ECOLOGICAL AND PHYSIOLOGICAL STUDIES ON THE BLOOMING OF OAT FLOWERS

By

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(With 1 Plate and 1 Text-figure)

CONTENTS

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Introduction

Ecological and physiological studies on the blooming of cereals are very valuable and interesting problems for plant breeding and crop science from both practical and scientific points of view. RIMPAU (1882), KÖRNICKE (1885), FRUWIRTH (1905), NOWACKI (1911) and others have studied on the blooming of oats. According to the results of their studies, blooming occurs in the afternoon unlike other cereals. They, however, differ in their opinions concerning the time of the day when blooming begins to take place. This is generally considered to be due to the fact that the external conditions differ according to the time and place of observation.

According to the writer's observation there is a marked difference each day in the time of blooming even at the same place and on certain days no blooming takes place at all even during the blooming period. This is generally thought to be probably due to the fact that environmental conditions differ each day, but there seems to be no definite opinion as to what the most important factor among the external conditions is, and also as to what significance the factor has on the physiology of blooming.

The writer carried out experiments upon these problems during the past few years and in the present work wishes to show the exact

relation between blooming and external conditions and also the significance of the factor with respect to the physiology of blooming.

I. Observation on the Blooming of Oat Flowers

1. Material and Methods

The plants on which most of the observations were made were those grown 1927, 1928, 1929 in the experimental farm of the College of Agriculture, Hokkaido Imperial University. The variety used was Clydesdale (*Avena sativa* L.). In this variety the spikelets are arranged in a panicle, in which the number of whorls ranges from four to nine, mostly five or six, the number of spikelets in a panicle being nearly 60. The spiklet consists of two or three florets and is covered with inner and outer glumes of thin membrane. Each floret has a lemma and a palet in which are contained a pistil and three stamens. The pistil is made up of a single ovary and two styles, the ends of which look like feathers. At the base of the ovary there is a pair of lodicules inside the lemma. When the flower has developed and the time of blooming comes, the lemma and palet open, making a certain angle. The filament elongates out of the lemma and palet, the anther scatters pollen and at the same time the stigma reaches the stage ready to receive pollen. This is the blooming process of oats.

In order to facilitate close observations on the order of blooming of a panicle, it was fixed on a wire gauge frame. The seeds were sown at three different periods so as to be able to make observations on the blooming for the longer period (from the end of June to the middle of October).

When the flowers began to bloom, their number was recorded every 15 minutes. The lemma of those flowers which had bloomed were cut off in order to distinguish them from those which bloomed later. Both temperature and humidity were measured by means of a psychrometer which was hung in a shelter situated in the experimental farm, and the computation of humidity was made according to Nakagawa's[28] appended Table VIII. The other meteorological data, such as rainfall, velocity of wind, hours of sunshine, etc., used in this study were procured from the Sapporo Weather Station.

2. Order and Duration of Blooming

Akemine[1] studied in detail on the order and duration of the

blooming of rice, and later a number of investigators (ISO,[9] LAUDE,[18] YAMAGUCHI[41] and JONES[11]) made similar observations on the same plant. KÖRNICKE,[16] FRUWIRTH,[5] LEIGHTY,[17] PERCIVAL[35] and OBERMAYER[34] studied on wheat, FRUWIRTH[5] and KÖRNICKE[16] on barely, and TSCHERMAK,[38] OBERMAYER,[34] KÖRNICKE[16] and FRUWIRTH[5] on rye. Very few studies have been made on oats and the reports made by KÖRNICKE[16] and FRUWIRTH[4&5] seem to be the only ones. The writer observed the blooming of oats, the order and duration of blooming.

Order and duration of blooming of flowers on a single plant of oats

Of the order of blooming of oat plants, FRUWIRTH[4] reported that blooming commences with the panicle of the main stem and goes to the tillers. Of rice AKEMINE[1] states that the one which begins to bloom first of the whole plant is the head of the main stem, but that when the head of the stooling stem emerges from the sheath at the same time with that of the main stem no difference in the speed of the blooming is recognized. The writer chose 2 plants and observations were made on each plant, the results being as shown in Table 1.

TABLE 1. *Order and duration of blooming of flowers on a single plant of oats in 1926*

Plant no.	Stem no.	The time when tke panicle emerges from the sheath		Time of blooming		The days required to complete the blooming	
		beginning	end	beginning	end	panicle	plant
I	1st	July 9 10 a.m.	July 14 5 p.m.	July 11	July 19	9 days	29 days
	2nd	„ 12 1 p.m.	„ 17 3 p.m.	„ 15	„ 23	9 „	
	3rd	„ 14 6 p.m.	„ 21 5 a.m.	„ 16	„ 25	10 „	
	4th	„ 18 7 p.m.	„ 25 4 a.m.	„ 21	„ 28	8 „	
	5th	„ 19 6 p.m.	„ 26 8 a.m.	„ 21	„ 29	9 „	
	6th	„ 28 7 p.m.	Aug. 3 3 p.m.	„ 30	Aug. 5	7 „	
	7th	„ 31 5 p.m.	„ 6 6 p.m.	Aug. 3	„ 8	6 „	
	8th	Aug. 5 4 p.m.	„ 11 3 p.m.	„ 8	„ ?	?	
II	1st	July 7 8 a.m.	July 13 9 a.m.	July 9	July 17	9 days	31 days
	2nd	„ 11 2 p.m.	„ 16 5 p.m.	„ 13	„ 22	10 „	
	3rd	„ 12 5 p.m.	„ 19 1 p.m.	„ 15	„ 24	10 „	
	4th	„ 20 9 a.m.	„ 26 9 a.m.	„ 22	„ 28	7 „	
	5th	„ 20 5 p.m.	„ 26 7 a.m.	„ 22	„ 29	9 „	
	6th	„ 28 7 a.m.	Aug. 2 5 p.m.	„ 29	Aug. 4	7 „	
	7th	Aug. 1 3 p.m.	„ 6 9 a.m.	Aug. 2	„ 7	6 „	
	8th	„ 4 10 a.m.	„ 9 12 p.m.	„ 5	„ 7	4 „	
	9th	„ 5 6 p.m.	„ 11 2 p.m.	„ 8	„ 11	4 „	
	10th	„ 6 10 a.m.	„ 11 6 p.m.	?	?	?	

As shown in Table 1, on each of the two plants the first flower to bloom is in the panicle of the main stem, the stooling stem following it, and blooming takes place according to the order of the emergence of the panicle from the sheath.

According to FRUWIRTH[5] it required from 11 to 14 days to complete the blooming of all the plants in the breeding nursery. It was noted by the writer to take from 29 to 31 days to complete the blooming of all panicles on a plant. In September 1927, it required over 40 days to complete the blooming of 30 plants and owing to low temperature many flowers remained unopen. But in the following summer (1928) when the blooming of 15 plants was observed it started on July 7 and was completed on July 19 requiring only 13 days. The days required for the whole plants to complete blooming, vary considerably according to the environmental conditions. The length of continuance of tillering is of course one of them, but the external conditions, especially temperature, have much to do with blooming. In a high temperature the blooming is completed in a short period of time while in low temperature a comparatively long period of time is required.

Order and Duration of Blooming of a Head

Regarding the order of blooming of the panicle, KÖRNICKE[16] states that blooming begins with the flower at the top of the panicle and extends downward.

The results of the writer's observations are similar to his as shown in Text Figure 1 and they may be itemized as follows:—

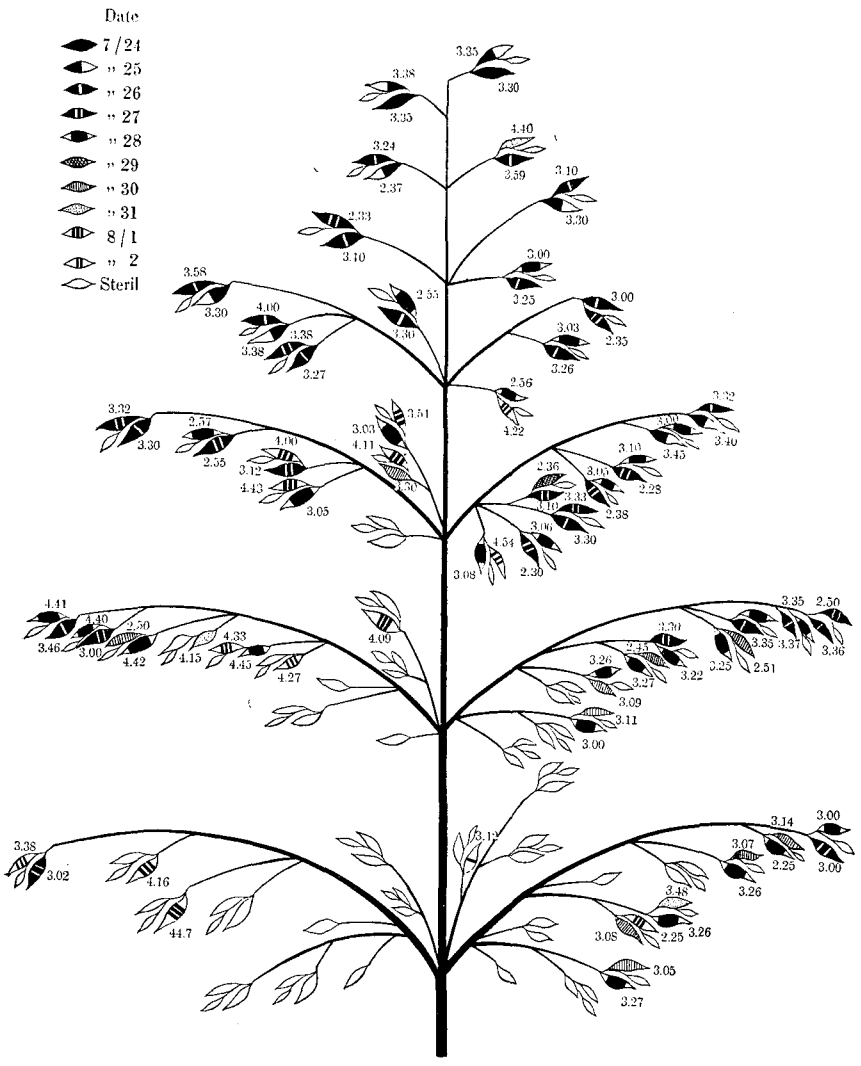
1:—The first flowers to open in the panicle are in the spikelet at the top of the main axis and the blooming goes on downwards, in the same order as reported by KÖRNICKE.

2:—When the same node has more than two branches, the flower in each branch opens according to the order of length. The flower on the longest branch blooms first and that on the shortest last.

3:—The order of blooming on a primary branch is similar to that in the panicle.

4:—The days required for completing the blooming of the entire panicle vary according to the external conditions, but when the conditions are favourable about 8 days are required.

5:—When there are more than two flowers in a spikelet, the lower flower opens first, then the second and the third in order. The intervals in the time of blooming of the first, the second and the third flower



Text-Figure I

Order of Blooming of Oats in 1926

vary according to the outside conditions. When the conditions are favourable the first and the second bloom almost at the same time, but when they are not so, the latter blooms two or three days after.

6:—According to the writer's observations in favourable weather, the time required from opening till closing of a flower was from about 50 minutes to an hour and a half. The majority required 60–80 minutes.

On the days when the hour of blooming was generally earlier they remain open a longer time, but on the days when the flowers bloomed later they closed in a short time.

TABLE 2. *Number of flowers opened in a single panicle and the time elapsing between the beginning and the end of blooming in the day in 1926*

Date	1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day	9th day	av.
Number of flowers opened.	6	10	15	19	3	3	2	14	7	8.8
Blooming time of the first flower. (P.M.)	3.00	2.55	2.21	2.57	2.25	3.10	3.43	2.44	3.00	
Blooming time of the last flower. (P.M.)	3.40	3.45	3.30	3.30	2.38	3.16	4.17	5.09	4.30	
Time elapsed between the beginning and end of blooming. (minutes)	40	50	69	33	13	6	34	145	90	53.3

7:—It should be noted in the blooming of oats that when the so-called blooming time comes, all plants in the whole field begin to bloom almost at the same time. When the blooming time has not come, blooming never takes place. The beginning and the end of the blooming of the day are clearly marked. Table 2 shows the time of the first blooming on the day, and that of the last blooming and the number of flowers opened on each day in a panicle.

As shown in Table 2, on the 6th day three flowers bloomed for only 6 minutes and on the 8th, 14 flowers required as long a duration as 145 minutes for blooming. That is, the average length of time in which the blooming took place was 53.3 minutes. The difference in the length of time is mainly due to the temperature changes, and on the day when the temperature rose to its highest point in the morning and then went

down, the length of time in which blooming occurred was short, but when the temperature which gradually rose went down gradually, it required a longer time.

3. Time of Blooming

According to the reports of observations made by Fruwirth, Godron, Hildebrand, Rimpau, Nowacki and Körnicke as to the blooming time of oat flowers they begin to open only in the afternoon, unlike rice, wheat, barley and rye which begin to open in the morning.

Tannert alone states that the oats bloom from 9 a.m. to 3 p.m. and recognizes the blooming in the morning. But many of the other workers state that the blooming takes place in the afternoon, although their opinions regarding the time differ from one another. Fruwirth states that the oat flowers begin to bloom between 2 and 3 p.m. and some open as late as at about 7 or 8 p.m. in the evening. Godron states that the blooming takes place between 2 and 4 p.m., Hildebrand between noon and sunset, and Rimpau that it begins at about 4 p.m. and the most intense blooming occurs between 5 and 6 in the evening. Nowacki states that the most intense blooming takes place between 3 and 4 p.m. and continues until about 8 p.m. in the evening. Körnicke states that some open intensely between 3 and 4 p.m. and some after 8 p.m. The writer also observed the time of blooming and reported the result of the observation in his previous papers.[19 & 20] Since then for three years (1927–28–29) the writer continued his observation. Before describing the result of these observations it seems necessary to the writer to limit the meaning of the "time of blooming" as mentioned in his work. As shown in the previous chapter, the beginning and the end of the blooming of oat flowers during the day are distinctly marked and until the time of blooming arrives, not a single flower opens, but as soon as the time does come, all the flowers in the field begin to bloom almost at the same time and ordinarily the blooming goes on for about an hour or so, but after that no blooming takes place at all. Therefore the beginning and the end of blooming are quite distinct and so the writer calls the time when the first flower of the experimental plants begins to bloom the time of blooming on that day.

From the results of observations made on the time and the number of flowers opened as shown in the appended tables, the days on which blooming took place at the same time, arranged in intervals of 15 minutes are collected in Table 3.

TABLE 3. *Time of blooming of oat flowers*

Time of blooming \ Year	Number of days			
	1927	1928	1929	Total
a.m.				
9.00	0	1	0	1
10.00	0	0	0	0
11.00	0	0	0	0
12.00	0	0	0	0
p.m.				
12.45	1	0	0	1
1.00	0	0	0	0
1.15	4	0	0	4
1.30	3	3	3	9
1.45	2	1	0	3
2.00	9	4	4	17
2.15	8	6	6	20
2.30	4	4	5	13
2.45	14	4	5	23
3.00	11	11	7	29
3.15	10	8	4	22
3.30	8	3	5	16
3.45	2	1	0	3
4.00	2	6	1	9
4.15	2	3	1	6
4.30	0	3	2	5
4.45	0	0	1	1
5.00	0	1	1	2
5.15	0	1	2	3
5.30	0	0	0	0
5.45	0	0	1	1
6.00	0	0	0	0
non-blooming days	15	13	15	43
Total	95	73	63	231

Of the results shown in Table 3, those of 1927 have already been reported. The whole number of days on which observation was made was 95, on 15 of which no blooming occurred. The earliest time of blooming on 80 days was between 12 m. and 12:45 p.m. and the latest was 4:15 p.m. The most intense blooming took place between 2 and 3 p.m. Further observations, however, showed that in 1928 no flowers bloomed on 13 days out of the 73 and on the remaining 60 days the

earliest flower opened at 9 a.m. This occurred only once during three years of observations and was an unique case. The next earliest one opened at 1:30 p.m. and the latest one at 5:15 p.m. Then in 1929, within 63 days of observation no blooming occurred on 15 days; the earliest flower during 48 days opened at 1:15 p.m. and the latest at 5:45 p.m. The maximum blooming was between 2 and 3:30 p.m. on most of these days. As shown above, the time of blooming of oat flowers varies much according to the day. These results indicate therefore that of 231 days on which observations were made no flower opened on 43 days.

4. Summary

1. The first flowers to open on oat plants are in the panicle on the primary stem and then those on the other tillering stems.

2. The days required to complete the blooming of all the panicles on a plant vary according to the climatic conditions, but range from 29 to 31 days. When temperature is high less days are required and when low, more days are required.

3. The first flowers to open in each panicle are in the spikelet at the top of the main axis.

4. The days required to complete the blooming of the entire panicle vary according to the external conditions, but under favourable conditions about 8 days are needed.

5. The blooming of oat flowers occurs within a certain period of time of the day which varies according to the climatic conditions. When the conditions are favourable it is shorter and when unfavourable it is longer and ordinarily it is about an hour in length.

6. The writer observed the blooming of oats under natural conditions on 231 days during 1927–1928–1929 and found that on 43 days out of them no blooming took place.

7. The time of blooming varies considerably according to the day, the earliest being 12:45 p.m. and the latest 5:45 p.m.

8. The blooming of oats in natural condition usually occurs in the afternoon, but of the 183 days on which flowers opened there was one day on which blooming took place at 9 a.m.

II. Ecological Studies on the Blooming of Oat Flowers

A. Relation between the blooming of oats and environmental factors

From observations on the blooming of oats, the writer found that there is a marked difference in the time of blooming during the day and also that on a number of days no blooming occurred at all. It can be easily considered that blooming is greatly influenced by the environmental factors. Therefore the writer made investigations on the relation between the environmental factors and blooming.

1. Relation between Blooming and Temperature

(i) Range of Temperature on the Days on which Blooming occurs and of the Temperature most suitable for Blooming

It has been believed that proper temperature is necessary for the blooming of cereals. A temperature higher or lower than certain degress hinders blooming, that is, blooming takes place only within a certain range of temperature. There exists, however, within this range an optimum temperature for the blooming of any cereals. In the present study, the writer has considered two kinds of temperature relations; the highest temperature of the day, and the temperature at the time when blooming occurs, because the blooming of oats takes place after the temperature has fallen from its highest point of the day and therefore that highest temperature plays an important part in the present study.

The highest temperature and the temperature at the time of blooming on each day of observation are shown in the appended tables. The maximum and minimum degrees of these temperatures and the temperature most suitable for blooming are picked out from those tables and are shown in Tables 4, 5 and 6.

As was already reported by the writer,[20] the highest temperature in 1927 was 16.8°–30.0°C. while the temperature at the time of blooming was 14.0°–29.4°C., but as shown in Table 4, during the three years (1927–28–29) of his observations the highest temperatures lay between 32.8° and 15°C. and the temperatures at the time of blooming were between 29.8°C. and 14°C. As shown in Table 5, the number of days on which the highest temperatures were between 27°C. and 29°C. is the largest, being 30.85% of the whole number of flowering days (188 days),

and the number of days on which the highest temperatures were 24°–26°C. and 21°–23°C. comes next, being 22.34% in the former and 23.94% in the latter.

As shown in Table 6, the number of days on which the temperatures at the time of blooming were between 24°C. and 26°C. is the largest, being 35.11% of all the flowering days, on 21.80% of the days the temperatures were 21°–23°C., on 18.08% of the days they were 18°–20°C. and on 18.62% of the days they were 27°–29°C. According the temperature suitable for blooming may be said to be 27°–29°C. as regards the highest temperature of the day and 24°–26°C. at the time of blooming.

TABLE 4. *Range of the highest temperature and temperature at time of blooming*

	1927	1928	1929
Highest temperature (C.)	30.0°—16.8°	32.8°—19.5°	32.6°—15.0°
Temperature at the time of blooming (C.)	29.4°—14.0°	29.2°—14.4°	29.8°—14.4°

TABLE 5. *Frequency distribution of the highest temperature on blooming days*

The highest temperature (°C.)	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°	31°	32°	Total
Year	Number of days																		
1927	0	1	2	0	2	5	9	7	13	6	7	5	8	7	7	1	0	0	89
1928	0	0	0	0	2	2	2	3	1	2	8	6	13	10	5	4	1	1	60
1929	1	2	2	1	3	1	5	4	1	2	0	6	3	1	4	3	5	4	48
Total	1	3	4	1	7	8	16	14	15	10	15	17	24	18	16	8	6	5	188
	8			16			45			42			58			19			188
%	4.26			8.51			23.94			22.34			30.85			10.11			100

TABLE 6. *Frequency distribution of temperature at time of blooming*

Temperature at the time of blooming (C.)	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	Total
Year	Number of days																
1927	0	1	3	1	2	4	10	8	10	8	9	3	10	9	2	0	80
1928	0	0	0	0	3	2	2	3	4	1	7	15	11	7	4	1	60
1929	1	1	2	3	4	4	3	2	4	1	3	3	5	3	4	5	48
Total	1	2	5	4	9	10	15	13	18	10	19	21	26	19	10	6	188
	12				34			41			66			35			188
%	6.38				18.08			21.80			35.11			18.62			100

(ii) Relation between Variation of Temperature and Blooming

a. Variation of temperature on blooming days

Temperature undergoes a continuous variation in the course of a day. The manner of its variation varies according to days and an exceedingly complicated variation can be experienced. Generally temperature is low at sunrise, then gradually it rises and the highest point is reached at about two o'clock in the afternoon and then it falls little by little.

The writer observed the variation of temperature at every 15 minute interval from 6 a.m. to 6 p.m. every day during his entire observations. He observed the variation of temperature on each of these days and also the flowering time of oats. These results are shown in the appended tables. The writer ascertained that there is an intimate relation between the variation of temperature and blooming and that blooming of oats occurs while the day's temperature is falling from its highest point. Scarcely any blooming takes place while the temperature is rising. Oats differ greatly in this respect from the flowering of many other cereals. The difference between the highest temperature and that at 8 a.m. and between the highest temperature and that at the time of blooming, and also the interval from the time of highest temperature to that when blooming begins to occur are shown in Tables 7, 8 and 9. As shown in Table 7, the difference between the highest temperature and that at 8 a.m. is 3°–5°C. in most cases and out of the 188 days of observation the same results were obtained on 99

TABLE 7. *Variation of difference between the highest temperature and the temperature at 8 a.m. on blooming days*

Difference of temperature (C.)	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	Total
Year	Number of days										
1927	1	4	7	14	12	14	9	11	4	4	80
1928	1	8	8	14	10	8	6	2	2	1	60
1929	0	2	6	6	9	12	7	2	3	1	48
Total	2	14	21	34	31	34	22	15	9	6	188
		37			99			46		6	188
%		19.68			52.66			24.47		3.19	100

TABLE 8. *Variation of difference between the highest temperature and the temperature at time of blooming*

Difference of temperature (C.)	Number of days			
	1927	1928	1929	Total
0.2°—0.5°	9	7	5	21
0.6—1.0	28	11	8	47
1.1—1.5	11	11	4	26
1.6—2.0	20	12	9	41
2.1—2.5	4	8	7	19
2.6—3.0	4	3	6	13
3.1—3.5	3	3	2	8
3.6—4.0	1	2	3	6
4.1—4.5	0	2	0	2
4.6—5.0	0	1	2	3
5.1—5.5	0	0	0	0
5.6—6.0	0	0	1	1
6.1—6.5	0	0	0	0
6.6—7.0	0	0	0	0
7.1—7.5	0	0	1	1
Total	80	60	48	188

days. There are, however, cases in which the difference in temperature is less than 2°C., but even then when compared with that before 8 a.m. a greater difference appears.

The difference between the highest temperature and that at the time of blooming (Table 8) is not uniform each day, the least being 0.2°C and the greatest 5°C. In a majority of cases the difference is from 0.6° to 2°C. The interval from the time of the highest temperature to that when blooming begins to occur, as shown in Table 9, varies each day. It requires from 30 minutes up to 4 hours, but in most cases the time required is from 1 to 2 hours.

TABLE 9. *Variation of intervals between the time of the highest temperature and that of blooming*

Year	1927	1928	1929	Total		%
The time elapsed (minutes)	Number of days					
15	1	0	0	1		
30	6	2	1	9	38	20.21
45	5	2	5	12		
60	9	6	1	16		
75	6	4	4	14		
90	11	3	0	14	56	29.79
105	5	3	4	12		
120	8	4	4	16		
135	6	4	4	14		
150	4	3	5	12	49	26.06
165	6	3	3	12		
180	7	3	1	11		
195	0	0	4	4		
210	2	6	1	9	26	13.83
225	3	6	1	10		
240	0	2	1	3		
255	0	4	2	6		
270	0	1	3	4	19	10.11
285	1	2	0	3		
300	0	2	4	6		
Total	80	60	48	188	188	100.00

b. Variation in temperature on days when no blooming takes place

The total number of days on which observations were made by the writer in the three years (1927–28–29) was 231 and on 43 days out of this number no blooming took place. On 10 days out of 43 the temperature was low and was out of the range of the highest temperatures of the days on which blooming took place. On the rest of the days it was within the range of the highest temperature of the day on which blooming occurred, but blooming did not take place. Of these days the highest temperature was 24.3°C. on August 31, 1928. But on a number of blooming days it was below that point as shown in Table 10. From the fact that the flower did not bloom even when the highest temperature of the day was within the range of the highest temperature of the blooming days, it may be considered that blooming is caused not only by the highest temperature, but by the influence of the variations of temperature before and after the time of the highest temperature or by other factors. The writer, therefore, investigated the variations in temperature on the days when no blooming occurred. The degrees of the fall of temperature after the time of the highest temperature and the difference between the highest temperature and that at 8 a.m. in the morning are shown in Table 10. The degree of the fall of temperature is indicated by the average of the difference between the highest temperature and the tempratures at the first the second and the third hour after the highest temperature.

As shown in Table 10, in the three years of observations the average fall in degrees during three hours after the highest temperature was 0.97°C., which was much less when compared with 1.37°C., averaged difference of temperature on blooming days. In some particular days the highest temperature was maintained till the evening or on other days it was observed towards evening. Next the variation during the forenoon, as shown in Table 10, differs on each day or in each year, but on an average, its difference is 2.71°C. when it is low and 3.88°C. when high, the average being 3.40°C. which is less than 5.55°C. the average difference of temperature on the days when blooming took place. From the above mentioned facts it will be seen that the variation of temperature on the non-blooming days is generally very slight when compared with that on blooming days.

TABLE 10. *Comparison of changes of temperature on blooming days on which the temperature is low and those on non-blooming days*

Non-blooming days								
Date	Highest temperature (C.)	Time of the highest temperature	Difference between the highest temperature and that at the 1st, 2nd and 3rd hours after the time of highest temperature				Temperature at 8 a.m. (C.)	Difference between the highest temperature and that at 8 a.m.
			1st hour	2nd hour	3rd hour	Average		
1927								
July 18	21.7°	1.30 p.m.	0.3°	0.7°	−0.1°	0.3°	19.8°	0.9°
Aug. 24	20.2	1.45 p.m.	0.7	0.7	0.4	0.6	18.4	1.6
„ 30	19.8	1.15 p.m.	0.2	0.6	0.4	0.4	19.2	0.6
Sep. 3	17.5	4.45 p.m.	—	—	—	—	16.2	1.3
„ 10	20.2	11.30 a.m.	0.3	1.0	1.4	0.9	17.8	3.0
„ 17	20.0	2.00 p.m.	0.8	2.6	3.7	2.4	18.4	1.6
Oct. 2	20.2	1.00 p.m.	0.4	0.8	2.0	1.1	18.6	1.6
„ 9	19.5	2.15 p.m.	0.7	1.1	—	0.9	15.0	4.5
„ 11	16.4	2.00 p.m.	0.6	3.0	—	1.8	9.8	6.6
„ 14	15.0	1.15 p.m.	1.0	0.2	3.0	1.4	9.6	5.4
Average	19.05					1.09	16.28	2.71
1928								
Aug. 31	24.3	1.45 p.m.	0.3	0.5	0.8	0.5	22.5	1.8
Sep. 1	22.1	1.00 p.m.	0.5	1.1	1.4	1.1	19.1	3.0
„ 12	23.5	12.00 m.	1.1	2.0	2.0	1.8	19.1	4.4
„ 19	18.1	9.00 a.m.	0.9	1.7	2.1	1.6	16.3	1.8
„ 21	20.5	1.00 p.m.	0.0	1.0	1.0	0.7	19.1	1.5
„ 23	16.3	12.00 m.	0.1	0.8	1.0	0.6	12.8	3.5
„ 26	18.5	11.00 a.m.	1.3	1.0	1.0	1.1	13.6	4.9
„ 28	19.0	3.30 p.m.	—	—	—	—	16.0	3.0
Oct. 1	16.5	1.00 p.m.	0.3	0.8	1.5	0.9	12.0	4.5
„ 3	19.6	3.45 p.m.	—	—	—	—	14.5	5.1
„ 5	16.3	1.15 p.m.	0.3	0.3	0.8	0.5	9.2	7.1
Average	19.52					0.98	15.84	3.69
1929								
July 4	20.2	3.00 p.m.	0.6	0.0	0.8	0.5	17.6	2.6
„ 5	16.6	12.30 p.m.	0.6	0.7	0.5	0.6	15.6	1.0
„ 6	17.1	1.00 p.m.	0.3	0.5	0.5	0.4	16.1	1.0
Aug. 4	23.6	4.00 p.m.	2.2	3.0	—	2.6	19.4	4.2
„ 22	18.4	1.30 p.m.	0.2	0.8	1.4	0.8	14.1	4.3
Sep. 30	15.1	1.00 p.m.	0.4	0.7	—	0.6	11.9	5.1
Oct. 7	19.2	1.45 p.m.	0.3	0.1	0.6	0.3	14.5	4.7
„ 8	18.0	1.30 p.m.	—	4.6	—	—	16.6	1.4
„ 10	15.0	1.15 p.m.	0.5	0.8	—	0.6	10.6	4.4
„ 11	15.1	9.00 a.m.	0.9	1.3	1.9	1.4	14.0	1.1
„ 17	19.6	2.00 p.m.	0.4	1.6	—	1.0	8.2	11.4
„ 18	15.1	1.00 p.m.	0.2	0.6	—	0.4	9.8	5.3
Average	17.75					0.84	14.08	3.88
Av. of three years						0.97	15.38	3.40

TABLE 10. (*Continued*)

Date	Highest temperature (C.)	Time of the highest temperature	Difference between the highest temperature and that at the 1st, 2nd and 3rd hours after the time of highest temperature				Temperature at 8 a.m. (C.)	Difference between the highest temperature and that at 8 a.m.
			1st hour	2nd hour	3rd hour	Average		
Blooming days								
1927								
Sep. 13	21.0°	1.45 p.m.	0.5°	1.0°	1.2°	0.9°	15.6°	5.4°
„ 21	20.0	10.30 a.m.	0.2	1.6	2.2	1.3	16.2	3.8
„ 22	19.6	11.30 a.m.	0.8	0.8	1.4	1.0	13.4	6.2
„ 23	20.8	2.00 p.m.	0.6	1.8	2.0	1.5	11.6	9.8
„ 24	20.6	1.15 p.m.	0.4	1.2	1.8	1.1	12.2	8.4
„ 25	19.4	1.45 p.m.	0.6	1.0	3.0	1.5	11.6	7.8
„ 26	21.0	2.00 p.m.	1.1	1.4	3.0	1.8	12.4	8.6
„ 27	21.4	2.15 p.m.	0.2	1.2	3.0	1.5	16.6	4.8
Oct, 10	20.4	10.45 a.m.	0.6	1.0	3.2	1.6	15.4	5.0
„ 16	16.4	1.45 p.m.	2.0	4.4	5.4	3.9	7.4	9.0
Average	20.06					1.61	13.21	6.88
1928								
July 16	22.5	10.30 a.m.	0.3	0.4	0.5	0.4	21.5	1.0
„ 19	23.3	1.15 p.m.	1.0	1.0	1.6	1.2	20.0	3.3
Sep. 16	22.0	1.00 p.m.	0.8	0.4	1.2	0.8	18.5	1.5
„ 17	19.5	11.00 a.m.	0.5	0.2	0.8	0.5	17.5	2.0
„ 18	20.2	1.00 p.m.	0.6	1.5	1.6	1.2	13.4	6.8
„ 20	24.5	1.30 p.m.	0.5	2.5	2.5	1.8	18.5	6.0
„ 22	19.8	1.15 p.m.	1.6	1.1	2.1	1.6	13.5	6.3
„ 24	21.0	1.30 p.m.	0.5	1.0	1.7	1.0	14.5	5.5
„ 27	20.0	10.30 a.m.	0.6	0.5	0.5	0.5	19.0	1.0
„ 29	22.0	11.00 a.m.	0.0	3.3	1.2	1.5	17.0	5.0
Oct. 2	21.5	10.30 a.m.	0.5	1.1	0.5	0.7	18.0	5.5
Average	21.50					1.02	17.40	4.08
1929								
July 8	19.4	12.00 m.	1.5	0.6	0.9	1.0	14.7	5.3
Sep. 21	22.6	10.00 a.m.	1.0	2.4	5.4	2.9	16.8	5.8
„ 23	19.8	1.15 p.m.	0.6	1.4	2.3	1.4	12.0	7.8
„ 24	21.5	12.30 p.m.	0.5	0.9	1.3	0.9	16.4	5.0
„ 26	21.0	1.00 p.m.	0.8	1.4	2.5	1.6	16.0	5.0
„ 27	19.4	1.30 p.m.	0.9	1.4	—	1.1	15.4	4.0
„ 29	21.4	12.00 m.	1.8	3.0	4.0	2.9	17.6	3.8
Oct. 1	16.8	1.45 p.m.	0.2	0.8	1.9	1.0	10.0	6.8
„ 3	22.1	2.15 p.m.	1.3	2.7	5.0	3.0	12.2	9.9
„ 5	21.6	2.15 p.m.	0.6	1.3	3.0	1.6	16.6	5.0
„ 9	17.5	12.00 m.	1.3	0.4	0.7	0.8	12.4	5.5
„ 16	15.0	12.00 m.	0.6	0.4	1.2	0.7	10.4	4.6
Average	19.84					1.49	14.21	5.71
Av. of three years						1.37	14.94	5.55

(iii) Relation between Variation of Temperature and the Time of Blooming

The time of the day's highest temperature in Sapporo, according to the writer's observations, was generally reached at about 1 or 2 o'clock when the weather was clear and fine, but the time depends upon the daily condition of the weather. On the other hand, as related (in I. 3), the most intense blooming took place at about 2 or 3 o'clock in the afternoon, but there was a marked difference in the time of blooming according to the day. Blooming, as is shown above, takes place when the temperature begins to fall after having passed its highest degree. Therefore it is possible to think that there may exist some close relation between the time of the highest temperature and that of blooming. Regarding this the writer in his preliminary report[20] stated that the sooner the temperature reaches its highest point, the quicker comes the time of blooming. The results of the writer's further observations rendered certain this fact. However when temperature does not begin to fall soon after it has reached its highest degree, but remains stationary for a considerable period, the time of blooming is delayed even when the time of the highest temperature is early. The writer observed such cases often on the hottest summer days, July 27, 28 and August 7, 1929 (appended table 7). Generally on the days when the highest temperature is reached comparatively early, it required much time before blooming occurs, while on the days when the highest temperature is reached later, there is a tendency for the flowers to bloom shortly after the temperature begins to decline.

2. Relation between Blooming and Humidity

(i) Range of Humidity on Blooming Days and Humidity suitable for Blooming

The writer in the present study has studied humidity in two different aspects, one is the lowest humidity of the day and the other, humidity at flowering time. From the results of his observations as shown in the appended tables, the writer determined the range of the lowest humidity on blooming days, the range of humidity at the time of flowering and the humidity suitable for blooming, which are shown in Tables 11, 12 and 13 respectively. The lowest humidity on a blooming day (Table 11) was 37.7 in 1929 and the highest one was 91 in the same

year, the lowest humidity at the time of blooming was 41.5 in 1929 and the highest one was 100 in 1928. As shown in Table 12, the days on which the lowest humidity was 60 were the most numerous, being 38.30% of all the flowering days (188); this is followed by the days on which the lowest percentage was 50, and then the days on which the lowest percentage was 70. Further, the number of days on which the humidity at the time of blooming, as shown in Table 13, was 70% was the largest, being 36.70% of the total, and this is followed by the number of those days on which the humidity was 60%.

TABLE 11. *Range of the lowest humidity on blooming days and that of humidity at the time of blooming*

Year	Lowest humidity on blooming days		Humidity at the time of blooming	
	Minimum	Maximum	Minimum	Maximum
	%	%	%	%
1927	49.0	86.0	53.0	95.0
1928	39.5	90.0	44.5	100.0
1929	37.7	91.0	41.5	99.0

TABLE 12. *Frequency distribution of the lowest humidity on blooming days*

	Lowest humidity	30%	40%	50%	60%	70%	80%	90%	100%	Total
	Year									
Number of days	1927	0	1	10	41	21	7	0	0	80
	1928	1	8	21	19	8	2	1	0	60
	1929	1	6	22	12	5	1	1	0	48
	Total	2	15	53	72	34	10	2	0	188
	%	1.06	7.98	28.19	38.30	18.09	5.32	1.06	0	100

TABLE 13. *Frequency distribution of humidity at the time of blooming in 1927, 1928 and 1929*

Humidity of blooming time		30%	40%	50%	60%	70%	80%	90%	100%	Total
	Year									
Number of days	1927	0	0	2	18	43	12	5	0	80
	1928	0	5	7	22	16	7	3	0	60
	1929	0	1	12	17	10	4	3	1	48
	Total	0	6	21	57	69	23	11	1	188
	%		3.19	11.71	30.32	36.70	12.23	5.85	0.53	100

(ii) Relation between Variation in Humidity and Blooming

The blooming of oat flowers occurs within the range of humidity as stated above (2.i). The humidity of the day constantly changes with the changes of temperature and therefore it can be considered that there exists a close relation between the changes of humidity and blooming. The writer studied this relation from the results of his observations which are shown in the appended tables.

Variations of humidity on blooming days

The writer in order to know the variations in humidity on blooming days observed the difference between the humidity at 8 a.m. and the lowest humidity, and the difference between the lowest humidity and the humidity at the time of blooming and the interval between the time of the lowest humidity and the flowering time. The data are arranged in Tables 14, 15 and 16. The number of days on which the difference between the humidity at 8 a.m. and the lowest humidity was 11–20% was the largest; next to this comes the number of days on which the difference was 21–25% and this is followed by the number of days on which the difference was 6–10%. The number of days on which the difference between the lowest humidity and the humidity at the flowering time in the entire day was 3–7% was the largest. Lastly the days on which from two to three hours elapsed from the time of the lowest humidity to the flowering time was the largest in number.

TABLE 14. *Variation of difference between the lowest humidity and humidity at 8 a.m. on the blooming days*

Year	1927	1928	1929	Total		%
Difference of Humidity (%)	Number of days					
1	1	0	0	1		
2	0	0	0	0		
3	0	0	0	0	7	3.72
4	1	0	1	2		
5	2	1	1	4		
6	1	0	2	3		
7	3	0	1	4		
8	2	1	1	4	19	10.11
9	4	0	2	6		
10	0	1	1	2		
11	3	0	3	6		
12	5	1	1	7		
13	3	1	3	7	30	15.96
14	4	0	0	4		
15	1	2	3	6		
16	4	1	3	8		
17	2	2	2	6		
18	3	2	1	6	39	20.74
19	5	4	2	11		
20	4	1	3	8		
21	2	3	3	8		
22	3	2	1	6		
23	5	2	3	10	40	21.28
24	5	2	2	9		
25	2	3	2	7		
26	1	2	0	3		
27	0	5	2	7		
28	3	2	0	5	25	13.30
29	3	2	1	6		
30	2	2	0	4		
31	0	0	1	1		
32	2	0	0	2		
33	1	3	1	5	13	6.91
34	0	3	0	3		
35	1	1	0	2		
36	0	1	0	1		
37	0	2	0	2		
38	1	4	1	6	15	7.98
39	0	0	0	0		
40	1	4	1	6		
Total	80	60	48	188	188	100.00

TABLE 15. *Variation of difference between the lowest humidity and the humidity at the time of blooming*

Year	1927	1928	1929	Total		%
Difference of humidity (%)	Number of days					
0	5	0	1	6	6	3.19
1	4	4	1	9		
2	4	5	4	13		
3	10	3	6	19	73	38.83
4	11	3	2	18		
5	3	7	4	14		
6	7	3	4	14		
7	8	4	3	15		
8	5	8	2	15	67	35.64
9	5	1	3	9		
10	6	5	3	14		
11	2	1	0	3		
12	2	0	4	6		
13	1	3	1	5	23	12.23
14	2	0	3	5		
15	0	2	2	4		
16	1	5	0	6		
17	1	0	0	1		
18	2	1	0	3	14	7.45
19	0	1	2	3		
20	0	1	0	1		
21	0	0	1	1		
22	0	0	1	1		
23	0	0	0	0	2	1.06
24	0	0	0	0		
25	0	0	0	0		
26	0	1	0	1		
27	1	0	0	1	3	1.60
51	0	0	1	1		
Total	80	60	48	188		100.00

TABLE 16. *Variation of interval between the time of the lowest humidity and blooming time*

Year	1927	1928	1929	Total		%
Length of time (minutes)	Number of days					
15	2	1	0	3		
30	4	3	3	10	30	15.96
45	3	3	1	7		
60	5	2	3	10		
75	3	3	5	11		
90	3	7	1	11	50	26.60
105	5	4	2	11		
120	7	4	6	17		
135	8	4	6	18		
150	6	4	4	14	46	24.47
165	2	2	3	7		
180	4	2	1	7		
195	4	4	1	9		
210	3	6	1	10	40	21.28
225	6	3	0	9		
240	7	4	1	12		
255	0	1	3	4		
270	1	1	3	5	17	9.04
285	3	1	1	5		
300	2	1	0	3		
315	0	0	1	1		
330	0	0	0	0	3	1.60
345	1	0	0	1		
360	1	0	0	1		
375	0	0	0	0	2	1.06
390	0	0	2	2		
Total	80	60	48	188		100.00

Variations in humidity on non-blooming days

As has already been mentioned, there were a number of days during the period of observations on which no blooming occurred at all. The variations in humidity on each of these days are shown by the difference between the humidity at 8 a.m. and the lowest humidity, and the

TABLE 17. *Comparison between changes of humidity on blooming days and those on non-blooming days*

Non-blooming days

Date	Lowest humidity	Time of lowest humidity	Difference between the lowest humidity and those at the 1st, 2nd and 3rd hours after the time of the lowest %				Humidity at 8 a.m.	Difference between the lowest humidity and that at 8 a.m.
			1st hour	2nd hour	3rd hour	Average		
1927	%		%	%	%	%	%	%
July 18	95	11.15 a.m.	0	0	0	0	95	0
Aug. 24	89	8.30 a.m.	11	11	11	11	94	5
„ 30	94	2.30 p.m.	0	0	1	0.3	100	6
Sep. 3	65	1.00 p.m.	5	8	12	8.3	88	23
„ 10	85	11.45 a.m.	0	9	9	6.0	89	13
„ 17	75	1.45 p.m.	5	4	8	5.7	84	9
Oct. 2	75	8.45 a.m.	6	5	5	5.3	80	5
„ 9	70	12.15 p.m.	0	5	14	6.3	94	24
„ 11	58	2.00 p.m.	5	8	—	6.5	80	22
„ 14	63	1.30 p.m.	0	1	2	1.0	80	17
Average	76.60					5.04	80.40	12.4
1928								
Aug. 31	95	10.00 a.m.	1	1	2	1.3	98	3
Sep. 1	89	1.00 p.m.	5	9	10	8.0	99	10
„ 12	64	12.00 m.	3	11	13	9.0	91	27
„ 19	70	9.00 a.m.	6	17	11	10.1	82	12
„ 21	62	1.15 p.m.	2	−5	6	1.0	74	12
„ 23	87	1.15 p.m.	7	3	8	6.0	87	0
„ 26	50	11.00 a.m.	7	5	5	5.6	62	12
„ 28	62	11.00 a.m.	2	2	5	3.0	70	8
Oct. 1	43	2.30 p.m.	4	12	16	8.0	72	29
„ 3	56	10.00 a.m.	0	20	16	12.0	78	22
„ 5	43	1.15 p.m.	12	−7	—	2.5	72	29
Average	65.55					6.04	80.45	14.9
1929								
July 4	74	12.00 m.	11	11	7	9.6	86	12
„ 5	86	12.30 p.m.	4	6	−5	1.6	98	12
„ 6	91	12.30 p.m.	1	2	3	2.0	95	4
Aug. 4	71	2.00 p.m.	1	4	25	10.0	87	16
„ 22	43	2.15 p.m.	4	6	7	5.6	55	12
Sep. 30	55	1.45 p.m.	3	—	10	6.5	77	12
Oct. 7	71	2.30 p.m.	3	7	—	5.0	95	24
„ 8	82	1.00 p.m.	0	15	16	10.3	98	14
„ 10	61	1.15 p.m.	6	16	19	10.3	78	17
„ 11	57	10.00 a.m.	3	7	3	4.3	62	5
„ 17	60	2.30 p.m.	0	3	—	1.5	100	40
„ 18	61	2.00 p.m.	5	—	—	5.0	83	22
Average	67.67					5.98	84.50	15.8
Av. of three years						5.35	84.45	14.37

TABLE 17. (*Continued*)

Blooming days

Date	Lowest humidity	Time of lowest humidity	Difference between the lowest humidity and those at the 1st, 2nd and 3rd hours after the time of the lowest %				Humidity at 8 a.m.	Difference between the lowest humidity and that at 8 a.m.
			1st hour	2nd hour	3rd hour	Average		
1927	%		%	%	%	%	%	%
Sep. 13	71	11.15 a.m.	1	1	1	1.0	88	17
„ 21	60	10.00 a.m.	1	7	10	6.0	69	9
„ 22	58	11.30 a.m.	12	12	12	12.0	82	24
„ 23	64	1.30 p.m.	0	6	5	3.4	87	23
„ 24	55	12.30 p.m.	9	13	9	10.3	87	32
„ 25	63	12.45 p.m.	8	8	8	8.0	87	24
„ 26	64	1.30 p.m.	0	12	16	9.3	87	23
„ 27	58	12.15 p.m.	7	10	6	7.6	78	20
Oct. 10	54	12.45 p.m.	12	7	6	8.3	73	19
„ 16	61	11.45 a.m.	13	13	11	12.3	78	17
Average	60.08					7.82	81.60	20.80
1928								
July 16	92	11.00 a.m.	5	4	3	4.0	95	3
„ 19	60	12.30 p.m.	3	6	10	6.3	80	20
Sep. 16	55	12.30 p.m.	14	15	16	15.0	84	29
„ 17	56	1.15 p.m.	3	3	3	3.0	66	10
„ 18	52	2.15 p.m.	1	8	10	6.3	82	30
„ 20	63	1.15 p.m.	5	3	5	4.3	84	21
„ 22	53	1.15 p.m.	0	11	20	10.3	87	32
„ 24	75	1.00 p.m.	5	6	19	10.0	100	25
„ 27	40	2.30 p.m.	1	3	7	3.9	55	15
„ 29	49	3.15 p.m.	3	—	—	3.0	87	38
Oct. 2	52	12.00 m.	3	2	10	5.0	57	5
Average	58.82					6.46	79.73	20.73
1929								
July 8	74	12.00 m.	5	0	−2	1.0	97	23
Sep. 21	42	10.30 a.m.	10	9	51	23.0	65	23
„ 23	57	1.15 p.m.	1	4	4	3.3	77	20
„ 24	51	1.00 p.m.	2	6	9	5.7	67	26
„ 26	53	1.15 p.m.	4	11	24	13.0	74	21
„ 27	52	1.00 p.m.	3	2	5	3.3	76	24
„ 29	67	12.00 m.	12	7	13	10.7	88	21
Oct. 1	45	1.00 p.m.	6	12	14	10.6	86	41
„ 3	52	2.00 p.m.	−3	12	26	11.7	77	25
„ 5	63	2.15 p.m.	3	16	24	14.3	64	1
„ 9	53	2.00 p.m.	9	10	28	15.6	82	29
„ 16	58	12.00 m.	—	3	1	1.0	72	14
Average	55.59					9.43	77.08	22.33
Av. of three years						7.90	79.47	21.29

humidity at one, two and three hours thereafter. By comparing these with the variations on blooming days the writer obtained the results shown in Table 17. On non-blooming days during three years the average difference between the lowest humidity and that at 8 a.m. was 14.37% and the increase in humidity after the time of the lowest humidity 5.35%, but on blooming days the former was 21.29% and the latter 7.90%.

(iii) Relation between Variation in Humidity and Blooming Time

When the variations of humidity in the course of the day are considered, it can be said that blooming always begins to take place while humidity is increasing from the lowest percentage and in the majority of cases blooming occurs 1–2 hours after the time of the lowest humidity. Accordingly there exists an intimate relation between the time of the lowest humidity and that of blooming; that is to say, on the days when the time of the lowest humidity comes early, the time of blooming is also early, and when the former comes late, the latter too is late.

3. Relation between Blooming and Rainfall

The data as to the relation between blooming and rainfall which were observed by the writer is shown in Table 18. There were 15 rainy days in 1927, 9 in 1928 and 10 in 1929, the total being 34 days, and these rainy days can be divided into the days on which there were showers and the days on which it rained the whole day. Blooming occurred as usual, in spite of rainfall, on those days when rain began to fall as early as about noon or as late as two o'clock in the afternoon. Rain shows a tendency to accelerate blooming. But on the days when it rained the whole day in some cases blooming occurred and in others no blooming took place. According to the writer's observations in 1927, it rained the whole day on July 7 and 21, and on September 4 and 6, but blooming occurred, which on July 18 and 24 and on September 3, 10 and 17 no blooming occurred under similar conditions. The reason for this can be understood by considering the temperature on these days. On flowering days temperature is generally high and on the days when temperature is high blooming takes place even when it rains, because there are considerable changes in temperature on these days. On the days when no blooming occurred, temperature was low, and changes in temperature were very slight.

4. Relation between Blooming and Wind

The writer, in order to ascertain the relation between blooming and wind, compared the number of flowers opened and the time of blooming on days when the average velocity of wind from 6 a.m. to 6 p.m. was 4.42–5.77 m/s with those on days when the average velocity from 6 a.m. to 6 p.m. was 1.14–2.91 m/s. The results are shown in Table 19.

Observations were made on blooming and the time of blooming on 11 days when the average velocity of wind was 4.42–5.77 m/s and 12 days when the average velocity of wind was 1.14–2.91 m/s. In the former it was found that blooming did not occur on July 18 and October 2 out of the 11 days and in the latter blooming occurred without exception. The blooming time of the day was between 2 and 4 o'clock in the afternoon on both days, and no difference between them was observed.

Thus the force of wind does not effect blooming nor the time of blooming in any way whatever.

TABLE 18. *Comparison between the amount of rainfall on non-blooming days and that on blooming days*

	Non-blooming days											
Time	6–7 a.m.	7–8 a.m.	8–9 a.m.	9–10 a.m.	10–11 a.m.	11–12 a.m.	12–1 p.m.	1–2 p.m.	2–3 p.m.	3–4 p.m.	4–5 p.m.	5–6 p.m.
Date	amount of rainfall (m.m.)											
1927												
July 18	0.1	2.2	4.5	0.1	3.8	5.8	4.4	1.0	0.6	0.2	0.1	0.5
Aug. 24	3.2	8.8	4.1	7.9	8.0	1.5	0.1	0.0	—	0.3	0.2	0.2
„ 30	0.4	2.1	6.5	6.1	5.4	6.4	2.4	0.4	0.0	—	—	0.0
Sep. 3	0.0	0.1	0.0	0.0	0.2	1.9	2.4	2.4	3.2	0.2	—	—
„ 10		—	0.0	0.2	0.0	0.0	0.0	0.4	0.9	0.3	0.1	0.1
„ 17		0.2	0.9	0.2	0.0	0.0						
1928												
Aug. 31	0.0	0.2	0.4	1.4	2.3	2.6	5.5	1.8	5.1	3.5	3.4	3.9
Sep. 1	1.8	0.8	0.1	0.0	0.0	—	—	0.0	0.1	0.6	1.3	0.3
„ 19				0.0	0.8	0.4	0.1	0.8	0.7	0.8	1.4	1.0
„ 23			0.0	0.0	0.4	0.5	0.7	1.2	1.0	1.3	1.9	2.0
1929												
Oct. 8	0.3	0.2	0.1	0.1	0.0	0.3	0.1	0.1	4.3	3.7	1.4	0.9

TABLE 18. (*Continued*)

Time / Date	6–7 a.m.	7–8 a.m.	8–9 a.m.	9–10 a.m.	10–11 a.m.	11–12 a.m.	12–1 p.m.	1–2 p.m.	2–3 p.m.	3–4 p.m.	4–5 p.m.	5–6 p.m.
	Blooming days											
	amount of rainfall (m.m.)											
1927												
July 13						0.0*	0.4	2.1 54†	2.0 **39**	3.5	10.7	12.5
„ 16									0.3 **52**	0.0 **64**	0.0 **7**	
„ 17	0.2	0.1	0.0	0.2	0.1	0.3	0.0	0.8 **9**	0.0 **90**	0.0 **17**	0.0	0.0
„ 21	0.2				0.0	0.0	0.1	0.3	0.8 **45**	0.6	0.4	1.3
Aug. 3					0.6	2.9				**19**	13.1 **5**	
Sep. 4		0.0	0.2		0.1	0.1	0.2	0.0	0.1 **48**	1.0 **16**		0.2
„ 16				0.0	0.0	0.1	0.0	0.0	**59**	**23**	0.4	0.0
„ 18	0.0	0.2	0.0				0.0	0.0	0.1 **56**	**94**	**8**	
„ 19						0.0	0.0	0.2	2.0	3.3 **165**	1.2 **21**	0.3
1928												
July 16	0.4	0.5	0.8	0.9	0.4	9.1	3.2	3.1	3.4 **11**	0.1 **5**		
„ 17							0.0	0.1 **260**	**386**	1.6 **13**	0.1	0.0
„ 30			0.0	0.0		0.0	0.0	0.0 **3**	**26**	**40**	**8**	
Sep. 13	0.0				0.0	2.2	3.6	1.0 **3**	2.4 **9**	1.0	0.2	1.1
„ 16								0.1	0.0 **1**	0.0	0.0	0.0
1929												
July 14	0.0	0.2	0.4	0.6	1.1	0.0			0.0 **81**	0.0 **78**	0.0 **4**	0.0
„ 23	0.0	0.0		0.0	1.4	0.8	1.0	0.5 32	0.5 **14**	4.2 **2**	3.5	3.7
„ 25									0.7	2.7 **138**	**31**	0.0
Aug. 14										0.1 **44**	0.0 **9**	0.0
„ 24			0.0	0.2	0.0		0.0	1.3	0.4	0.0 **22**	0.0 **1**	0.0
„ 27	3.7	1.3	0.5	0.2	0.0	0.0	1.1	0.0	**2**	0.0 **23**		
„ 28							0.0	0.2		0.2 **39**	0.0	
„ 29								1.3	4.0 **10**	2.0 **2**	1.5	0.6

* ....amount of rainfall

† ....number of flowers bloomed

TABLE 19. *Number of blooming flowers days when the average velocity of wind from 6.00 a.m. to 6.00 p.m. was 4.42–5.77 m/s and that on days when the average velocity of wind from 6.00 a.m. to 6.00 p.m. was 1.14–2.91 m/s.*

Date	Average velocity of wind from 6 a.m. to 6 p.m.	Blooming time															Total
		2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	
		Number of blooming flowers															
July 26	5.77							8	26	9	12						55
Aug. 29	5.58			2	84	30	27	10	2	1							154
Sep. 2	4.48			1	0	0	4	2	8	4	1						20
„ 9	4.42				11	13	1	1									26
„ 18	4.95				56	9	44	23	18	8							158
„ 27	4.51				16	24	36	15	5								96
„ 29	4.42				1	9	7	10	16	7	3						53
Oct. 2	7.06																0
„ 8	5.42					27	18	11	3								59
Average	5.18																
July 24	2.16		4	0	9	27	2	22	4	1							69
Aug. 19	1.73									16	22	61	61	16	6		182
„ 20	1.25			18	51	40	12	12	5	2							140
„ 23	1.71	1	0	0	74	54	17	26	22	4							198
Sep. 8	1.25							7	4	4							15
„ 13	1.14						5	4	1	1							11
„ 22	2.18			35	31	24	20	13	6	3							132
„ 24	2.91					10	20	28	17	2							77
Oct. 1	2.17					31	27	27	20	6							111
Average	1.83																

5. *Relation between Blooming and Duration of Sunshine*

In order to understand the relation between blooming and the duration of sunshine the writer compared the hours of sunshine on 10 blooming days with those on 18 non-blooming days. The results are shown in Table 20. Most of the non-blooming days were cloudy or rainy, but on September 17, 1927, September 19 and 21, 1928, and August 22, 1929, the duration of sunshine was considerably long, but no blooming took place. On the other hand, there was sunshine on most

TABLE 20. *Duration of sunshine on blooming days and that on non-blooming days*

Non-blooming days

Date \ Time	6–7 a.m.	7–8 a.m.	8–9 a.m.	9–10 a.m.	10–11 a.m.	11–12 a.m.	12–1 p.m.	1–2 p.m.	2–3 p.m.	3–4 p.m.	4–5 p.m.	5–6 p.m.	Total
	Hours of sunshine (Jordan's recorder)												
1927													
July 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aug. 24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
„ 30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sep. 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.55
„ 10	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
„ 17	0.18	0.10	0.20	0.00	0.00	0.06	0.00	0.30	1.80	0.65	0.00	0.00	3.29
Oct. 3	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.20	0.03	0.00	0.00	0.00	0.26
1928													
Sep. 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
„ 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
„ 19	0.00	0.00	0.00	0.00	0.20	0.82	0.52	0.82	0.17	0.60	0.65	0.00	3.78
„ 21	0.00	0.70	0.20	0.00	0.50	0.00	0.20	0.90	0.08	0.35	0.25	0.00	3.18
„ 23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
„ 28	0.00	0.00	0.00	0.00	0.40	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.70
1929													
July 4	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
Aug. 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.10
„ 22	0.07	1.00	1.00	0.72	0.22	0.60	0.40	0.30	0.00	0.60	0.16	0.00	4.71
Oct. 7	0.00	0.00	0 00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
„ 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 20. (*Continued*)

Blooming days

1927													
July 13	0.45	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95
„ 17	00.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
„ 21	0.00	0.45	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55
Aug. 27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1928													
July 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	00.0	0.00	1.96	0.42	0.00	2.38
Aug. 10	0.82	0.68	0.53	0.30	0.00	0.00	0.00	0.35	0.00	0.00	0.36	0.20	3.24
„ 24	0.00	0.00	1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22
Sep. 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1929													
July 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
„ 23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

of the blooming days, but on ten days as shown in Table 20, blooming occurred although the duration of sunshine was short. These results show that there is no intimate relation between the duration of sunshine and blooming.

6. *Relation between Blooming and Sunlight*

The writer performed the following experiment in order to find out the relation between the blooming of oat flowers and the sunlight. He made a cardboard cylinder 9 inches long and 3 inches diameter and 5 heads of oats which were to bloom on the day were taken and put into 4 glass bottles which were again put into the cylinder made of cardboard, the sunlight being thus intercepted. The cylinder was placed in the experimental room together with the remaining one as a control. The flowers of those heads were examined after a certain period of time; the results are shown in Table 21.

TABLE 21. *Number of blooming flowers when plant was exposed to sunlight and when it was intercepted*

Date (1929)	Time at which heads were examined	Number of blooming flowers				
		Control (one head)	Sunlight intercepted			
			No. 1	No. 2	No. 3	No. 4
	p.m.					
July 8	3.00	3	2	4	5	3
„ 9	3.30	4	3	5	4	4
„ 10	3.30	2	3	2	3	1
„ 11	4.00	3	2	3	4	2
„ 12	5.00	5	4	4	5	3
„ 13	4.00	3	1	4	2	4
„ 14	4.00	4	5	3	3	2

These results show that even when the sunlight was intercepted blooming took place. The writer also observed that when a head of oats growing on the experimental plot was put into a camera of small size, blooming took place in just the same manner as in those growing outside. But the blooming in this case occurred later than those outside on a clear and hot day, and the blooming occurred almost at the same time as those outside on a cloudy day. The writer considers that this is due to the changes of temperature.

While the experiment (II. B. 1.) was being performed to find the relation between temperature and blooming, it was observed that the oats which had been put into a thermostat under ground bloomed at night between 8 and 10 o'clock. And also in the dark room blooming took place as in the case of those growing outside when other conditions were suitable. These facts confirm that sunlight is not necessary for the blooming of oats.

7. *Summary*

1. The range of temperature on the days on which blooming occurred was 15–32°C. for the highest temperature and 14–29.8°C. for the temperature at blooming time. The most suitable highest temperature was 27–29°C. and the best temperature for blooming time 24–26°C.

2. There is an intimate relation between the changes of temperature in the day and blooming. Blooming began to take place when the difference between the temperature at about 8 a.m. and the highest temperature of the day was 3–8°C., and when temperature fell 1.0–2.5°C. within an hour or two after the time of the day's highest temperature.

3. There were days on which no blooming occurred even though the temperature was within the range of blooming, and the changes of temperature on these days were quite slight when compared with those on a blooming day.

4. There is a close relation between blooming time and the time of the highest temperature of the day. When the highest temperature was attained early, the blooming time was also early, and when the highest temperature came late, the blooming time was also late.

5. The range of minimum humidity on blooming days was 37.7–91.0% and 41.5–100% when the humidity at the time of blooming was considered. The most suitable minimum humidity was 50–60%, the best humidity at the time of blooming was 60–70%.

6. There is a close relation between blooming and changes of humidity. Blooming occurred when the difference between the morning humidity and the minimum humidity was 10–20%, and when humidity increased by 3–7% within an hour or two after the time of the minimum humidity.

7. There were days on which blooming did not take place although the humidity of the day was within the range suitable for blooming.

When the humidity on these days was compared with that of blooming days, there were generally found to be less changes in humidity on the non-blooming days.

8. There is an intimate relation between the blooming time and the time of the minimum humidity of the day. When the minimum humidity was reached early, blooming also took place early, and on the contrary, when the former came late, the latter also took place late.

9. There were many rainy days during the observation of blooming under natural conditions, and on some of these rainy days no blooming occurred at all and on others blooming occurred just as it did on the days when it did not rain. Therefore rainfall itself has no direct influence on blooming.

10. There is no direct relation between the force of wind and blooming and its time.

11. When there was more sunshine, more blooming occurred, but there were instances in which no blooming took place in spite of much sunshine. Therefore no direct relation exists between sunshine and blooming.

12. Blooming occurred as under natural conditions even when sunlight was intercepted and therefore there is no relation between sunlight and blooming.

B. Control of Blooming of Oat Flowers

The results of the observations stated in the foregoing chapter show that among the external factors the variations of temperature and humidity have an intimate relation to blooming. In order to prove this fact further, the writer performed the following described experiments regarding the control of the time of blooming during the day and control of blooming on blooming and non-blooming days by temperature and humidity and also to find out which of these two factors has a particularly important relation to blooming.

1. Blooming controlled by temperature

(i) Control of Blooming Time during the Day

The writer stated in his preliminary report[20] that by changing temperature he succeeded in controlling the time of blooming during the day and in controlling the blooming on blooming days and non-blooming

days. The writer repeated the same experiments to render those findings more certain. The results of these experiments are recorded below.

Materials and Methods

In 1927 and 1928, the writer picked those heads which were to bloom between 5 a.m. and 2 p.m. in the day, and put them in a small glass bottle containing water and changed the temperature by the following methods:—

1:—A head which was put in a small glass bottle was put into a thermostat having a temperature higher than that of atmosphere at the time when this head was cut. At a difinite hour it was again removed to a thermostat the temperature of which was low. It is, however, necessary here to describe two different ways of removing the materials from the atmospheric temperature to a higher one.

a:—To put into a thermostat raised suddenly to a high tempara-ture.

b:—To put into a thermostat the temperature of which is made gradually higher.

2:—The methods of changing the temperature were similar to those of 1 b, but the time at which the heads were cut and put into thermostat was earlier than in 1 b.

3:—Heads in natural condition were cut when the flowers had not yet opened. They were put into a small glass bottle and immediately removed into a thermostat the temperature of which was lower than it was outside at that time.

The results of the experiments

No. 1:—Table 22 which follows shows the results of the experiments conducted according to the method given in 1 a. In each case the blooming occurred at hours different from the natural blooming time of the day. Blooming took place sooner or later than the natural blooming time of that day according to the time when the temperature was altered from high degrees to low ones.

TABLE 22. *Results of the experiments on the control of blooming time conducted according to method No. 1 a*

Experiment 1

(July 16, 1927)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed									Number of heads used in the experiments	Time of natural blooming
		High	Low	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.		
8 a.m. 24.8°C.	10.00 a.m.	27°	22°	0	0	0	3	0	0	0	0	0	1	2.15 p.m.
		30°	22°	0	0	0	6	0	0	0	0	0	1	
	12.00 m.	27°	22°			2	0	0	0	0	0	0	1	
		30°	22°			0	0	0	0	0	0	0	1	
	2.00 p.m.	27°	22°					5	0	0	0	0	1	
		30°	22°					0	1	0	0	0	1	
	4.00 p.m.	27°	22°							2	0	0	1	
		30°	22°							1	0	0	1	
	6.00 p.m.	27°	22°									0	1	
		30°	22°									7	1	

TABLE 22. (*Continued*)
Experiment 2
(July 2, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed					Number of heads used in the experiments	Time of natural blooming
		High	Low	12.30 p.m.	1.30 p.m.	2.30 p.m.	3.30 p.m.	4.30 p.m.		
8.30 a.m. 22°C.	11.30 a.m.	26°	20°	5	4	0	0	0	2	2.15 p.m.
		24°	20°	8	4	0	0	0	2	
	1.30 p.m.	26°	20°			12	0	0	2	
		24°	20°			14	0	0	2	
	2.30 p.m.	26°	20°				4	0	2	
		24°	20°				6	0	2	

TABLE 22. (*Continued*)
Experiment 3
(July 17, 1927)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed								Number of heads used in the experiments	Time of natural blooming
		High	Low	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.		
9 a.m. 23.2°C.	11.00 a.m.	29°	23°	0	0	6	3	0	0	0	0	1	1.30 p.m.
		31°	23°	0	0	8	4	0	0	0	0	1	
	1.00 p.m.	29°	23°			7	1	0	0	0	0	1	
		31°	23°			0	7	0	0	0	0	1	
	3.00 p.m.	29°	23°					4	0	0	0	1	
		31°	23°					7	0	0	0	1	
	5.00 p.m.	29°	23°							3	0	1	
		31°	23°							3	0	1	

TABLE 22. (*Continued*)

Experiment 4

(July 5, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed				Number of heads used in the experiments	Time of natural blooming
		High	Low	4 p.m.	5 p.m.	6 p.m.	7 p.m.		
9 a.m. 21°C.	3.00 p.m.	29°	19°	2	0	0	0	2	1.45 p.m.
	4.00 p.m.	29°	19°		2	1	0	2	

TABLE 22. (*Continued*)

Experiment 5

(July 6, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed					Number of heads used in the experiments	Time of natural blooming
		High	Low	2 p.m.	4 p.m.	4 p.m.	5 p.m.	6 p.m.		
9 a.m. 20°C.	1.00 p.m.	22.8°	19°	6	0	0	0	0	2	2.20 p.m.
	3.00 p.m.	22.8°	19°			2	0	0	2	
	4.00 p.m.	22.8°	19°					0	2	

TABLE 22. (*Continued*)
Experiment 6
(July 9, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed							Number of heads used in the experiments	Time of natural blooming
		High	Low	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.		
9 a.m. 21°C.	12.00 m.	29°	19°	10	10	0	0	0	0	0	5	2.20 p.m.
	2.00 p.m.	29°	19°				22	0	0	0	5	
	4.00 p.m.	29°	19°						31	0	5	
	5.00 p.m.	29°	19°							17	5	

TABLE 22. (*Continued*)
Experiment 7
(July 10, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed						Number of heads used in the experiments	Time of natural blooming
		High	Low	1.30 p.m.	2.30 p.m.	3.30 p.m.	4.30 p.m.	5.30 p.m.	5.30 p.m.		
9.30 a.m 25°C.	12.30 p.m.	32°	20°	0	2	0	0	0	0	1	1.15 p.m.
		28°	20°	4	0	0	0	0	0	1	
	1.30 p.m.	32°	20°		0	4	1	0	0	1	
		28°	20°		3	0	0	0	0	1	
	2.30 p m.	32°	20°			0	3	0	0	1	
		28°	20°			6	0	0	0	1	
	3.30 p.m.	32°	20°				2	7	0	1	
		28°	20°				2	0	0	1	

TABLE 22. (*Continued*)
Experiment 8
(July 16, 1927)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed						Number of heads used in the experiments	Time of natural blooming
		High	Low	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.		
10 a.m. 27.2°C.	12.00 m.	32°	22°	0	1	0	0	0	0	1	2.30 p.m.
	2.00 p.m.	32°	22°			1	0	0	0	1	
	4.00 p.m.	32°	22°				1	0	0	1	
	6.00 p.m.	32°	22°						3	1	

TABLE 22. (*Continued*)
Experiment 9
(July 7, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed					Number of heads used in the experiments	Time of natural blooming
		High	Low	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.		
10 a.m. 21.4°C.	1.00 p.m.	30°	19°	9	0	0	0	0	3	2.45 p.m.
	2.00 p.m.	30°	19°		8	0	0	0	3	
	3.00 p.m.	30°	19°			12	0	0	3	

TABLE 22. (*Continued*)

Experiment 10

(July 17, 1927)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed					Number of heads used in the experiments	Time of natural blooming
		High	Low	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.		
11 a.m. 25.1°C.	1.00 p.m.	29°	23°	2	1	0	0	0	1	1.30 p.m.
		31°	23°	1	2	0	0	0	1	
	3.00 p.m.	29°	23°			4	0	0	1	
		31°	23°			4	0	0	1	
	5.00 p.m.	29°	23°					3	1	
		31°	23°					1	1	

TABLE 22. (*Continued*)

Experiment 11

(July 9, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed					Number of heads used in the experiments	Time of natural blooming
		High	Low	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.		
11 a.m. 23.8°C.	2.00 p.m.	29°	19°	1	12	0	0	0	5	2.20 p.m.
	4.00 p.m.	29°	19°			14	0	0	5	
	5.00 p.m.	29°	19°				18	0	5	

TABLE 22. (*Continued*)

Experiment 12

(July 16, 1927)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed			Number of heads used in the experiments	Time of natural blooming
		High	Low	5 p.m.	6 p.m.	7 p.m.		
12 m. 27.4°C.	4.00 p.m.	30°	22°	3	0	0	1	1.30 p.m.
	6.00 p.m.	30°	22°			2	1	

TABLE 22. (*Continued*)

Experiment 13

(July 4, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed					Number of heads used in the experiments	Time of natural blooming
		High	Low	4 p.m.	5 p.m.	6 p.m.	7 p.m.	10.30 p.m.		
12 m. 22.8°C.	3.00 p.m.	25°	19°	5	0	0	0	0	2	1.15 p.m.
	4.00 p.m.	25°	19°		4	0	0	0	2	
	9.00 p.m.	25°	19°					7	2	

TABLE 22. (*Continued*)

Experiment 14

(July 17, 1927)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed				Number of heads used in the experiments	Time of natural blooming
		High	Low	4 p.m.	5 p.m.	6 p.m.	10.30 a.m. (Jul. 18)		
1.00 p.m. 24.6°C.	3.00 p.m.	29°	23°	1	0	0		1	1.30 p.m.
		31°	23°	4	0	0		1	
	5.00 p.m.	29°	23°			2		1	
		31°	23°			4		1	
	9.30 a.m. (Jul. 18)	29°	23°				4	1	
		31°	23°				1	1	

TABLE 22. (*Concluded*)

Experiment 15

(July 9, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed				Number of heads used in the experiments	Time of natural blooming
		High	Low	3 p.m.	4 p.m.	5 p.m.	6 p.m.		
1 p.m. 25.5°C.	2.00 p.m.	29°	19°	1	6	0	0	5	2.20 p.m.
	4.00 p.m.	29°	19°			9	0	5	
	5.00 p.m.	29°	19°				6	5	

No. 2:—Table 23 shows the results of the experiments conducted according to method 1. b. These experiments are different from 1. a. method in the changing of the temperature, but as in No. 1 the hours of blooming can be controlled in each case.

TABLE 23. *Results of the experiments on the control of blooming time conducted according to method No. 1 b*

Experiment 16

(July 18, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed								Number of heads used in the experiments	Time of natural blooming
		High	Low	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.		
8 a.m. 24°C.	10.00 a.m.	26°	20°	0	0	8	0	0	0	0	0	2	1.30 p.m.
	12.00 m.	26°	20°			8	0	0	0	0	0	2	
	2.00 p.m.	26°	20°					9	0	0	0	2	
	4.00 p.m.	26°	20°							7	0	2	
	5.00 p.m.	26°	20°								6	2	

TABLE 23 (*Continued*)
Experiment 17
(July 18, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)			Blooming time and number of flowers which bloomed						Number of heads used in the experiments	Time of natural blooming
		Low	High	Low	1 p.m.	2 p.m.	3 p'm.	4 p.m.	5 p.m.	6 p.m.		
8 a,m. 24°C.	12.00 m.	26°	28°	22°	0	6	0	0	0	0	2	1.30 p.m.
	2.00 p.m.	26°	28°	22°			11	0	0	0	2	
	4.00 p.m.	26°	28°	22°					14	0	2	
	5.00 p.m.	26°	28°	22°						16	2	

TABLE 23 (*Continued*)
Experiment 18
(July 18, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)				Blooming time and number of flowers which bloomed				Number of heads used in the experiments	Time of natural blooming
						3 p.m.	4 p.m.	5 p.m.	6 p.m.		
8 a.m. 24°C.	2.00 p.m.	26°	28°	32°	26°	10	0	0	0	2	1.30 p.m.
	4.00 p.m.	26°	28°	32°	26°			2	5	2	
	5.00 p.m.	26°	28°	32°	26°				6	2	

TABLE 23 (*Continued*)

Experiment 19

(July 18, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed						Number of heads used in the experiments	Time of natural blooming
		High	Low	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.		
10 a.m. 24°C.	12.00 m.	28°	26°	4	9	0	0	0	0	2	4.30 p.m.
	2.00 p.m.	28°	26°			12	0	0	0	2	
	4.00 p.m.	28°	26°					10	0	2	
	5.00 p.m.	28°	26°						3	2	

TABLE 23 (*Continued*)

Experiment 20

(July 18, 1928)

Time and temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)			Blooming time and number of flowers which bloomed				Number of heads used in the experiments	Time of natural blooming
		Low	High	Low	2 p.m.	4 p.m.	5 p.m.	6 p.m.		
10 a.m. 24°C.	2.00 p.m.	28°	32°	26°	4	9	0	0	2	4.30 p.m.
	4.00 p.m.	28°	32°	26°			5	8	2	

No. 3:—The results given in Table 24 are obtained by method 2. These results show that when no change was made in temperature at all, blooming never occurred, but when there was change in temperature, every head bloomed before the time of the natural blooming. The earliest one began to open at 11.00 a.m. It took place about 4 hours earlier than the earliest under natural conditions.

TABLE 24. *Results of the experiments on the control of blooming time conducted according to method No. 3*

Experiment 21

(July 21, 1928)

Temperature outside at 5: 30 a.m. .....16.3°C.

Blooming time	I		II		III		IV		V		VI	
	(1) T	(2) B	T	B	T	B	T	B	T	B	T	B
a.m.												
5.30	22°		24°		24°		22°		22°		19°	
7.00	22		24		24		22		22		19	
8.00	22		24		26		24		26		19	
9.00	22		24		26		26		28		19	
10.00	28		22		24		26		22		19	
10.30	27		22		20		26		22		19	
11.00	27		22		20		22		22		19	
11.30	26		22		20	**1**	22		22		19	
12.00	26		22	**1**	20	**3**	20		20		19	
p.m.												
0.30	25	**5**	22	**1**	20	**2**	20		20		19	
1.00	25	**9**	22	**6**	20	**7**	20		20		19	
1.30	24	**3**	22	**13**	20	**15**	20	**7**	20	**8**	19	
2.00	24	**6**	22	**7**	20	**4**	20	**3**	20	**10**	19	
2.30	22	**4**	22	**2**	20	**1**	20	**2**	20	**3**	19	
3.00	22		22	**1**	20		20	**1**	20	**2**	19	
3.30	22		22		20		20		20		19	
4.00	21		22		20		20		20		19	
Total		**27**		**31**		**33**		**13**		**23**		**0**
Number of heads used in the experiment	5		5		5		2		3		5	
Time of natural blooming	3 p.m.											

(1) T = Temperature of thermostat (*c.*)

(2) B = Number of flowers bloomed

TABLE 24. (*Concluded*)

Experiment 22

(July 24, 1928)

Temperature of outside at 5:00 a.m. .....20°C.

Blooming time	I		II		III		IV		V		VI		VII		VIII		IX		X	
	T	B	T	B	T	B	T	B	T	B	T	B	T	B	T	B	T	B	T	B
a.m.	°		°		°		°		°		°		°		°		°		°	
5.00	20		20		24		24		24		24		22		22		20		15	
6.00	20		20		24		24		24		24		24		24		20		15	
7.00	20		20		24		24		27		27		27		27		20		15	
8.00	20		20		24		25		27		27		27		27		20		15	
9.00	31		31		20		15		24		15		20		15		20		15	
10.00	31		31		20		15		24		15		20		15		20		15	
11.00	21		15		20		15	**1**	24		15	**1**	20		15		20		15	
11.30	21	**2**	15		20		15	**1**	24		15	**4**	20		15	**2**	20		15	
12.00	21	**7**	15	**5**	20	**6**	15	**1**	24	**2**	15	**1**	20	**2**	15	**1**	20		15	
p.m.																				
0.30	21	**21**	15	**29**	20	**21**	15	**17**	24	**3**	15	**3**	20	**30**	15	**11**	20		15	
1.00	21	**9**	15	**2**	20	**4**	15	**6**	24	**5**	15	**17**	20	**5**	15	**6**	20		15	
1.30	21	**4**	15	**7**	20	**3**	15	**4**	24	**3**	15	**6**	20	**3**	15	**3**	20		15	
2.00	21		15	**1**	20	**1**	15	**1**	24	**1**	15		20	**1**	15		20		15	
2.30	21		15		20		15		24		15		20		15		20		15	
3.00	21		15		20		15		24		15		20		15		20		15	
3.30	21		15		20		15		24		15		20		15		20		15	
4.00	21		15		20		15		24		15		20		15		20		15	
Total		**43**		**44**		**53**		**31**		**22**		**32**		**41**		**23**		**0**		**0**
Number of heads used in the experiment	5		5		5		5		5		5		5		5		5		5	
Time of natural blooming	2.30 p.m.																			

No. 4:—Table 25 gives the result of the experiment conducted according to method 3 as described above. These results show that heads put into the lower temperature after 9.00 a.m. bloomed earlier than the time of blooming under natural conditions. But those treated in the same way between 6.00 a.m. and 9.00 a.m. never bloomed. This is because there were slight differences between the outside and the thermostat's temperature.

TABLE 25. *Results of the experiments on the control of blooming time conducted according to method No. 3*

Experiment 23

(July 11, 1928)

Time and outside temperature when heads were put into the thermostat of low temperature (C.)	Temperature of the thermostat (C.)	Blooming time and number of flowers which bloomed										Number of heads used in the experiment	Time of natural blooming
		9 a.m.	9.30 p.m.	10 p.m.	10.30 a.m.	11 a.m.	12 m.	12.30 p.m.	1 p.m.	2 p.m.	3 p.m.		
8.00 a.m. 22.0°	21.0°	0	0	0	0	0	0	0	0	0	0	2	2 p.m.
8.30 a.m. 24.3°	21.0°		0	0	0	0	0	4	0	0	0	2	
9.00 a.m. 25.8°	21.0°			0	0	0	0	5	0	0	0	2	
9.30 a.m. 26.8°	21.0°				0	0	0	6	0	0	0	2	
10.00 a.m. 26.8°	21.0°					0	0	0	5	0	0	2	
11.00 a.m. 27.4°	21.0°						0	0	4	0	0	2	
12.00 m. 28.1°	21.0°							0	0	3	0	2	
1.00 p.m. 28.5°	21.0°									5	0	2	
2.00 p.m. 25.0°	21.0°										11	2	

TABLE 25—(*Continued*)

Experiment 24

(July 14, 1928)

Time and outside temperature when heads were put into the thermostat of low temperature (C.)	Temperature of the thermostat (C.)	Blooming time and number of flowers which bloomed										Number of heads used in the experiment	Time of natural blooming
		7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.		
6.30 a.m. 18.8°	19.0°	0	0	0	0	0	0	0	0	0	0	2	4.15 p.m.
7.00 a.m. 20.5°	19.0°		0	0	0	0	0	0	0	0	0	2	
9.00 a.m. 23.1°	19.0°				0	0	0	1	4	0	0	2	
10.00 a.m. 24.1°	19.0°					0	0	3	5	0	0	2	
11.00 a.m. 25.5°	19.0°						0	5	5	0	0	2	
12.00 m. 26.2°	19.0°							0	8	0	0	2	
1.00 p.m. 26.3°	19.0°								7	0	0	2	
2.00 p.m. 26.4°	19.0°									15	0	2	
3.00 p.m. 27.0°	19.0°										15	2	

TABLE 25—(*Continued*)

Experiment 25

(July 13, 1928)

Time and outside temperature when heads were put into the thermostat of low temperature (C.)	Temperature of the thermostat (C.)	Blooming time and number of flowers which bloomed							Number of heads used in the experiment	Time of natural blooming
		10 a.m.	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.		
9.00 a.m. 21.0°	21.0°	0	0	0	0	0	0	0	2	4.00 p.m.
10.00 a.m. 24.3°	21.0°		0	0	0	6	0	0	2	
11.00 a.m. 26.7°	21.0°			0	0	4	0	0	2	
12.00 m. 28.0°	21.0°				0	7	0	0	2	
1.00 p.m. 27.3°	21.0°					0	4	0	2	
2.00 p.m. 28.0°	21.0°						7	0	2	
3.00 p.m. 27.5°	21.0°							8	2	

TABLE 25—(*Continued*)

Experiment 26

(July 6, 1928)

Time and outside temperature when heads were put into the thermostat of low temperature (C.)	Temperature of the thermostat (C.)	Blooming time and number of flowers which bloomed							Number of heads used in the experiment	Time of natural blooming
		11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.		
10.00 a.m. 21.1°	13.0°	0	0	3	0	0	0	0	3	2.45 p.m.
11.00 a.m. 21.8°	13.0°		0	3	0	0	0	0	3	
12.00 m. 21.8°	13.0°			7	0	0	0	0	3	
1.00 p.m. 21.8°	13.0°				5	0	0	0	3	
2.00 p.m. 21.7°	13.0°					9	0	0	3	

TABLE 25—(*Continued*)

Experiment 27

(July 10, 1928)

Time and outside temperature when heads were put into the thermostat of low temperature (C.)	Temperature of the thermostat (C.)	Blooming time and number of flowers which bloomed				Number of heads used in the experiment	Time of natural blooming
		10.30 a.m.	11.30 a.m.	12.30 p.m.	1.30 p.m.		
9.30 a.m. 25.0°	21.0°	0	0	4	0	3	1.50 p.m.
10.30 a.m. 26.8°	21.0°		0	8	0	3	
11.00 a.m. 27.5°	21.0°		0	3	0	3	
11.30 a.m. 27.5°	21.0°			0	6	3	

TABLE 25—(*Continued*)

Experiment 28

(July 7, 1928)

Time and outside temperature when heads were put into the thermostat of low temperature (C.)	Temperature of the thermostat (C.)	Blooming time and number of flowers which bloomed							Number of heads used in the experiment	Time of natural blooming
		10 a.m.	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.		
9.00 a.m. 19.5°	19.5°	0	0	0	0	0	0	0	3	2.45 p.m.
10.00 a.m. 20.0°	19.5°		0	0	0	0	0	0	3	
11.00 a.m. 22.4°	19.5°			0	4	3	0	0	3	
12.00 m. 22.5°	19.5°				6	1	0	0	3	
1.00 p.m. 23.2°	19.5°					7	0	0	3	
2.00 p.m. 23.2°	19.5°						13	0	3	

TABLE 25—(*Concluded*)

Experiment 29

(July 9, 1928)

Time and outside temperature when heads were put into the thermostat of low temperature (C.)	Temperature of the thermostat (C.)	Blooming time and number of flowers which bloomed							Number of heads used in the experiment	Time of natural blooming
		10 a.m.	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	5 p.m.		
9.00 a.m. 21.0°	20.0°	0	0	0	0	0	0	0	2	2.20 p.m.
10.00 a.m. 23.4°	20.0°		0	0	19	0	0	0	2	
11.00 a.m. 23.8°	20.0°			0	13	0	0	0	2	
12.00 m. 23.5°	20.0°				5	2	0	0	2	
1.00 p.m. 25.5°	20.0°					20	0	0	2	
2.00 p.m. 25.5°	20.0°						24	0	2	

(ii) Control of blooming on blooming and non-blooming days

According to the writer's observation, there are a number of days when no blooming takes place even though the day's temperature is in the range of blooming temperature on the blooming days, and on these days the variations of temperature are not so remarkable as compared with the days on which blooming occurs. Therefore the writer conducted experiments concerning the control of blooming, anticipating that, by adjusting the temperature, he could make flowers open on the days when no blooming would be supposed to occur and could suppress blooming on the days favourable for blooming. The results of the experiments, as described below, coincide with those already stated in his preliminary report.[20]

a :—Control of blooming on the days when blooming does not occur.

Materials and Method

Fully developed heads were cut on a day when no blooming was supposed to occur and put in a glass bottle. These were put for a certain length of time first into a thermostat the temperature of which was higher than the outside temperature at the time and then removed into a thermostat whose temperature was lower.

Results of the experiments

The results are shown in Table 26. Each experiment shows that, by adjusting temperature artificially, blooming can be made to occur on the days when flowers do not open under natural conditions. It is necessary to pay special attention to the fact that on these days high temperature does not merely cause flowering, but that only when temperature falls does blooming occur.

TABLE 26. *Results of experiments on the control of blooming on non-blooming days.*

Experiment 30

(July 8, 1928)

Time and outside temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed			Number of heads used in the experiment
		High	Low	1.00 p.m.	2.00 p.m.	3.00 p.m.	
10.00 a.m. 18.8°C.	12.00 p.m.	29°	20°	0	8	0	2
		26°	20°	0	6	0	2
	1.00 p.m.	29°	20°		12	0	2
		26°	20°		9	0	2
	2.00 p.m.	29°	20°			9	2
		26°	20°			8	2

TABLE 26—(*Continued*)

Experiment 31

(August 31, 1928)

Time and outside temperature when heads were put into the thermostat of high temperature	Time at which heads were transferred from the thermostat of high temperature to that of low	Temperature of the thermostat (C.)		Blooming time and number of flowers which bloomed			Number of heads used in the experiment
		High	Low	2.00 p.m.	3.00 p.m.	4.00 p.m.	
9.30 a.m. 23.8°C.	1.00 p.m.	28°	20°	4	2	0	5
	1.00 p.m.	29°	20°	2	4	0	5

TABLE 26—(*Continued*)

Experiment 32

(September 1, 1928)

	Blooming time and number of flowers which bloomed								Number of heads used in the experiment
	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	Total	
A	0	0	0	3	0	0	0	3	2
B	0	0	0	2	0	0	0	2	2
C	0	0	0	0	0	0	0	0	2
D	0	0	0	0	0	0	0	0	2

A and B were put into a thermostat set at 25.5°C. at 10 a.m. when the outside temperature was 20°C., and then A was put in another thermostat set at 20°C. at 1 p.m. B was exposed to the high temperature of 29°C. from 12 m. to 1 p.m. and then to the lower temperature of 20°C., and C was kept in a thermostat set at 20°C. (the same temperature as outside) and no change in the temperature was made. D, which had been cut, was left on the plot in the natural temperature.

TABLE 26—(*Continued*)

Experiment 33

(September 12, 1928)

	Blooming time and number of flowers which bloomed								Number of heads used in the experiment
	10 a.m.	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	Total	
A				0	0	3	0	0	3	2
B	0	0	0	0	0	0	0	0	0	2
C	0	0	0	0	0	0	0	0	0	2

The heads A, B and C were cut at 9.30 a.m. when the temperature was 19.5°C. A was put in the thermostat set at 27°C. and at 12.30 p.m. it was lowered to 19°C. B was kept in the thermostat set at 19°C. all day, and C was left on the plot and exposed to the natural temperature.

TABLE 26—(*Continued*)

Experiment 34

(September 19, 1928)

Time		9.30 a.m.	10 a.m.	11 a.m.	12 m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	Total	Number of heads used in the experiment
I.	T(1)	25°	25°	25°	21°	21°	21°	21°	21°	21°		
	B(2)						6	0	0	0	6	3
II.	T	25°	25°	25°	25°	25°	21°	21°	21°	21°		
	B							5	0	0	5	3
III.	T	25°	25°	25°	25°	29°	21°	21°	21°	21°		
	B							7	0	0	7	3
IV.	T'(3)	17°	17.2°	16.4°	16°	16°	15.5°	15.4°	15.2°	15.2°		
	B										0	3

(1)——T Temperature of the thermostat (C.)
(2)——B Number of flowers opened
(3)——T' Natural temperature of the day

TABLE 26—(*Concluded*)

Experiment 35

(September 21, 1928)

Time		9 a.m.	10 a.m.	11 a.m.	12 m.	1 p.m.	2.30 p.m.	3.30 p.m.	3.30 p.m.	4 p.m.	Total	Number of heads used in the experiment
I.	T(1)	19°	19°	19°	19°	28°	19°	19°	19°	19°		
	B(2)							0	2	0	2	2
II.	T	19°	19°	19°	19°	28°	28°	28°	19°	19°		
	B									3	3	2
III.	T'(3)	16.8°	18.5°	19°	19.5°	20.5°	20.5°	9.5°	19.8°	19.5°		
	B										0	2

(1)——T Temperature of the thermostat (C.)
(2)——B Number of flowers opened
(3)——T' Natural temperature of the day

b:—Control of blooming on the days when blooming occurs.

Heads were cut on a day when the external conditions were most favourable for normal blooming and were put into a thermostat whose temperature was almost the same as that outside at the time of cutting. In this case no flowers open, as is shown in the foregoing tables (Table 24. Ex. 21, Ex. 22. Table 25. Ex. 23, 24, 25, 28 and 29). Thus on the days for blooming, it can be checked by controlling the temperature.

2. *Blooming controlled by Humidity*

As is shown in the results of the observations described in the previous chapter, an intimate relation between the variations of humidity and blooming can be recognized, but the variations of humidity are caused only subordinately to those of temperature and it can be considered that they are not connected directly with blooming. The writer in order to make this point clear, conducted experiments concerning the blooming time and blooming in humid variations.

Materials and Methods

In this investigation, fully developed heads were used. Humidity is divided into the following three different kinds.

A :—Natural state of humidity inside a tent pitched in the experimental farm, in a dark room or in a thermostat. This is called "A" in the following.

B :—A small quantity of water is poured into a glass jar with a lid. In a little while the air in the jar is saturated with moisture. This state of humidity is hereafter called "B".

C :—A small quantity of calcium chloride (for drying) is poured into a glass jar and the air in it is made dry. This state of dryness is called "C".

The heads were cut at three different hours between 6 a.m. and 7 a.m., between 10 a.m. and 11 a.m. and between 1 p.m. and 2 p.m. and were put in small glass bottles. These bottles were put again into glass jars whose humidity was "B" and "C" respectively and were placed in the tent on the farm, in the dark room of the laboratory, and in the thermostat. At the same time the heads put into other small glass bottles were placed side by side with the glass jar in each of the three above mentioned places. The heads thus treated were subjected to the following variations in temperature and humidity.

From 6 a.m. to 7 a.m. the temperature is low and humidity high. When the heads cut during this time are put in small glass bottles which are put again into the glass jar of humidity "B" and are placed in the tent, the humidity increases a little, while in those put into the glass jar of humidity "C" it decreases. The temperature depends on that of the day as under natural conditions. Those put into the dark room are subject to the same changes in humidity as in the above case. The tem-

perature of the dark room is low and no changes are caused during the whole day. Those put into the thermostat are subjected to the same changes of humidity as in the case of the tent, but the temperature could be changed at will.

From 10 a.m. to 11 a.m. temperature rises a little and humidity decreases somewhat. The heads cut during this time and put into the glass jar of humidity "B" and then placed in the tent are subjected to the change of a little more increase in humidity and those heads in the glass jar of humidity "C" are affected by the changes caused by a decrease of humidity. The changes of temperature depend on those in the natural state of that day. Those placed in the dark room undergo the same changes in humidity as those put in the tent. The temperature in the dark room is lower than that from 10 a.m. to 11 a.m. and therefore the heads are affected by changes caused by its decrease. Those put into the thermostat are subject to the same effect as in the case of the tent. Its temperature can be adjusted at will.

From 1 p.m. to 2 p.m. temperature becomes much higher and humidity decreases very much. The heads put into the glass jar of humidity "B" in the tent undergo changes caused by a great increase of humidity and those in the glass jar "C" are affected by the changes caused by decrease. The temperature depends on the changes in natural state. Those heads placed in the dark room are affected by the same changes in humidity as caused in the tent; the temperature in the room is lower than outside at this time, therefore they are subjected to much greater changes caused by decrease than in the case from 10 a.m. to 11 a.m. Those put in the thermostat receive the same change of humidity as caused in the tent and temperature can be kept at the same degree as that outside and can be made higher than that.

The results of the experiments

The results of the experiments conducted in the above described manner, are shown in Table 27.

The flowering time should be considered with reference to the results shown in Table 27. The natural flowering time on July 16th (Experiment 1) was 3:30 p.m. and the heads put in the tent on the farm bloomed almost at the same time as those in the natural condition. Those put in the dark room began to bloom earlier than those in the natural condition.

TABLE 27. *Relation between blooming and humidity*

Experiment 1

(July 16, 1929)

The places in which heads were put		In shed on the experimental plot									In dark room									In thermostat						Control
Time at which heads were cut		6.00–7.00 a.m.			10 00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			
Humidity / Time		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Number of flowers bloomed	p.m. 0.30										2	2	3													
	1.00										1	6	2													
	1.30										0	0	3	1	0	0										
	2.00													8	8	8										
	2.30													1	0	0										
	3.00	5	0	0	2	0	0	0	0	0	0	0	0				10	17	10							
	3.30	6	11	12	7	10	16	7	7	0							0	0	0							8
	4.00	0	3	6	0	5	0	0	5	6																2
	Total	11	14	18	9	15	16	7	12	6	3	8	8	10	8	8	10	17	10							10

A = Natural state of humidity.

B = The air in the bottle is saturated with moisture.

C = The air in the bottle is made dry.

TABLE 27—(*Continued*)

Experiment 2

(July 18, 1929)

The places in which heads were put		In shed on the experimental plot									In dark room									In thermostat						Control
Time at which heads were cut		6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			
Time \ Humidity		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Number of flowers bloomed	p.m.																									
	1.00										0	2	4	3	7	2										
	1.30										3	3	0	8	9	8										
	2.00																20	15	14							
	2.30																1	15	1							
	3.00	6	0	0	9	0	0	7	0	0																
	3.30	6	15	15	1	22	15	0	9	5																17
	4.00	0	0	0	0	0	1	0	0	0																
	Total	12	15	15	10	22	16	7	9	5	3	5	4	11	16	10	21	30	15							17

A = Natural state of humidity.

B = The air in the bottle is saturated with moisture.

C = The air in the bottle is made dry.

TABLE 27—(*Continued*)

Experiment 3

(July 23, 1929)

The places in which heads were put		In shed on the experimental plot									In dark room									In thermostat						Cintrol
Time at which heads were cut		6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m			6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			
Humidity / Time		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Number of flowers bloomed	p.m.																									
	1.00										0	0	0	16	7	16										
	1.30										0	0	0	0	0	0										
	2.00										0	0	0	0	0	0										16
	2.30										0	0	0	0	0	0										
	3.00										0	0	0	0	0	0	28	28	36							
	3.30										0	0	0	0	0	0	0	0	0							
	4.00										0	0	0	0	0	0	0	0	0							
	4.30										0	0	0	0	0	0	0	0	0							
	5.00										0	0	0	0	0	0	0	0	0	8	12	15				
	5.30										0	0	0	0	0	0	0	0	0	0	0	0				
	Total										0	0	0	16	7	16	28	28	36	8	12	15				16

A = Natural state of humidity.

B = The air in the bottle is saturated with moisture.

C = The air in the bottle is made dry.

TABLE 27—(*Concluded*)

Experiment 4

(July 25, 1929)

The places in which heads were put		In shed on the experimental plot									In dark room									In thermostat						Control
Time at which heads were cut		6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			
Humidity / Time		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Number of flowers bloomed	p.m.																									
	1.00													0	0	0										
	1.30										0	0	0	5	1	0										
	2.00										0	0	0	9	3	3										
	2.30										0	0	0	8	10	14										
	3.00										0	0	0	0	0	0										
	3.30	9	0	0	9	0	0																			16
	4.00	5	14	8	8	13	19																			4
	4.30	1	7	4	0	0	0													9	10	8	11	0	0	
	Total	15	21	12	17	13	19				0	0	0	22	14	17				9	10	8	11	0	0	20

A = Natural state of humidity.

B = The air in the bottle is saturated with moisture.

C = The air in the bottle is made dry.

This fact could be proved true on the other days (July 18th and 25th (Experiments 2 and 4.)). When the heads which were cut at different times and put into jars of different humidity and then placed in the tent, were observed, there could be perceived no difference between those cut early in the morning and those cut in the afternoon. In the case of dark room, the earlier they were put into it, the sooner they bloomed. In the natural condition they bloomed at 3:30 p.m. on July 16, but those put into the low temperature from between 6 and 7 a.m. bloomed at 12:30 p.m. and those between 1 p.m. and 2 p.m. bloomed at 3 p.m. This shows that they all bloomed earlier than the natural flowering time.

Next, it was investigated whether blooming occurs or not as a result of changes in humidity, and the result was that, whenever the heads in natural condition bloomed, those placed in the tent on the farm did also, regardless of the time when changes in humidity took place and of the differences in humidity. But it was not so with those placed in the dark room. Difference arises according to the time when changes in humidity take place. When changes in humidity took place between 10 and 11 a.m. and between 1 and 2 p.m. every head bloomed, but when changes took place between 6 and 7 a.m. the blooming varied according to days. As shown in Table 27, on July 16 and 18 blooming occurred in the three different humidities but on July 23 and 25 no blooming took place in them.

From these points it can be understood that blooming does not depend on humidity, but on something else. On the other hand, from the view point of temperature, on the days (July 23rd and 25th in Table 27) when no blooming occurred in the dark room (heads were cut early in the morning and put in bottles B and C) the temperature at 6 a.m. on July 23rd was 20.8°C and at 7 a.m. on July 25th was 22°C. These were almost the same as the temperature in the dark room which was 21°C. On the days (July 16, 18), when blooming occurred the temperature of the early morning was 26°C. which was much higher than that of the dark room, temperature of which being 23°C. This fact shows that on the days when no blooming occurs, there is little variation in temperature and that in the latter case the variation in temperature is great. Therefore it can be considered that blooming is caused not by the variation of humidity, but by that of temperature.

3. Summary

1. Experiments were conducted on the blooming of oats and the control of the time of blooming by the variation in temperature and humidity.

2. Blooming and the time of blooming can be controlled by changing temperature, but can not be controlled by changing humidity.

3. When the heads in the blooming stage are cut at different times and are first put in the higher temperature and then in the lower one, they can be made to bloom 3 or 4 hours earlier or later than the natural blooming time.

4. When the heads are put in a lower temperature than that at the time they are cut, they can be made to bloom 2 hours earlier than the natural blooming time.

5. By adjusting temperature oats can be made to bloom on days when no blooming occurs under the natural conditions.

6. By adjusting temperature the blooming can be checked.

7. The heads in the blooming stage are cut and put in the natural state of humidity in the air, in a glass jar which is saturated with moisture and in a glass jar which is made dry with calcium chloride. While there is no difference with regard to the time of blooming under those states of humidity, when the time of blooming arrives the heads in the 3 different humidities all bloom and if no blooming occurs it is the same in all three humidities.

III. Physiological studies on the Blooming of Oat Flowers

The writer found as the results of his observations and experiments given in chapter II, that variations in temperature have an intimate relation with blooming, and from this fact it follows that there must also be a very close relation between the swelling of the lodicules which is the direct cause of blooming and variations in temperature. In order to determine whether the variations of temperature are the direct cause of the swelling of the lodicules or not, the writer studied on the relation between the opening and closing of stomata and also the relation between blooming and absorption of water by the plant. Further, the writer studied on the relation between the morphological and chemical changes of the lodicules at the time of blooming and the temperature in order

to make clear the relation between temperature and physiology of blooming. The following are the results of these studies:—

1. *Relation between the Opening and Closing of the Stomata and Temperature, Humidity and Blooming*

Materials and Method

Oats in blooming stage were used as materials and the opening and closing of stomata on the dorsal side of the uppermost leaf of the main stem were carefully observed. The method of observation was by the use of cobaltchloride paper. This method was applied three times on the same leaf and its value was determined by their average. The writer observed it every hour between 9 a.m. and 4:30 p.m. The degrees of the opening and closing were shown by the length of time required for the deep standard colour to change to light standard colour.

Results of the experiment

From the results set down in Table 28, it is evident that stomata become wider as temperature rises and humidity decreases and they become smaller after the highest temperature with the least humidity of the day. That is to say, the opening and closing of stomata have parallel relation with temperature and humidity. Regarding such parallel relation between the environmental factors and transpiration BRIGGS and SCHANTZ[3] performed experiments with oats and they too obtained the same result as the writer did. As blooming occurs while the temperature of the day is declining from its highest point so the same thing happens while the stomata are closing. That is to say, when the quantity of water transpired from the stomata decreases, blooming occurs.

Therefore, it seems as if there exists a relation between blooming and the opening and closing of stomata, but the results of the experiment "on the relation between blooming and absorption" as shown in the following section proves that there is no direct relation between them.

2. *Relation between Blooming and Absorption of Water by Plants*

The results of the experiment reported in the previous section have shown that when temperature rises and stomata open wider and the transpiration from plants increases more and more, plants absorb more

TABLE 28. *Relation between the opening and closing of stomata and temperature, humidity and blooming 1928*

Date	Time	Length of time in seconds required for deep standard colour to change to lights tandard colours								Temperature (C.)	Humidity (%)	Time of blooming
		I		II		III		Average				
September 4.	9.30 a.m.	48	9/19	45	17/20	47	4/5	47	31/60	26.5°	75	
	10.30 a.m.	43	9/10	46	9/10	41	3/5	44	2/15	27.6	66	
	11.30 a.m.	51	7/10	47	9/10	69	3/10	56	9/10	27.7	71	3.00
	1.30 p.m.	77	3/5	73	9/10	75		75	1/2	28.2	69.5	p.m.
	2.30 p.m.	78	2/5	76	1/4	77	1/10	77	1/4	26.9	74	
	3.00 p.m.	80	2/5	84	3/5	88	3/10	84	1/10	26.0	80	
September 5.	10.00 a.m.	61		64		62	7/10	62	17/30	27.2	68	
	11.00 a.m.	52	1/10	52	1/10	53	1/5	52	7/15	27.4	65	
	12.00 a.m.	46	7/10	41	1/4	45	9/10	45	11/60	28.0	65	
	1.00 p.m.	54	3/4	60	4/5	63	7/10	60	11/12	27.6	67.5	3.00
	2.00 p.m.	67	1/5	67	7/20	69	1/10	68	19/60	27.0	70	p.m.
	3.00 p.m.	80	1/2	80	3/4	77	3/20	79	11/15	25.5	80	
	4.00 p.m.	96	1/5	82	1/5	90	1/5	89	59/60	24.5	86	
September 6.	10.00 a.m.	70	7/10	70	1/4	71	7/10	70	53/60	27.0	74	
	11.00 a.m.	61	3/20	58	1/4	64	9/10	61	13/30	26.7	76	
	12.00 a.m.	63	7/10	62	1/2	69	3/5	65	4/15	25.9	78	2.00
	1.00 p.m.	62	2/5	67	4/5	71	4/5	68	8/15	26.0	77.5	p.m.
	2.00 p.m.	75		81	7/10	70	9/10	75	9/10	26.0	78	
September 7.	10.00 am.	67	9/10	71	1/10	67		68	1/3	27.5	67	
	11.00 a.m.	60	1/10	71	7/10	58		63	4/15	28.6	60	
	12.00 a.m.	66	1/2	70	1/10	70	2/5	68	2/3	29.0	54	3.00
	1.00 p.m.	70	1/2	69	1/10	69	2/5	69	1/3	30.0	48	p.m.
	2.00 p.m.	66	7/10	65	1/4	69	3/5	66	11/60	30.4	51.5	
	3.00 p.m.	74	3/5	76	9/10	75	3/10	75	3/5	28.3	62	
September 8.	10.00 a.m.	102	2/5	92	3/5	100	1/10	98	11/30	19.0	52	
	12.00 a.m.	101	1/10	101	3/5	102	2/5	101	7/10	19.0	59	
	1.00 p.m.	125	7/10	125	2/5	125	3/10	125	7/15	20.2	58	3.00
	2.30 p.m.	163	1/10	155	9/10	161	3/5	160	1/5	19.9	54	p.m.
	3.30 p.m.	198	1/4	191	2/5	178	9/10	189	31/60	19.0	59	
	4.00 p.m.	247	2/5	277		271	2/5	265	4/15	18.2	67	
September 22.	9.30 a.m.	166	2/5	165	7/10	169	2/5	167	1/6	18.3	59	
	1.30 a.m.	112		110	9/10	110	7/10	111	1/5	18.8	55.5	
	12.30 p.m.	106	9/10	108	4/5	108	17/20	106	51/60	19.6	58	3.00
	2.00 p.m.	158	2/5	154	1/4	158	3/10	156	59/60	18.5	62	p.m.
	3.00 p.m.	137	3/5	131	4/5	111		126	11/15	19.0	63	
	4.00 p.m.	145		144	2/5	147	3/4	145	43/60	17.8	70	

water from the earth. But from this fact alone it can not be asserted that the increase of water has a direct relation with blooming, because the writer often observed in his experiment that the heads which were put into the bottle containing no water bloomed like those in the natural condition. From this fact, it seems that oats do not require much water at the time of blooming. The writer, therefore in order to make this relation clear, conducted the following experiments on the relation between absorption of water and blooming.

Materials and Method

Three heads of oats were put into each of the bottles, one of which contained some water. These were again put into glass jars, one of which had been saturated with moisture and the other was dry. These were ararnged under different environmental conditions, temperature was controlled and blooming was observed. (See Chapter II)

The results of experiment

The results are shown in Table 29. When the blooming of a head put into the bottle containing some water and that of another head put *into the bottle containing no water are compared, under favourable* environmental conditions the former never fails to bloom, but the latter sometimes blooms and sometimes does not. When heads are cut and put into the bottles and then exposed to the atmosphere, those in the bottle with water bloom, but those in the bottle with no water do not bloom. But those cut when the hours of blooming of the day approach, bloom when treated in the latter way. However, those put into the glass jars bloomed alike no matter whether water was present or not. When the heads are exposed to the atmosphere those in the bottle containing no water do not bloom because the transpiration from the head is so great that the head withers from the lack of water supplied from below. On the other hand, those in the bottles containing water do not wither, but bloom as usual because water is supplied from below. Inside the glass jars which are saturated with moisture, the humidity is high and there is no air current and so no water is lost from the plant, and those in the bottles containing no water need not be supplied water from the bottom, for blooming without withering away.

In the glass jars whose air is dried, those kept in the small bottle with no water in it, though there is no water to make up for the loss, do not wither. This is because, owing to the extraordinary changes in

TABLE 29. *Comparison of the blooming in the bottles which contain some water with blooming in others which contain no water under different humidities in shed and in room of low temperature*

Experiment 1 (July 16, 1929)

Places in which heads were put			In shed on the experimental plot									In room of low temperature									In thermostat						Control
Time at which heads were cut			6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			
Time \ Humidity			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Number of flowers bloomed	p.m. 0.30	I										2	2	3													
		II										0	2	0													
	1.00	I										1	6	2													
		II										0	6	0													
	1.30	I										0	0	3	1	0	0										
		II										0	0	6	2	0	0										
	2.00	I													8	8	8										
		II													7	10	9										
	2.30	I													1	0	0										
		II													2	0	0										
	3.00	I	5	0	0	2	0	0	0	0	0	0	0	0				10	17	10							
		II	0	0	0	0	0	0	0	0	0							13	10	10							
	3.30	I	6	11	12	7	10	16	7	7	0							0	0	0							8
		II	0	7	3	0	12	3	5	4	0							1	0	0							
	4.00	I	0	3	6	0	5	0	0	5	6																2
		II	0	4	7	0	5	0	9	2	11																
	Total	I	11	14	18	9	15	16	7	12	6	3	8	8	10	8	8	10	17	10							10
		II	0	11	10	0	17	3	14	6	11	0	9	6	11	10	9	14	10	10							

A = Natural state of humidity.
B = The air in the bottle is saturated with moisture.
C = The air in the bottle is made dry.

I = The bottle which contained some water.
II = The bottle which contained no water.

TABLE 29—(*Continued*)

Experiment 2 (July 18, 1929)

Places in which heads were put			In shed on the experimental plot									In room of low temperature									In thermostat						Control
Time at which heads were cut			6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			
Time \ Humidity			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Number of flowers bloomed	p.m. 1.00	I										0	2	4	3	7	2										
		II										0	1	1	0	0	1										
	1.30	I										3	3	0	8	9	8										
		II										0	3	1	0	4	1										
	2.00	I																20	15	14							
		II																10	10	8							
	2.30	I																1	15	1							
		II																10	10	0							
	3.00	I	6	0	0	9	0	0	7	0	0																
		II	0	0	0	0	0	0	3	1	2																
	3.30	I	6	15	15	1	22	15	0	9	5																17
		II	0	9	0	0	16	10	0	10	5																
	4.00	I	0	0	0	0	0	1	0	0	0																
		II	0	1	2	0	1	1	0	0	0																
	Total	I	12	15	15	10	22	16	7	9	5	3	5	4	11	16	10	21	30	15							17
		II	0	10	2	0	17	11	3	11	7	0	4	2	0	4	2	20	20	8							

A = Natural state of humidity.
B = The air in the bottle is saturated with moisture.
C = The air in the bottle is made dry.

I = The bottle which contained some water.
II = The bottle which contained no water.

TABLE 29—(*Continued*)

Experiment 3 (July 23, 1929)

Places in which heads were put			In shed on the experimental plot									In room of low temperature									In thermostat						Control
Time at which heads were cut			6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			
Time \ Humidity			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Number of flowers bloomed	p.m. 1.00	I										0	0	0	16	7	16										
		II										0	0	0	14	14	14										
	1.30	I										0	0	0	0	0	0										
		II										0	0	0	0	0	0										
	2.00	I										0	0	0	0	0	0										16
		II										0	0	0	0	0	0										
	2.30	I										0	0	0	0	0	0										
		II										0	0	0	0	0	0										
	3.00	I										0	0	0	0	0	0	28	28	36							
		II										0	0	0	0	0	0	42	31	27							
	3.30	I										0	0	0	0	0	0	0	0	0							
		II										0	0	0	0	0	0	0	0	0							
	4.00	I										0	0	0	0	0	0	0	0	0							
		II										0	0	0	0	0	0	0	0	0							
	4.30	I										0	0	0	0	0	0	0	0	0							
		II										0	0	0	0	0	0	0	0	0							
	5.00	I										0	0	0	0	0	0	0	0	0	8	12	15				
		II										0	0	0	0	0	0	0	0	0	15	3	6				
	5.30	I										0	0	0	0	0	0	0	0	0	0	0	0				
		II										0	0	0	0	0	0	0	0	0	0	0	0				
	Total	I										0	0	0	16	7	16	28	28	36	8	12	15				16
		II										0	0	0	14	14	14	42	31	27	15	3	6				

A = Natural state of humidity.
B = The air in the bottle is saturated with moisture.
C = The air in the bottle is made dry.

I = The bottle which contained some water.
II = The bottle which contained no water.

TABLE 29—(*Concluded*)

Experiment 4 (July 25, 1929)

Places in which heads were put			In shed on the experimental plot									In room of low temperature									In thermostat						Control
Time at which heads were cut			6.00–7.00 a.m.			10.00–11.00 a.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 p.m.			1.00–2.00 p.m.			6.00–7.00 a.m.			10.00–11.00 a.m.			
Time \ Humidity			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Number of flowers bloomed	p.m. 1.00	I													0	0	0										
		II													0	0	0										
	1.30	I										0	0	0	5	1	0										
		II										0	0	0	0	1	0										
	2.00	I										0	0	0	9	3	3										
		II										0	0	0	1	3	9										
	2.30	I										0	0	0	8	10	14										
		II										0	0	0	5	4	4										
	3.00	I										0	0	0	0	0	0										
		II										0	0	0	10	0	0										
	3.30	I	9	0	0	9	0	0																			16
		II	0	0	0	0	0	0																			
	4.00	I	5	14	8	8	13	19																			4
		II	0	14	5	10	10	15																			
	4.30	I	1	7	4	0	0	0													9	10	8	11	0	0	
		II	0	6	12	0	5	1													19	11	14	2	0	0	
	Total	I	15	21	12	17	13	19				0	0	0	22	14	17				9	10	8	11	0	0	20
		II	0	20	17	10	15	16				0	0	0	16	8	13				19	11	14	2	0	0	

A = Natural state of humidity.
B = The air in the bottle is saturated with moisture.
C = The air in the bottle is made dry.

I = The bottle which contained some water.
II = The bottle which contained no water.

humidity, the stomata close, the transpiration decreases and there is no current of air, and therefore the loss of water from the plant body is very slight.

From the above mentioned experimental results, the writer has come to the following conclusion regarding the relation between blooming and absorption of water: a great quantity of water is not necessary to be taken up from the earth for the swelling of lodicules when blooming occurs, but the plant needs only enough water to keep itself from withering away.

3. Changes in the Forms of the Lodicules at the Time of Blooming of Oats and their Relation to Temperature

The writer recognized through the experiments described in sections 1 and 2 that the variation of temperature is the direct cause of blooming. Therefore, in order to make clear the relation between the swelling of lodicules, which is thought to be the mechanic action of blooming and variation of temperature, observation was made upon the morphological changes of lodicules at the time of blooming.

Materials and Methods

It may suffice to observe and compare the form of the lodicules at the three periods; before, during and after blooming. As the nature of this experiment makes it impossible to observe these three forms by using the same lodicules, so for those before blooming, according to the results of the previous observations on the order of blooming (Sec. 2. Chap. 1.), the lodicules in the order of blooming on the day were chosen and put into use.

The results

(i) Forms of lodicules of oats before blooming

The lodicules of oats 4–5 hours prior to blooming have forms as represented by Figs. 3 and 4 in Plate I. The form of lodicules seen from the front is shown in 3.A. and from the back in 4.A. The two lodicules are joined at their base. When these are separated, the forms appear as shown in Figs. 3.B. and 4.B. The form is flat and slender and the size is 2.11 mm. in length, 0.80 mm. in width and 0.50 mm. in thickness. The contents can be seen by the naked eye. The upper part is colourless and transparent while the lower part is of yellowish brown colour. There is a "hinter zahn" on the edge at the back which is

flat in form and of the same nature as the upper half of the lodicules as found by HACKEL[7] in the lodicule of *Festuca gigantea.*

(ii) Forms of lodicules of oats at the time of blooming

The forms of lodicules at the time of blooming are shown in Figs. 5 and 6 in Plate I. The lodicules at the time of blooming differ considerably from those before blooming when compared with each other. As can be seen at the first glance, the former are much more swollen than the latter and the part that swells is the lower part which is of yellowish brown colour. The swelling goes on outward (towards the lemma) while the back and upper parts do not swell so much.

There is one thing which requires special attention with regard to the lodicules at the time of blooming. When the lodicules are swollen to the fullest extent, cracks are produced. Figure 7 in Plate I shows the lodicule with a crack in it.

As shown in the Figure, a crack is made across the front edge as if it were cut by a knife. Cracks are also sometimes produced in other parts of the lodicules. Such cracks are not made on the days when the environmental conditions are not favourable. Fluid is secreted from these cracks. This fact led the writer to have doubt whether the appearance of cracks has anything to do with the closing of flowers and led him to study this point more in detail.

(iii) Forms of lodicules of oats after closing

The form of the lodicules after the closing of a flower is shown in Fig. 8, Plate I. The part which swells most when blooming occurred sinks and two or three folds are made horizontally.

TABLE 30. *The size of lodicule*

(Averaged value of 50 Lodicules)

	4½ hours before blooming	1½ hours before blooming	Beginning of blooming	1 hour after blooming	1 hour after flower closing
Length (mm.)	2.1645	2.1647	2.0702	1.9600	1.9290
%	100	100	96	91	89
Width (mm.)	0.7845	0.8231	1.4295	1.0736	0.9741
%	100	105	182	137	124
Thickness (mm.)	0.4598	0.5081	0.8835	0.6690	0.5335
%	100	111	192	146	116

TABLE 31. *Relation between the changes in the form of lodicules and temperature on July 4, 1930*

Time	9.00 a.m.	10.00 a.m.	11.00 a.m.	12.00 m.	1.00 p.m.	1.30 p.m.	1.45 p.m.	2.00 p.m.	2.30 p.m.	3.00 p.m.	3.30 p.m.	4.00 p.m.	4.30 p.m.
Temperature (C.)	18.0°	18.8°	19.8°	20.2°	20.6°	20.8°	21.0°	20.6°	19.7°	19.4°	19.0°	18.9°	18.8°
Length (mm.)	—	2.1750	—	2.1825	—	2.1825	—	—	2.0550	2.0700	1.9200	—	1.8525
Width (mm.)	—	0.7725	—	0.7800	—	0.8175	—	—	1.3875	1.1100	0.9300	—	0.8325
Thickness (mm.)	—	0.4500	—	0.4800	—	0.4875	—	—	0.9150	0.7500	0.5925	—	0.5025

(Averaged 10 Lodicules)

TABLE 32. *Changes in the weight of lodicules before and after the time of blooming in 1930*

	4½ hours before blooming	1½ hours before blooming	Beginning	1 hour after blooming	1 hour after the flower closing
Weight (mg.)	0.49	0.53	1.07	0.82	0.58
%	100	108	218	167	118

(Averaged 50 Lodicules)

The foregoing statement deals only with the outer forms of the lodicules before, during and after blooming respectively. Table 30 shows the measurements of the lodicules at each stage of blooming.

Table 30 indicates that prior to blooming almost no changes can be recognized in length and when blooming begins the lodicule has a tendency to become shorter by degrees. Suppose the length of the lodicule 4½ hours before blooming is 100 in ratio, then at the beginning of blooming it becomes 96 and when it closes the length becomes 89. Neither the width nor thickness show any marked difference before blooming, but when blooming occurs they increase rapidly and nearly double in measurement.

In Table 31 the changes in the form of the lodicule as mentioned above are correlated with temperature.

As shown in Table 31, the changes in the form of the lodicule do not occur while the temperature rises, and there is hardly any difference recognizable between the sizes of the lodicule at 1:30 p.m., and those at 12 a.m. and at 12 m. But when these sizes are compared with those of lodicules of the flowers beginning to bloom at 2:30 p.m., there is a remarkable difference in form. Therefore the changes in size seem to take place rapidly between 1:30 p.m. and 2:30 p.m., and the highest degree of temperature on this day was registered at 1:45 p.m. Therefore it seems that the changes in size occur rapidly when the temperature begins to lower from its highest point. This is made clear when we observe the changes in the matter contained in the lodicule as related in section 4.

Table 32 gives the results of the comparison of weight as perceived while the changes are going on.

As shown in Table 32, in weight, too, there is hardly any difference recognizable before blooming, but as soon as the flower begins to bloom, the lodicule increases rapidly in weight. When compared with that 4½ hours before blooming, it becomes more than twice as heavy.

4. Chemical Changes in Lodicule of Oats

As mentioned in the preceding section, the lodicule of oats undergoes a remarkable change in its external aspect when booming takes place. This fact easily suggests that some chemical changes may occur in its contents. The writer, therefore, conducted the following experiments in order to find out how the two qualities, quantity of reducing sugar and the action of diastase, differ before blooming, during blooming

and after closing respectively, and the relation between these chemical changes and the changes of temperature.

Materials used for these experiments were the same as those used in the experiments described in Section 3.

(i) Quantity of reducing sugar in lodicule

ZUDELLEL,[42] NAKAO[30] and others have studied on the sugars contained in lodicule-cells of cereals and reported that the swelling of the lodicule is due to the tremendous increase of turgidity which is caused by these sugars.

NAKAO stated that the materials which cause turgidity are sugars that reduce Fehling's solution, the chief sugar being glucose.

The writer experimented to find out what changes occur in the quantity of reducing sugars (chiefly glucose) contained in the lodicule at the time before, during and after blooming respectively and also to find whether there is any relation between temperature and these changes.

Materials and Methods

The writer made an experiment on the qualitative reaction of reducing sugars by using Benedict's reagent[31] of sugar. He put two crushed lodicules at each time on a slide and poured two drops of reagent on them and then heated. When reducing sugars were present a reddish yellow deposit was formed.

In this case, of course, the quantity of reducing sugar can not be shown, but the degree of deposition can be shown by the number of positive signs. Table 33 shows the results of this experiment.

As shown in Table 33 the fact that a small quantity of deposit is formed before blooming indicates that there exists only a small quantity of reducing sugars (glucose). As the hour of blooming approaches, the quantity of deposit increases by degrees and at the time when blooming takes place its deposit increases in great quantity. And after the blooming the deposit increases more and more as time elapses until the greatest quantity of deposit is formed just before and after closing. The period of deposit formation before the time of blooming is after the highest temperature of the day is reached.

In the above experiment the reducing sugar contained in the lodicule was detected by means of reagent and therefore the reducing sugar at each period could not be compared quantitatively with one another. The writer, therefore, in order to find out the quantity of reducing

TABLE 33. *Results of experiments on the qualitative reaction of reducing in the lodicules of oats before, during and after blooming in 1930*

Date \ Time		8.30 a.m.	9.00 a.m.	9.30 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 a.m.	1.00 p.m.	1.30 p.m.	2.00 p.m.	2.30 p.m.	3.00 p.m.	3.30 p.m.	4.00 p.m.	4.30 p.m.	5.00 p.m.	5.30 p.m.	Time of blooming
June 30	T(1)		23.4		25.1		25.4		26.6		25.0		25.0		24 5			24.3		24.0	2.00 p.m.
	S(2)		+		+		+		+		+ +		+ + + +		+ + + +			+ + + +		+ + +	
July 1	T	20.0		22.2		23.0		23.5	23.8	23.3	23.2			22.0		21.0	20.5		20.0		2.30 p.m.
	S	+		+		+		+	+	+	+			+ + + +		+ + + + +	+ + +		+ + + +		
July 2	T	22.0		23.0		24.0		25.2		25.2	27.8	26.4	26.4	27.6	26.4	25.8	26.0	25 8	25.4	25.0	4.30 p.m.
	S	+		+		+		+		+	+	+	+	+	+ +	+ +	+ +	+ + + +	+ + + +	+ + + +		
July 3	T	19.4		21.8		22.8	23.4	22.9	22.6	22.8	22.5	20.4		19.8	19.6		16.8			15.0	1.30 p.m.
	S	+		+		+	+	+	+	+	+ +	+ + + +		+ + + + +	+ + + + +		+ + + +			+ + + +		
July 4	T		17.6		19.0		17.8		19.8		20.0		19.5		19.8	19.2		18.6		18.0	2.00 p.m.
	S		+		+		+		+		+		+ + + +		+ + + + +	+ + + +		+ + + +		+ + + +	
July 5	T		19.8		20.0		21.0		21.3		21.3		21.8	21.0	20.8			19.8		19.0	2.30 p.m.
	S		+		+		+		+		+		+	+ + + +	+ + + + +			+ + + +		+ + + +	

(1) T = Temperature (C.)

(2) S = Degree of deposit.

sugar made use of the "Beltrand" method, using 100 lodicules at each period. As glucose is the chief constituent of reducing sugar, the writer taking the whole reducing sugar found in this way as glucose, determined its quantity in one lodicule at each period. Table 34 shows the results thus obtained.

TABLE 34. *Result of quantitative analysis of reducing sugar in a lodicule* of oats obtained before, during and after blooming period in 1930*

	Before blooming (2–3 hours)	In the process of blooming	After blooming (1–1½ hours)
Glucose (mg.)	0.0147	0.0673	0.0392
%	100	450	260

* (An average of 100 lodicules)

As shown in Table 34, the quantity of glucose contained in the lodicule is the greatest in the process of blooming. It is 4.5 times as great in comparison with the quantity of glucose before blooming. The quantity decreases after the closing of a flower, but remains 2.6 times that contained before the opening of a flower.

(ii) Action of enzyme

It was mentioned in the preceding paragraph that at the time of blooming the sugar quantity increases enormously in the lodicule. The fact that sugar increases in this way makes it necessary to investigate the manner of diastase action on starch in the lodicule in connection with the formation of sugar. Therefore the writer experimented in the following manner on the action of diastase in the lodicule before, during and after blooming.

Methods

Two crushed lodicules were put in a watch-glass and two drops of 0.02% solution of soluble starch were added and this was covered with another watch-glass of the same size. The glass was kept in a thermostat at 30°C for one hour and then taking it out $N/10$ of j. j. Kali solution was added. If any starch is contained in it, an alkaline reaction results, but when starch is saccharified by enzyme this reaction does not take place.

The writer investigated whether there is any action of diastase in the lodicule by means of this method, the following being the results.

TABLE 35. *Result of experiment on the action of diastase in the lodicules of oats obtained before, during and after blooming in 1930*

	Before blooming				In the process of blooming		After blooming
	More than 3 hours	3–1½ hours	1½–½ hours	½ hour	Blooming flower	Non-blooming flower	After closing
Jul. 25	− − −	− − −		+ + +	+ + +	− − −	+ − −
„ 26	− − −	− − −		+ + +	+ + +	− − −	− − −
„ 27		− − −	− − +		+ + +	− − −	− − −
„ 28	− − −				+ + +	− − −	+ − −
Aug. 1	− − −		− − −		+ + +	− − −	− − −
„ 2	− − −		− − −		+ + +	− − −	+ − −
„ 3		− − −		− − −	+ + +	− − −	− − −
„ 20		− − −			+ + +	− − −	− − −
„ 22		− − −		+ − +	+ + +	− − −	− − +
„ 23	− − −	− − −			+ + +	− − −	− − −

(−) signifies negative results as to the action of diastase and (+), positive.

Table 35, shows that the action of enzyme is negative in the majority of those lodicules before blooming and that it is positive in every one of those during blooming, that is, starch has already been saccharified. The action is negative in most cases after the closing of the flower. At the same time an immature spikelet which was to bloom the next day was taken and the action of diastase in it was investigated, the results being that every one of them was negative.

Again, there are lodicules which show positive action of enzyme even before blooming, and when considered in connection with the changes of temperature of the day, there is shown a reaction of starch before the highest temperature is reached, but when the temperature grows lower no starch reaction is shown.

From this fact it can be considered that the action of enzyme commences when the temperature begins to decline.

5. SUMMARY.

1. The opening and closing of the stomata are in a parallel relation with temperature and humidity. Blooming occurs when the stomata begin to close.

2. When a head is put in a bottle containing some water, blooming

always takes place, but when it is put in a bottle containing no water and is exposed to the air, blooming never takes place. But when the latter is put in a glass jar and is cut off from the outer air, blooming takes place. That is to say, a special supply of water is not necessary for blooming, but only so much water is needed as is sufficient to keep the heads alive.

3. Almost no changes take place in the form of the lodicule before blooming.

4. Extraordinary changes occur during blooming. The lower half of the lodicule swells considerably.

5. Its decreases during blooming, but both its width and thickness increase about double.

6. Its weight which was 0.49 m.g. before blooming becomes 1.07 m.g., about double.

7. Such changes take place when the temperature begins to go down from its highest point of the day.

8. Reducing sugars exist in a very small quantity before opening occurs, and do not increase up to a certain period of time. The quantity, however, goes on increasing from the time immediately before the flower opens and when blooming occurs it increases rapidly until it attains about 4.5 times the quantity Present before blooming.

9. The action of enzyme is hardly recognizable before opening, but the action takes place actively immediately before opening. The maximum is reached during blooming and no action is recognized after closing of the flower.

10. The changes of reducing sugar and enzyme action have intimate relation with temperature. When temperature is rising, no change takes place in reducing sugar nor is any enzyme action recognized. But when temperature goes down and reaches a certain point, the reducing sugar increases, and the action of enzyme appears remarkably.

Discussion

Which element of all outside conditions has the closest influence upon the blooming of a plant varies according to the different kinds of plants. Each investigator has a different opinion upon this question. A. D. VIRVILLE and F. OBATON (1925) made a biologic study on the opening of some flowers and methodical observations made under natural conditions have led them to the conclusion that the movements of the

corolla, particularly in the case of ephemeral flowers, are dependent upon the variable meteorology of the day, more particularly upon variations in temperature. It was shown that temperature is the only agent that determines the movements of the petals as well as their fall and accordingly blooming does not take place during rainy or cold weather. It was also shown that each different species has a different time of blooming, because its flower begins to bloom at a different degree of temperature. After experimenting on the relation between blooming and illumination, they state that illumination apart from temperature has no important influence on blooming except that it has some relation with the nutriment of a plant. They state also that the moisture has very little to do with blooming. GOLDSMITH (1925) who studied the cause of opening and closing movements of a flower reported that in some flowers they are influenced by the changes in temperature, but in others by the changes in illuminating power. Low temperature makes some flowers close and high temperature has the same effect on others.

In summarising various opinions regarding the relations of these meteorological factors to cereals, most investigators are of the opinion that the most important factors are light, temperature and humidity and that pressure, wind and other factors have no direct relation to it. Investigators differ in their opinions as to which of these factors, light, temperature and humidity, is the most important of all.

KÖRNICKE (1885) observed that the blooming of cereal flowers occurred in a small number on a clear day and came to the conclusion that strong sunshine hinders the opening of flowers. AKEMINE (1914) stated that light has no direct connection with the blooming of rice flowers. NAKAO (1911) stated that a part of weak reflected rays help flowers to bloom. NOGUCHI (1929) stated that orange rays urge flowers to bloom sooner than others followed by yellowish rays, and that it is due to their stimulation that flowers are urged to open. This stimulation is felt by the organization in the ovary and the swelling of the lodicules that has a direct relation with the opening of flowers is caused by the transmission of this stimulation.

C. E. LEIGHTY (1924) observed that most of the wheat flowers under observation bloomed in daylight, but flowers kept in a dark room bloomed completely and in the same manner as those under natural conditions. These facts led him to conclude that light is not essential for blooming.

T. K. WOLFE (1925) observed the blooming of orchard grass and found that of the 5861 flowers observed in the process of blooming,

76.9% bloomed from sunrise to noon, 6.6% from noon to sunset, 0.3% from sunset to midnight, and 16.3% from midnight to sunrise and he also denied the indispensibility of light to blooming.

The present writer observed the relation between the blooming of oat flowers and daylight and came to the conclusion that the time of blooming in the day and the opening of flowers do not depend on the number of hours of daylight. He also succeeded in causing flowers to bloom under favourable conditions of temperature even when light was shut out or when they were placed in a dark room. The writer found as reported in another paper[21] that *Avena strigosa, Avena balbata* and *Triticum aegilopoides* under observation in Sapporo did not bloom during daylight, but opened after sunset, from about 8 to 9 p.m. Now his further observations and experiments recounted in this paper show that light has nothing to do with the blooming of *Avena sativa* also. The blooming of oat flowers occurs in rainy weather just like that of rice flower does as reported by AKEMINE (1914). This fact shows that rain itself does not hinder the blooming of flowers.

KÖRNICKE (1885) states that a shower on a fine day hastens blooming, and the writer also observed this fact often in the process of his experiments. When water was poured on the panicle from a watering pot, the opening of flowers occurred from two to three hours earlier than those under natural conditions. This is considered to be due to the fall of temperature caused by pouring the water and not to the mechanical reaction of the flower thereto.

KOBAYASHI (1925) states that as the blooming of rice flowers occurs when humidity is decreasing, the variation of decrease of humidity may have some relation to blooming.

In the writer's observations, in oats just the opposite result to NOGUCHI's was obtained, that is, when humidity was increasing, blooming occurred. Furthermore the writer succeeded in bringing about the blooming of oat flowers by changing temperature only and not humidity. From this fact it is to be concluded that humidity has no direct relation to blooming, but humidity variations are only secondary results caused by the changes in temperature.

It is generally considered that temperature is one of the important external factors that affect blooming. KÖRNICKE (1885) states that during night and morning when temperature is low the blooming of wheat flowers is delayed.

RIMPAU (1882) states that the intensive blooming of wheat flowers

of a day depends upon the temperature of early morning. There are, however, very few investigators who discuss what action of temperature is related to blooming. AKEMINE (1914) alone touches upon this problem. He states that blooming has relation not merely to the temperature at the moment of its occurrence, but that it occurs after flowers are exposed to the temperature higher than a certain degree for some time. That is to say, blooming does not result from the momentary action of temperature, but it can be considered to be the result of continuous action of temperature.

The writer observed occasionally in oats that, when the temperature of the day was within the range of temperature for blooming or when it was the optimum, no blooming occurred in natural conditions. He also observed that even in the thermostat which maintains the optimum temperature oat heads did not bloom through an entire day. From these facts the influence of temperature upon blooming can not be considered to depend on only the high or low degrees of temperature nor on continuous optimum temperature. According to the writer's investigations, oat flowers bloom when temperature is falling from the maximum of the day and they never open when temperature is rising. Even when blooming began to occur after the fall of temperature, if it rises again, the rest of the flowers stop blooming for a time and when temperature begins to fall, the flowers again begin to bloom. Therefore the time of blooming within a day depends on the variations of temperature. It varies also considerably according to the day, the earliest being 12:45 p.m. and the latest 5:45 p.m. That is to say, on the days when the highest temperature is reached comparatively early, the time of blooming is also early, and on the days when the highest temperature is reached later, the time of blooming is also later. When the variations of temperature are slight, no blooming occurs. From the results mentioned above, it can be considered that the influence of temperature on blooming is derived from its variations.

NAKANO (1929) and ISEDA (1930) observed that in rice flowers most blooming occurred when temperature was rising and a little occurred when temperature was falling. Just the opposite conditions of temperature are considered to encourage blooming of oat flowers. There seems to be a difference in sensibility to these temperature variations between oats and rice, the former depending on the decrease of temperature and the latter on the increase thus causing difference in the time of blooming. Further studies may solve this problem.

As has been discussed above the writer ascertained that blooming of oat flowers depends mostly upon temperature, especially its decreasing variations. Therefore the writer desires further to discuss what the action of the variation of temperature has to do with the physiology of blooming.

HACKEL (1881), RIMPAU (1882) and AKEMINE (1914) have already proved that the swelling of lodicules is the direct cause of blooming not only in cereals but also in many graminaceous plants. The writer also studied on the morphological change of the lodicules of oats at the time of blooming and came to the same conclusion. ZUDELLEL (1910) studied regarding the physiology or swelling of the lodicules and he proved that the lodicule-cells contain highly permeable materials. NAKAO (1911) states that the swelling of the lodicule is caused by the marked increase of turgidity. This increase of turgidity is caused by the change of disaccharoid into mono-saccharoid in the lodicule cells. The closing of flowers is caused by the protoplasmic membrane of the lodicule cells degenerating into permeative nature and the sugars which caused swelling are sent out of the cells with the consequent shrinkage of the lodicule and the closing up of the elastic outer glumes.

There has, however, been no one who has tried to discuss the cause which brings forth the change in the matter contained in the cells of the lodicules. The writer has observed that the variations of temperature affect blooming directly. From this fact it can be considered that the swelling of the lodicule has an intimate relation with the variations of temperature. According to the writer's experiment, the lodicules do not swell while the temperature is rising, but they begin to swell when the temperature starts to lower from the highest point reached on the day. At the time of blooming the swelling reaches its maximum. Considering from the above fact it is clear that the cause which brings forth the change of the matter in the cells of the lodicules is variation of temperature. NAKAO (1911) states that glucose is one of the chief substances which cause the swelling of the lodicules in rice flowers. The writer conducted experiments on sugars in the oat lodicules, especially on reducing sugar (glucose), in the cells before and after blooming and ascertained that when temperature begins to lower from its highest point of the day, glucose begins to increase and at the time of blooming it increases suddenly. This fact coincides with the morphological variations of the lodicules. From the fact that at the time of blooming the sugars increase rapidly in the cells of the lodicule

it can be easily imagined that action of enzyme is in progress in this case. According to the writer's experiment on this point, just before blooming, when temperature begins to come down from its maximum point, the action of enzyme makes its appearance. The action is most remarkable at the time of blooming.

Conclusion

The blooming of oat flowers, as recognized by many investigators, takes place in the afternoon, but the time of blooming differs considerably according to the day, the earliest being 12:40 p.m. and the latest 5:45 p.m. There are, however, some cases in which no blooming takes place throughout the whole day even in the flowering period. These facts are considered, according to the observations, to be due to various meteorological factors particularly to the variations of temperature and of humidity. Blooming never occurs before the temperature reaches the highest degree of the day, but it occurs during its fall from the highest point.

The range of the highest temperature during the day, in the writer's observation, is 32.8–15°C.; that of the temperature at the blooming time is 29.8–14°C.; the fall of temperature differs according to the meteorological condition of the day, but the difference between the highest temperature and the temperature at the time of blooming is 0.2–7.5°C.; the blooming time is 16–285 minutes after the hour of the highest temperature. Blooming occurs during the increase in humidity which is caused by the fall of temperature.

The writer has made various studies in order to determine which of these causes of blooming, the variation of temperature or that of humidity, is the more effective and direct one.

He at last succeeded in controlling both blooming time and blooming itself by means of the artificial adjustment of temperature. He failed, however, in controlling them by adjusting humidity.

This fact has led the writer to the conclusion that the most effective external factor which controls the blooming of oats is temperature. To cause blooming, the fall of temperature which has risen to the above mentioned range is necessary and with this the humidity increases and the stomata show a tendency of closing themselves. Therefore it can be considered that blooming takes place when it becomes unnecessary for a plant to take in a great quantity of water.

The chemical changes of the lodicule cells that are necessary for their swelling at the time of blooming do not take place while temperature is rising, but they take place during the fall of temperature from its highest degrees. Therefore the action of temperature on blooming is not caused by high or low temperature, but by its variations in the day, especially by the decrease of temperature after the time of its maximum. The fall of temperature causes the change of the matter in the lodicule cells and water is accumulated in them, the result being that the lodicules swell up and blooming takes place.

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EXPLANATION OF PLATE 1.

(*Avena sativa* L.)

Fig. 1. Floral organ. o, ovary s, style f, filament
a, anther l, lodicule

Fig. 2. Cross section of the spikelet.
d, outer glume v, inner glume
l, lodicule f, filament
o, ovary

Fig. 3A. Front view of the lodicule before blooming.

Fig. 4A. Back view of the lodicule at the time of blooming.

Fig. 5A. Front view of the lodicule at the time of blooming.

Fig. 6. Back view of the lodicule at the time of blooming.

Fig. 7. Lodicule with a crack in it.

Fig. 8. Front view of the lodicule after the closing of a flower.

B shows the lateral view of A and C the dorsal view of B.

PLATE 1

Fig. 6.

Fig. 5A.

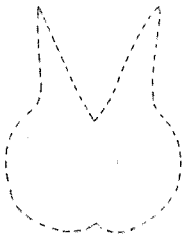


Fig. 3A.

Fig. 4A.

Fig. 1.

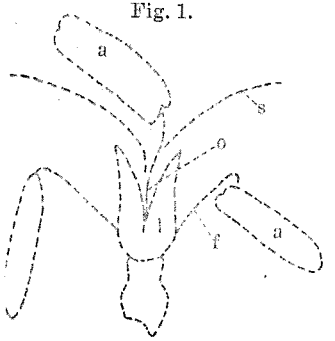


Fig. 7.

Fig. 5B.

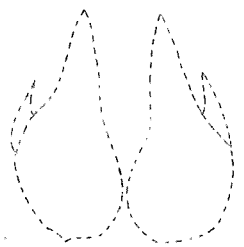


Fig. 3B.

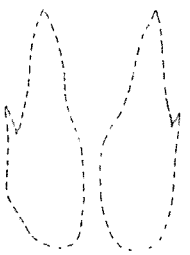


Fig. 4B.

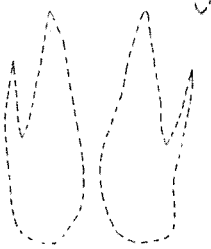


Fig. 2

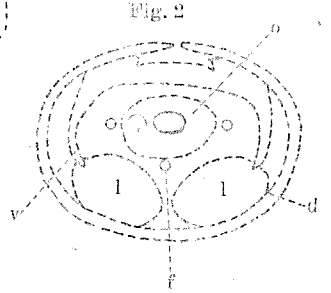


Fig. 8.

Fig. 5c.

Fig. 3c.

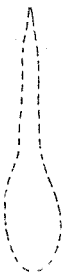
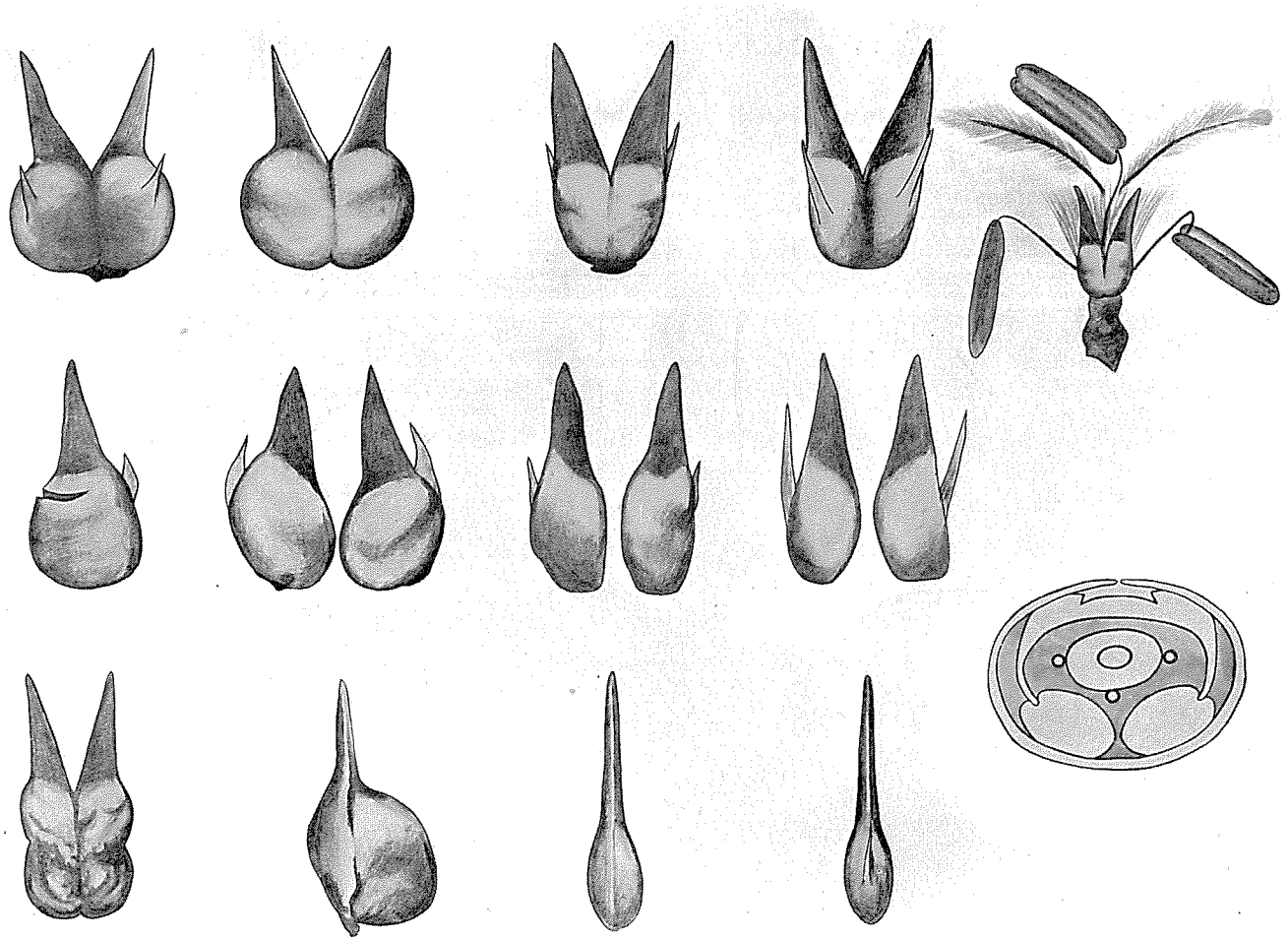


Fig. 4c.

Misonoo and Yoshida del.



APPENDIX

APPENDED

(Number of experi

		8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 p.m.	12.15 p.m.	12.30 p.m.	12.45 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Jul. 11, 1927	T.(1)	—	26.9	25.8	28.2	28.3	28.3	28.1	28.5	28.0	28.2	**29.0**	29.0	28.5
	H.(2)	—	—	—	—	—	—	—	—	—	—	—	—	63
	B.(3)													
„ 12, „	T.	—	—	27.0	27.2	27.4	27.8	28.4	27.8	28.2	28.9	28.2	27.8	28.4
	H.	—	—	68	72	72	69	69	69	69	69	69	72	72
	B.													
„ 13, „	T.	25.2	24.6	26.6	26.2	**27.0**	25.0	25.4	24.9	24.1	23.6	23.6	23.2	23.0
	H.	78	82	75	82	72	78	82	82	86	90	90	90	90
	B.												*17*	*24*
„ 14, „	T.	21.1	19.8	22.2	**23.0**	23.0	22.8	22.4	21.4	22.4	20.8	20.1	20.6	20.9
	H.	85	100	95	90	90	90	90	90	90	89	95	90	90
	B.												*1*	*1*
„ 15, „	T.	19.6	21.1	22.4	24.4	24.8	25.8	**26.6**	24.2	23.6	24.6	24.0	24.2	24.8
	H.	*100*	*95*	*100*	*82*	*86*	*86*	*86*	*86*	*86*	*90*	*86*	*90*	*86*
	B.													*12*
„ 16, „	T.	24.8	26.6	27.2	27.0	28.2	28.1	27.4	27.8	28.2	28.4	29.8	**30.0**	29.8
	H.	86	79	75	75	75	72	75	75	75	75	73	70	67
	B.													
„ 17, „	T.	22.6	23 2	**25.4**	25.2	25.1	25.4	25.4	25.0	24.2	24.2	24.6	24.4	24.4
	H.	100	95	86	86	90	86	86	90	90	90	90	90	95
	B.													*3*
„ 18, „	T.	19.8	20.4	20.7	20.5	20.6	21.0	20.8	21.0	21.0	21.2	21.4	21.4	**21.7**
	H.	95	100	95	95	100	100	100	100	100	100	100	100	100
	B.													
„ 19, „	T.	20.6	22.0	22.2	22.1	22.6	24.6	24.6	**24.8**	23.0	23.9	23.2	23.1	23.8
	H.	100	90	90	95	90	95	82	82	82	74	81	81	82
	B.										*29*	*12*	*89*	*36*
„ 20, „	T.	20.2	21.4	**24.5**	24.0	23.8	23.7	23.4	23.5	23.2	23.2	22.9	22.9	22.4
	H.	89	85	78	74	78	82	77	81	81	81	81	81	81
	B.													
„ 21, „	T.	20.6	22.0	23.0	**23.2**	23.0	22.9	22.9	22.9	22.9	22.9	22.9	22.8	22.6
	H.	100	90	86	85	81	90	86	86	86	86	86	86	86
	B.													
„ 22, „	T.	21.0	24.4	25.6	26.0	25.8	25.8	24.6	24.6	25.6	26.2	26.0	**27.3**	27.3
	H.	90	86	78	78	82	82	82	82	82	78	82	79	79
	B.													
„ 23, „	T.	19.2	20.0	21·2	21.8	21.2	21.5	21.8	22.2	22.0	22.2	22.1	22.3	22.6
	H.	89	100	80	81	85	85	81	85	81	85	81	81	81
	B.													

(1)—T = Temperature (C°.) (2)—H = Humidity (%).

(3)—B = Number of flowers opened.

TABLE 1.

mental-plants 10)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
27.0	26.6	26.4	26.0	26.0	26.4	28.5	28.6	27.9	28.2	27.4	27.8	28.2	27.4	26.7	27.2	26.5	25.1
72	72	75	75	75	75	66	66	72	72	75	75	72	75	75	72	75	82
				22	*1*			*20*	*9*			*8*	*9*				
28.8	28.8	**29.0**	29.0	28.6	28.2	28.0	28.8	28.4	27.5	27.6	26.7	26.3	26.1	26.1	25.8	25.5	25.0
69	69	69	60	69	69	72	72	69	72	75	75	71	78	78	78	78	82
									15	*47*	*17*	*7*					
22.9	22.7	22.3	21.9	21.5	21.1	20.9	21.0	20.9	20.4	20.0	20.0	20.2	20.4	19.8	19.6	19.1	18.6
90	95	100	95	95	100	95	95	100	100	100	100	100	100	100	100	94	94
13	*3*	*24*	*6*	*6*													
21.0	20.9	20.7	20.6	20.4	19.8	19.9	19.5	20.2	20.4	20.3	20.0	20.0	19.8	19.4	19.4	19.4	19.4
90	90	90	95	95	95	95	100	95	95	95	95	95	95	100	100	100	100
	20	*17*	*12*														
24.4	25.0	25.0	25.0	25.8	25.8	26.4	26.0	26.2	25.5	26.8	26.8	26.0	25.3	25.2	25.2	25.0	24.5
86	86	86	95	91	82	78	83	82	82	79	83	82	82	86	86	82	82
15	*90*	*47*	*3*	*4*			*17*	*6*									
29.0	29.4	27.0	26.3	26.2	25.4	25.2	24.9	24.1	23.4	22.8	22.8	23.0	22.5	22.7	22.6	22.7	21.8
72	69	79	75	82	82	82	86	90	90	90	90	90	90	90	90	86	95
		1	*30*	*21*	*31*	*21*	*12*	*9*	*7*								
24.5	25.4	24.7	24.2	24.1	24.1	24.1	24.2	24.6	24.2	24.8	24.4	24.2	24.0	23.9	23.9	23.7	23.4
95	86	90	90	90	90	95	90	90	90	90	90	90	90	95	95	90	95
6		*60*	*14*	*16*	*11*	*6*											
21.5	21.4	21.6	21.4	21.4	21.4	21.4	21.0	21.5	21.6	21.6	21.8	21.7	21.6	21.4	21.2	21.0	21.0
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
24.0	24.2	24.2	22.8	22.6	22.5	22.1	22.2	21.6	20.8	20.8	20.6	20.6	20.8	20.4	20.2	19.6	19.0
82	78	78	77	81	81	85	81	85	90	85	85	90	90	89	89	95	100
6	*5*		*48*	*12*		*4*											
22.0	22.0	22.6	22.4	24.0	24.4	24.6	24.2	24 2	24.2	24.2	23.6	23.4	22.2	21.4	20.8	20.4	19.8
85	85	86	81	82	78	78	78	78	78	78	82	81	85	90	90	89	95
20	*40*	*9*	*20*					*8*									
22.4	22.0	21.8	21.2	21.1	21.1	21.1	20.6	20.4	20.2	19.9	20.0	21.0	20.0	20.2	20.2	20.2	20.4
90	90	90	95	95	95	95	95	95	95	95	100	95	100	95	95	100	95
	20	*22*		*3*													
27.0	27.0	27.2	27.2	27.0	27.0	26.6	26.3	26.2	25.6	25.6	25.4	25.2	25.4	25.2	24.6	24.6	24.8
79	79	79	79	79	79	83	82	82	78	82	82	82	82	82	86	90	90
						10	*9*	*21*	*11*	*12*	*4*						
22.0	22.6	**23.2**	22.4	22.6	22.7	22.2	22.2	22.2	22.6	22.2	22.2	22.2	21.8	21.8	21.8	21.0	20.5
90	81	81	77	77	77	81	81	77	77	81	81	81	81	81	77	80	85
				3		*2*											

TABLE 1—

		8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.15 p.m.	12.30 p.m.	12.45 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Jul. 24, 1927	T.	21.0	22.5	24.0	24.8	25.1	26.0	26.9	26.0	26.4	27.0	27.2	**28.0**	27.8
	H.	90	85	74	74	71	71	68	68	65	65	68	69	72
	B.													
„ 25, „	T.	21.0	23.0	23.8	25.4	26.2	26.8	27.0	27.4	27.3	27.8	28.0	27.7	**28.2**
	H.	90	86	82	74	75	72	68	68	65	69	69	66	66
	B.													
„ 26, „	T.	23.2	23.8	24.7	24.2	25.4	26.1	26.2	26.2	26.0	26.0	26.2	26.3	26.4
	H.	77	78	71	74	74	68	68	68	68	71	71	68	71
	B.													
„ 27, „	T.	24.2	25.4	25.2	25.6	26.0	26.3	26.8	26.7	27.3	27.7	27.5	27.7	27.6
	H.	78	74	78	78	75	75	75	72	72	66	72	72	69
	B.													
„ 28, „	T.	24.4	26.2	27.8	26.6	27.0	27.2	27.6	27.6	27.8	**28.3**	27.6	27.8	27.2
	H.	82	78	72	72	68	68	69	69	66	66	69	69	65
	B.													
„ 29, „	T.	23.2	24.0	24.3	25.6	25.6	27.1	26.8	27.0	27.0	**27.3**	27.0	26.5	27.0
	H.	86	82	74	75	68	72	65	68	65	65	62	68	68
	B.													
„ 30, „	T.	25.4	25.4	26.2	27.2	27.2	28.2	28.8	**29.2**	28.7	29.0	28.8	28.6	28.4
	H.	71	71	71	68	68	66	66	66	66	66	69	69	69
	B.													
„ 31, „	T.	22.8	24.4	25.2	24.6	24.6	24.6	24.6	**25.2**	25.0	24.6	24.8	24.4	24.4
	H.	95	90	86	82	82	86	82	82	82	82	82	82	86
	B.												*2*	*5*
Aug. 1, „	T.	21.8	23.2	25.6	26.0	26.6	26.4	27.6	27.3	27.2	27.6	28.0	27.7	27.9
	H.	95	95	86	82	79	82	75	75	75	75	79	75	75
	B.													
„ 2, „	T.	26.4	27.2	**28.6**	28.4	28.2	28.2	27.8	27.8	27.8	27.6	27.6	27.6	28.4
	H.	78	75	69	69	72	72	75	75	72	75	75	75	72
	B.													
„ 3, „	T.	25.4	25.4	28.2	26.6	25.4	25.0	25.8	26.4	26.4	27.0	28.6	**29.0**	28.4
	H.	100	95	79	87	90	90	91	86	91	83	83	79	75
	B.													
„ 4, „	T.	25.6	26.4	27.1	27.0	27.2	27.4	27.8	27.8	27.6	28.2	28.4	28.5	**28.6**
	H.	82	82	79	75	75	75	75	69	72	69	69	69	72
	B.													
„ 5, „	T.	25.2	26.8	27.8	28.6	28.4	28.2	28.4	28.8	**29.0**	28.2	27.9	27.6	27.8
	H.	86	83	75	72	72	75	72	72	72	72	76	75	75
	B.													
„ 6, „	T.	26.6	26.4	25.6	25.6	25.4	26.4	**26.8**	26.8	27.0	26.8	26.6	26.4	26.2
	H.	83	82	82	82	82	82	83	83	83	79	83	82	82
	B.													

(*Continued*)

1.45 m.p.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
26.6	26.8	26.6	26.4	25.9	25.4	25.6	25.8	24.8	24.6	25.0	24.2	24.2	24.0	23.0	23.4	23.2	22.8
72	72	72	65	68	67	72	71	71	74	74	78	82	82	86	86	81	86
		4		*9*	*27*	*2*	*22*	*4*	*1*								
27.6	27.5	27.3	27.0	26.5	26.7	27.2	27.5	27.3	26.8	26.4	25.5	25.2	25.2	24.6	24.3	24.1	23.9
69	68	75	72	71	72	72	72	72	75	75	74	78	78	86	86	86	90
										21	*36*	*8*					
26.6	26.8	26.9	**27.0**	27.0	26.8	26.6	26.2	26.4	25.4	25.2	25.2	25.0	24.8	24.3	24.0	23.8	23.5
68	68	68	68	68	68	72	71	75	74	74	74	78	74	78	78	82	78
							8	*29*	*9*	*12*							
27.6	**28.0**	27.4	27.5	27.2	26.8	26.5	27.0	26.2	26.4	26.6	25.6	25.4	25.4	25.4	25.4	25.4	25.0
72	72	62	68	72	72	71	78	75	75	75	78	78	82	82	82	82	82
					12		*5*		*13*		*1*						
27.0	26.7	26.5	27.0	26.8	26.4	27.0	26.8	26.8	26.4	25.8	25.6	26.0	25.4	25.4	24.6	24.4	24.6
68	72	75	68	71	75	68	68	72	71	71	75	75	74	78	78	78	82
					7		*2*	*6*	*4*	*5*	*2*						
27.0	27.4	27.0	26.2	26.8	26.4	26.2	26.0	25.8	25.5	25.5	24.8	25.0	24.9	24.2	24.2	24.0	23.2
68	68	62	65	68	71	71	68	71	74	74	78	74	78	78	82	78	90
				9		*5*	*4*	*5*	*1*								
27.8	27.8	27.6	27.6	27.4	27.4	27.0	26.4	26.3	26.0	25.4	24.8	24.4	24.4	24.6	24.4	24.4	22.2
69	69	72	69	72	68	72	71	75	75	78	78	82	78	78	78	78	100
						4	*8*	*5*		*7*	*3*	*3*					
24.6	25.2	25.2	24.8	25.0	25.0	24.5	23.8	23.6	23.6	23.4	23.4	23.0	22.6	22.6	22.6	22.2	22.2
82	78	82	82	82	82	82	86	86	86	86	86	90	90	90	90	90	90
2	*2*	*3*	*2*	*1*													
27.6	28.0	28.0	28.5	**29.0**	28.6	28.2	28.6	27.8	**27.8**	28.6	26.9	26.5	25.6	25.4	25.0	24.8	24.4
72	69	69	69	66	69	69	69	63	72	72	75	78	78	82	82	82	82
							6		*2*	*10*	*6*	*13*	*1*				
28.3	28.0	27.8	27.6	27.0	26.2	26.3	26.0	25.8	25.8	25.8	25.4	25.0	25.0	24.8	24.8	24.6	24.2
75	72	75	75	75	78	82	86	86	91	91	95	100	100	100	100	100	100
				12	*7*	*1*		*12*		*1*							
28.0	28.4	28.4	29.0	28.6	28.8	28.6	27.2	26,8	26.4	26.4	25.2	25.2	24.8	24.8	24.2	23.8	23.4
79	79	79	76	76	76	76	79	79	82	82	90	95	95	90	95	95	95
							13	*6*	*5*								
28.6	28.6	28.4	28.0	27.8	27.8	27.5	27.3	27.2	27.0	26.6	26.4	26.2	25·9	25.9	25.0	24.6	23.2
72	69	69	72	72	72	72	72	75	72	75	75	75	78	78	82	86	90
				5	*2*	*1*	*4*	*4*		*1*							
27.8	27.8	27.8	27.6	27.6	27.2	27.0	26.5	26.2	26.0	26.0	26.0	25.4	25,6	25.2	25.0	25.0	25.0
75	75	75	75	75	79	82	82	86	86	86	86	86	86	86	86	86	86
					6	*3*		*3*	*3*								
25.8	26.0	26.0	25.8	25.6	25.0	24.6	24.8	24.6	24.2	24.2	23.8	23.6	22.8	22.6	22.6	22.6	22.4
82	82	82	82	82	82	86	82	82	82	82	86	86	95	95	95	90	90
	2	*4*	*3*	*2*	*2*	*2*	*1*	*2*									

APPENDED

(Number of experi

		8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.15 p.m.	12.30 p.m.	12.45 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Aug. 17, 1927	T.	—	—	—	—	25.4	25.6	26.1	26.5	26.4	26.6	26.4	**26.8**	26.6
	H.	—	—	—	—	78	78	78	78	75	75	75	75	75
	B.													
„ 18, „	T.	23.6	24.2	23.6	23.6	24.2	24.2	24.4	24.6	24.8	**25.0**	25.0	25.0	25.0
	H.	90	82	86	90	86	86	82	82	82	82	82	82	82
	B.													
„ 19, „	T.	24.0	25.4	26.4	27.2	26.6	27.8	27.6	28.2	27.6	27.9	28.3	28.4	29.3
	H.	90	82	82	75	83	79	79	75	75	75	72	72	72
	B.													
„ 20, „	T.	22.2	23.8	25.6	26.3	26.2	**27.2**	26.8	26.6	26.6	26.4	26.4	26.9	26.8
	H.	85	70	68	65	68	62	65	65	65	62	65	72	68
	B.													
„ 21, „	T.	22.0	24.6	25.8	26.6	26.8	27.0	27.6	27.6	27.4	27.6	27.8	28.0	28.0
	H.	81	74	71	68	68	62	66	66	59	62	63	63	63
	B.													
„ 22, „	T.	23.0	24.2	24.8	24.4	24.8	26.2	**26.8**	25.4	24.8	24.8	24.6	24.8	25.0
	H.	90	86	82	90	86	78	79	82	82	80	86	86	82
	B.													
„ 23, „	T.	23.0	23.0	24.7	24.8	24.6	24.6	26.2	26.6	**27.4**	26.2	26.0	25.8	26.1
	H.	77	77	71	71	78	75	71	65	65	65	68	68	71
	B.													
„ 24, „	T.	18.4	18.4	18.2	18.2	18.2	19.0	19.0	19.0	19.2	19.0	19.2	19.4	19.4
	H.	94	100	100	100	100	100	100	100	100	94	100	100	100
	B.													
„ 25, „	T.	21.8	22.1	21.6	23.4	23.8	23.6	24.4	24.4	**25.0**	24.4	24.6	24.2	24.3
	H.	85	85	90	81	82	82	78	82	74	78	78	82	78
	B.													
„ 26, „	T.	20.6	21.8	23.4	24.0	24.8	25.4	25.4	25.4	25.6	25.2	25.2	25.6	**25.8**
	H.	100	100	81	78	74	71	71	71	71	74	71	71	68
	B.													
„ 27, „	T.	19.6	20.0	20.4	20.6	20.4	23.6	22.0	22.6	22.8	23.0	23.0	23.2	23.4
	H.	100	100	100	100	100	95	90	90	90	90	90	86	81
	B.													
„ 28, „	T.	20.6	20.8	22.4	23.0	23.8	23.6	23.4	23.0	23.6	23.7	23.7	24.0	**24.2**
	H.	100	90	85	77	74	73	73	73	74	78	74	74	74
	B.													
„ 29, „	T.	20.2	21.0	22.0	22.8	23.0	23.4	**23.8**	23.2	22.6	22.6	22.8	22.8	23.2
	H.	85	76	77	73	69	73	74	73	73	73	77	81	73
	B.													
„ 30, „	T.	19.2	18.4	18.6	19.2	19.2	19.0	18.8	18.8	19.6	19.6	19.6	**19.8**	19.4
	H.	100	100	1.00	100	100	100	100	100	100	95	100	100	100
	B.													

TABLE 2.

mental-plants 55)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
26.5	26.6	26.6	26.6	26.4	26.0	25.9	25.6	25.7	25.4	25.5	25.2	24.7	24.5	—	—	—	—
75	72	72	72	71	72	71	71	71	71	71	74	78	78	—	—	—	—
						59	*16*	*15*	*43*	*23*	*13*	*11*					
24.9	24.8	24.8	24.6	24.7	24.8	24.6	24.5	24.5	24.6	24.2	24.1	23.9	23.8	23.8	23.6	23.4	23.2
82	82	82	82	82	82	82	82	86	86	86	86	86	90	90	90	95	95
	47	*25*	*9*	*10*	*4*	*39*	*14*	*11*	*4*	*10*	*2*	*2*					
28.8	28.8	28.8	**29.6**	29.2	29.6	29.4	28.4	27.8	27.6	27.5	26.9	26.6	25.6	25.6	25.6	25.0	**24.6**
76	69	69	70	76	76	72	75	75	75	79	79	79	82	82	82	86	86
									16	*22*	*61*	*61*	*16*	*6*			
26.9	26.9	25.9	25.6	25.2	25.0	24.6	24.6	24.8	24.8	24.0	23.8	24.0	24.0	23.6	23.0	23.0	23.0
68	68	65	72	74	74	74	78	74	78	78	82	82	82	86	86	90	90
			18	*51*	*40*	*12*	*12*	*5*	*2*								
28.0	**28.6**	27.8	27.8	27.8	27.8	27.5	27.8	27.0	27.0	26.2	25.7	25.4	24.8	24.8	24.2	24.0	24.0
63	63	60	63	63	66	65	75	75	75	75	82	82	86	86	86	86	86
							8	*18*	*15*	*19*	*9*						
24.4	24.4	25.0	24.4	24.0	24.6	23.6	23.2	24.1	23.8	24.4	23.8	24.0	24.2	24.2	24.2	24.0	23.8
86	86	86	86	90	86	89	95	90	90	90	90	90	90	95	95	95	95
			44	*29*	*18*	*14*	*16*	*2*	*2*		*1*						
25.0	26.7	26.7	26.2	25.6	25.4	25.6	25.1	26.1	26.2	25.8	26.2	25.6	25.2	25.0	24.8	24.6	24.4
67	68	68	68	68	67	74	74	74	74	68	71	75	78	74	78	78	78
	1			*74*	*54*	*17*	*26*	*22*	*4*								
20.0	19.7	19.4	19.4	19.3	19.2	19.4	19.1	19.3	19.2	19.6	19.4	19.6	19.5	19.4	19.4	19.4	19.2
95	95	95	94	94	94	94	94	94	94	100	100	95	94	94	94	94	94
24.8	24.4	24.6	23.7	25.2	23.6	24.0	24.1	23.6	23.6	23.4	23.1	23.0	22.9	22.8	22.2	21.6	21.2
78	78	78	78	78	86	82	78	82	82	82	81	81	81	86	85	90	90
	2	*42*	*96*	*73*	*43*	*39*											
25.6	24.9	24.5	24.3	24.2	24.3	24.1	24.6	23.9	23.9	23.8	23.6	23.4	23.0	22.6	22.6	22.4	22.0
71	71	71	71	74	74	74	74	78	78	82	78	81	86	86	86	85	90
						37	*18*	*14*	*4*	*2*							
23.6	23.4	23.6	23.6	23.1	23.0	22.7	22.7	22.6	22.5	22.2	21.9	21.8	21.8	21.4	21.4	21.2	21.2
86	82	86	86	86	90	90	90	90	95	100	95	95	95	95	95	95	95
								1									
23.6	23.8	23.4	23.2	23.2	23.1	23.2	23.8	23.1	23.0	22.6	22.2	21.8	21.2	21.7	21.5	21.2	20.8
74	74	74	74	74	74	78	78	81	86	86	90	90	95	90	90	95	95
	23	*43*	*44*	*29*	*46*	*38*	*26*	*18*	*6*	*5*	*1*						
23.6	23.3	23.4	22.4	22.4	22.4	22.2	22.1	22.0	22.0	21.8	21.4	21.0	20.4	20.0	20.0	19.8	19.8
77	73	77	77	77	77	73	81	77	77	81	80	76	89	95	95	95	95
			2	*84*	*30*	*27*	*10*	*2*	*1*								
19.6	19.7	19.6	19.4	19.0	19.2	19.0	19.0	19.2	19.4	19.6	19.6	19.8	19.6	19.6	19.4	19.2	19.1
100	100	100	100	100	100	100	100	100	100	100	100	95	100	100	100	100	95

TABLE 2—

		8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.15 p.m.	12.30 p.m.	12.45 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
	T.	17.8	21.0	20.8	21.4	22.6	23.4	22.4	23.2	**23.8**	22.6	22.4	22.4	23.6
Aug. 31, „	H.	60	57	66	69	72	72	80	75	76	72	55	79	76
	B.													
	T.	20.2	22.2	23.8	24.8	24.8	24.4	24.4	25.2	25.4	**26.0**	26.0	25.8	25.7
Sep. 1, „	H.	68	66	60	58	58	60	60	61	58	54	64	64	72
	B.													
	T.	20.2	23.0	22.8	23.6	24.2	24.8	25.2	25.0	25.0	25.2	**25.6**	25.0	24.8
„ 2, „	H.	80	73	73	70	70	73	67	67	67	64	56	56	56
	B.													
	T.	16.2	16.4	16.4	16.6	16.6	15.6	15.4	15.4	15.4	15.4	15.1	15.3	15.4
„ 3, „	H.	88	88	88	89	89	94	88	94	94	94	65	67	67
	B.													
	T.	18.6	19.8	22.0	**23.0**	19.8	20.6	20.4	20.4	19.8	20.0	19.5	19.8	20.0
„ 4, „	H.	89	80	66	60	72	76	68	68	72	72	94	94	94
	B.													
	T.	20.6	21.6	23.4	23.0	23.4	23.7	**24.6**	21.4	22.4	22.1	22.4	22.4	23.2
„ 5, „	H.	68	66	60	63	63	63	64	72	81	77	81	70	63
	B.													*17*
	T.	17.6	19.8	21.6	21.6	23.6	23.6	23.8	24.4	24.0	24.6	**25.6**	25.4	25.2
„ 6, „	H.	84	76	73	73	70	74	74	67	74	74	67	67	74
	B.													
	T.	19.8	22.4	23.0	22.8	23.2	23.6	**23.8**	23.6	23.8	23.6	23.8	23.8	23.6
„ 7, „	H.	85	77	73	81	77	78	78	74	74	74	74	74	78
	B.													
	T.	16.2	18.2	21.0	21.0	22.4	23.2	24.0	23.6	**24.2**	22.8	23.6	23.0	24.2
„ 8, „	H.	88	84	80	80	77	77	74	70	70	73	67	70	74
	B.													
	T.	19.4	19.8	21.4	20.0	20.2	20.4	20.3	20.0	20.4	20.8	20.8	21.4	21.5
„ 9, „	H.	84	85	80	85	80	76	76	76	76	77	100	68	68
	B.													
	T.	17.8	18.8	19.2	19.6	19.8	**20.2**	20.2	19.8	19.9	19.6	19.6	19.6	19.2
„ 10, „	H.	89	84	89	85	85	76	85	85	85	85	89	89	94
	B.													
	T.	19.6	20.0	20.8	21.2	21.4	23.2	24.2	25.1	25.4	25.1	25.0	25.2	25.4
„ 11, „	H.	100	100	100	95	95	90	86	86	86	86	86	86	86
	B.													
	T.	19.2	20.2	20.1	20.6	20.3	22.6	**22.7**	22.6	22.6	22.6	22.6	22.4	22.6
„ 12, „	H.	89	95	95	90	77	81	70	66	66	66	66	66	66
	B.													
	T.	15.6	16.9	19.0	19.2	19.3	19.6	20.2	20.6	20.4	20.6	**21.0**	20.9	21.0
„ 13, „	H.	88	83	84	80	75	72	72	72	72	72	68	72	68
	B.													

(*Continued*)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
23.8	23.6	23.4	22.8	22.8	23.0	22.4	23.1	22.8	22.2	21.8	21.8	21.3	21.4	20.6	20.0	19.8	
76	72	69	65	66	62	63	60	60	59	60	58	60	59	62	63	63	
				50	*48*	*3*					**3**						
25.0	24.8	24.2	24.4	24.2	23.2	22.8	23.4	22.8	22.0	21.8	21.4	21.2	21.2				
68	68	66	65	68	67	68	84	84	89	84	84	79	79				
		3			*7*	*10*	*8*	*12*									
25.0	24.4	24.6	23.6	24.0	23.4	23.2	22.8	22.8	22.2	22.2	21.7	21.4	21.0				
54	61	62	62	67	63	66	66	66	66	69	72	72	72				
			1			*4*	*2*	*8*	*4*	*1*							
15.5	15.6	15.6	15.8	16.4	16.6	16.8	17.0	17.2	17.0	17.4	17.4	**17.5**	17.2				
67	70	67	74	74	73	73	77	73	77	81	80	80	85				
21.0	21.2	21.8	20.6	20.4	19.8	19.8	18.2	18.2	18.2	18.2	18.2	17.8	17.6				
100	100	100	100	100	94	94	94	94	89	94	89	89	89				
		12	*28*	*8*	*4*	*6*	*3*	*3*									
23.4	23.0	22.6	24.0	23.2	23.2	22.2	21.2	20.8	20.8	21.2	21.6	21.4	21.2				
63	63	66	58	57	57	59	62	65	58	65	59	58	58				
4	*1*						*3*		*2*								
25.8	26.4	26.4	26.0	25.2	25.6	25.6	24.4	24.8	24.6	23.2	23.0	22.2	22.0				
68	68	68	68	71	75	75	75	74	74	78	77	81	81				
							3	*3*		*5*	*2*	*1*					
23.4	23.2	23.2	22.6	22.6	22.6	22.8	22.6	22.2	22.0	21.8	21.2	20.8	21.0				
74	73	63	73	73	73	73	73	73	73	77	76	80	80				
					8	*6*	*8*	*6*	*4*	*2*							
23.0	23.7	22.2	23.0	24.2	23.8	23.2	23.4	22.8	22.2	22.0	21.4	20.8	20.2				
73	78	73	77	70	74	74	77	77	81	81	85	85	90				
							7	*4*	*4*								
21.6	**22.0**	21.6	21.4	21.2	21.4	21.4	21.4	21.2	21.4	21.2	20.8	20.4	20.1				
66	66	69	72	80	68	68	68	68	68	68	72	72	72				
				11	*3*	*1*	*1*										
19.2	19.2	18.8	18.8	18.4	18.3	18.3	18.4	18.4	18.4	18.2	18.2	18.2	18.2				
94	94	94	94	94	94	94	94	94	94	94	94	94	94				
26.8	27.0	**27.2**	26.2	25.0	24.4	23.8	23.5	23.6	23.2	22.6	22.3	22.0	21.8				
79	79	72	75	74	74	74	78	78	77	86	86	86	86				
				36	*35*	*11*	*13*	*7*	*3*		*2*						
22.7	22.6	22.7	22.4	21.8	21.5	21.0	20.8	20.6	20.8	21.0	20.2	19.6	19.2				
66	66	66	69	69	68	72	72	72	72	65	72	76	75				
				19	*10*	*16*	*5*										
21.0	20.5	20.6	20.5	20.0	20.0	19.9	19.7	19.7	19.8	19.6	19.4	19.3	19.2				
68	68	72	68	68	72	72	72	76	72	72	75	71	75				
						5	*4*	*1*	*1*		*1*						

APPENDED

(Number of experi

		8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.15 p.m.	12.30 p.m.	12.45 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Sep. 11, 1927	T.	19.6	20.0	20.8	21.2	21.4	23.2	24.2	25.1	25.4	25.1	25.0	25.2	25.4
	H.	100	100	100	95	95	90	86	86	86	86	86	86	86
	B.													
„ 12, „	T.	19.2	20.2	20.1	20.6	22.3	22.6	**22.7**	22.6	22.6	22.6	22.6	22.4	22.6
	H.	89	95	95	90	77	81	70	66	66	66	66	66	66
	B.													
„ 13, „	T.	15.6	16.9	19.0	19.2	19.3	19.6	20.2	20.6	20.4	20.6	**21.0**	20.9	21.0
	H.	88	83	84	80	75	72	72	72	72	72	68	72	68
	B.													
„ 14, „	T.	15.6	17.8	17.8	17.8	19.0	20.0	19.8	20.4	20.4	20.4	20.6	21.0	20.7
	H.	94	84	89	89	80	76	72	76	76	72	68	65	65
	B.													
„ 15, „	T.	19.8	21.0	22.5	22.7	22.9	23.4	**23.8**	23.6	23.4	23.8	23.2	23.4	23.0
	H.	85	80	77	77	70	70	74	70	70	70	73	73	66
	B.													
„ 16, „	T.	18.8	20.0	22.0	22.2	21.6	21.4	22.2	22.0	22.9	23.9	24.0	**24.2**	23.5
	H.	89	80	73	69	81	76	81	81	77	74	70	74	70
	B.													
„ 17, „	T.	18.4	17.5	17.8	18.9	18.4	18.7	18.4	18.6	18.6	18.5	18.5	19.0	19.4
	H.	84	94	94	89	94	89	89	89	89	84	79	80	80
	B.													
„ 18, „	T.	14.3	16.8	18.8	19.8	**20.3**	19.8	19.2	19.2	19.8	19.4	19.4	19.2	19.2
	H.	94	89	89	85	85	80	89	89	85	89	89	89	89
	B.													
„ 19, „	T.	18.8	21.4	22.0	21.4	21.2	19.0	19.0	20.2	20.2	20.8	21.2	**22.2**	21.2
	H.	89	80	81	80	80	89	94	84	85	85	85	81	85
	B.													
„ 20, „	T.	16.8	18.2	19.6	20.6	20.8	22.2	21.8	21.2	21.4	22.0	**23.2**	23.0	23.2
	H.	89	70	72	62	65	59	59	62	68	59	60	51	49
	B.													
„ 21, „	T.	16.2	17.8	19.3	**20.0**	19.7	19.2	18.8	18.4	19.6	19.3	18.2	17.8	18.2
	H.	69	63	60	58	61	63	67	63	68	67	70	67	67
	B.													
„ 22, „	T.	13.4	15.4	17.1	17.8	18.7	**19.6**	19.2	18.5	18.8	19.2	19.3	19.2	18.8
	H.	82	78	79	75	67	58	67	67	70	70	67	70	70
	B.													
„ 23, „	T.	11.6	13.4	16.8	17.2	17.4	18.8	19.0	19.2	19.6	19.8	19.6	20.2	20.2
	H.	87	87	79	70	74	71	71	67	68	68	68	68	64
	B.													
„ 24, „	T.	12.2	14.8	16.8	18.2	18.6	19.8	19.8	20.4	21.2	20.0	20.2	**20.6**	20.4
	H.	87	73	66	67	67	68	64	61	55	61	61	65	64
	B.													

TABLE 3.

mental-plants 30)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
26.8	27.0	**27.2**	26.2	25.0	24.4	23.8	23.5	23.6	23.2	22.6	22.3	22.0	21.8				
79	79	72	72	75	74	74	74	78	78	77	86	86	86				
						2	*2*	*8*	*1*		*1*						
22.7	22.6	22.7	22.4	21.8	21.5	21.0	20.8	20.6	20.8	21.0	20.2	19.6	19.2				
66	66	66	69	69	68	72	72	72	72	65	72	76	75				
				1	*6*	*38*											
21.0	20.5	20.6	20.5	20.2	20.0	19.9	19.7	19.7	19.8	19.6	19.4	19.3	19.2				
68	68	72	69	68	72	72	72	76	72	72	75	71	75				
					3	*18*	*5*		*2*								
21.0	**21.2**	21.2	20.8	20.8	20.8	20.6	20.5	20.4	20.4	20.4	20.2	19.9	19.6				
68	65	65	65	65	75	68	68	68	72	68	72	76	80				
						2	*32*	*9*	*3*								
22.6	22.1	22.4	23.0	22.2	22.0	22.0	21.8	21.8	21.3	21.3	21.2	21.0	20.8				
73	77	77	73	77	77	77	77	81	76	80	80	80	85				
				136	*26*	*4*	*3*										
23.2	22.4	22.0	21.8	21.6	22.0	22.7	22.8	21.6	21.3	21.2	20.8	20.0	19.4				
73	73	73	77	73	73	63	63	69	68	65	65	72	80				
		33	*20*	*6*	*23*												
19.5	**20.0**	20.0	19.9	19.3	19.2	18.7	18.2	17.9	17.4	17.0	16.9	16.7	16.3				
75	76	80	68	80	80	75	79	79	83	83	83	83	83				
19.0	19.0	19.2	19.8	20.0	20.0	20.2	19.0	19.2	19.2	19.0	18.6	18.6	18.4				
83	83	83	85	85	85	85	94	89	84	89	89	89	90				
				56	*9*	*44*	*23*	*18*	*8*								
20.4	20.6	20.3	20.3	20.0	21.0	20.0	19.6	20.4	20.0	19.0	18.5	18.2	17.8				
80	80	89	80	85	80	85	85	80	80	89	79	84	79				
	68	*6*	*55*	*36*	*18*	*3*											
23.1	22.8	22.8	23.0	22.2	22.2	22.3	22.3	21.8	21.4	20.8	20.7	20.4	20.2				
49	47	54	54	51	53	51	48	51	53	53	58	68	61				
					25	*13*	*16*	*25*	*23*	*12*							
18.1	17.2	17.1	16.8	16.2	15.2	14.2	13.4	13.3	13.2	13.3	12.9	12.8	12.6				
67	79	74	74	78	83	88	94	94	94	87	94	94	94				
				1													
19.4	19.4	18.6	18.2	18.4	18.2	17.6	17.6	17.4	17.2	17.8	17.7	18.0	17.6				
70	70	70	70	70	70	75	75	74	74	84	75	79	75				
			31	*31*	*21*	*20*	*13*	*6*	*3*								
20.4	**20.8**	20.6	20.6	20.4	20.2	20.0	19.6	19.3	19.2	19.4	19.4	19.0	18.8				
65	65	64	64	68	68	64	72	75	71	71	71	75	80				
							1	*14*	*13*	*7*	*3*						
20.4	20.4	20.2	20.2	19.8	19.6	19.4	19.6	19.0	19.0	18.8	18.4	18.0	17.8				
64	64	64	68	64	61	63	64	68	67	71	71	75	75				
					10	*20*	*28*	*17*	2								

TABLE 3—

		8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.15 p.m.	12.30 p.m.	12.45 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Sep. 25, 1927	T.	11.6	14.4	15.8	17.0	18.6	18.6	19.2	18.2	18.6	18.8	19.0	19.2	19.2
	H.	87	72	69	74	75	71	71	67	67	63	69	71	67
	B.													
„ 26, „	T.	12.4	14.6	15.9	17.1	18.0	18.0	18.4	18.7	19.0	19.4	19.7	19.9	20.0
	H.	87	78	78	74	75	70	63	67	67	71	71	71	64
	B.													
„ 27, „	T.	16.6	18.8	20.4	20.2	20.8	20.6	21.2	21.2	21.2	20.8	20.6	21.2	**21.4**
	H.	78	75	64	64	65	65	62	58	58	62	62	65	58
	B.													
„ 28, „	T.	15.8	19.0	20.6	21.2	21.3	22.2	22.6	22.6	22.6	21.8	22.0	22.3	22.6
	H.	94	67	68	65	62	62	66	63	63	62	66	66	63
	B.													
„ 29, „	T.	15.5	18.8	20.8	20.8	21.0	21.4	21.6	21.6	21.4	**21.8**	21.8	21.4	21.4
	H.	78	80	68	68	65	62	59	59	58	62	59	65	62
	B.													
„ 30, „	T.	14.2	15.6	17.8	19.2	19.8	19.8	20.8	21.2	21.8	21.6	21.6	21.6	**22.0**
	H.	94	94	84	75	80	80	72	72	69	69	69	73	66
	B.													
Oct. 1, 1927	T.	16.4	18.4	20.8	21.2	21.8	22.0	22.2	22.7	**23.0**	22.8	22.2	23.0	22.6
	H.	88	84	76	72	73	73	73	73	73	73	77	73	73
	B.													
„ 2, „	T.	18.6	19.0	18.6	18.8	18.6	18.8	19.2	19.2	18.6	20.0	**20.2**	20.0	20.2
	H.	80	80	84	84	84	80	80	80	80	80	80	81	77
	B.													
„ 3, „	T.	16.8	18.6	20.6	19.6	20.0	20.2	19.4	19.4	20.2	20.6	21.2	21.6	**22.0**
	H.	94	84	76	79	76	76	89	80	89	85	80	81	77
	B.													
„ 4, „	T.	16.8	18.0	21.0	21.6	20.8	19.8	21.3	21.4	21.8	21.4	21.1	21.7	**22.4**
	H.	88	72	65	66	65	59	58	65	66	68	68	66	62
	B.													
„ 5, „	T.	14.4	18.0	21.0	21.6	20.8	19.8	19.6	19.8	20.8	21.2	21.4	20.6	21.0
	H.	88	70	76	69	72	76	76	80	72	72	72	76	76
	B.													
„ 6, „	T.	14.2	17.4	21.0	21.4	22.4	22.6	22.3	22.2	22.4	22.0	22.4	22.6	22.8
	H.	63	62	58	58	59	60	59	62	59	66	66	66	66
	B.													
„ 7, „	T.	15.2	18.4	21.0	21.1	21.4	22.2	21.6	22.8	23.3	23.2	23.6	23.2	23.0
	H.	94	89	76	72	76	72	80	73	73	73	70	73	73
	B.													
„ 8, „	T.	16.0	19.0	21.0	21.0	21.6	21.6	**21.8**	21.2	21.6	21.4	21.4	21.2	21.4
	H.	100	71	65	65	66	62	62	65	66	65	65	65	65
	B.													

(*Continued*)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
19.4	19.0	19.0	18.8	19.2	18.8	18.8	18.6	18.4	18.2	17.4	16.8	16.4	16.6				
71	71	71	71	71	71	17	71	71	71	70	74	79	79				
						2	*6*	*5*	*10*	*7*							
20.2	**21.0**	20.0	20.2	20.0	19.9	20.0	20.6	19.6	19.6	19.4	19.6	18.8	18.0				
68	68	72	64	68	68	80	76	76	72	75	80	84	89				
							7	*60*	*22*	*12*	*4*						
20.2	21.2	21.4	21.2	21.1	20.4	20.2	20.2	19.8	19.6	19.0	18.4	18.2	18.6				
61	58	58	58	62	68	64	64	64	68	63	75	75	70				
				16	*24*	*36*	*15*	*5*									
23.2	23.0	**23.4**	22.6	22.4	21.6	21.6	21.6	21.2	21.0	20.2	19.6	19.4	19.0				
66	66	66	66	66	66	69	37	72	68	76	80	84	84				
						3	*15*	*24*	*10*	*16*							
20.8	20.4	20.6	20.8	20.2	20.2	19.8	19.6	19.6	19.2	19.0	18.8	18.6	18.2				
68	72	68	65	65	68	76	68	68	71	71	71	75	80				
				1	*9*	*7*	*10*	*16*	*7*	*3*							
21.8	21.7	21.8	21.4	21.0	20.4	20.0	19.7	19.3	19.0	18.4	18.2	18.0	17.6				
67	69	73	72	76	80	80	76	80	80	84	84	84	89				
						12	*2*	*4*	*7*	*6*							
22.4	22.6	22.4	22.0	21.8	21.9	21.2	21.6	21.0	20.6	20.6	20.2	20.0	—				
73	73	73	77	80	77	77	77	85	80	80	85	85	—				
					31	*27*	*27*	*20*	*6*								
19.8	19.8	19.6	19.6	19.4	19.4	19.0	18.6	18.2	18.0	17.8	17.6	17.4	—				
76	76	76	76	80	80	80	80	80	80	80	94	94	—				
20.8	20.8	20.8	20.8	20.4	20.2	20.2	20.2	20.2	19.8	19.6	19.2	—	—				
76	76	76	76	80	80	80	80	80	80	84	89	—	—				
	33	*24*	*8*	*24*	*19*	*10*											
22.2	21.6	21.0	20.6	20.6	20.2	19.6	19.4	19.4	19.0	18.4	18.0	17.6	—				
62	62	65	65	72	72	68	71	75	67	70	79	79	—				
	4	*15*	*21*	*31*	*28*	*10*	*3*	*2*									
21.4	**21.8**	21.6	21.4	21.4	21.2	20.0	20.8	20.6	20.4	19.8	19.2	—	—				
76	59	59	53	55	55	61	55	58	58	64	61	—	—				
					2	*21*	*19*	*17*	*20*								
23.0	22.4	22.2	21.4	20.6	20.2	20.0	20.5	21.2	20.4	19.0	18.8	18.6	—				
66	66	69	72	80	85	85	80	80	80	80	80	84	—				
					27	*14*	*2*		*30*	*5*	*8*						
22.8	22.9	2.30	22.2	**23.7**	23.4	22.0	21.2	20.8	20.4	20.2	19.8	19.6	—				
77	77	73	81	78	73	81	85	90	89	80	89	89	—				
					5	*12*	*26*	*17*	*2*								
21.8	21.4	20.8	20.6	20.5	20.0	19.6	19.4	19.2	19.0	18.8	18.6	—	—				
66	65	68	68	72	72	72	71	75	75	80	80	—	—				
					27	*18*	*11*	*3*									

TABLE 3—

		8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.15 p.m.	12.30 p.m.	12.45 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Oct. 9, 1927	T.	15.0	14.9	15.8	16.4	16.8	17.6	18.0	18.0	18.4	18.4	18.8	19.0	19.1
	H.	94	94	88	88	83	84	79	70	79	75	80	75	75
	B.													
„ 10, „	T.	15.4	18.2	18.8	19.4	**20.4**	19.6	19.6	19.4	19.5	19.4	18.2	18.0	17.6
	H.	73	63	67	63	64	72	64	63	60	54	59	59	56
	B.													
„ 11, „	T.	9.8	11.6	13.2	13.8	14.1	14.4	15.2	15.4	15.4	14.6	15.0	15.4	15.6
	H.	80	76	76	68	68	68	68	68	68	68	68	64	64
	B.													
„ 12, „	T.	7.5	6.8	9.0	9.8	11.8	11.2	**12.8**	12.2	12.8	11.8	11.8	10.4	10.0
	H.	78	85	74	69	70	70	76	71	69	66	76	74	74
	B.													
„ 13, „	T.	10.4	11.6	11.2	12.6	**13.6**	12.8	12.8	13.2	13.5	12.5	11.4	11.8	**11.8**
	H.	80	81	81	76	77	76	82	82	76	81	81	76	76
	T.													
„ 14, „	T.	9.6	13.2	12.6	12.6	11.2	13.6	14.6	13.8	13.0	14.7	14.8	**15.0**	14.4
	H.	80	71	71	76	81	77	68	68	67	64	64	64	63
	B.													
„ 15, „	T.	11.0	11.4	13.4	14.2	**14.8**	14.2	14.9	14.4	14.4	14.0	13.3	12.6	12.4
	H.	81	75	82	77	78	68	73	77	68	68	76	81	93
	B.													
„ 16, „	T.	7.4	10.6	13.8	14.6	15.4	15.8	15.4	16.2	16.2	15.8	15.6	16.0	**17.6**
	H.	78	87	68	73	68	65	69	69	69	74	78	78	70
	B.													
„ 17, „	T.	7.2	8.6	10.6	11.8	12.2	12.8	13.4	**13.6**	13.4	13.6	13.4	13.0	12.4
	H.	100	100	100	93	87	87	82	88	82	77	76	76	81
	B.													
„ 19, „	T.	9.2	12.5	14.4	14.4	15.1	15.8	16.2	16.2	16.0	16.2	16.0	16.2	16.4
	H.	79	81	68	68	64	67	65	61	65	58	61	65	58
	B.													
„ 20, „	T.	8.8	13.6	15.2	15.8	15.6	16.4	**17.0**	16.8	16.4	16.4	16.4	16.4	16.4
	H.	74	77	73	69	74	69	70	66	65	65	69	74	74
	B.												**2**	**2**

(Continued)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
19.2	19.1	**19.5**	19.3	19.2	18.8	19.0	19.0	18.8	18.4	18.0	17.4	—					
75	75	75	75	75	80	80	84	89	84	84	89	—					
17.2	17.2	16.8	16.4	16.4	15.8	15.2	15.0	15.1	14.4	14.0	13.4	—					
66	66	62	61	61	58	57	60	60	59	59	63	—					
9	*22*	*24*	*21*	*9*	*11*	*3*											
15.8	**16.4**	15.4	15.6	15.2	15.8	14.4	14.4	14.8	13.4	11.8	11.4	—					
64	58	60	63	63	63	58	62	62	66	66	65	—					
9.0	8.6	9.6	10.0	8.0	9.8	8.8	9.4	8.8	8.6	8.4	8.4	—					
79	86	86	80	80	80	80	80	79	79	79	85	—					
11.0	11.0	12.4	12.6	13.0	13.4	12.6	12.8	12.8	12.2	12.0	11.8	11.0					
81	81	81	82	76	76	82	76	76	76	81	81	87					
13.4	14.2	14.0	14.8	15.2	15.2	14.8	14.2	14.0	13.2	12.0	11.4	11.2					
63	63	68	60	64	64	60	59	68	63	69	65	65					
12.8	13.4	13.6	13.4	13.2	11.7	11.8	11.8	—	—	—	—	—					
87	82	87	87	87	87	93	93	—	—	—	—	—					
16.4	16.0	15.6	14.6	14.4	14.2	13.6	12.6	12.0	11.8	11.6	11.0	—					
74	74	69	68	72	68	68	76	76	81	81	87	—					
		1		*1*													
12.3	12.2	12.8	12.6	12.0	11.8	11.6	11.0	10.6	10.4	10.0	9.7	—					
81	81	82	76	87	87	87	81	88	86	86	86	—					
16.8	16.8	16.2	16.6	16.6	16.8	16.6	16.2	16.0	15.6	14.2	—	—					
61	62	62	62	62	66	59	61	65	65	72	—	—					
		1	*15*	*74*	*15*	*16*	*25*	*15*	*12*	*5*							
16.6	16.2	16.0	16.0	16.0	16.0	15.9	16.0	15.4	15.0	14.8	14.8	—					
69	69	69	78	69	78	83	88	88	88	88	88	—					
1	*1*																

APPENDED

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		6.30 a.m.	7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Jul. 11, 1928	T.	19.5	20.5	22.0	25.8	26.8	27.3	27.4	27.5	28.1	28.1	**28.5**	27.7	26.6
	H.	95	92	87	76	68	68	68	67	62	59	59	67	70
	B.													
„ 12, „	T.	19.5	20.0	21.5	23.5	25.3	26.0	26.4	26.8	**27.0**	27.0	27.0	26.5	26.5
	H.	95	95	85	80	71	69	65	62	61	62	62	62	63
	B.													
„ 13, „	T.	16.5	17.2	19.7	21.8	24.3	25.7	26.7	27.3	28.0	28.0	27.3	27.2	27.3
	H.	100	95	83	79	67	63	62	56	55	56	59	59	57
	B.													
„ 14, „	T.	18.8	20.5	22.8	23.1	24.0	24.5	25.5	26.0	26.2	26.5	26.3	26.2	26.5
	H.	86	82	76	73	70	71	68	66	66	67	66	66	66
	B.													
„ 15, „	T.	20.8	22.0	22.2	23.4	25.5	25.4	24.8	25.0	24.5	26.3	**26.8**	26.1	26.5
	H.	86	81	79	76	78	71	74	74	74	69	67	70	70
	B.													
„ 16, „	T.	21.0	21.4	21.5	22.0	22.2	**22.5**	22.5	22.3	22.0	22.1	22.1	22.1	22.0
	H.	97	95	95	94	94	93	92	94	97	96	96	96	96
	B.													
„ 17, „	T.	19.2	19.4	19.8	21.5	24.7	24.5	25.1	**25.7**	25.5	24.4	23.2	22.0	21.4
	H.	97	96	97	90	78	78	75	76	72	83	88	79	92
	B.													*260*
„ 18, „	T.	18.5	20.8	24.0	**25.0**	24.0	24.5	23.5	23.0	22.7	22.5	22.5	22.5	22.5
	H.	100	87	74	72	76	75	75	79	80	81	81	81	82
	B.													*5*
„ 19, „	T.	17.5	18.5	20.0	20.6	22.4	22.4	22.4	22.4	22.8	23.0	**23.5**	23.5	23.0
	H.	94	87	80	74	68	68	70	68	65	60	63	63	63
	B.													
„ 20, „	T.	18.7	19.8	21.2	22.0	23.5	23.4	23.5	24.3	24.8	25.2	25.5	26.0	26.5
	H.	87	86	74	71	67	69	68	70	66	63	63	61	61
	B.													
„ 21, „	T.	17.4	18.5	20.5	22.6	24.0	24.5	25.0	26.0	26.8	27.4	**27.5**	27.4	26.6
	H.	90	86	72	76	69	65	65	60	55	52	53	56	70
	B.													
„ 22, „	T.	15.2	16.0	20.0	23.0	25.0	25.5	26.2	27.6	27.8	28.7	28.7	29.3	29.3
	H.	99	94	80	71	65	49	62	60	56	54	52	51	51
	B.													
„ 23, „	T.	22.2	23.0	24.0	24.7	25.8	25.7	26.0	26.4	25.5	26.0	26.3	26.6	26.6
	H.	75	77	70	70	64	62	61	60	63	60	57	57	57
	B.													
„ 24, „	T.	20.5	21.0	21.8	23.0	23.0	23.4	25.1	25.0	23.7	25.4	25.0	**25.7**	25.4
	H.	88	87	82	76	76	74	72	73	76	70	63	68	70
	B.													

TABLE 4

mental plants 15)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
25.4	25.0	25.0	24.6	23.8	23.3	23.0	23.1	22.8	22.7	—	22.5	—	22.8	—	—	—	—
71	74	73	74	79	83	80	81	81	80	—	81	—	81	—	—	—	—
	1		*1*		*1*	*1*		*1*									
26.4	26.0	26.0	25.3	25.0	24.6	24.1	23.4	22.5	22.0	20.7	20.7	—	20.2	—	—	—	—
63	63	62	66	67	74	73	76	81	82	87	88	—	87	—	—	—	—
					3		*24*	*5*	*10*	*2*							
28.0	28.0	28.3	**28.4**	28.0	27.5	27.8	27.4	27.2	27.5	27.2	27.5	27.5	26.7	25.7	25.3	24.5	—
54	56	52	52	56	56	52	54	59	57	60	57	58	62	63	63	73	—
									1	*3*	*16*	*19*	*31*	*25*			
26.7	26.4	26.5	27.0	27.0	27.0	**27.6**	27.2	27.5	27.0	26.5	26.3	26.4	26.2	25.4	25.4	25.4	24.5
66	67	66	67	65	66	65	66	65	65	67	68	67	70	70	70	71	74
										65	*140*	*8*					
25.7	25.7	25.4	25.0	25.7	24.7	24.4	24.0	23.5	23.5	23.6	23.4	23.0	22.7	22.7	23.0	—	23.5
72	73	74	74	74	74	75	78	79	79	80	80	81	81	81	81	—	81
			3	*70*	*81*	*68*	*69*	*20*	*5*								
22.0	22.3	21.8	21.8	22.2	22.3	22.0	22.2	22.6	23.6	24.0	24.0	24.0	24.1	24.0	23.4	22.7	22.5
96	95	96	99	98	97	97	95	97	88	84	84	83	82	82	84	87	88
		2	*1*	*8*	*2*	*2*	*1*										
21.6	22.5	20.7	20.4	19.8	20.0	20.0	20.0	20.2	20.0	20.0	20.2	20.3	20.3	20.1	20.0	20.0	20.0
84	91	93	93	95	95	93	94	93	96	95	94	93	93	94	94	95	94
100	*146*	*120*	*50*	*70*	*9*	*4*											
22.5	22.3	21.3	21.1	20.9	20.5	20.6	20.5	20.6	20.5	20.5	20.4	20.5	20.4	20.0	20.0	19.9	19.7
79	81	83	84	82	84	83	83	83	84	82	85	82	83	84	85	85	85
7	*45*	*183*	*147*	*105*	*14*	*9*											
23.0	22.5	22.7	22.5	22.7	22.5	22.2	22.0	22.1	21.9	21.5	21.4	21.4	21.2	20.7	20.5	20.7	19.7
61	65	69	66	66	66	66	70	71	72	71	76	76	76	78	80	82	82
	23	*68*	*72*	*108*	*70*	*70*	*57*	*27*	*7*	*4*							
25.8	26.4	26.7	**27.0**	26.7	26.7	26.3	25.8	25.3	24.7	24.7	24.5	24.3	24.0	24.3	23.5	23.2	23.2
61	60	61	58	67	66	65	68	71	72	73	73	72	73	72	76	75	75
					2	*10*	*19*	*37*	*168*	*123*	*135*	*51*	*13*	*6*			
26.3	25.8	25.5	25.2	25.7	25.5	26.0	26.0	25.9	26.0	25.5	25.1	25.3	24.7	25.0	24.6	24.6	24.0
70	72	72	70	72	71	72	72	70	70	**71**	72	72	75	73	74	76	77
					3	*5*	*12*	*21*	*46*	*40*	*115*	*70*	*60*	*20*			
29.3	29.3	29.4	**29.5**	29.2	29.0	29.0	29.3	29.2	29.2	29.2	29.2	28.7	28.3	27.6	27.5	27.0	26.5
51	52	47	47	46	46	47	47	47	49	47	48	52	52	56	56	58	58
												20	*45*	*55*	*53*	*71*	*10*
26.4	26.1	26.5	**27.2**	26.5	26.5	26.5	26.4	26.2	26.5	26.3	26.0	25.0	25.0	24.8	24.5	25.4	25.0
57	56	56	55	55	55	56	56	56	56	58	58	60	60	62	62	62	68
					9	*4*	*51*	*56*	*68*	*72*	*26*	*14*					
24.6	25.0	25.0	24.9	25.0	25.0	25.0	24.5	24.7	24.7	25.0	25.2	25.0	25.5	24.2	23.5	23.0	22.5
71	63	69	69	68	69	67	69	69	70	65	68	69	72	74	77	86	80
			16	*35*	*17*	*36*	*33*	*8*	*4*								

TABLE 4—

		6.30 p.m.	7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 p.m.	11.30 p.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Jul. 25, 1928	T.	21.7	22.5	23.4	23.5	24.2	24.0	24.7	25.0	24.7	25.7	25.5	26.0	**27.0**
	H.	76	78	72	71	69	69	69	65	68	62	66	64	59
	B.													
„ 26, „	T.	19.1	20.5	23.5	26.2	28.2	28.2	28.6	28.0	29.0	29.7	29.7	30.5	30.5
	H.	89	77	77	60	50	50	56	56	47	44	46	44	42
	B.													
„ 27, „	T.	23.0	24.0	25.7	26.5	26.8	27.0	27.3	28.0	28.0	27.5	28.0	27.8	28.4
	H.	80	70	69	66	68	68	66	64	65	63	62	61	60
	B.													
„ 28, „	T.	23.5	24.0	25.5	26.6	27.7	27.5	28.0	28.0	28.4	28.5	28.3	28.5	**29.0**
	H.	78	77	71	69	66	67	65	64	61	61	62	60	59
	B.													
„ 29, „	T.	22.8	23.9	24.9	25.5	25.4	26.0	26.7	27.2	**27.6**	27.6	27.0	27.0	27.5
	H.	80	82	72	71	71	68	65	65	63	66	66	66	65
	B.													
„ 30, „	T.	22.6	23.0	23.5	24.4	24.5	25.0	25.4	25.5	25.5	**25.7**	25.0	25.0	24.9
	H.	84	80	81	76	73	69	70	69	69	71	73	73	74
	B.													
„ 31, „	T.	22.0	22.5	24.3	25.3	25.9	26.0	26.5	27.2	27.4	**27.6**	26.3	26.0	26.0
	H.	84	80	73	67	64	63	59	55	60	56	58	58	58
	B.													
Aug. 1, „	T.	20.0	22.4	24.0	25.5	27.7	27.0	27.7	27.7	27.3	28.0	28.8	29.3	**29.8**
	H.	89	73	65	57	50	50	49	46	48	46	42	41	38
	B.													
„ 2, „	T.	20.0	22.0	24.0	25.5	26.4	26.5	26.4	27.2	26.9	27.8	27.7	27.7	28.0
	H.	84	78	63	55	55	52	52	51	48	45	45	45	47
	B.													

(*Continued*)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 n.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
26.5	26.2	26.2	25.9	26.0	25.7	25.5	25.3	25.5	25.6	25.7	25.3	25.0	24.8	24.6	24.0	23.9	23.2
60	64	63	63	63	65	66	·66	64	66	64	64	65	66	67	69	70	73
		2	*1*	*3*	*6*	*10*	*20*	*20*	*16*	*8*							
30.2	**31.2**	30.5	30.0	30.2	29.7	30.0	29.7	29.4	29.0	29.2	26.0	25.5	24.6	24.3	23.8	23.8	23.7
44	40	42	43	44	46	46	47	49	48	50	66	69	72	74	75	75	76
											45	*32*	*19*	*2*			
28.4	28.2	28.4	28.1	28.5	**28.8**	28.2	28.4	27.8	27.7	28.0	26.9	26.6	26.7	26.4	25.7	24.9	24.4
60	63	61	62	59	60	60	60	63	64	61	65	66	67	68	73	76	78
									65	*15*	*18*	*14*	*4*		*1*		
28.5	28.5	28.5	28.0	28.0	27.5	27.2	27.5	28.0	28.2	27.5	27.8	27.0	27.0	27.0	26.4	25.8	25.0
59	60	60	60	60	62	62	63	64	61	63	61	65	65	65	68	70	71
						34	*20*	*7*	*1*	*3*	*2*	*3*	*18*	*6*	*6*		
27.5	26.5	27.1	27.3	27.3	27.0	27.2	26.6	26.1	26.0	26.0	25.5	25.5	25.2	24.5	24.4	24.0	24.0
65	66	66	64	64	65	65	66	67	67	67	68	69	71	74	74	78	77
							8	*34*	*27*	*26*	*18*	*3*	*2*				
25.0	25.1	25.8	25.8	25.4	25.5	25.4	25.5	25.0	25.5	26.0	25.5	24.8	24.5	24.3	24.0	23.9	23.8
73	73	70	72	72	74	74	75	75	73	71	74	74	77	77	79	78	79
3	*8*	*14*	*4*		*17*	*12*	*1*	*10*	*6*	*2*							
26.0	25.4	25.5	25.5	26.5	26.5	25.5	25.3	25.4	24.7	25.0	24.7	24.5	24.0	23.8	23.7	23.5	23.0
58	58	58	56	54	53	55	56	58	61	61	63	64	66	67	69	68	71
		2	*3*	*1*	*1*	*13*	*3*	*4*									
29.5	29.0	29.0	28.8	28.5	28.5	28.5	28.5	28.5	28.2	28.1	27.0	26.4	26.2	26.1	25.5	25.0	24.5
40	43	43	44	43	43	46	46	46	46	46	49	50	51	52	49	55	60
										2	*3*	*7*	*3*				
28.5	28.5	28.3	28.0	28.0	27.8	27.6	26.8	26.5	26.0	26.0	25.2	25.0	24.4	24.0	—	23.6	23.5
46	46	46	46	47	48	48	51	53	52	52	54	55	55	57	—	58	59
									2	*1*							

APPENDED

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		6.30 a.m.	7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Aug. 11, 1928	T.	20.5	21.0	23.7	25.5	26.8	26.6	27.0	27.2	**27.7**	27.7	27.6	27.5	27.6
	H.	89	87	79	78	65	66	64	64	62	62	62	63	62
	B.													
„ 12, „	T.	20.0	20.5	24.0	24.6	26.7	27.5	27.7	27.3	**28.0**	27.5	27.3	27.5	27.5
	H.	79	84	64	68	64	57	57	59	56	57	58	58	60
	B.													
„ 13, „	T.	23.0	24.0	25.0	25.3	25.5	26.4	**26.5**	26.5	25.5	25.0	25.4	25.5	25.6
	H.	76	68	69	67	66	63	60	63	69	71	68	69	68
	B.													
„ 14, „	T.	20.0	21.4	23.0	24.5	24.8	24.5	25.0	**26.0**	26.0	26.0	26.0	26.0	26.0
	H.	—	86	72	61	63	65	60	56	58	58	58	58	58
	B.													
„ 16, „	T.	23.5	24.0	25.4	26.1	26.5	27.0	27.2	27.6	28.0	27.6	27.5	**28.6**	28.0
	H.	81	79	72	67	64	63	63	65	62	63	63	60	61
	B.													
„ 17, „	T.	22.5	23.0	24.6	26.0	26.8	25.5	27.2	27.0	27.6	28 0	**28.4**	28.0	27.4
	H.	80	79	72	67	65	66	64	64	66	64	61	64	65
	B.													
„ 18, „	T.	24.5	25.4	26.5	26.2	26.2	27.8	28.7	29.8	29.3	29.3	**30.2**	29.3	29.0
	H.	77	74	70	72	75	65	63	57	58	59	55	58	59
	B.													
„ 19, „	T.	24.5	24.8	26.2	27.3	27.8	28.5	28.6	28.8	28.8	28.8	29.5	29.6	29.8
	H.	71	68	61	66	58	57	56	54	53	53	50	50	48
	B.													
„ 20, „	T.	23.0	26.0	28.8	29.5	31.5	32.0	32.0	32.0	**32.8**	30.4	30.8	31.0	32.0
	H.	74	64	53	55	48	49	47	49	47	53	52	51	49
	B.													
„ 21, „	T.	23.5	23.8	26.5	28.2	29.4	29.8	30.1	**30.5**	30.0	28 8	28.4	28.4	28.1
	H.	81	81	71	65	60	59	57	57	57	60	63	64	73
	B.													
„ 22, „	T.	23.2	24.4	25.8	27.0	27.5	**28.5**	28.4	28.1	27.9	28.5	28.3	28.4	28.0
	H.	93	87	79	70	65	60	63	65	64	64	65	64	65
	B.													
„ 23, „	T.	20.0	21.2	24.2	25.5	25.7	26.7	25.5	26.2	26.0	**27.4**	26.9	26.9	25.3
	H.	89	83	71	66	68	56	69	62	64	59	60	63	68
	B.													
„ 24, „	T.	22.0	22.7	24.0	23.2	24.4	25.0	25.7	**26.0**	25.5	25.3	25.5	25.4	25.0
	H.	90	87	86	93	84	71	68	68	66	66	63	68	74
	B.													
„ 25, „	T.	20.8	21.8	23.5	25.4	26.7	27.4	29.0	**29.5**	29.4	29.0	27.5	26.2	26.0
	H.	97	89	82	74	72	68	63	59	59	60	70	69	73
	B.													

TABLE 5

mental plants 15)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
27.5	26.5	27.0	26.8	26.6	26.6	26.3	26.0	26.0	26.6	27.0	26.7	27.0	26.7	25.9	25.5	25.4	25.0
63	66	64	66	62	65	67	68	66	60	56	56	55	55	57	*60*	61	63
								1		*2*	*2*	*27*	*7*	*1*			
27.2	27.2	27.0	27.0	26.4	26.5	26.0	26.5	26.3	24.6	24.0	24.4	24.4	24.7	25.0	25.0	25.0	24.5
60	59	59	60	63	66	66	60	60	—	64	64	63	60	58	62	60	64
									13	*9*	*5*	*3*					
26.2	26.2	26.2	26.2	26.2	25.5	25.0	24.8	24.2	24.0	24.0	23.7	23.0	23.0	22.8	23.0	22.5	22.5
67	67	64	66	66	69	73	74	75	77	77	73	79	78	78	76	80	79
						1	*22*	*17*	*1*								
25.6	26.0	25.8	25.5	26.0	25.7	25.0	25.1	24.5	24.4	23.8	23.6	23.1	23.0	23.0	23.0	23.0	22.7
58	56	55	58	55	57	65	60	65	64	67	69	71	72	71	72	72	79
					2	*9*	*14*	*14*	*12*	*8*							
27.5	26.4	25.8	25.5	25.7	25.4	25.0	25.2	25.3	25.1	24.4	24.6	25.0	24.5	—	—	—	—
62	65	67	68	68	70	71	71	69	69	72	73	70	72	—	—	—	—
			2		*17*	*15*	*13*	*12*	*4*		*1*						
27.5	27.6	28.0	28.0	28,0	27.3	27.8	27.5	27.6	27.1	27.0	27.0	26.5	26.4	26.0	25.6	25.3	25.0
66	66	64	64	64	68	65	65	64	66	74	66	66	69	70	73	71	70
									1	*6*	*3*	*3*	*13*	*10*	*5*		
28.8	29.2	29.0	28.8	28.5	28.5	28.6	29.0	28.6	28.4	27.6	27.5	27.1	27.0	26.7	26.6	26.2	25.7
59	59	59	60	60	60	60	59	59	60	61	63	62	63	65	66	67	68
											1	*3*	*12*	*19*	*14*	*4*	
29.5	29.3	29.0	29.0	29.1	29.4	30.0	**30.4**	30.2	30.2	30.1	30.0	29.8	29.4	29.2	29.0	28.5	28.0
47	50	48	48	48	47	46	45	45	45	46	45	46	47	47	48	51	51
														1	*10*	*24*	*18*
31.5	31.8	31.0	31.1	30.7	30.7	30.5	31.7	31.0	30.1	29.1	29.3	28.6	28.5	28.5	28.5	29.2	29.3
49	49	53	53	53	54	53	50	52	55	60	60	63	64	64	67	59	57
													1	*16*	*32*	*18*	*3*
28.0	28.5	28.5	28.5	28.4	27.9	27.5	27.0	26.3	26.0	25.8	25.8	25.7	25.8	25.8	26.0	26.0	25.7
65	64	64	64	65	68	69	71	76	78	82	82	83	82	83	81	82	83
					2	*5*	*4*	*22*	*18*	*2*	*1*						
28.0	27.4	27.4	27.5	26.8	26.5	26.5	26.5	26.0	25.9	25.3	25.3	25.0	25.0	24.9	24.5	24.2	23.6
67	68	68	68	70	70	68	66	69	70	73	72	73	73	72	75	76	80
						6	*3*	*3*	*14*	*14*	*10*	*4*	*3*				
26.5	26.0	25.4	25.7	26.0	26.0	25.8	25.5	25.5	25.4	24.5	24.1	24.5	24.1	23.8	23.5	23.4	23.0
61	64	66	64	63	63	63	67	68	67	71	70	69	70	71	69	69	73
									2	*14*	*16*	*8*	*4*				
24.5	24.5	24.3	24.0	24.2	23.8	23.6	23.5	23.6	23.8	24.0	24.9	23.8	23.5	23.6	23.4	23.2	23.0
77	80	79	78	77	82	82	81	83	79	81	70	82	82	84	75	88	90
		3	*1*	*3*	*4*	*1*	*1*										
26.1	26.4	26.0	26.0	26.5	26.4	26.1	25.7	25.8	25.4	25.0	24.5	24.4	24.5	24.5	24.0	24.0	24.0
73	71	73	70	70	73	72	75	76	76	77	77	76	75	73	72	77	77
							2	*2*	*2*	*6*	*2*						

TABLE 5—

		6.30 a.m.	7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Aug. 26, 1928	T.	22.0	24.0	25.0	26.0	28.0	27.0	27.7	28.4	28.5	29.0	**29.4**	29.1	28.5
	H.	90	81	81	67	60	62	59	55	54	52	52	54	52
	B.													
„ 31, „	T.	22.5	23.0	22.5	23.0	24.0	24.0	24.2	24.0	24.0	23.9	23.8	24.2	24.2
	H.	—	—	—	—	95	96	96	98	96	96	97	96	98
	B.													
Sep. 1, „	T.	18.6	18.7	19.1	19.3	20.0	20.2	20.4	21.0	21.7	22.0	**22.1**	22.0	22.0
	H.	100	100	99	99	100	98	98	95	90	90	89	89	92
	B.													
„ 3, „	T.	22.4	22.4	25.4	26.2	27.0	26.6	**27.3**	27.0	27.0	26.6	26.4	26.3	26.5
	H.	90	90	76	73	74	77	75	75	75	76	78	78	80
	B.													
„ 4, „	T.	22.0	22.6	25.0	26.5	27.3	27.6	28.1	27.7	28.0	**28.8**	28.5	28.3	28.3
	H.	95	94	88	75	72	66	70	70	69	68	69	75	70
	B.													
„ 5, „	T.	23.5	24.0	24.8	25.9	27.2	27.2	27.4	27.8	**28.0**	27.3	27.6	27.5	27.5
	H.	82	83	82	75	68	68	65	64	65	68	68	67	70
	B.													
„ 6, „	T.	24.5	25.0	25.4	**27.2**	27.0	27.0	26.7	26.5	25.9	26.0	26.0	26.3	26.4
	H.	86	86	83	75	74	74	76	78	78	78	78	78	78
	B.													
„ 7, „	T.	21.7	21.7	22.5	26.3	27.5	28.0	28.6	29.3	29.0	29.6	30.4	**30.7**	30.4
	H.	84	85	83	70	67	71	60	57	54	52	48	50	51
	B.													
„ 8, „	T.	21.4	23.4	24.6	26.3	27.0	26.5	26.2	26.4	26.5	26.8	**27.4**	26.8	26.8
	H.	81	69	68	61	59	64	69	66	63	65	63	68	70
	B.													
„ 9, „	T.	18.8	19.2	21.5	22.7	24.5	25.3	26.3	26.0	25.9	26.0	**26.5**	26.2	26.0
	H.	91	93	90	86	75	73	68	70	70	68	69	66	68
	B.													
„ 10, „	T.	22.7	22.7	23.5	23.9	23.7	24.0	24.0	24.3	24.0	24.5	25.4	25.6	**25.7**
	H.	95	93	89	88	91	90	89	91	90	90	87	84	84
	B.													
„ 11, „	T.	19.5	20.5	23.6	23.4	25.5	**25.9**	25.5	25.0	25.0	24.5	24.0	23.9	24.0
	H.	95	89	73	73	69	62	62	65	64	69	69	72	72
	B.													
„ 12, „	T.	19.2	19.0	19.1	19.5	21.4	22.0	22.7	23.1	**23.5**	23.1	22.3	22.0	21.7
	H.	87	89	91	89	79	90	74	69	64	67	67	69	74
	B.													
„ 13, „	T.	19.0	19.2	24.0	**24.5**	24.5	24.5	24.3	23.7	23.3	22.5	22.8	23.0	22.8
	H.	100	100	90	87	86	84	81	93	93	96	97	95	97
	B.													*1*

(*Continued*)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
28.5	28.1	27.8	27.8	27.7	27.8	27.0	26.5	26.5	26.5	26.6	26.5	26.6	26.5	26.5	26.5	26.0	26.0
56	59	57	60	61	60	63	66	68	70	72	70	69	70	73	70	70	70
											2	*7*	*2*	*1*			
24.3	24.0	24.0	24.0	24.0	23.8	—	23.8	—	23.9	—	23.5	—	23.5	—	23.2	—	22.5
96	97	96	98	98	99	—	99	—	98	—	100	—	99	—	98	—	100
22.0	21.6	21.5	21.3	21.0	21.0	—	21.0	—	20.7	—	20.6	—	20.5	—	20.3	—	—
92	94	94	96	97	98	—	98	—	100	—	99	—	100	—	100	—	—
26.6	26.5	26.5	26.0	25.4	25.0	25.0	24.8	25.5	25.5	—	24.0	—	23.9	—	23.5	—	—
77	76	78	82	84	86	86	88	89	88	—	90	—	90	—	92	—	—
				5		*1*	*1*	*2*									
27.6	27.2	27.4	26.9	26.3	25.0	26.0	25.5	25.3	25.3	25.0	24.5	—	24.5	—	24.0	—	—
74	74	70	74	82	84	83	84	86	86	86	88	—	89	—	90	—	—
					1	*1*	*3*	*2*	*2*	*1*							
27.0	27.0	26.6	26 5	26 1	25.5	25.2	25.0	24.8	24.5	24.4	24.4	—	24.0	—	24.0	—	—
70	70	73	74	74	80	81	81	83	86	85	85	—	88	—	88	—	—
					4	*1*	*2*	*3*	*2*								
26.2	26.0	26.3	26.6	26.4	26.4	26.3	26.5	26.2	25.6	—	24.9	—	24.3	—	24.0	—	—
76	78	75	75	77	77	78	75	76	81	—	83	—	85	—	88	—	—
	2	*1*		*6*	*4*	*7*	*1*										
29.9	30.4	30.0	28.9	28.4	28.3	28.2	28.6	27.9	27.9	27.5	27.4	—	26.5	—	—	—	—
53	52	57	61	63	62	64	63	65	68	65	71	—	76	—	—	—	—
						2	*2*		*6*	*2*							
27.4	28.0	27.0	26.7	27.0	27.0	26.4	26.2	25.4	25.0	—	25.2	—	24.7	—	—	—	—
68	72	70	69	69	70	70	72	75	81	—	76	—	80	—	—	—	—
						8	*2*										
26.0	26.0	25.6	25.5	25.3	25.3	25.2	25.3	25.3	25.0	25.0	24.5	—	24.0	—	23.5	—	—
68	70	71	72	75	74	71	68	67	69	69	69	—	80	—	75	—	—
					1	*1*	*1*	*4*	*1*								
25.4	25.5	25.5	25.5	25.5	25.5	25.5	25.4	25.3	25.4	25.0	25.0	—	24.5	—	—	—	—
83	82	83	83	83	83	84	83	85	83	87	86	—	89	—	—	—	—
				2	*1*		*2*		*1*								
24.0	23.7	23.6	23.8	23.9	24.0	23.8	23.7	23.6	23.5	—	23.0	—	22.5	—	—	—	—
72	73	75	72	72	72	71	72	74	74	—	76	—	78	—	—	—	—
		4		*1*	*3*												
21.5	21.5	21.5	21.6	21.5	21.5	21.6	21.8	21.5	21.2	21.0	21.0	—	20.6	—	—	—	—
74	75	77	79	71	77	76	78	75	80	80	80	—	83	—	—	—	—
22.6	22.5	22.5	22.5	22.5	22.5	—	23.0	—	23.0	—		—	22.7	—	—	—	—
99	100	100	99	99	99	—	95	—	95	—		—	83	—	—	—	—
2	*5*	*1*	*2*	*1*													

TABLE 5—

		6.30 a.m.	7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Sep. 14, 1928	T.	19.3	19.2	20.5	22.5	23.7	23.8	24.4	25.0	25.5	**26.0**	25.0	25.5	25.5
	H.	95	98	95	90	88	86	82	79	72	78	77	77	71
	B.													
„ 15, „	T.	18.0	18.8	21.5	23.0	23.8	23.0	24.4	24.2	24.5	24.5	25.2	25.0	25.0
	H.	94	89	81	76	74	80	74	73	73	73	74	71	73
	B.													
„ 16, „	T.	16.7	18.4	18.5	19.2	20.0	20.3	20.8	21.0	21.8	**22.0**	22.0	21.7	21.2
	H.	92	76	84	77	69	67	68	67	59	55	60	60	69
	B.													
„ 17, „	T.	—	16.6	17.5	18.0	18.4	19.0	**19.5**	19.0	19.0	19.0	19.3	18.5	18 8
	H.	—	67	66	64	61	58	57	59	57	57	58	56	58
	B.													
„ 18, „	T.	11.0	11.8	13.4	16.8	19.0	18.9	18.6	18.4	19.0	19.4	**20.2**	20.0	19.8
	H.	89	83	83	70	52	53	60	58	59	55	58	56	55
	B.													
„ 19, „	T.	15.0	15.3	16.3	**18.1**	17.2	16.3	16.4	16.0	16.0	16.2	16.0	15.5	15.5
	H.	87	85	82	70	76	88	87	88	81	81	84	88	88
	B.													
„ 20, „	T.	14.8	16.5	18.5	20.5	21.5	21.7	22.0	23.3	22.7	23.6	24.0	24.3	**24.5**
	H.	97	87	84	78	75	78	75	73	73	67	64	63	65
	B.													
„ 21, „	T.	13.2	14.3	19.0	16.8	18.5	19.5	19.0	19.0	19.5	20.2	**20.5**	20.2	20.2
	H.	97	96	74	95	89	77	74	73	70	68	66	64	65
	B.													
„ 22, „	T.	11.2	11.6	13.5	15.8	18.3	18.7	18 5	18 8	19.5	19.6	19.6	**19.8**	19.6
	H.	88	88	87	72	59	66	63	56	57	58	55	53	56
	B.													
„ 23, „	T.	11.0	11.8	12.8	13.8	14.6	15.1	15.7	16.0	**16.6**	16.3	16.2	16.0	16.0
	H.	94	89	87	90	93	94	92	92	93	91	90	87	87
	B.													
„ 24, „	T.	14.0	14.0	14.5	15.8	18.0	18.2	19.2	20.5	20.5	20.6	**21.0**	21.0	21.0
	H.	97	100	100	98	**91**	92	85	88	77	80	75	76	77
	B.													
„ 25, „	T.	22.0	22.2	24.0	**25.5**	19.5	21.5	22.1	21.6	22.0	22.5	22.6	22.1	20.4
	H.	80	88	82	77	100	87	83	79	76	72	75	74	76
	B.												*1*	*1*
„ 26, „	T.	10.8	11.5	13.6	14.1	15.7	17.3	**18.5**	17.2	17.2	17.4	17.5	17.5	17.5
	H.	68	64	62	66	57	56	50	54	57	54	55	54	55
	B.													
„ 27, „	T.	15.0	16.7	19.0	19.5	19.5	**20.0**	19.5	19.4	19.3	19.5	19.4	19.4	19.5
	H.	66	61	55	54	47	44	42	42	43	42	40	40	40
	B.													

(*Continued*)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
25.2	25.2	25.0	24.9	24.7	24.6	24.5	24.5	24.3	24.0	23.8	23.5	23.4	23.5				
68	71	75	80	81	76	82	79	83	81	82	82	84	85				
						1		*2*	*1*	*1*	*2*						
25.3	**25.7**	25.5	25.4	25.0	24.0	23.5	23.5	23.4	23.0	—	—	—	22.8				
68	70	69	70	73	77	76	76	77	80	—	—	—	80				
					2	*3*	*4*	*1*									
21.0	20.0	20.6	20.6	20.0	19.8	19.6	19.7	19.2	19.0	—	18.7	—	18.4				
67	75	70	70	70	70	71	71	73	74	—	74	—	73				
					1												
19.0	18.7	19.2	18.9	18.8	18.8	18.5	18.7	—	18.5	—	18.5	—	17.6				
57	56	59	76	67	59	56	57	—	59	—	59	—	63				
				3													
20.0	19.6	20.0	19 9	19.7	19.7	19.5	19.0	18.9	18.6	—	18.2	—	17.6				
53	53	52	54	56	57	53	59	60	60	—	67	—	72				
			1	*12*	*8*	*4*	*2*	*1*	*1*								
15.5	15.5	15.3	15.2	15.2	15.4	15.3	15.3	15.2	15.2	15.2	15.1	—	15.2				
88	85	87	88	88	88	90	90	92	90	89	90	—	88				
24.3	24.0	24·1	24.0	23.0	22.5	22.5	22.0	22.1	22.4	—	22.0	—	21.0				
64	64	68	67	72	70	66	71	71	68	—	71	—	80				
		7	*2*	*2*	*4*	*1*											
20.3	20.5	20.6	20.5	20.5	19.5	20.0	19.8	19.5	19.5	19.0	19.5	—	17.5				
64	62	62	63	66	64	58	57	59	57	60	58	—	68				
18.5	18.5	18.2	18.5	18.7	19.0	18.7	18.5	18.2	17.8	17.7	17.8	—	—				
60	62	63	64	63	63	64	63	67	70	73	75	—	—				
							1		*1*								
15.7	15.5	15.5	15.5	15.5	15.3	15.3	15.2	15.6	14.5	14.2	14.0	—	14.0				
87	90	94	90	92	90	90	92	92	90	95	96	—	96				
20.5	20.5	20.8	20.0	20.0	20.0	19.9	19.6	19.4	19.3	19.2	19.4	—	19.0				
80	80	77	81	81	81	82	83	85	86	87	85	—	89				
	1	*3*	*7*	*8*	*5*	*1*	*1*	*1*									
20.6	19.9	18.5	18.5	17.7	17.6	16.8	16.2	16.7	16.5	16.0	15.8	—	14.8				
77	76	76	75	75	61	67	65	61	64	67	67	—	73				
1	*2*																
17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.7	17.5	17.5	17.4	—	16.5				
55	55	55	56	58	55	54	58	54	55	55	54	—	59				
19.3	19.4	19.2	19.0	18.7	18.5	18.3	18.1	18.0	17.5	17.3	17.0	—	16.0				
40	41	37	37	42	43	42	42	43	47	47	49	—	57				
				4													

TABLE 5—

		6.30 a.m.	7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Sep. 28, 1928	T.	14.0	16.0	16.0	15.6	16.5	17.8	18.8	18.5	18.5	18.5	18.5	18.7	18.7
	H.	79	79	70	69	74	70	62	64	64	62	64	63	63
	B.													
„ 29, „	T.	16.0	16.0	17.0	19.0	19.2	21.2	**22.0**	22.0	22.0	21.0	18.7	19.0	20.0
	H.	88	90	87	69	62	58	57	58	55	56	75	72	67
	B.													
„ 30, „	T.	10.0	10.5	12.2	13.0	14.4	14.4	**14.5**	13.6	14.0	14.0	14.5	14.0	14.0
	H.	82	78	67	65	60	62	69	65	65	65	60	65	65
	B.													
Oct. 1, „	T.	8.0	8.4	12.0	13.0	14.7	15.5	15.9	16.2	16.3	16.4	**16.5**	16.2	16.3
	H.	91	94	72	76	63	55	47	50	49	46	47	47	45
	B.													
„ 2, „	T.	—	16.0	18.0	20.0	21.1	**21.5**	21.4	21.0	19.5	20.4	21.0	20.5	20.6
	H.	—	74	57	63	57	63	56	49	52	53	55	52	55
	B.													
„ 3, „	T.	—	13.4	14.5	18.8	19.2	19.3	19.3	15.7	15.5	15.8	16.5	17.5	18.5
	H.	—	81	78	58	56	63	56	42	76	69	72	68	56
	B.													
„ 4, „	T.	—	11.0	13.5	10.0	10.5	11.7	9.9	11.2	13.0	13.0	13.7	13.5	13.7
	H.	—	74	64	94	94	79	100	84	87	75	64	62	58
	B.													
„ 5, „	T.	—	8.0	9.2	12.0	14.6	14.8	15.3	15.8	15.5	16.0	**16.3**	16.3	16.0
	H.	—	59	72	63	53	52	49	50	53	51	51	50	53
	B.													

APPENDED

(Number of experi

		6.30 a.m.	7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Jul. 4, 1929	T.	16.0	16.2	17.6	17.3	19.2	—	18.4	—	18.5	18.4	19.2	—	19.2
	H.	88	88	86	87	83	—	93	—	74	83	85	—	83
	B.													
„ 5, „	T.	15.0	—	15.6	15.9	16.3	16.2	16.2	16.4	16.3	**16.6**	16.0	—	16.0
	H.	80	—	98	95	94	93	90	90	88	86	89	—	90
	B.													
„ 6, „	T.	15.2	—	16.1	16.4	16.6	16.8	17.0	16.9	16.8	17.1	**17.3**	—	17.1
	H.	98	—	95	93	94	92	91	91	91	91	92	—	92
	B.													
„ 7, „	T.	15.2	15.4	16.2	16.6	16.9	**18.9**	17.8	18.6	18.6	18.5	18.7	—	17.6
	H.	98	98	90	88	94	84	91	91	78	77	90	—	82
	B.													**1**

(*Continued*)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
18.7	18.7	18.6	18.5	18.5	18.7	18.9	**19.0**	18.8	18.6	18.0	17.0	—	17.0				
67	67	73	74	72	69	67	73	62	64	74	69	—	83				
20.5	20.8	21.3	20.7	20.5	20.5	20.4	19.9	19.6	19.3	—	18.5	—	17.6				
57	60	57	56	50	50	50 *2*	52	53	52	—	45	—	46				
14.3	14.0	14.5	14.3	12.5	13.0	13.7	14.2	14.0	14.5	13.5	12.8	12.5	12.5				
64	65	64	64	71	67	68	64	64	60	65	68	69	69				
16.5	16.2	16.0	16.1	15.8	15.7	15.6	15.4	15.3	15.0	14.5	14.0	—	13.0				
46	45	45	43	56	47	49	47	49	59	52	55	—	59				
21.0	20.8	21.4	21.5	21.5	21.0	21.0	20.0	19.0	19.3	19.2	—	17.5	—				
53	54	52	53	62	62	48 *2*	47	47 *2*	50	54	—	56	—				
19.0	18.7	18.5	18.0	18.4	18.0	18.5	19.0	**19.6**	19.6	19.5	19.0	18.0	17.4				
56	55	59	58	61	68	67	63	56	60	57	58	63	66				
13.8	**14.2**	13.8	13.4	14.0	13.8	12.8	12.6	13.0	12.5	—	12.8	—	11.3				
57	57	57	60	60	61	59	61	59	69	—	65	—	78				
15.8	16.0	15.5	15.9	15.7	16.0	15.8	15.7	15.6	15.5	15.0	15.0	—	13.7				
50	53	47	50	47	43	50	55	55	55	57	58	—	36				

TABLE 6

mental plants 15)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
—	19.6	—	19.4	—	**20.2**	—	19.8	—	19.6	—	—	—	20.2	—	—	—	19.4
—	85	—	87	—	81	—	83	—	83	—	—	—	81	—	—	—	85
—	16.1	—	15.9	—	16.2	—	16.1	—	15.9	—	15.8	—	15.6	—	15.6	—	15.6
—	88	—	92	—	79	—	81	—	92	—	90	—	94	—	93	—	93
—	16.8	—	16.8	—	16.8	—	16.6	—	16.6	—	16.6	—	16.2	—	15.8	—	15.8
—	93	—	93	—	93	—	94	—	93	—	93	—	93	—	98	—	98
17.8	17.9	18.0	—	17.4	16.8	—	—	17.2	16.4	17.6	17.9	—	17.2	—	—	—	15.8
80	79	78	—	82	93	—	—	79	92	82	78	—	83	—	—	—	93
1																	

TABLE 6—

		6.30 a.m.	7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Jul. 8, 1929	T.	13.8	13.8	14.7	15.4	16.6	18.0	17.9	**19.4**	18.7	17.7	17.9	18.2	18.4
	H.	100	100	97	93	88	92	90	86	74	77	79	77	76
	B.													
„ 9, „	T.	14.6	16.4	19.6	22.0	—	21.2	22.2	**22.6**	22.5	22.0	21.0	21.6	21.4
	H.	100	95	94	84	—	71	71	67	65	68	70	69	68
	B.													
„ 10, „	T.	15.2	16.4	19.6	22.0	24.5	25.1	25.8	**26.4**	25.2	25.0	23.9	23.4	22.8
	H.	100	94	79	84	64	59	61	58	61	62	65	67	72
	B.													
„ 11, „	T.	16.2	17.8	20.3	21.8	22.1	23.0	24.6	25.3	26.2	26.1	26.9	**27.0**	26.4
	H.	95	87	80	78	78	75	71	68	65	66	66	63	81
	B.													
„ 12, „	T.	20.2	22.4	26.9	28.8	29.8	30.8	30.2	31.2	30.6	30.6	**31.8**	30.4	30.1
	H.	85	77	66	56	52	50	53	50	48	53	48	51	53
	B.													
„ 13, „	T.	20.8	22.4	25.6	26.2	26.1	25.7	26.8	28.4	28.1	28.6	**30.2**	30.0	29.3
	H.	91	94	79	69	72	75	72	68	69	68	57	58	59
	B.													
„ 14, „	T.	—	—	21.8	22.4	22.8	22.9	23.2	23.3	24.0	24.4	**24.6**	—	24.3
	H.	—	—	96	92	92	92	91	91	90	88	88	—	89
	B.													
„ 15, „	T.	20.0	21.8	24.0	27.2	28.8	28.6	29.2	29.4	29.5	30.8	30.7	30.5	31.8
	H.	100	88	84	75	70	69	67	66	66	59	60	65	55
	B.													
„ 16, „	T.	22.8	26.2	29.1	31.0	**31.4**	—	26.8	26.3	26.2	26.6	28.8	28.4	28.6
	H.	84	73	63	57	62	—	73	74	75	74	71	69	68
	B.													
„ 17, „	T.	21.8	23.4	26.8	29.8	30.9	30.4	30.0	29.3	30.2	29.5	31.0	—	31.9
	H.	87	86	72	59	57	59	68	70	61	62	56	—	52
	B.													
„ 18, „	T.	21.8	22.8	24.6	26.1	26.9	27.6	28.0	**28.2**	26.4	26.4	25.8	—	25.5
	H.	98	92	85	67	66	62	60	59	66	71	70	—	71
	B.													
„ 19, „	T.	17.8	20.4	24.2	25.8	26.8	—	27.6	—	**27.8**	27.4	27.0	26.6	26.0
	H.	87	81	60	63	69	—	52	—	49	55	58	56	54
	B.													

(*Continued*)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
18.6	18.8	19.0	18.7	18.5	19.1	18 4	18.6	17.8	17.9	17.9	17.4	—	17.2	—	—	—	16.3
76	74	76	75	75	72	77	76	78	71	71	81	—	80	—	—	—	76
			1	*20*	*13*		*2*	*1*									
20.6	21.0	20.8	21.2	22.0	20.7	20.6	20.6	20.1	20.3	—	20.0	—	20.0	—	—	18.0	—
72	70	72	69	58	71	71	76	76	67	—	79	—	79	—	—	87	—
		10	*18*	*36*	*29*	*6*	*7*	*12*									
22.6	22.7	22.9	23.4	22.6	22.8	21.0	21.6	22.0	22.0	22.1	21.7	—	19.4	—	—	18.8	18.6
73	71	70	69	70	66	73	74	77	72	71	72	—	80	—	—	86	88
		6	*7*	*79*	*26*	*57*	*4*										
26.6	26.4	26.5	26.1	25.9	25 9	25.6	26.4	26.4	25.3	24.9	24.6	24.4	24.5	24.4	22.9	—	21.8
64	66	68	66	67	68	70	67	68	71	72	72	72	73	72	80	—	82
					1	*2*	*1*	*23*	*91*	*34*	*11*	*7*					
29.8	29.4	29.8	29.6	30.0	29.4	29.3	29.1	29.0	28.6	28.1	28.0	27.7	27.5	27.4	27.3	27.1	26.7
53	56	55	55	55	57	59	60	64	59	46	62	65	66	65	66	68	69
					2		*1*				*66*	*77*	*59*	*74*	*16*		
28.6	28.1	28.0	27.8	28.0	28.0	28.1	28.2	28.8	28.6	28.2	28.0	27.8	27.6	27.5	27.4	27.3	27.2
53	65	64	59	64	62	65	64	63	63	64	65	65	65	65	65	67	67
						3	*1*		*4*	*2*	*6*	*79*	*120*	*68*	*42*	*8*	*4*
24.3	24.2	24.2	24.1	24.0	23.7	23.4	23.0	23.2	22.8	22.1	21.8	21.1	20.4	—	20.2	—	20.0
92	92	90	89	90	91	92	92	91	93	94	96	95	95	—	96	—	98
		5	*49*	*27*	*29*	*42*	*3*	*4*	*2*	*2*							
32.4	—	**32.6**	32.0	30.9	29.7	28.4	27.0	27.3	26 9	26.8	27.5	27.9	26.6	—	27.4	—	26.2
55	—	53	60	64	70	71	74	74	73	74	73	79	74	—	71	—	71
							128	*153*	*74*	*54*	*21*	*4*					
28.0	27.8	27.8	28.4	29.2	29.0	28.2	26.6	25.4	25.4	25.2	25.5	—	23.8	—	22.6	—	22.4
68	69	69	71	67	66	70	72	80	81	78	77	—	83	—	88	—	88
							28	*91*	*36*	*19*							
32.0	31.8	30.2	—	29.6	29 3	29.3	29.2	29.2	29.6	29.2	28.6	28.6	28.6	28.6	28.0	27.8	27.6
53	55	58	—	59	59	59	59	59	59	59	59	60	59	60	61	64	64
											32	*31*	*28*	*57*	*10*	*19*	
25.4	26.4	27.0	25.8	25.2	24.6	24.4	24.0	24.0	24.2	—	25.0	—	23.4	—	23.2	—	22.6
70	65	50	51	54	55	58	59	59	58	—	56	—	64	—	65	—	72
				49	*31*	*52*	*38*	*11*	*7*								
26.0	26.4	26.4	26.2	26.2	25.8	26.2	26.0	26.0	25.2	25.2	25.2	25.2	25.2	—	24.6	—	24.0
52	52	52	54	54	55	56	56	58	59	61	61	61	61	—	65	—	71
						10	*3*	*3*	*50*	*70*	*40*	*16*					

APPENDED

(Number of experi

		6.30 a.m.	7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Jul. 22, 1929	T.	19.0	19.2	19.8	21.4	22.0	—	23.6	23.6	24.4	**26.4**	25.4	24.8	24.0
	H.	96	96	91	86	84	—	77	77	74	68	70	73	75
	B.													
„ 23, „	T.	20.8	22.0	22.2	**23.2**	23.0	22.0	21.6	21.0	20.6	20.4	20.4	20.4	20.4
	H.	100	94	94	90	94	98	98	98	100	100	100	100	100
	B.													*23*
„ 24, „	T.	19.4	19.8	20.2	21.6	23.8	24.8	25.8	26.2	26.0	26.4	26.6	**26.8**	25.8
	H.	100	98	96	90	79	80	76	73	69	75	77	77	78
	B.													
„ 25, „	T.	21.0	21.8	23.8	25.2	26.5	28.4	28.4	28.8	28.2	28.0	28 4	27.8	28.0
	H.	96	96	88	96	92	76	76	76	79	77	77	80	80
	B.													
„ 27, „	T.	—	—	—	—	29.4	—	30.2	—	30.8	—	31.4	31.8	31.8
	H.	—	—	—	—	70	—	66	—	69	—	62	62	62
	B.													
„ 28, „	T.	—	24.6	23.4	—	28.4	—	29.2	—	31.2	—	**31.8**	31.0	31.2
	H.	—	85	81	—	74	—	73	—	64	—	62	66	63
	B.													
„ 29, „	T.	22.9	23.4	—	25.6	28 6	30.4	**30.6**	30.0	30.6	—	30.2	30.4	29.6
	H.	98	88	—	82	63	54	56	59	50	—	56	58	60
	B.													
„ 30, „	T.	19.0	21.9	24.6	27.0	26.6	27.6	28.0	—	29.0	29.4	29.4	29.2	**29.6**
	H.	89	71	69	58	60	58	60	—	56	54	53	54	55
	B.													
„ 31, „	T.	23.2	24.2	28.0	31.2	**32.4**	32.2	31.6	31.8	31.4	31.0	31.0	31.4	31.4
	H.	88	88	74	54	59	60	58	61	60	63	65	62	62
	B.													
Aug. 4, „	T.	18.0	18.8	19.4	19 8	20.2	20.6	20.8	—	21.0	—	21.8	—	—
	H.	100	91	87	77	91	85	83	—	83	—	76	—	—
	B.													
„ 7, „	T.	21.2	22.8	23.4	25.0	28.2	—	29.8	—	30.4	—	31.6	31.7	**31.8**
	H.	91	90	84	83	71	—	63	—	64	—	58	57	58
	B.													
„ 8, „	T.	24.2	25.2	28 6	30.7	**31.5**	30.2	30.6	30.4	30.4	29.1	29.5	29.6	29.6
	H.	88	90	70	70	61	65	65	64	64	67	66	66	66
	B.													
„ 9, „	T.	20.2	22.0	23.8	25.4	27.4	28.4	**29.2**	28.9	29.0	—	28.5	28.3	28.2
	H.	100	94	86	81	72	67	62	64	65	—	64	63	65
	B.													
„ 10, „	T.	19.6	23.2	26.4	27.8	28.9	29.9	**30.3**	30.2	27.6	25.9	25.5	26.9	27.4
	H.	87	82	64	56	54	51	49	49	57	72	66	67	59
	B.													

TABLE 7

mental plants 10)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
23.2	22.8	22.6	22.5	22.6	22.6	22.6	23.2	23.8	23.8	23.6	24.2	25.0	23.0	—	21.4	—	22·0
79	82	82	83	82	83	84	82	81	88	81	81	74	80	—	81	—	86
				1	*6*	*10*	*6*		*9*	*1*	*3*						
20.4	20.4	20.4	20.4	20.0	20.0	20.0	19.6	—	19.6	—	—	—	—	—	—	—	19.6
100	100	98	100	100	100	100	100	—	100	—	—	—	—	—	—	—	100
9	*10*		*2*	*2*	*2*												
25.8	26.0	25.8	26.0	26.2	26.6	26.9	26.8	26.2	25.0	24.2	23.8	23.4	22.8	—	22.2	—	21.8
80	82	77	83	78	75	80	78	77	83	85	84	84	88	—	94	—	94
			1		*1*	*1*	*2*	*96*	*77*	*27*	*5*	*2*	*1*				
29.0	**29.2**	28.8	28.6	28.0	27.2	26.0	24.6	24.2	24.4	—	23.6	—	24.0	—	23.8	—	23.4
76	73	77	77	85	92	96	96	96	95	—	96	—	94	—	94	—	94
					5	*7*	*92*	*34*	*20*		*8*						
31.6	31.6	31.4	**32.0**	31.6	31.4	31.4	31.0	31.0	30.8	31.0	30.4	30.4	29.8	28.4	28.4	28.2	27.8
62	60	59	62	63	62	65	64	65	64	64	70	66	68	73	74	73	76
													5	*30*	*60*	*48*	*22*
30.8	30.8	30.6	31.4	31.2	30.4	30.0	31.4	31.4	31.4	30.8	30.8	30.0	29.6	29.3	28.8	28.2	27.2
67	67	66	56	57	62	64	68	56	59	67	68	68	69	72	70	76	79
														1	*12*	*86*	*67*
29.8	29.8	29.0	28.8	28.4	28.4	28.4	28.2	28.0	27.8	27.2	26.8	27.0	25.8	—	26.4	—	26.4
59	60	62	60	62	63	60	60	64	65	66	69	69	69	—	75	—	73
							3	*36*	*49*	*36*	*38*	*14*	*4*				
29.2	29.4	29 4	29.6	29.9	29.4	29.5	29.0	29.2	29.0	29.0	29.6	29.4	29.6	29.0	28.6	28.2	27.8
53	53	54	61	57	54	54	56	59	59	59	59	57	59	60	59	60	65
												6	*3*	*12*	*61*	*6*	
31.4	31.4	31.0	30.2	30.0	29.8	30.0	30.4	30.8	29.6	29.4	29.4	29.8	29.6	29.2	29.6	28.8	29.0
62	63	68	69	69	69	72	66	67	73	74	73	74	70	75	73	76	75
																1	*10*
—	22.4	—	—	—	23.0	—	—	—	**23.6**	—	—	—	21.4	—	—	—	20.6
—	71	—	—	—	72	—	—	—	75	—	—	—	96	—	—	—	89
31.6	31.5	31.2	30.6	31.2	31.0	30.0	30.4	30.0	30.4	30.2	29.8	29.9	29.6	29.0	28.8	28.6	28.4
58	61	60	59	58	62	63	63	63	64	64	66	64	66	67	70	71	71
														3	*12*	*26*	*13*
29.0	28.2	26.7	26.8	24.8	24.4	24.4	24.0	24.1	23.9	23.6	23.3	—	22.8	—	22.8	—	22.8
62	68	75	76	85	88	87	88	87	85	87	89	—	88	—	88	—	89
			3	*6*	*15*	*9*	*8*	*4*	*2*								
28.5	28.2	28.4	28.6	28.3	28.2	28.0	27.7	27.6	27.4	27.2	27.0	27.0	26.8	26.8	26.3	25.9	25.8
65	65	59	56	60	61	60	62	64	62	65	68	68	69	70	70	70	71
										5	*3*	*10*	*13*	*6*	*16*	*4*	
27.6	27.6	27.6	27.4	27.2	27.1	27.0	26.8	27.0	26.8	26.6	26.4	25.8	25.5	25.5	25.1	25.0	24.6
62	67	65	68	68	70	64	68	66	66	66	68	70	72	72	73	84	76
											23	*26*	*12*	*3*	*5*		

TABLE 7—

		6.30 a.m.	7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.
Aug. 11, 1929	T.	20.2	23.8	25.1	26.2	26.6	26.3	26.9	26.6	26.8	**27.0**	26.0	25.6	25.2
	H.	89	74	72	69	68	64	64	66	63	60	61	62	66
	B.													
„ 12, „	T.	18.0	21.0	22.9	23.4	25.9	26.0	26.8	26.8	26.6	26.6	26.4	—	**26.9**
	H.	89	80	75	74	62	61	62	59	59	59	58	—	58
	B.													
„ 13, „	T.	17.6	—	23.6	25.0	25.4	25.6	25.6	**26.0**	26.0	25.9	24.7	24.8	24.9
	H.	93	—	66	60	61	57	57	53	51	51	59	58	54
	B.													
„ 14, „	T.	20.2	—	22.7	23.0	23.4	23.8	23.2	—	23.8	24.8	25.2	—	25.8
	H.	83	—	72	73	74	72	77	—	72	69	68	—	67
	B.													

APPENDED

(Number of experi

		7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.	1.45 p.m.
Sep. 20, 1929	T.	14.8	17.8	19.2	20.5	20.9	21.2	21.2	21.4	21.5	22.7	**23.0**	21.8	22.0
	H.	90	76	59	59	46	40	43	40	39	40	40	37	44
	B.													
„ 21, „	T.	13.2	16.8	19.5	**22.6**	22.5	21.6	21.0	20.2	19.4	17.2	16.4	—	16.1
	H.	66	65	57	43	42	50	52	66	51	86	93	—	95
	B.													
„ 22, „	T.	8.2	14.1	15.4	15.8	16.6	17.0	17.4	18.2	18.0	18.0	18.2	**18.4**	18.4
	H.	91	55	50	51	49	46	45	46	46	45	43	45	45
	B.													
„ 23, „	T.	9.0	12.0	16.2	18.7	18.6	18.8	19.2	19.2	19.6	19.6	**19.8**	19.5	19.4
	H.	85	77	62	58	61	62	62	62	60	60	57	57	59
	B.													
„ 24, „	T.	13.8	16.4	18.8	20.0	20.3	20.5	20.2	20.2	**21.5**	21.2	—	21.0	21.0
	H.	75	67	65	61	61	63	61	61	53	51	—	52	48
	B.													
„ 25, „	T.	—	18.4	18.7	19.7	19.4	19.6	19.5	20.1	21.2	21.6	22.0	21.0	22.0
	H.	—	68	73	71	69	73	75	72	63	56	58	62	61
	B.													
„ 26, „	T.	11.6	16.0	17.2	18.8	19.2	19.2	19.8	20.2	**21.0**	21.0	20.8	20.6	19.8
	H.	86	74	71	63	62	60	62	59	56	56	53	53	53
	B.													
„ 27, „	T.	12.6	15.4	17.6	18.4	18.6	18.4	19.1	18.9	—	19.2	19.0	**19.4**	19.1
	H.	89	76	68	58	55	55	52	55	—	52	54	56	56
	B.													

(*Continued*)

1.45 p.m.	2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
25.2	25.2	25.2	25.2	—	24.8	24.2	24.0	23.8	25.0	—	—	—	24.0	—	—	—	21.8
66	68	66	68	—	69	72	72	74	70	—	—	—	72	—	—	—	84
					13	*46*	*12*	*6*	*1*								
26.5	26.0	25.8	25.9	25.9	25.9	25.4	25.0	24.7	24.6	24.4	24.1	24.0	23.8	—	23.1	—	22.2
58	*57*	*58*	*58*	*59*	*59*	*61*	*60*	*61*	*63*	*63*	*63*	*63*	*64*	—	*69*	—	*70*
							8	*14*	*30*	*23*	*16*	*12*	*2*				
—	23 8	23.8	23.6	23.1	23.2	23.2	23.2	23.0	22.8	22.6	22.4	—	21.6	—	21.4	—	21.3
—	60	60	63	64	63	65	65	65	68	65	66	—	71	—	72	—	71
				19	*7*	*16*	*7*	*9*	*4*	*1*							
26.2	25.6	25.8	25.9	**26.2**	25.3	25.2	24.2	24.2	24.3	24.0	23.9	—	23.4	—	—	—	23.0
64	64	68	63	67	66	71	75	75	74	77	76	—	79	—	—	—	80
							28	*16*	*6*	*3*							

TABLE 8

mental plants 15)

2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
22.0	22.6	22.4	22.6	22.0	22.2	21.8	21.7	21.6	—	—	—	20.4				
45	41	43	39	39	39	39	40	47	—	—	—	53				
1	*1*															
15.4	—	15.4	—	15.4	15.4	—	—	15 4	—	—	—	14.6				
93	—	93	—	90	86	—	—	88	—	—	—	67				
2		*3*														
18.4	18.0	18.2	17.7	17.8	17.6	17.6	17 6	17.6	—	17.0	—	16.0				
46	47	47	47	47	49	49	49	49	—	50	—	55				
19.2	19.2	19.2	18 8	18.6	18 4	18.2	18.2	17.6	—	17.4	—	16.6				
58	58	60	59	59	61	61	61	61	—	51	—	54				
				9	*5*	*2*	*3*									
20.8	20.8	20.6	20.6	20.6	20.4	20.2	19 7	19 4	—	18.2	—	17.8				
53	53	55	56	57	57	57	59	60	—	63	—	66				
				12	*4*	*3*	*3*	*1*								
22.6	**24.0**	23.8	22.2	22.6	23.0	22.8	22.4	22.5	—	21.4	—	20.6				
58	58	48	55	54	54	54	57	57	—	59	—	77				
			10			*1*	*1*									
20.2	19.2	19.0	18.8	—	18.0	17.8	17.6	—	—	—	16.2	—				
55	57	56	60	—	58	64	68	—	—	—	77	—				
	4	*5*	*6*		*14*	*1*	*3*									
18.8	18.8	18.7	18 5	18.4	18.2	18.0	17.8	18.7	—	—	—	—				
55	55	55	54	50	50	54	55	57	—	—	—	—				
	1	*1*		*17*	*4*	*2*										

TABLE 8—

		7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.	1.45 p.m.
Sep. 28, 1929	T.	14.0	18.4	20.1	21.2	21.8	**22.6**	22.0	22.2	21.7	21.8	21.8	21.8	21.8
	H.	87	67	63	54	47	51	53	57	59	57	59	59	59
	B.													
„ 29, „	T.	15.0	17.6	19.2	20.2	20.6	20.8	21.2	**21.4**	19.8	19.6	19.8	19.3	18.6
	H.	90	88	73	70	68	68	69	67	79	79	73	79	73
	B.													
„ 30, „	T.	11.8	11.9	12.4	13.4	14.0	14.0	14.1	14.3	14.4	**15.1**	15.0	14.8	14.8
	H.	84	77	74	66	62	62	62	65	57	59	58	55	55
	B.													
Oct. 1, „	T.	8.4	10.0	12.0	14.0	14.8	—	15.8	16.2	16.0	16.3	16.6	16.6	**16.8**
	H.	88	86	77	62	59	—	57	56	51	45	47	53	56
	B.													
„ 2, „	T.	9.2	12.2	15.8	18.4	17.8	18.9	19.6	21.0	21.0	21.0	21.2	21.5	21.7
	H.	91	77	74	68	64	63	59	60	57	57	57	52	52
	B.													
„ 4, „	T.	10.9	11.8	14.1	18.4	18.8	19.6	19.7	**20.0**	20.0	19.5	19.7	19.6	19.5
	H.	94	92	87	76	74	71	75	77	73	81	79	79	79
	B.													
„ 5, „	T.	—	16.6	18.0	17.4	19.4	20.3	21.2	21.0	21.3	21.2	21.2	21.2	21.2
	H.	—	73	74	89	81	73	73	68	68	63	63	65	66
	B.													
„ 6, „	T.	13.2	15.8	15.8	17.2	17.6	18.8	18.8	20.2	**21.4**	21.2	20.2	20.5	20.6
	H.	85	72	81	80	82	74	74	73	61	76	72	72	72
	B.													
„ 7, „	T.	13.6	14.5	15.4	17.8	18.0	18.2	18.5	18.4	18.6	18.8	19.0	19.0	19.2
	H.	100	95	90	76	76	78	72	72	73	73	74	74	74
	B.													
„ 8, „	T.	16.2	16.6	16.3	17.3	17.0	17.2	17.3	17.0	—	17.8	—	**18.0**	—
	H.	100	98	98	73	76	82	84	78	—	82	—	88	—
	B.													
„ 9, „	T.	10.8	12.4	14.1	16.3	16.4	16.9	17.1	**17.9**	16.8	16.6	16.7	16.8	—
	H.	89	82	85	62	63	67	60	64	57	59	72	62	—
	B.													
„ 10, „	T.	10.0	10.6	11.0	11.4	11.8	13.0	13.5	14.0	—	14.8	**15.0**	14.8	14.8
	H.	80	78	81	81	81	70	71	69	—	61	61	61	63
	B.													
„ 11, „	T.	10.8	14.0	**15.1**	14.2	14.8	13.8	13.4	13.2	13.4	13.7	—	—	—
	H.	86	62	58	57	59	60	62	64	64	60	—	—	—
	B.													
„ 12, „	T.	10.6	11.3	10.7	12.6	12.2	12.4	—	13.6	14.2	13.9	—	14.1	—
	H.	86	84	92	82	89	82	—	80	67	75	—	71	—
	B.													

(*Continued*)

2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
22.0	22.4	22.4	22.5	21.6	21.4	21.3	21.1	20.9	—	—	—	18.0				
61	58	58	58	58	59	61	62	65	—	—	—	79				
					32	*7*										
18.4	18.0	17.7	17.5	17.4	—	—	16.6	16.2	—	—	—	15.4				
74	78	78	80	80	—	—	88	88	—	—	—	88				
4	*17*	*8*	*2*													
14.7	14.8	14.6	14.8	14.4	—	—	—	—	13.4	12.4	—	—				
57	58	57	58	57	—	—	—	—	66	65	—	—				
16.4	16.6	16.3	16.6	16.6	16.4	16.3	16.0	15.9	—	—	—	14.9				
51	53	51	54	57	57	53	59	59	—	—	—	84				
		1			*3*	*1*	*2*									
21.5	**22.1**	21.7	21.7	21.5	20.8	20.6	20.5	19.8	19.4	19.2	18.0	17.1				
52	52	52	50	49	49	57	58	64	67	69	76	78				
								27	*12*	*2*						
19.6	19.7	19.5	19.8	19.5	19.2	18.9	18.8	18.6	—	—	—	18.0				
79	79	81	79	83	85	87	87	89	—	—	—	91				
					3	*5*	*4*									
21.5	**21.6**	21.4	21.2	21.0	20.8	20.6	20.5	20.3	—	—	—	18.6				
67	63	65	65	66	66	68	79	79	—	—	—	87				
				12	*22*	*21*	*2*									
20.8	20.8	20.0	19.8	19.8	—	—	—	19.0	—	—	—	18.9				
70	70	72	69	69	—	—	—	76	—	—	—	76				
			4													
19.0	19.1	19.0	18.9	19.0	19.0	19.2	**19.3**	19.2	—	18.6	—	—				
74	73	71	73	74	76	74	77	86	—	98	—	—				
—	—	—	—	14.6	—	13.4	—	12.0	—	—	—	—				
—	—	—	—	97	—	98	—	98	—	—	—	—				
17.5	17.2	17.1	17.1	17.0	—	16.8	16.4	16.6	16.8	16.6	—	15.2				
53	53	53	60	62	—	62	65	63	71	77	—	81				
		2	*26*	*22*		*14*	*10*	*10*	*6*	*2*						
—	14.5	—	14.5	14.2	—	13.5	—	13.2	—	—	—	—				
—	67	—	69	77	—	79	—	80	—	—	—	—				
12.2	—	10.9	—	12.0	—	11.0	—	8.6	—	—	—	—				
69	—	78	—	67	—	66	—	71	—	—	—	—				
14.6	—	14.4	—	14.4	—	—	—	12.8	—	—	—	—				
67	—	65	—	69	—	—	—	72	—	—	—	—				

TABLE 8—

		7.00 a.m.	8.00 a.m.	9.00 a.m.	10.00 a.m.	10.30 a.m.	11.00 a.m.	11.30 a.m.	12.00 m.	12.30 p.m.	1.00 p.m.	1.15 p.m.	1.30 p.m.	1.45 p.m.
	T.	7.8	9.2	9.4	11.2	12.0	12.4	—	12.6	12.6	13.0	—	**13.2**	—
Oct. 13, 1929	H.	94	85	74	81	77	72	—	82	87	84	—	82	—
	B.													
	T.	11.8	14.0	16.0	16.5	17.0	**17.5**	16.4	16.3	17.2	17.4	—	17.4	17.4
„ 14, „	H.	81	73	71	69	68	66	69	71	71	68	—	66	68
	B.												*105*	*89*
	T.	12.4	12.9	12.7	12.7	12.6	12.0	13.8	12.6	13.6	13.6	—	**14.4**	—
„ 15, „	H.	74	59	68	63	74	60	68	60	60	62	—	72	—
	B.													
	T.	5.9	10.4	12.8	13.6	14.2	14.9	14.6	**15.0**	—	14.4	—	14.4	—
„ 16, „	H.	87	72	62	55	61	58	59	59	—	61	—	58	—
	B.													
	T.	8.0	8.2	8.4	9.1	—	11.4	—	18.2	18.4	18.0	—	18.4	—
„ 17, „	H.	97	100	97	97	—	97	—	76	76	78	—	78	—
	B.													
	T.	9.0	9.8	11.6	13.0	13.0	14.0	—	15.0	—	**15.1**	—	14.8	—
„ 18, „	H.	85	83	69	64	66	67	—	63	—	68	—	63	—
	B.													
	T.	6.3	12.6	14.5	—	**16.3**	15.8	—	15.8	—	15.8	—	16.0	—
„ 19, „	H.	63	63	64	—	57	59	—	57	—	57	—	57	—
	B.													

(*Continued*)

2.00 p.m.	2.15 p.m.	2.30 p.m.	2.45 p.m.	3.00 p.m.	3.15 p.m.	3.30 p.m.	3.45 p.m.	4.00 p.m.	4.15 p.m.	4.30 p.m.	4.45 p.m.	5.00 p.m.	5.15 p.m.	5.30 p.m.	5.45 p.m.	6.00 p.m.
13.0	—	—	—	12.2	—	—	—	11.8	—	12.0	—	—				
84	—	—	—	92	—	—	—	92	—	92	—	—				
17.2	17.0	17.0	17.0	16.6	16.6	16.3	—	15.6	—	15.0	—	13.4				
68	69	73	83	86	88	72	—	81	—	76	—	82				
38	*7*	*24*	*17*	*4*	*6*	*2*										
11.9	—	13.4	—	12.6	—	—	—	11.4	—	—	—	—				
85	—	57	—	59	—	—	—	81	—	—	—	—				
14.6	14.4	14.5	14.3	13.8	—	—	13.0	—	—	—	—	—				
59	59	58	59	62	—	—	65	—	—	—	—	—				
	1	*3*														
19.6	—	19.2	—	19.2	—	19.2	—	18.0	—	16.8	—	—				
64	—	60	—	60	—	60	—	59	—	63	—	—				
14.9	—	14.8	—	14.5	—	—	—	—	—	12.2	—	—				
61	—	65	—	65	—	—	—	—	—	79	—	—				
16.0	15.9	16.0	16.0	15.8	—	15.7	—	14.6	—	—	—	—				
61	71	65	64	64	—	71	—	72	—	—	—	—				
14	*3*	*7*	*15*	*9*		*3*										