	18.9	9.0	9.9	17.2	7.9	9.3
3	54	129.2	94.2	92.5	- 1.7	14.7	7.2	7.5	13.1	6.6	6.5
4	55	131.0	84.2	67.5	-16.7	----	---	---	----	---	---
5	56	132.8	89.2	65.8	-23.4	17.7	8.4	9.3	17.9	8.3	9.6
6	58	136.4	90.0	85.8	- 4.2	16.6	8.0	8.6	17.2	8.0	9.2
7	60	140.0	86.7	59.2	-27.5	13.5	5.0	8.5	12.4	4.0	8.4
8	65	149.0	88.3	71.7	-16.6	16.7	7.8	8.9	15.0	6.0	9.0
9	66	150.8	21.7	20.8	- 0.9	17.6	8.0	9.6	17.1	7.1	10.0
10	67	152.6	85.8	60.0	-25.8	19.2	9.4	9.8	18.0	8.2	9.8
11	69	156.2	90.8	68.3	-22.5	15.3	6.9	8.4	14.7	5.7	9.0
12	70	158.0	80.8	64.2	-16.6	17.4	7.2	10.2	17.0	7.1	9.9
13	71	159.8	92.5	73.3	-19.2	16.9	6.3	10.6	16.5	6.2	10.3
14	74	165.2	85.8	29.2	-56.6	17.0	6.0	11.0	16.6	5.7	10.9
15	75	167.0	85.8	14.2	-71.6	18.3	6.2	11.1	17.2	5.6	11.6
16	76	168.8	90.8	13.3	-77.5	18.8	6.0	12.8	17.3	5.1	12.2
17	80	176.0	92.5	5.0	-87.5	15.1	5.2	9.9	13.2	4.4	8.8
18	81	177.8	92.5	10.8	-81.7	15.4	4.6	10.8	13.1	3.9	9.2
19	85	185.0	92.5	13.3	-79.2	14.1	3.7	10.4	12.0	2.8	9.2

TABLE IV--SHOWING THE MOISTURE CONTENT AND GERMINATION OF CORN AS AFFECTED BY STORAGE AFTER DRYING

Stored	After Drying	Moisture Content of Grain						After Drying	Germination						
		After Storing		In Well Ventilated		In Sack	On Rack		After Storing		In Well Ventilated		In Sack	On Rack	
		In Basement		In Barn Loft					In Basement		In Barn Loft				
		In Sack	On Rack	In Sack	On Rack				In Sack	On Rack	In Sack	On Rack			
Jan. 29	4.7	----	13.8	----	13.0	10.0	9.8	99.0	----	100.0	----	99.5	99.0	100.0	
Feb. 1	7.3	13.6	14.0	13.2	13.6	9.9	10.1	99.5	99.5	99.5	99.5	100.0	100.0	99.5	
" 9	10.5	14.0	14.2	13.2	13.1	----	----	99.5	99.0	99.5	99.5	99.0	----	----	
" 15	7.6	13.4	14.0	13.1	12.6	----	----	100.0	99.5	100.0	100.0	100.0	----	----	
" 16	8.0	13.7	13.7	13.2	12.9	----	----	99.5	99.5	100.0	99.5	99.0	----	----	
Average	7.6	13.7	13.9	13.2	13.0	9.9	9.9	99.5	99.5	99.8	99.6	99.5	99.5	99.8	

ed decrease in germination after heating at temperatures as high as 77° C., for twenty-four hours.

(2) That there was an abrupt drop in germination above 77° C.

(3) That some of the corn still germinated after being subjected to a temperature of 93° C., for twenty-four hours.

Lot III. The corn in this lot had been damaged both in the field and in storage. It had been harvested about December 20, during rainy weather. Cob rot and mold had started in many of the ears. It was stored for two months in small lots on the floor of a heated basement. Only the better looking ears were taken for samples. The moisture content varied, but on the whole it was rather high, the average being 16.8 per cent for the grain and 15.8 per cent for the cob. The object in using this lot was to determine the effect of poor quality upon the maximum safe drying temperatures.

The results in Table III show--(1) That there was a noticeable decrease in germination after drying, from 54° C. on up.

(2) The abrupt break appears between 71° and 74° C.

Table IV. The water content of the samples in Table IV after storage was determined May 11, making the period of storage approximately three months. The moisture content had increased to practically that of undried corn stored in the same

places. The germination was apparently not affected one way or the other by this increase.

The average results for the samples stored in the basement show a slightly higher moisture content for those on racks. With the samples stored in the barn loft the reverse is true, those stored in sacks showing the higher average moisture content. This would indicate that after drying, corn may be safely stored in bulk.

Summary

(1) The maximum safe drying temperature for corn with a high water content is around 55° C., though it may be heated as high as 70° without serious injury to its germination.

(2) Fairly rapid drying of corn does not injure its germination if ample circulation of air is maintained.

(3) Corn of poor quality has a slightly lower maximum safe drying temperature than corn of good quality.

(4) A low initial water content raises the maximum safe drying temperature.

(5) A low final water content does not affect germination adversely.

(6) The absolute killing temperature for corn is above 93° C.

(7) The moisture content of corn after drying increases during storage to practically that of undried corn stored in the same place. This increase in moisture content had no marked effect upon germination.

PART II--MOISTURE CONTENT AND GERMINATION OF
CORN AS AFFECTED BY PLACE AND METHOD OF STORAGE

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CORN AS AFFECTED BY PLACE AND METHOD OF STORAGE

Seed Corn storage is receiving increasing attention on the part of farmers and experiment stations in the corn growing states. The farmers and the experiment stations of Michigan, Wisconsin, and Minnesota have both increased their yields and extended the northern limit of successful corn production. This has been accomplished chiefly through the selection and improvement of earlier maturing varieties and through careful curing and storing of the corn to be used as seed.

The best places and methods of storing corn in Wisconsin are conclusively shown by the following results from the Experiment Station of that state*. The table gives data regarding the storage, germination, and stand of 350 farmers' corn, scattered widely over the state.

*Crop Demonstrations on State and County Farms--Wisconsin Experiment Station Bulletin No. 208.

<u>Method of Storage</u>	<u>Germination</u>			<u>Number of Tests</u>	<u>Average Stand 1909-1910</u>
	1909	1910	Average		
Kiln Dried	93	90	91.5	16	89
Furnace Room	93	89	91.0	8	--
Room Above Kitchen	92	81	86.5	112	81
Average of Above	92.6	86.6	89.6	136	
Attics	92.0	77.0	84.5	75	79
Under Porches	79.0	62.0	70.5	27	63
Granaries	65.0	43.0	54.0	20	77
Barns, Tool Houses, & Other Outbuildings	86.0	52.0	69.0	52	60
Corn Cribs	38.0	37.0	37.5	26	49
In Shock During Winter	81.0	1.5	41.2	4	41
Windmills & Outside of Walls of Buildings	45.0	23.0	34.0	10	56
Average	76.4	55.5	65.9	350	59.5

This and other experiments show the highest germination and a correspondingly high stand in the case of kiln dried corn and the poorest germination and a correspondingly low stand with corn stored in bulk and in damp places. As far as is known, however, little has been recorded as to the relation between the moisture content of corn and its germination.

This paper is a report on experiments conducted with a view

to determining this relation, and the effect of the following factors upon both moisture content and germination:

1. Time of Harvest.
2. Variety.
3. Maturity.
4. Storage in Different Places.
5. Different Methods of Storage.
6. Moisture Content of Cob.

Description of Materials

The corn used was of the 1915 crop, grown on the College farm east of the Willamette River. The soil on this farm is of the sandy loam type and well adapted to corn growing. The 1915 crop was exceptionally good. The plots chosen for this experiment were marked out about the time the corn was ripe. They were considered representative of the types desired. The two common varieties, Minnesota No. 23 and Minnesota No. 13, were used. The immature lots of each variety resulted from approximately two weeks' later planting than the mature. The mature Minnesota No. 13 was from a special grain type selection, planted approximately one week before the Minnesota No. 23.

Procedure

The corn was harvested in the ordinary way. The first harvest was made October 26. The husks of the mature corn of

both varieties were dry but the stalks were still somewhat green. There was not any great difference between the appearance of the immature Minnesota No. 23 and that of the mature, but the difference in the maturity of the two lots of Minnesota No. 13 was marked, the husks of the immature being partly green in many cases.

The second harvest was made December 9. There was little opportunity for the corn to dry in the field during the period between the harvesting dates. An examination of the weather record shows that only three of the forty-four days were clear. Eight were partly cloudy and the remaining thirty-three were cloudy. Rain fell on twenty-seven days within the period, the total precipitation for the interval being 13.92 inches. An overflow of the Willamette River November 24 and 25 reached the base of the shocks of the mature Minnesota No. 23, and this may have damaged it to some extent. December 7 and 8 were partly cloudy, and December 9 (the date of the second harvest) was clear and the corn stalks and husks were dry.

The original plan was to make three harvests at intervals of about one month, and to leave one lot standing in the stalk all winter. The first harvest was made when the earliest lot matured. Weather conditions prevented the carrying out of this plan, and the only harvests that could be made were those of October 26 and December 9.

Moisture and germination tests were made immediately after harvesting and the corn stored as soon as possible.

Four methods of storage were used;

1. In small flour sacks.
2. In fruit boxes or crates.
3. On solid shelves, with the ears touching each other.
4. On studded racks, on which each ear was separate from the others.

The size of the samples was approximately one peck. They were suspended from the ceiling to keep them from rats and mice.

Four different places of storage were chosen:

1. The loft of the old College barn. This was a large hay loft about one-third full. There was good ventilation.
2. Near the ceiling on the first floor of the same barn, not far from the horse stable. This was a good place except that the samples may have been affected some by moisture from the stalls.
3. In one corner of the basement of the Agronomy Building. Because of the idea usually associated with a basement, it may be well to mention that this one was dry and well ventilated.
4. The attic of Professor Hyslop's house. This place was well ventilated and heated to some extent by the flue.

TABLE I - MOISTURE CONTENT AND GERMINATION OF CORN AS AFFECTED BY TIME OF HARVEST.

A. Harvested from standing stalks, October 26.

MOISTURE CONTENT											GERMINATION			
		Min. # 23				Min. # 13				Min. # 23		Min. # 13		
Where stored.	How stored	Mature grain	Immature cob	Mature grain	Immature cob	Mature grain-cob	Immature grain-cob	Mature grain-cob	Immature grain-cob	Mature	Immature	Mature	Immature	
Before storing		26.1	37.6	31.8	45.1	31.7	44.6	37.8	49.8	99.4	97.2	97.4	97.0	
After storing in	Barn loft	Sack	15.8	15.6	18.9	20.4	14.1	14.8	18.9	23.2	93.5	79.0	93.0	64.0
	"	Box	15.0	13.5	15.0	12.6	14.0	12.6	15.4	15.2	91.0	78.5	97.5	83.5
	"	Rack	13.2	----	13.2	11.5	13.2	10.5	13.3	11.4	99.5	99.5	99.5	95.5
	"	Shelf	13.3	11.3	13.7	12.0	13.0	11.6	13.5	11.0	94.0	98.0	95.5	92.0
	Barn	Sack	15.2	17.4	19.2	20.8	18.5	19.8	19.0	20.5	96.5	80.5	91.5	81.5
	"	Box	16.0	16.2	18.1	20.6	16.4	16.2	18.7	18.0	91.5	80.5	97.5	84.5
	"	Rack	14.5	11.2	14.8	13.3	13.6	11.0	14.4	12.4	98.0	98.0	98.0	99.0
	"	Shelf	13.8	11.6	14.4	13.0	13.6	10.8	14.8	12.4	85.5	100.0	99.5	93.0
	Attic	Sack	11.5	10.3	11.2	9.8	12.0	10.1	12.1	10.2	97.5	92.0	96.0	91.0
	"	Box	10.8	10.0	11.7	9.6	10.6	9.7	12.0	10.0	99.5	100.0	98.5	97.0
	"	Rack	10.6	9.9	10.4	9.2	10.4	9.3	10.5	9.3	98.0	99.5	99.5	100.0
	"	Shelf	10.3	10.0	10.5	9.9	10.3	9.9	10.8	10.0	98.0	99.5	99.5	99.0
	Basement	Sack	12.0	10.4	12.2	10.0	12.3	10.5	12.0	10.3	99.0	92.0	96.0	97.5
	"	Box	12.0	10.4	----	----	11.6	11.2	11.6	9.6	92.5	----	100.0	97.0
	"	Rack	11.9	10.3	11.6	9.5	11.4	10.6	11.4	10.1	99.5	99.0	99.5	99.0
Average after storage			13.1	12.0	13.9	13.0	13.0	11.9	13.9	12.9	95.6	92.6	97.4	91.6

B. Harvested from standing stalks, December 9

Before storing			25.4	41.2	28.0	44.2	22.5	34.5	31.8	46.9	99.5	97.5	98.0	97.0
After storing	Barn loft	Sack	15.8	18.0	17.2	21.4	15.6	15.8	20.5	25.6	69.5	90.5	91.0	80.5
	"	Box	14.3	13.2	16.5	16.0	14.5	14.0	-----	-----	83.0	92.0	97.5	-----
	"	Rack	13.1	11.4	13.8	11.0	12.5	10.4	13.1	11.4	98.5	97.5	99.5	92.0
	"	Shelf	14.9	12.0	14.0	11.2	13.3	12.0	15.5	12.6	99.0	88.0	100.0	77.5
	Barn	Sack	18.0	18.9	18.2	19.0	18.9	20.1	18.9	19.8	83.0	85.5	88.0	71.0
	"	Box	16.2	16.1	14.8	14.0	16.1	15.3	-----	-----	88.0	92.0	90.0	-----
	"	Rack	13.8	13.0	13.7	12.6	14.5	14.0	12.2	10.6	95.5	99.2	97.5	96.0
	"	Shelf	13.8	13.0	14.5	13.1	14.4	14.0	14.6	14.0	98.0	99.5	97.5	86.5
	Attic	Sack	10.6	9.6	10.8	9.4	11.4	10.1	12.6	10.5	84.5	98.0	93.0	90.5
	"	Box	10.4	9.8	11.5	9.5	-----	-----	11.0	9.9	98.0	100.0	-----	99.0
	"	Rack	9.3	9.3	10.2	9.0	9.2	9.0	10.6	9.7	98.0	100.0	100.0	99.0
	"	Shelf	9.6	9.5	10.6	9.3	-----	-----	10.7	9.8	97.5	100.0	-----	97.5
	Basement	Sack	12.5	10.4	12.2	10.4	11.9	10.2	12.5	10.6	85.5	96.5	96.0	88.0
	"	Box	12.2	10.8	13.0	11.4	11.6	10.2	11.0	10.0	96.5	97.5	99.0	99.0
	"	Rack	11.8	10.2	12.3	10.6	11.2	10.0	11.0	10.0	96.0	99.5	99.5	99.5
Average after storage			13.1	12.4	13.6	12.5	13.5	12.7	13.4	12.7	91.4	95.7	96.0	89.7

TABLE I - MOISTURE CONTENT AND GERMINATION OF CORN AS AFFECTED BY TIME OF HARVEST.

C. Harvested from shocks., December 9

MOISTURE CONTENT										GERMINATION				
	Where stored	How stored	Min. # 23				Min. # 13				Min. # 23		Min. # 13	
			Mature		Immature		Mature		Immature		Mature	Immature	Mature	Immature
			grain	cob	grain	cob	grain	cob	grain	cob				
Before storing			25.8	40.4	30.9	51.4	24.4	39.0	32.1	52.6	98.0	97.0	98.5	96.0
After storing	Barn loft	Sack	16.7	19.2	18.0	16.5	15.3	16.4	21.3	25.8	74.5	61.5	82.5	70.5
	"	Box	15.1	14.0	17.6	15.4	----	----	----	----	80.0	70.0	----	----
	"	Rack	12.6	10.0	13.0	10.0	13.0	11.2	13.3	10.0	99.5	99.0	99.0	97.5
	"	Shelf	13.7	12.0	14.6	11.2	13.2	10.8	13.4	10.8	72.0	51.0	97.0	91.5
	Barn	Sack	18.6	19.5	21.1	22.5	17.9	18.4	16.0	19.0	76.0	64.0	83.5	76.0
	"	Box	15.3	15.0	15.1	14.0	15.2	15.2	----	----	79.0	76.0	83.5	----
	"	Rack	14.0	12.0	13.3	13.2	13.2	13.2	14.2	11.6	94.0	94.0	95.2	98.0
	"	Shelf	14.1	12.4	14.3	13.1	13.8	13.0	14.2	12.9	89.5	80.0	96.0	82.0
	Attic	Sack	11.0	10.2	12.3	10.6	11.4	9.5	12.6	10.5	96.0	99.5	96.5	90.5
	"	Box	10.9	9.8	10.5	10.3	10.8	9.3	----	----	96.5	99.0	97.5	----
	"	Rack	10.6	9.6	11.0	10.0	10.4	9.6	11.0	10.2	98.0	96.5	98.0	98.5
	"	Shelf	10.6	9.6	10.7	9.1	10.3	9.2	11.1	10.2	97.5	100.0	98.0	99.0
	Basement	Sack	12.3	10.4	12.6	10.5	12.0	10.8	12.9	10.8	95.0	98.0	95.5	93.0
	"	Box	11.6	10.2	12.2	10.8	----	----	----	----	97.0	98.0	----	----
	"	Rack	11.0	10.0	11.9	10.3	10.5	9.8	11.8	10.3	98.5	98.5	100.0	99.0
Average after storage			13.2	12.3	13.9	12.5	12.9	12.0	13.8	12.9	89.5	85.7	94.0	90.5

D. Summary.

Harvested from stalks	October 26	13.1	12.0	13.9	13.0	13.0	11.9	13.9	12.9	95.6	92.6	97.4	91.6	
"	"	December 9	13.1	12.4	13.6	12.5	13.5	12.7	13.4	12.7	91.4	95.7	96.0	89.7
"	" shocks	December 9	13.2	12.3	13.9	12.5	12.9	12.0	13.8	12.9	89.5	85.7	94.0	90.5
Average after storage			13.1	12.2	13.8	12.7	13.1	12.2	13.7	12.8	92.2	91.3	95.9	90.6
Average at time of harvest			25.8	39.7	30.2	46.9	26.7	39.4	33.9	49.8	99.0	97.2	98.0	96.7

Presentation of Data

The results are presented chiefly in tabular form. In Table I, all of the samples harvested October 26 are grouped under "A"; those harvested from standing stalks December 9, under "B"; and those from shocks December 9, under "C". The averages for each group were obtained and placed in a summary table "D".

At the time of the first harvest, October 26, the mature Minnesota No. 23 had the lowest water content and the highest germination. This was followed by mature Minnesota No. 13, immature Minnesota No. 23, and immature Minnesota No. 13, in the order named. The same is true for the harvest from standing stalks, December 9. However, in the case of that harvested from the shock December 9, the mature Minnesota No. 13 had the lowest moisture content and the highest germination. This was followed by mature Minnesota No. 23, immature Minnesota No. 23, and immature Minnesota No. 13, in the order named. The mature Minnesota No. 13 dried considerably more in the shock than the others.

Two weeks before the corn was harvested, water from an overflow of the river was around the shocks of this mature Minnesota No. 23, and at the time of husking the stalks were still wet around the bottom.

The moisture content of all of the samples harvested from standing stalks December 9 was less than it was October 26, and

with the exception of the immature Minnesota No. 13, the germination had increased. This exception can be accounted for by the fact that this lot had partly spoiled on account of the excessively wet weather. In fact, all of the immature Minnesota No. 13 harvested December 9 was so bad that much of it was discarded in the field. On this account it is hardly fair to compare what was left with the other samples.

At the time of harvest the moisture content of the corn harvested from shocks was greater than that harvested from standing stalks. The germination was less, except in the case of the mature Minnesota No. 13. In general, the standing corn, December 9, shows a better condition than the shocked corn.

The average moisture content of the samples after storage shows very little difference due to time of harvest. This difference is in favor of the later harvest. However, there is considerable difference in the germination. This difference is in favor of the earlier harvest, with the exception of the standing immature Minnesota No. 23. There was a decided increase in the case of this lot. This was probably due to the increased maturity while standing. The shocked corn shows practically the same moisture content as the standing. However, its germination was lower, with the exception of the immature Minnesota No. 13, which may be disregarded.

TABLE II - MOISTURE CONTENT AND GERMINATION OF CORN AS AFFECTED BY VARIETY AND MATURITY

A. Mature Minnesota #13.

MOISTURE CONTENT

GERMINATION

	At time of harvest.		After storage								At time of harvest	After storage			
	grain	cob	In sack		In box		On rack		On shelf			sack	In box	On rack	On shelf
Harvested from stalks October 26	31.7	44.6	14.1	14.8	14.0	12.6	13.2	10.5	13.0	11.6	97.4	93.0	97.5	99.5	95.5
			18.5	19.8	16.4	16.2	13.6	11.0	13.6	10.8		91.5	97.5	98.0	99.5
			12.0	10.1	10.6	9.7	10.4	9.3	10.3	9.9		96.0	98.5	99.5	99.5
			12.3	10.5	11.6	11.2	11.4	10.6	----	----		96.0	100.0	99.5	----
Harvested from stalks December 9	22.5	34.5	15.6	15.8	14.5	14.0	12.5	10.4	13.3	12.0	98.5	91.0	97.5	99.5	100.0
			18.9	20.1	16.1	15.3	14.5	14.0	14.4	14.0		88.0	90.0	97.5	97.5
			11.4	10.1	----	----	9.2	9.0	----	----		93.0	----	100.0	----
			11.9	10.2	11.6	10.2	11.2	10.0	----	----		96.0	99.0	99.5	----
Harvested from shocks December 9	24.4	39.0	15.3	16.4	----	----	13.0	11.2	13.2	10.8	98.0	82.5	----	99.0	97.0
			17.9	18.4	15.2	15.2	13.2	13.2	13.8	13.0		83.5	83.5	95.2	96.0
			11.4	9.5	10.8	9.3	10.4	9.6	10.3	9.2		96.5	97.5	98.0	98.0
			12.6	10.8	----	----	10.5	9.8	----	----		95.5	----	100.0	----
Average	26.7	39.4	14.3	13.9	13.4	12.6	11.9	10.7	12.7	11.4	98.0	91.9	95.7	98.8	97.9

B. Mature Minnesota #23

Harvested from stalks October 26.	26.1	37.6	15.8	15.6	15.0	13.5	13.2	-----	13.3	11.3	99.4	93.5	91.0	99.5	94.0
			15.2	17.4	16.0	16.2	14.5	11.2	13.8	11.6		96.5	91.5	98.0	85.5
			11.5	10.3	10.8	10.0	10.6	9.9	10.3	10.0		97.5	99.5	98.0	98.0
			12.0	10.4	12.0	10.4	11.9	10.3	-----	-----		99.0	92.5	99.5	-----
Harvested from stalks December 9	25.4	41.2	15.8	18.0	14.3	13.2	13.1	11.4	14.9	12.0	99.5	69.5	83.0	98.5	99.0
			18.0	18.9	16.2	16.1	13.8	13.0	13.8	13.0		83.0	88.0	95.5	98.0
			10.6	9.6	10.4	9.8	9.3	9.3	9.6	9.5		84.5	98.0	98.0	97.5
			12.5	10.4	11.6	10.2	11.0	10.0	-----	-----		88.5	96.5	96.0	-----
Harvested from shocks December 9	25.8	40.4	16.7	19.2	15.1	14.0	12.6	10.0	13.7	12.0	98.0	74.5	80.0	99.5	72.0
			18.6	19.5	15.3	15.0	14.0	12.0	14.1	12.4		76.0	79.0	94.0	89.5
			11.0	10.2	10.9	9.8	10.6	9.6	10.6	9.6		96.0	96.5	98.0	97.5
			12.3	10.4	11.6	10.2	11.0	10.0	-----	-----		95.0	97.0	98.5	-----
Average	25.8	39.7	14.1	14.2	13.3	12.4	12.1	10.6	12.7	11.3	99.0	90.0	91.0	97.8	94.6

TABLE II - MOISTURE CONTENT AND GERMINATION OF CORN AS AFFECTED BY VARIETY AND MATURITY

C. Immature Minnesota # 23.

	M O I S T U R E C O N T E N T										G E R M I N A T I O N				
	At time		After storage								At time		In		
	of harvest		In sack		In box		On rack		On shelf		of harvest	sack	In box	On rack	On shelf
	grain	cob	grain	cob	grain	cob	grain	cob	grain	cob					
Harvested from stalks	31.8	45.1	18.9	20.4	15.0	12.6	13.2	11.5	13.7	12.0	97.2	79.0	78.5	99.5	98.0
October 26			19.2	20.8	18.1	20.6	14.8	13.3	14.4	13.0		80.5	80.5	98.0	100.0
			11.2	9.8	11.7	9.6	10.4	9.2	10.5	9.9		92.0	100.0	99.5	99.5
			12.2	10.0	----	----	11.6	9.5	----	----		92.0	----	99.0	----
Harvested from stalks	28.0	44.2	17.2	21.4	16.5	16.0	13.8	11.0	14.0	11.2	97.5	90.5	92.0	97.5	88.0
December 9			18.2	19.0	14.8	14.0	13.7	12.6	14.5	13.1		85.5	92.0	99.2	99.5
			10.8	9.4	11.5	9.5	10.2	9.0	10.6	9.3		98.0	100.0	100.0	100.0
			12.2	10.4	13.0	11.4	12.3	10.6	----	----		96.5	97.5	99.5	----
Harvested from shocks	30.9	51.4	18.0	16.5	17.6	15.4	13.0	10.0	14.6	11.2	97.0	61.5	70.0	99.0	51.0
December 9			21.1	22.5	15.1	14.0	13.3	13.2	14.3	13.1		64.0	76.0	94.0	80.0
			12.3	10.6	10.5	10.3	11.0	10.0	10.7	9.1		91.0	97.0	100.0	99.0
			12.6	10.5	12.2	10.8	11.9	10.3	----	----		98.0	98.0	98.5	----
Average	30.2	46.9	15.3	15.1	14.2	13.1	12.4	10.8	13.0	11.3	97.2	85.7	89.2	98.6	90.6

D. Immature Minnesota # 13.

Harvested from stalks	37.8	49.8	18.9	23.2	15.4	15.2	13.3	11.4	13.5	11.0	97.0	64.0	83.5	95.5	92.0
October 26			19.0	20.5	18.7	18.0	14.4	12.4	14.8	12.4		81.5	84.5	99.0	93.0
			12.1	10.2	12.0	10.0	10.5	9.3	10.8	10.0		91.0	97.0	100.0	99.0
			12.0	10.3	11.6	9.6	11.4	10.1	-----	-----		97.5	97.0	99.0	-----
Harvested from stalks	31.8	46.9	20.5	25.6	-----	-----	13.1	11.4	15.5	12.6	97.0	80.5	-----	92.0	77.5
December 9			18.9	19.8	-----	-----	12.2	10.6	14.6	14.0		71.0	-----	96.0	86.5
			12.6	10.5	11.0	9.9	10.6	9.7	10.7	9.8		90.5	99.0	99.0	97.5
			12.5	10.6	11.0	10.0	11.0	10.0	-----	-----		88.0	99.0	99.5	-----
Harvested from shocks	32.1	52.6	21.3	25.8	-----	-----	13.3	10.0	13.4	10.8	96.0	70.5	-----	97.5	91.5
December 9			16.0	19.0	-----	-----	14.2	11.6	14.2	12.9		76.0	-----	98.0	82.0
			12.6	10.5	-----	-----	11.0	10.2	11.1	10.2		90.5	-----	98.5	99.0
			12.9	10.8	-----	-----	11.8	10.3	-----	-----		93.0	-----	99.0	-----
Average	33.9	49.8	15.8	16.4	14.6	12.1	12.2	10.6	13.2	11.5	96.7	82.8	93.3	97.8	90.9

E. Summary.

	25.8	39.7	14.1	14.2	13.3	12.4	12.1	10.6	12.7	11.3	99.0	90.0	91.0	97.8	94.6
	26.7	39.4	14.3	13.9	13.4	12.6	11.9	10.7	12.7	11.4	98.0	91.9	95.7	98.8	97.9
	30.2	46.9	15.3	15.1	14.2	13.1	12.4	10.8	13.0	11.3	97.2	85.7	89.2	98.6	90.6
	33.9	49.8	15.8	16.4	14.6	12.1	12.2	10.6	13.2	11.5	96.7	82.8	93.3	97.8	90.9
Average	32.4	46.4	14.9	14.9	13.7	12.6	12.1	10.7	12.9	11.4	97.7	87.6	92.0	98.3	93.5

Variety

In Table II, all of the samples of mature Minnesota No. 13 are grouped under "A", those of mature Minnesota No. 23 under "B", those of immature Minnesota No. 23 under "C", those of immature Minnesota No. 13 under "D", and an average of each group of results in a summary---"E".

The results in this table indicate no constant relation between moisture content and variety. The water content of the Minnesota No. 23 is higher than that of the Minnesota No. 13 in some cases and lower in others, both before and after storage. The mature Minnesota No. 23 shows an equal or higher germination than the Minnesota No. 13 at the time of harvest, but after storage the reverse is true. The immature Minnesota No. 23 shows a higher germination than the immature Minnesota No. 13 at the time of harvest and in two cases out of four after storage. On account of the heavy discard of immature Minnesota No. 13 in the field at the time of harvest, as before mentioned, it is hardly fair to use it in comparisons. No variety influence on the relation between moisture content and germination is indicated.

Maturity

The results in Table II show that at the time of harvest maturity is indicated by relatively low moisture content and high germination, and that immaturity is accompanied by high moisture content and relatively low germination. This relation, in gen-

TABLE III - MOISTURE CONTENT AND GERMINATION OF CORN AS AFFECTED BY STORAGE IN DIFFERENT PLACES.

A. Stored in a barn.

	M O I S T U R E C O N T E N T										G E R M I N A T I O N				
	At time										At time		In		
	of harvest		After Storing								of harvest	sack	In box	On rack	On shelf
	grain	cob	grain	cob	grain	cob	grain	cob	grain	cob			A f t e r S t o r i n g		
Min. #23 Mature	26.1	37.6	15.2	17.4	16.0	16.2	14.5	11.2	13.8	11.6	99.4	96.5	91.5	98.0	85.5
"	25.4	41.2	18.0	18.9	16.2	16.1	13.8	13.0	13.8	13.0	99.5	83.0	88.0	95.5	98.0
"	25.8	40.4	18.6	19.5	14.5	15.0	14.0	12.0	14.1	12.4	98.0	76.0	79.0	94.0	89.5
Min. #23 Immature	31.8	45.1	19.2	20.8	18.1	20.6	14.8	13.3	14.4	13.0	97.2	80.5	80.5	98.0	100.0
"	28.0	44.2	18.2	19.0	14.8	14.0	13.7	12.6	14.5	13.1	97.5	85.5	92.0	99.2	99.5
"	30.9	51.4	21.1	22.5	15.1	14.0	13.3	13.2	14.3	13.1	97.0	64.0	76.0	94.0	80.0
Min. #13 Mature	31.7	44.6	18.5	19.8	16.4	16.2	13.6	11.0	13.6	10.8	97.4	91.5	97.5	98.0	99.5
"	22.5	34.5	18.9	20.1	16.1	15.3	14.5	14.0	14.4	14.0	98.5	88.0	90.0	97.5	97.5
"	24.4	39.0	17.9	18.4	15.2	15.2	13.2	13.2	13.8	13.0	98.0	83.5	83.5	95.2	96.0
Min. #13 Immature	37.8	49.8	19.0	20.5	18.7	18.0	14.4	12.4	14.8	12.4	97.0	81.5	84.5	99.0	93.0
"	31.8	46.9	18.9	19.8	-----	-----	12.2	10.6	14.6	14.0	97.0	71.0	-----	96.0	86.5
"	32.1	52.6	16.0	19.0	-----	-----	14.2	11.6	14.2	12.9	96.0	76.0	-----	98.0	82.0
Average	29.0	43.9	18.3	19.6	16.2	16.1	13.8	12.3	14.2	12.8	97.7	81.4	86.3	96.9	92.3

B. Stored in a barn loft.

Min. #23 Mature	26.1	37.6	15.8	15.6	15.0	13.5	13.2	-----	13.3	11.3	99.4	93.5	91.0	99.5	94.0
"	25.4	41.2	15.8	18.0	14.3	13.2	13.1	11.4	14.9	12.0	99.5	69.5	83.0	98.5	99.0
"	25.8	40.4	16.7	19.2	15.1	14.0	12.6	10.0	13.7	12.0	98.0	74.5	80.0	99.5	72.0
Min. #23 Immature	31.8	45.1	18.9	20.4	15.0	12.6	13.2	11.5	13.7	12.0	97.2	79.0	78.5	99.5	98.0
"	28.0	44.2	17.2	21.4	16.5	16.0	13.8	11.0	14.0	11.2	97.5	90.5	92.0	97.5	88.0
"	30.9	51.4	18.0	16.5	17.6	15.4	13.0	10.0	14.6	11.2	97.0	61.5	70.0	99.0	51.0
Min. #13 Mature	31.7	44.6	14.1	14.8	14.0	12.6	13.2	10.5	13.0	11.6	97.4	93.0	97.5	99.5	95.5
"	22.5	34.5	15.6	15.8	14.5	14.0	12.5	10.4	13.3	12.0	98.5	91.0	97.5	99.5	100.0
"	24.4	39.0	15.3	16.4	-----	-----	13.0	11.2	13.2	10.8	98.0	82.5	-----	99.0	97.0
Min. #13 Immature	37.8	49.8	18.9	23.2	15.4	15.2	13.3	11.4	13.5	11.0	97.0	64.0	83.5	95.5	92.0
"	31.8	46.9	20.5	25.6	-----	-----	13.1	11.4	15.5	12.6	97.0	80.5	-----	92.0	77.5
"	32.1	52.6	21.3	25.8	-----	-----	13.3	10.0	13.4	10.8	96.0	70.5	-----	97.5	91.5
Average	29.0	43.9	17.3	19.4	15.3	14.1	13.1	10.8	13.8	11.5	97.7	79.2	85.9	98.0	87.8

TABLE III - MOISTURE CONTENT AND GERMINATION OF CORN AS AFFECTED BY STORAGE IN DIFFERENT PLACES.

C. Stored in a basement.

M O I S T U R E C O N T E N T										G E R M I N A T I O N					
After storing										After Storing					
At time of harvest		In sack		In box		On rack		On shelf		At time of harvest		In sack	In box	On rack	On shelf
Grain cob		Grain cob		Grain cob		Grain cob		Grain cob		Grain cob		Grain cob		Grain cob	
Min. #23 Mature	26.1	37.6	12.0	10.4	12.0	10.4	11.9	10.3		99.4	99.0	92.5	99.5		
"	25.4	41.2	12.5	10.4	12.2	10.8	11.8	10.2		99.5	85.5	96.5	96.0		
"	25.8	40.4	12.3	10.4	11.6	10.2	11.0	10.0		98.0	95.0	97.0	98.5		
Min. #23 Immature	31.8	45.1	12.2	10.0	----	----	11.6	9.5		97.2	92.0	----	99.0		
"	28.0	44.2	12.2	10.4	13.0	11.4	12.3	10.6		97.5	96.5	97.5	99.5		
"	30.9	51.4	12.6	10.5	12.2	10.8	11.9	10.3		97.0	98.0	98.0	98.5		
Min. #13 Mature	31.7	44.6	12.3	10.5	11.6	11.2	11.4	10.6		97.4	96.0	100.0	99.5		
"	22.5	34.5	11.9	10.2	11.6	10.2	11.2	10.0		98.5	96.0	99.0	99.5		
"	24.4	39.0	12.6	10.8	----	----	10.5	9.8		98.0	95.5	----	100.0		
Min. #13 Immature	37.8	49.8	12.0	10.3	11.6	9.6	11.4	10.1		97.0	97.5	97.0	99.0		
"	31.8	46.9	12.5	10.6	11.0	10.0	11.0	10.0		97.0	88.0	99.0	99.5		
"	32.1	52.6	12.9	10.8	----	----	11.8	10.3		96.0	93.0	----	99.0		
Average	29.0	43.9	12.3	10.4	11.8	10.5	11.5	10.1		97.7	94.6	97.4	99.0		

D. Stored in Attic

Min. #23 Mature	26.1	37.6	11.5	10.3	10.8	10.0	10.6	9.9	10.3	10.0	99.4	97.5	99.5	98.0	98.0
"	25.4	41.2	10.6	9.6	10.4	9.8	9.3	9.3	99.6	99.5	99.5	84.5	98.0	98.0	97.5
"	25.8	40.4	11.0	10.2	10.9	9.8	10.6	9.6	10.6	9.6	98.0	96.0	96.5	98.0	97.5
Min. #23 Immature	31.8	45.1	11.2	9.8	11.7	9.6	10.4	9.2	10.5	9.9	97.2	92.0	100.0	99.5	99.5
"	28.0	44.2	10.8	9.4	11.5	9.5	10.2	9.0	10.6	9.3	97.5	98.0	100.0	100.0	100.0
"	30.9	51.4	12.3	10.6	10.5	10.3	11.0	10.0	10.7	9.1	97.0	99.5	99.0	96.5	100.0
Min. #13 Mature	31.7	44.6	12.0	10.1	10.6	9.7	10.4	9.3	10.3	9.9	97.4	96.0	98.5	99.5	99.5
"	22.5	34.5	11.4	10.1	----	----	9.2	9.0	----	----	98.5	93.0	----	100.0	----
"	24.4	39.0	11.4	9.5	10.8	9.3	10.4	9.6	10.3	9.2	98.0	96.5	97.5	98.0	98.0
Min. #13 Immature	37.8	49.8	12.1	10.2	12.0	10.0	10.5	9.3	10.8	10.0	97.0	91.0	97.0	100.0	99.0
"	31.8	46.9	12.6	10.5	11.0	9.9	10.6	9.7	10.7	9.8	97.0	90.5	99.0	99.0	97.5
"	32.1	52.6	12.6	10.5	----	----	11.0	10.2	11.1	10.2	96.0	90.5	----	98.5	99.0
Average	29.0	43.9	11.6	10.1	11.0	9.8	10.3	9.5	10.5	9.7	97.7	93.8	98.5	98.8	98.7

Summary for Table III.

Barn	29.0	43.9	19.3	19.6	16.2	16.1	13.8	12.3	14.2	12.8	97.7	81.4	86.3	96.9	92.3
Barn loft	29.0	43.9	17.3	19.4	15.3	14.1	13.1	10.8	13.8	11.5	97.7	79.2	85.9	98.0	87.8
Basement	29.0	43.9	12.3	10.4	11.8	10.5	11.5	10.1	----	----	97.7	94.6	97.4	99.0	----
Attic	29.0	43.9	11.6	10.1	11.0	9.8	10.3	9.5	10.5	9.7	97.7	93.8	98.5	98.8	98.7
Average	29.0	43.9	14.9	14.9	13.6	12.6	12.2	10.7	12.8	11.3	97.7	87.3	92.0	98.2	92.9

eral, still holds true after storage--with one exception, that of Minnesota No. 13 stored in boxes.

Place of Storage

In Table III, the samples stored in the barn, barn loft, basement, and attic, were grouped under these heads in the order in which they decrease in moisture content.

The results in this table indicate that both moisture content and germination after storage are affected by the place of storing. In this experiment, the moisture content of the samples stored in the barn was only slightly higher than that of the barn loft samples. The moisture content of the basement samples was slightly higher than that of those stored in the attic. Both of the latter had considerably less moisture than either of the first two.

In general, the samples having the highest moisture content had the lowest germination. This inverse variation between moisture content and germination, however, did not hold in the case of the barn and barn loft samples, the barn samples having a higher moisture content and also a higher germination.

Method of Storage

The data in Table IV are arranged according to the method by which the samples were stored. Those stored in sacks are grouped in "A", those in boxes in "B", those on shelves in "C",

TABLE IV - MOISTURE CONTENT AND GERMINATION OF CORN AS AFFECTED BY METHOD OF STORAGE

A. Stored in Sacks

Variety	MOISTURE CONTENT										At time of harvest	In barnloft	GERMINATION		
	At time of harvest		After storing										After storing		
			In barnloft		In barn		In attic		In basement				In barn	In attic	In basement
	grain	cob	grain	cob	grain	cob	grain	cob	grain	cob					
Min.#23 Mature	26.1	37.6	15.8	15.6	15.2	17.4	11.5	10.3	12.0	10.4	99.4	93.5	96.5	97.5	99.0
"	25.4	41.2	15.8	18.0	18.0	18.9	10.6	9.6	12.5	10.4	99.5	69.5	83.0	84.5	88.5
"	25.8	40.4	16.7	19.2	18.6	19.5	11.0	10.2	12.3	10.4	98.0	74.5	76.0	96.0	95.0
Min.#23 Immature	31.8	45.1	18.9	20.4	19.2	20.8	11.2	9.8	12.2	10.0	97.2	79.0	80.5	92.0	92.0
"	28.0	44.2	17.2	21.4	18.2	19.0	10.8	9.4	12.2	10.4	97.5	90.5	85.5	98.0	96.5
"	30.9	51.4	18.0	16.5	21.1	22.5	12.3	10.6	12.6	10.5	97.0	61.5	64.0	99.5	98.0
Min.#13 Mature	31.7	44.6	14.1	14.8	18.5	19.8	12.0	10.1	12.3	10.5	97.4	93.0	91.5	96.0	96.0
"	22.5	34.5	15.6	15.8	18.9	20.1	11.4	10.1	11.9	10.2	98.5	91.0	88.0	93.0	96.0
"	24.4	39.0	15.3	16.4	17.9	18.4	11.4	9.5	12.6	10.8	98.0	82.5	83.5	96.5	95.5
Min.#13 Immature	37.8	49.8	18.9	23.2	19.0	20.5	12.1	10.2	12.0	10.3	97.0	64.0	81.5	91.0	97.5
"	31.8	46.9	20.5	25.6	18.9	19.8	12.6	10.5	12.5	10.6	97.0	80.5	71.0	90.5	88.0
"	32.1	52.6	21.3	25.8	16.0	19.0	12.6	10.5	12.9	10.8	96.0	70.5	76.0	90.5	93.0
Average	29.0	43.9	17.3	19.4	18.3	19.6	11.6	10.1	12.3	10.4	97.7	79.2	81.4	93.8	95.4

B. Stored in boxes.

Min.#23 Mature	26.1	37.6	15.0	13.5	16.0	16.2	10.8	10.0	12.0	10.4	99.4	91.0	91.5	99.5	92.5		
"	25.4	41.2	14.3	13.2	16.2	16.1	10.4	9.8	12.2	10.8	99.5	83.0	88.0	98.0	96.5		
"	25.8	40.4	15.1	14.0	15.3	15.0	10.9	9.8	11.6	10.2	98.0	80.0	79.0	96.5	97.0		
Min.#23 Immature	31.8	45.1	15.0	12.6	18.1	20.6	11.7	9.6	-----	-----	97.2	78.5	80.5	100.0	-----		
"	28.0	44.2	16.5	16.0	14.8	14.0	11.5	9.5	13.0	11.4	97.5	92.0	92.0	100.0	97.5		
"	30.9	51.4	17.6	15.4	15.1	14.0	10.5	10.3	12.2	10.8	97.0	70.0	76.0	99.0	98.0		
Min.#13 Mature	31.7	44.6	14.0	12.6	16.4	16.2	10.6	9.7	11.6	11.2	97.4	97.5	97.5	98.5	100.0		
"	22.5	34.5	14.5	14.0	16.1	15.3	-----	-----	11.6	10.2	98.5	97.5	90.0	-----	99.0		
"	24.4	39.0	-----	-----	15.2	15.2	10.8	9.3	-----	-----	98.0	-----	83.5	97.5	-----		
Min.#13 Immature	37.8	49.8	15.4	15.2	18.7	18.0	12.0	10.0	11.6	9.6	97.0	83.5	84.5	97.0	97.0		
"	31.8	46.9	-----	-----	-----	-----	11.0	9.9	11.0	10.0	97.0	-----	-----	99.0	99.0		
"	32.1	52.6	-----	-----	-----	-----	-----	-----	-----	-----	96.0	-----	-----	-----	-----		
Average	29.0	43.9	15.3	14.1	16.2	16.1	11.0	9.8	11.9	10.5	97.7	85.9	86.3	98.5	97.4		

TABLE IV - MOISTURE CONTENT AND GERMINATION OF CORN AS AFFECTED BY METHOD OF STORAGE

C. Stored on shelves

M O I S T U R E C O N T E N T										G E R M I N A T I O N										
Variety	After Storing									After Storing										
	At time		In barnloft		In barn		In attic		In basement		At time		In barn-		In		In attic		In base-	
	of harvest	grain cob	grain cob	grain cob	grain cob	grain cob	grain cob	grain cob	grain cob	of harvest	loft	barn	barn	barn	attic	ment.				
Min.#23 Mature	26.1	37.6	13.3	11.3	13.8	11.6	10.3	10.0		99.4	94.0	85.5	98.0							
"	25.4	41.2	14.9	12.0	13.8	13.0	9.6	9.5		99.5	99.0	98.0	97.5							
"	25.8	40.4	13.7	12.0	14.1	12.4	10.6	9.6		98.0	72.0	89.5	97.5							
Min.#23 Immature	31.8	45.1	13.7	12.0	14.4	13.0	10.5	9.9		97.2	98.0	100.0	99.5							
"	28.0	44.2	14.0	11.2	14.5	13.1	10.6	9.3		97.5	88.0	99.5	100.0							
"	30.9	51.4	14.6	11.2	14.3	13.1	10.7	9.1		97.0	51.0	80.0	100.0							
Min.#13 Mature	31.7	44.6	13.0	11.6	13.6	10.8	10.3	9.9		97.4	95.5	99.5	99.5							
"	22.5	34.5	13.3	12.0	14.4	14.0	----	----		98.5	100.0	97.5	----							
"	24.4	39.0	13.2	10.8	13.8	13.0	10.3	9.2		98.0	97.0	96.0	98.0							
Min.#13 Immature	37.8	49.8	13.5	11.0	14.8	12.4	10.8	10.0		97.0	92.0	93.0	99.0							
"	31.8	46.9	15.5	12.6	14.6	14.0	10.7	9.8		97.0	77.5	86.5	97.5							
"	32.1	52.6	13.4	10.8	14.2	12.9	11.1	10.2		96.0	91.5	82.0	99.0							
Average	29.0	43.9	13.8	11.5	14.2	12.8	10.5	9.7		97.7	88.7	92.3	98.7							

D. Stored on racks

Min.#23 Mature	26.1	37.6	13.2	-----	14.5	11.2	10.6	9.9	11.9	10.3	99.4	99.5	98.0	98.0	99.5	
"	25.4	41.2	13.1	11.4	13.8	13.0	9.3	9.3	11.8	10.2	99.5	98.5	95.5	98.0	96.0	
"	25.8	40.4	12.6	10.0	14.0	12.0	10.6	9.6	11.0	10.0	98.0	99.5	94.0	98.0	98.5	
Min.#23 Immature	31.8	45.1	13.2	11.5	14.8	13.3	10.4	9.2	11.6	9.5	97.2	99.5	98.0	99.5	99.0	
"	28.0	44.2	13.8	11.0	13.7	12.6	10.2	9.0	12.3	10.6	97.5	97.5	99.2	100.0	99.5	
"	30.9	51.4	13.0	10.0	13.3	13.2	11.0	10.0	11.9	10.3	97.0	99.0	94.0	96.5	98.5	
Min.#13 Mature	31.7	44.6	13.2	10.5	13.6	11.0	10.4	9.3	11.4	10.6	97.4	99.5	98.0	99.5	99.5	
"	22.5	34.5	12.5	10.4	14.5	14.0	9.2	9.0	11.2	10.0	98.5	99.5	97.5	100.0	99.5	
"	24.4	39.0	13.0	11.2	13.2	13.2	10.4	9.6	10.5	9.8	98.0	99.0	95.2	98.0	100.0	
Min.#13 Immature	37.8	49.8	13.3	11.4	14.4	12.4	10.5	9.3	11.4	10.1	97.0	95.5	99.0	100.0	99.0	
"	31.8	46.9	13.1	11.4	12.2	10.6	10.6	9.7	11.0	10.0	97.0	92.0	96.0	99.0	99.5	
"	32.1	52.6	13.3	10.0	14.2	11.6	11.0	10.2	11.8	10.3	96.0	97.5	98.0	98.5	99.0	
Average	29.0	43.9	13.1	10.8	13.9	12.3	10.3	9.5	11.5	10.1	97.7	98.0	96.9	98.8	99.0	

E. Summary.

Sack	29.0	43.9	17.3	19.4	18.3	19.6	11.6	10.1	12.3	10.4	97.7	79.2	81.4	93.8	95.4	
Box	29.0	43.9	15.3	14.1	16.2	16.1	11.0	9.8	11.9	10.5	97.7	85.9	86.3	98.5	97.4	
Shelf	29.0	43.9	13.8	11.5	14.2	12.8	10.5	9.7	-----	-----	97.7	88.7	92.3	98.7	-----	
Rack	29.0	43.9	13.1	10.8	15.4	12.3	10.3	9.5	11.5	10.1	97.7	98.0	96.9	98.8	99.0	
Average	29.0	43.9	15.2	13.7	15.6	15.2	10.8	9.8	11.9	10.3	97.7	88.1	93.4	97.5	97.2	

and those on racks in "D". The moisture content decreased in the order given, and the germination increased in the same order. This data in this table show in all cases an inverse variation between moisture content and germination.

Moisture Content of Grain and Cob Compared

At the time of harvest, the average moisture content of the cob was 14.9 per cent higher than that of the grain. At the end of the storage period, it contained, on the average, 1 per cent less water than the grain.

Mold

The comparisons made between samples stored in different places by the various methods are not fair in all cases, many of the samples being very moldy. This moldiness was not fully indicated by either moisture content or germination. In future work, it may be possible to show the relative amount of mold by finding out whether or not the actual loss in weight of the different samples corresponds to their loss of water.

Summary

The results of the experiments described in this report may be briefly summarized as follows:

- (1) In general, there is an inverse variation between the

TABLE V - SUMMARY OF RESULTS.

Description	AVERAGE MOISTURE CONTENT				AVERAGE GERMINATION	
	At time of harvest		After storing		At time of harvest	After storing
	grain	cob	grain	cob		
Harvested from stalks Oct. 26	31.8	44.3	13.5	12.2	97.8	92.7
Harvested from stalks Dec. 9	26.9	41.7	13.4	12.5	98.0	93.2
Harvested from shocks Dec. 9	28.3	45.9	13.4	12.4	97.6	89.7
Minnesota #23 Mature	25.8	39.7	13.1	12.2	99.0	92.2
Minnesota #13 Mature	26.7	39.4	13.1	12.2	98.0	95.9
Minnesota #23 Immature	30.2	46.9	13.8	12.7	97.2	91.3
Minnesota #13 Immature	33.9	49.8	13.7	12.8	96.7	90.6
Stored in barn loft	29.0	43.9	15.2	13.7	97.7	88.1
Stored in barn	29.0	43.9	15.2	15.2	97.7	93.4
Stored in basement	29.0	43.9	11.9	10.3	97.7	97.2
Stored in attic	29.0	43.9	10.2	9.8	97.7	97.5
Stored in sacks	29.0	43.9	14.9	14.9	97.7	87.3
Stored in boxes	29.0	43.9	13.6	12.6	97.7	92.0
Stored on shelves	29.0	43.9	12.8	11.3	97.7	92.9
Stored on racks	29.0	43.9	12.2	10.7	97.7	98.2
Average of all samples	29.0	43.9	13.4	12.4	97.7	92.5

moisture content of corn and its germination--a low moisture content going with high germination, and vice versa. This holds for both grain and cob.

(2) The moisture content of corn in the field was lower and the germination higher December 9 than it was October 26. In general, the standing corn, December 9, showed a better condition than the shocked corn.

(3) The average moisture content of the samples after storage shows very little difference due to time of harvest. This difference is slightly in favor of the later harvest. The difference in germination, however, is in favor of the earlier harvest. The shocked corn showed practically the same moisture content after storage as the standing, but its germination was considerably less.

(4) No constant relation between moisture content and variety was noted after storage, though at the time of harvest the Minnesota No. 23 contained less water. It also had a slightly higher germination at the time of harvest.

(5) Maturity at the time of harvest is indicated by comparatively low moisture content and high germination. In general, this relation holds true after storage.

(6) The samples stored in dry, well ventilated places had a lower moisture content and higher germination than those stored in places where the ventilation was not so good.

(7) Corn stored on studded racks that allowed free circulation all about the ears had the lowest moisture content after stor-

age. The germination of these samples was higher than at the time of harvest.

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