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By the time this reaches you, you shall be in receipt of a few seeds but more will reach you soon. I think your plan a very good one and herewith I give you the desired information.

Since I had a study made of this plant, there is a great deal of material on hand, concerning its habits, both as regards its wild and cultivated form.

The plant happens to be a native of this valley as well as of Kashmir, though scientific data does not mention the former. In former years the valley must have been an importance source of this plant, but this tract has now been completely exhausted. (This is the ultimate fate of other valuable herbs). There are still a few individual plants left in the jungle and I had my studies made from them.

About two years ago the experimental plantations had been started at 3,000 feet below the lowest line reached by the plant in its wild state. (Altitude of the plantations is 6,000 ft). The results are most gratifying, inasmuch as the plants grow to much larger proportion than in their natural wild state and were of a much better quality. To give an illustration: a portion of the fields flowered and bore seeds the spring of the second year whereas normally they would do so at the end of the third year. But experience has shown that there are definite rules to be carried out at this altitude, otherwise the plants are slow and not as robust as they ought to be.

I answer your questions point by point.

1) RAINFALL. The plant thrives in Kashmir, but also in Lahul (Western Tibet). Kashmir has an average monsoon, whereas Lahul has none and is rather dry. Kulu, which reminds of Kashmir, has a monsoon lasting from June to September, when there is a general humidity in addition to rain. The average for Naggar (Kulu) of rainfall according to a 27 years records is:

from 1st Oct. to 31st of March.....20.62 inches

from 1st April to 30th Sept....29.78 inches

Kulu has snow, sporadically at our altitude, though the ground is frozen from November till March, thawing out in the noon sun and freezing again at night.

Where the plants grow wild the snow lasts from the end of November till April. The rainfall is extremely variable from year to year, from 62 inches one year to 30 inches the following year.

2) TEMPERATURE. The average temperature for Naggar you shall find on the attached chart, Naggar as mentioned above being at 6,000 feet. As there is a difference of 3°F for every 1000 ft elevation, at 9,000 feet the temperature would be about 9 degrees less. Naggar is where the plantations are situated, and I repeat again the results were very satisfactory.

3) THE PLANT prefers partial shade at the lower altitudes (of India) but then the sun is extremely hot and the leaves being very large (up to 3-4 feet) there is a big area of evaporation. However the plants left in the open, provided the slope faces north, the plants recover within an hour of all ill effects of the sun, and while the sun may scorch the leaf's edges, this does not affect the plant apparently.

4) SOIL. It prefers timber soil, but not pine forests. It thrives best under birches. In Kashmir it forms a regular undergrowth under these trees and I think this may be used as a good indicator. The pine trees have a retarding effect upon this plant, especially our local *Pinus excelsa*. The deodar (*Śādrasādhāwari Debdarsādhāwari*) is less detrimental.

5) I doubt that the soil where Indian Corn thrives, would be suitable as the corn grows on a wider range of altitudes and does not mind the direct sun. In my opinion the Adirondacks are an ideal place for this plant, or possibly some higher places of the Middle West.

6) The plant will grow well in ordinary garden soil. Fertilizers greatly improve its growth, the plant being very sensitive to a well worked soil. A deep soil is of great help since the roots grow to be very large and in a loose soil penetrate better without forming side branches. The soil ought to be well drained, at least this was found to be a necessity at Naggar. Some roots became affected in the damp heat of the monsoon, when the soil was not sufficiently drained and the water remained stagnant. I have found that ridges, such as used for potatoes, are very helpful to force its growth. Even if it does tend to make the soil warmer for the roots. On account of excessive rains during the monsoon the water is better carried off from the main root and herewith I enclose a photograph of an average root 1½ years old, weight 9 ounces, the root being the part required. The plant will grow well, where *Inula Helenium* thrives, since *Inula* is used to adulterate the roots of this plant and is often grown alongside. *Inula Helenium*, I believe, grows in the U.S. and should be a good indicator.

The root of our plant contains manganese and the fertilizers ought to supply it in case the ground lacks a natural supply. Controlled hot air will be very useful in drying the root. The local people use primitive stoves and most of the root becomes smoked and sometimes even charred. In drying the roots loose from two-thirds to three-quarters in weight.

I only answer these points briefly, so as to give you a general picture of the requirements. I am sure the plant will do well in the U.S.

*)

With all best wishes and greetings to yourself and congratulations for your nomination as plenipotentiary to sign the pact on behalf of the U.S.

*) As you probably know most of the root is at present exported to China as is used for medical purposes. It has also been used for incense and as insecticide, but I believe that its medical properties are of much greater importance than any of the other uses.

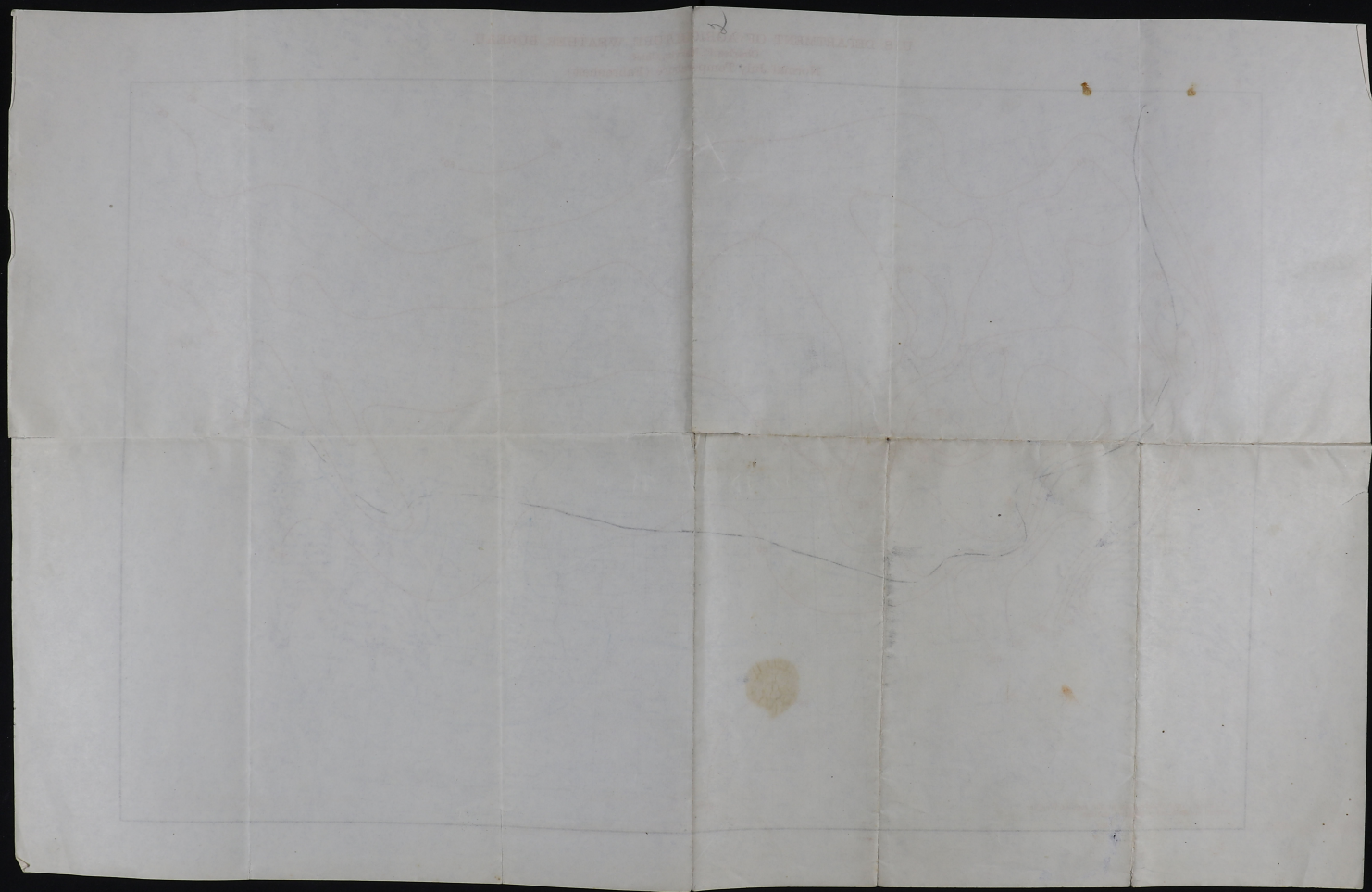
U. S. DEPARTMENT OF AGRICULTURE, WEATHER BUREAU
Charles F. Marvin, Chief.
Normal July Temperature (Fahrenheit)



Mean Temp.
37°

Best fit when all months considered.

The curve given is about 50° too high for this area.



3

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
WASHINGTON

December 12, 1934.

MEMORANDUM FOR THE SECRETARY

Dear Sir:

In answer to the memorandum from Mr. Baldwin under date of December 8, requesting information regarding the temperature of soil, I am submitting the following estimates and remarks.

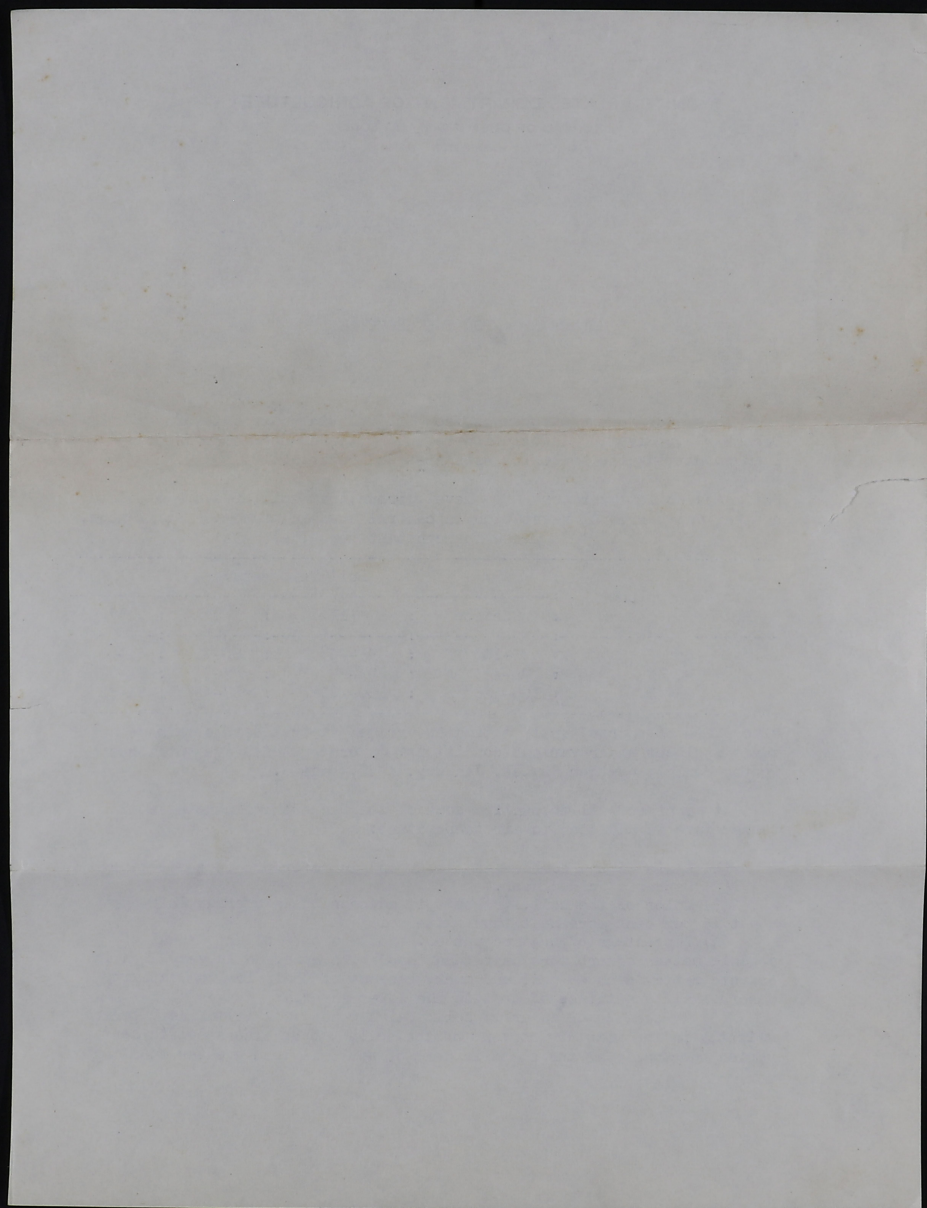
Estimated soil temperature of a level, brown, loam soil, of average moisture content and barren of vegetation in central Iowa in midsummer at 12 noon.*
(Assuming constant sunshine)

Air Temperature	Soil Temperature			
	Surface	1"	2"	5"
85° F	90-100° F	91-95° F	86-91° F	84-86° F
90° F	94-105° F	94-99° F	87-92° F	84-87° F
95° F	100-120° F	100-110° F	87-95° F	84-88° F

*These are of course purely estimates arrived at from data obtained in various places under various conditions. Several results are published in the Monthly Weather Review, January, 1931, page 6.

It might be well to mention some of the factors influencing soil temperature in addition to air temperature:

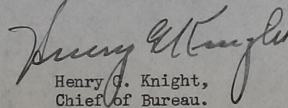
- (1) Angle of the surface of the ground in reference to sun's rays.
- (2) Degree of cloudiness.
- (3) Color of the soil. (Black soil adsorbs on an average July day about 15 per cent more heat than white soil)
- (4) Percentage of organic matter. (Soils with a slight amount of organic matter adsorb more heat than those with none. Soils very high in organic matter such as peat and muck, because of their low conductivity adsorb small quantities of heat in the lower layers)
- (5) Percentage of water in soil. (a) The conductivity of heat varies slightly in the moisture content of the soil, but (b) the specific heat varies enormously as the specific heat of water is much greater than that

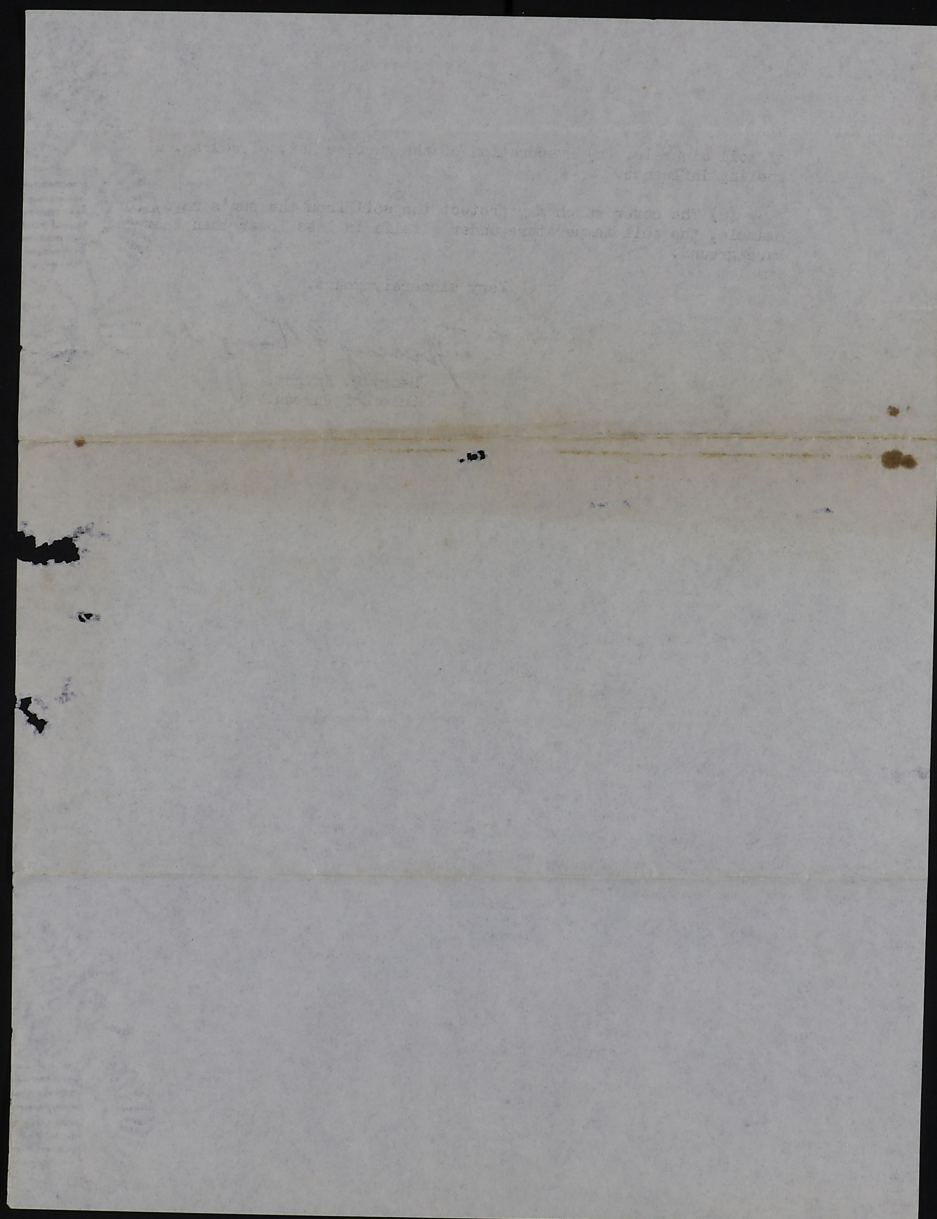


of soil minerals. (c) Evaporation of the surface has, of course, a cooling influence.

(6) The cover which may protect the soil from the sun's rays, for example, the soil temperature under alfalfa is less lower than that on bare ground.

Very sincerely yours,


Henry C. Knight,
Chief of Bureau.



NORMALS

-

DES MOINES, IOWA.

5

	<u>Precipitation</u>	<u>Temperature</u>
Jan.	1.07	20.1
Feb.	1.12	23.7
Mar.	1.78	35.9
Apr.	2.91	50.1
May	4.56	61.3
June	4.76	70.6
July	3.50	75.4
Aug.	3.52	73.1
Sept.	3.67	65.6
Oct.	2.50	53.4
Nov.	1.43	38.4
Dec.	<u>1.22</u>	<u>26.0</u>
Sum	32.04	Mean. Ave. 49.5

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Average Temperature and Precipitation of
Colorado Spring, Colorado
(altitude -- 6,098 ft)

Thirty-seven Year Average

green mt.
Falls
alt. 7800
↓

Month	Temperature	Precipitation	T	P
January	29.8	0.22	26°	.30
February	30.5	0.22	27°	.50
March	37.2	0.72	31	1.20
April	45.1	1.57	38	2.00
May	53.4	2.21	46	2.30
June	62.4	1.82	56	2.30
July	67.2	2.94	60	3.60
August	66.2	2.29	60	3.10
September	59.6	1.08	54	1.2
October	48.8	0.64	43	1.0
November	38.9	0.35	34	.5
December	30.3	0.31	27	.5
Average	47.4	14.51		18.5

Irrigation available at
Colorado Springs

THE UNIVERSITY OF CHICAGO
LIBRARY
1971

1971-1972

Author	Title	Year
1.	1.	1971
2.	2.	1972
3.	3.	1973
4.	4.	1974
5.	5.	1975
6.	6.	1976
7.	7.	1977
8.	8.	1978
9.	9.	1979
10.	10.	1980
11.	11.	1981
12.	12.	1982
13.	13.	1983
14.	14.	1984
15.	15.	1985
16.	16.	1986
17.	17.	1987
18.	18.	1988
19.	19.	1989
20.	20.	1990

Normal Monthly Rainfall and Temperature at Five
Stations in the United States.

	Concord, N. H.		Santa Fe		St. Paul		Mount		Klamath Falls,	
	Rainfall		N. M.		Minn.		Weather, Va.		Oregon	
	inches	deg. F.	R.	T.	R.	T.	R.	T.	R.	T.
			in.	deg.	in.	deg.	in.	deg.	in.	deg.
Jan.	3.00	21.6	.67	28.8	.92	12.6	2.84	30.2	2.01	28.9
Feb.	2.89	22.8	.75	33.1	.92	15.8	2.32	31.2	1.44	33.3
Mar.	3.03	30.3	.80	39.7	1.43	29.1	2.63	39.3	1.20	39.2
Apr.	2.78	43.4	1.00	46.7	2.35	45.6	3.60	49.4	.83	46.2
May	3.01	54.3	1.26	55.7	3.27	57.9	3.72	59.4	.88	53.2
June	3.19	62.9	1.08	64.8	4.14	67.1	4.76	66.6	.76	59.8
July	3.56	68.5	2.33	69.0	3.57	72.1	3.98	71.1	.29	67.8
Aug.	3.54	66.8	2.23	67.4	3.01	69.4	4.54	69.2	.24	66.8
Sept.	3.45	59.3	1.45	60.9	3.07	61.3	2.99	63.2	.57	58.3
Oct.	2.85	49.7	1.13	50.4	2.20	48.6	3.62	51.6	.99	48.8
Nov.	3.08	37.7	.68	38.9	1.30	32.5	2.39	42.1	1.30	38.8
Dec.	3.13	26.8	.74	30.7	1.06	19.0	2.64	32.3	1.30	30.9
Annual	37.51		14.27		27.24		40.03		12.81	
Annual Mean		45.4		48.3		44.2		50.5		47.7

Concord, N. H. -	Lat. 43° 12' N.	Long. 71° 32' W.	Alt. 289 ft.
Santa Fe, N.M. -	" 35 41 N.	" 105 57 W.	" 7,013 "
St. Paul, Minn.-	" 44 58 N.	" 93 3 W.	" 837 "
Mount Weather, Va."	39 4 N.	" 77 35 W.	" 1,725 "
Klamath Falls, Oreg. "	42 15 N.	" 121 54 W.	" 4,100 "

[illegible]

Normal temperature

8

70°F

60

50

40

30

20

10

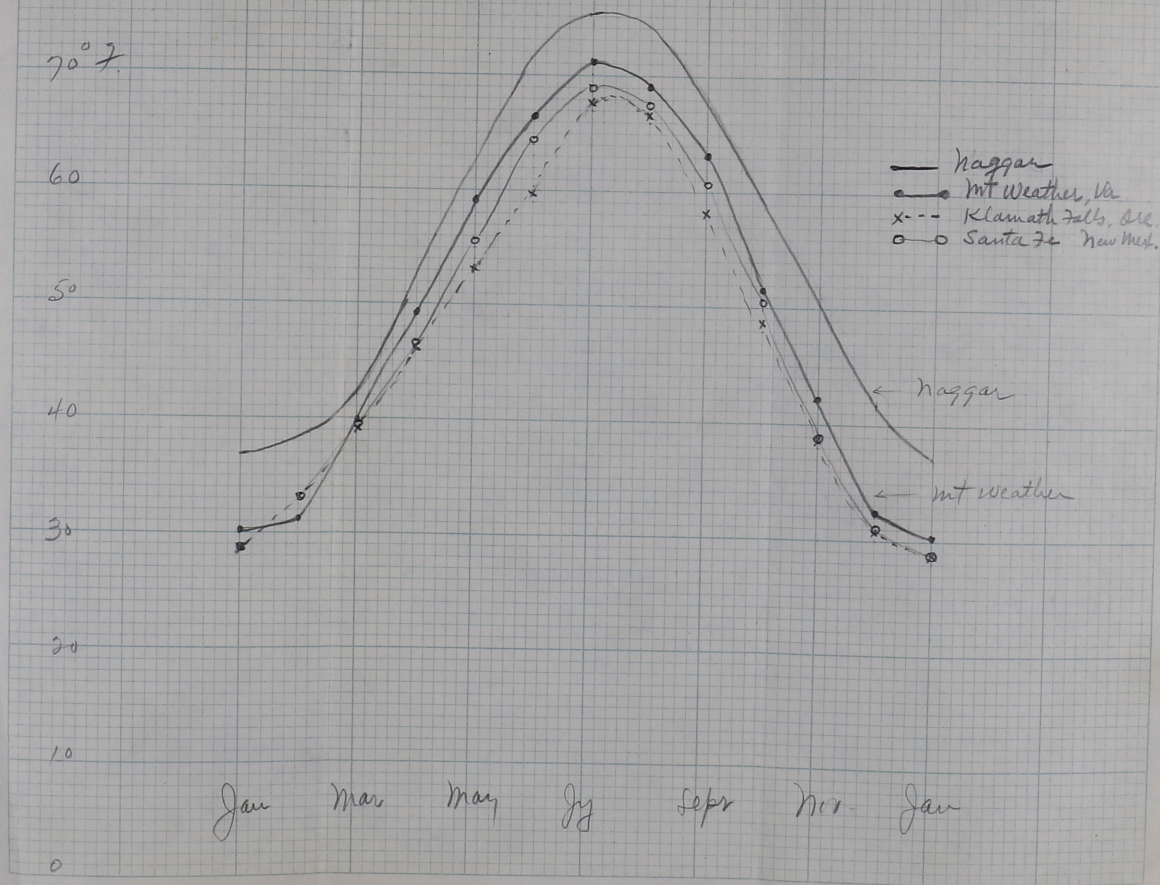
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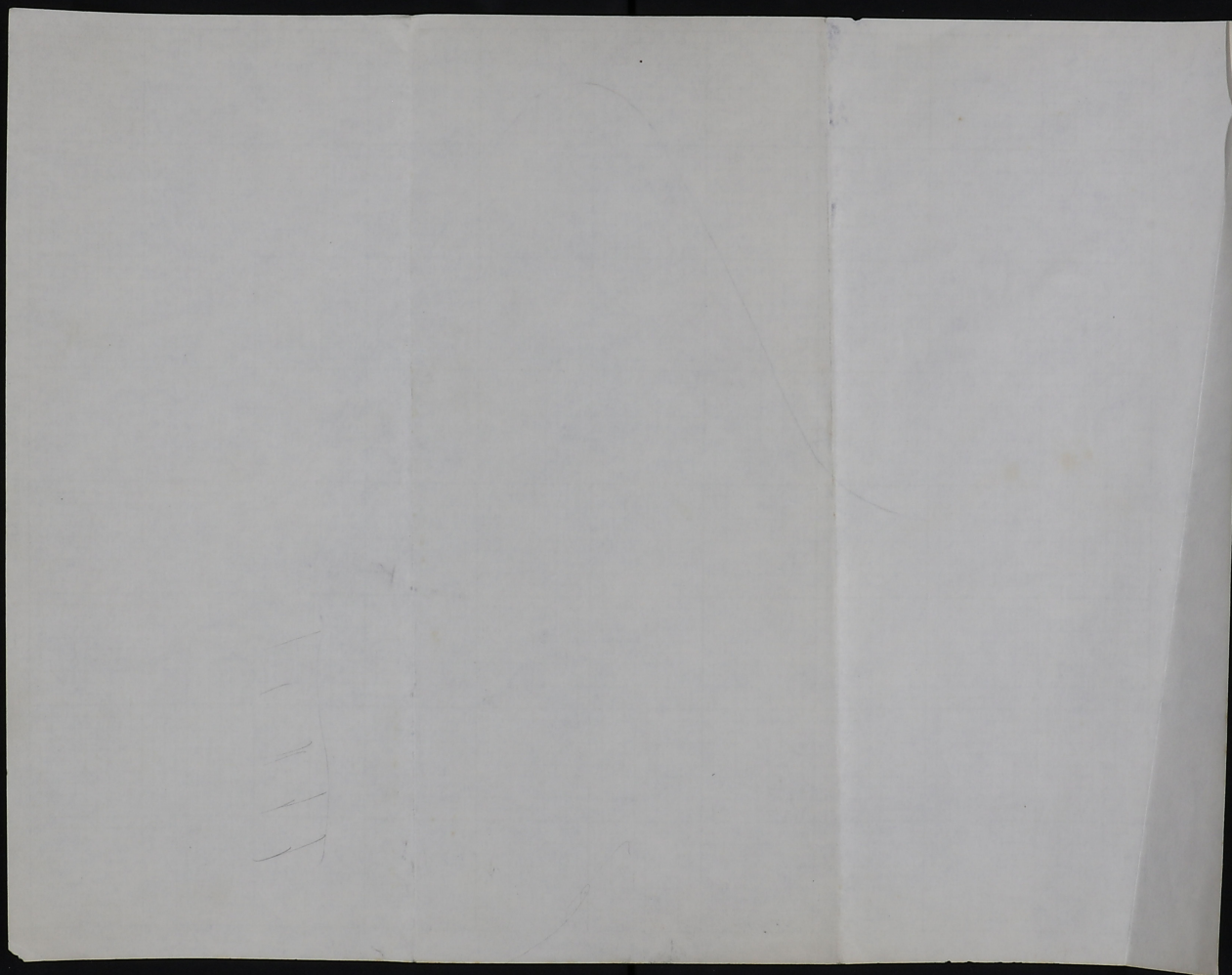
Jan Mar May Jy Sept Nov Jan

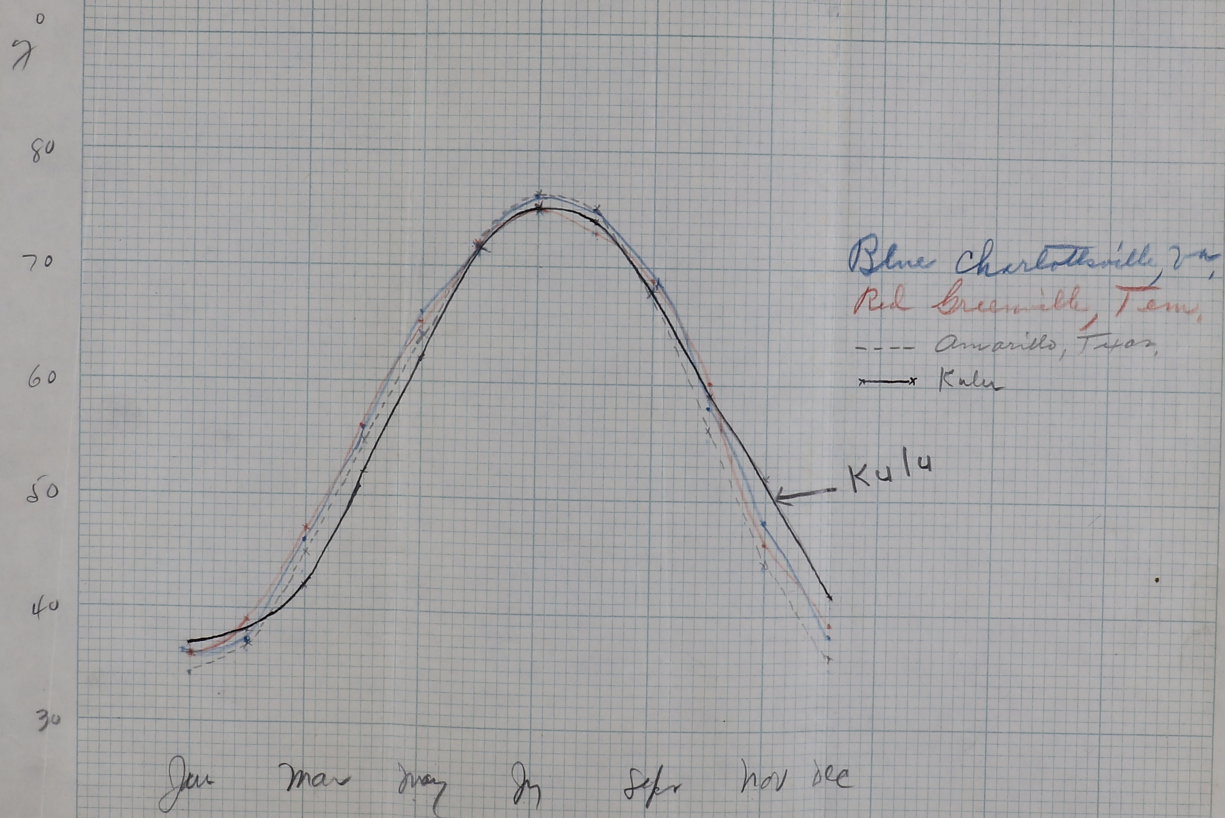
- Naggar
- Mt Weather, Va.
- x-- Klamath Falls, Ore.
- o-- Santa Fe New Mex.

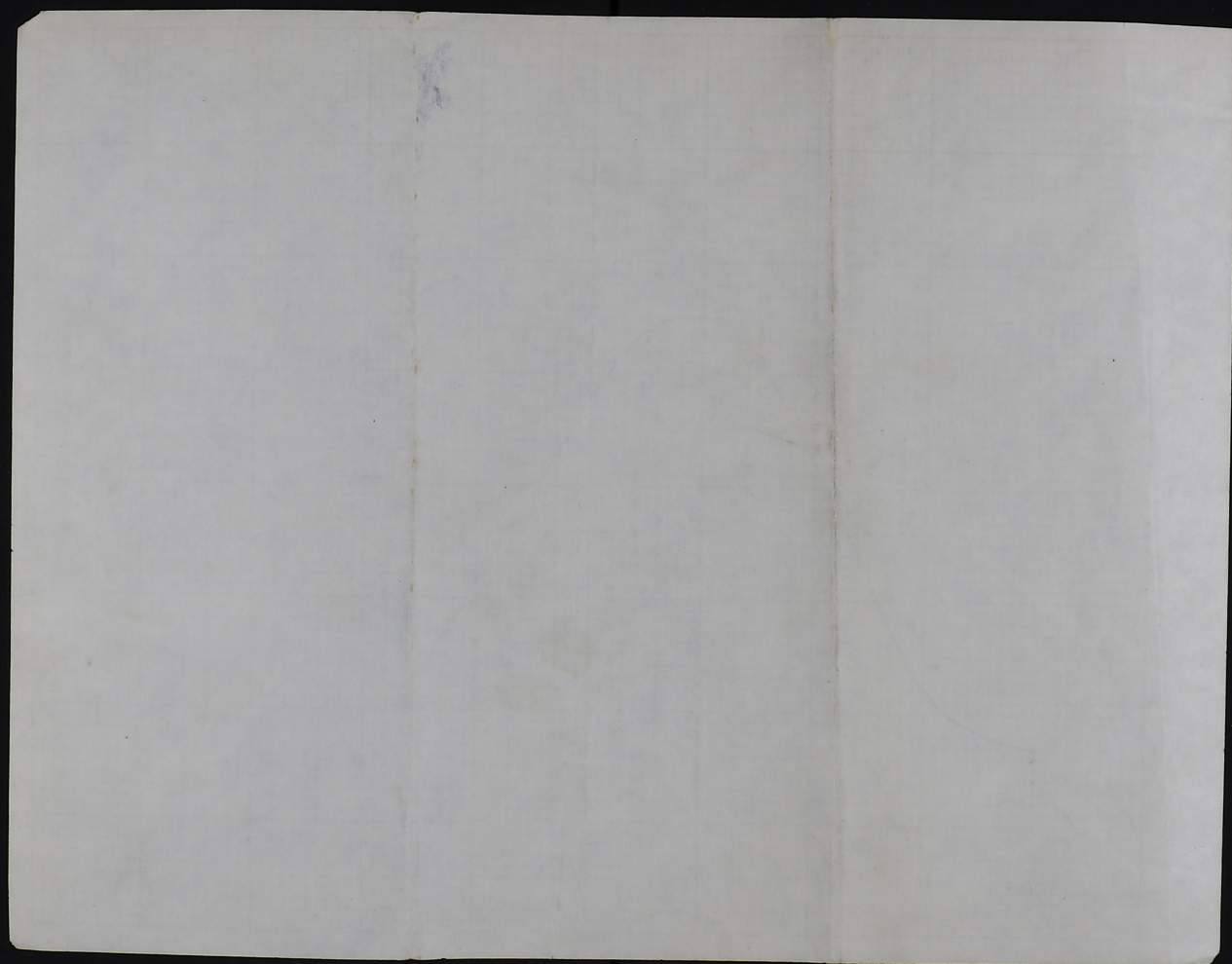
← Naggar

← Mt Weather









Normal Temperature

10

70°

60

50

40

30

20

10

Jan Mar May July Sept Nov Jan

- Naggar
- Concor, N.H.
- x--x St Paul, Minn
- (x)---(x) De Moines Iowa

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