A PRELIMINARY NOTE ON DISEASES OF GRAM

THIS preliminary note deals with aspects of mineral nutrition of gram. From an examination of the gram plants of the Indian Agricultural Research Institute Farm in 1946-47 it was found that the diseased plants exhibited the following symptoms: (1) Top Yellowing, (2) Bottom Yellowing, (3) Yellowing and Bronzing, (4) Bronzing. A brief description of the above symptoms is given below. The disease was sporadic in distribution.

(1) *Top Yellowing.* As the name implies, the growing tips of the gram plants turn yellowish which are bleached to cream colour with age. It reduces the growth of the plants and consequently the yield suffers. The yellow colour disappears at about the time of flowering.

(2) *Bottom Yellowing.* The lower leaves first turn yellowish and progressively the top ones are affected. As the disease advances the plants show folded drooping leaves. Premature shedding of leaves also results.

(3) *Yellowing and Bronzing.* The symptoms of the disease at the early stage start with the bottom leaves. The colour is intermixed showing both bronze and yellow in the same leaflet. The top leaves show marginal bronzing in the beginning and later on the entire leaflets turn bronze. Thus while bottom leaves show both yellowing and bronzing, the top leaves show only bronzing.

(4) *Bronzing.* The bronze colour develops initially from the lower leaves, then affects other parts of the plant, progressively rising from the bottom. Within the leaflet itself the bronze colour is first seen on the margins, then on the base of the leaflet and finally on the rest of the leaflet. Among other features of the disease are retarded growth, dwarfing of the plants and decreased number of branches. Except in the case of "Bottom Yellowing" where fungal organism was found, the others were free from pathogenic organisms.

RESULTS AND DISCUSSION

The results of the chemical analysis of the healthy and diseased sample are given in the table. In this work the whole shoot was selected for analysis and each sample was composite of five healthy and diseased plants respectively, chosen at random. Three composite samples, each healthy, were also analysed.

The diseased plants in general seem to show a deficiency of boron as compared to healthy ones. Silica content in all the diseased plants is more than those of the healthy ones, the SiO_2 content being most marked in that of the "Bottom Yellowing". Other features of the nutritional disturbances as revealed through chemical analysis are given below.

Top Yellowing. The content of Mn is markedly less than that of healthy plants, the figure for the diseased being 63·6 p.p.m. and that of healthy being 153·5 to 101·5 p.p.m. Ash and P_2O_5 content is also higher than those of the healthy. There seems to be more iron and probably more molybdenum in diseased samples as compared to healthy ones.

TABLE I

Description of the sample	*Ash %	SiO_2 %	P_2O_5 %	K_2O %	CaO %	MgO %	B p.p.m.	Mn p.p.m.	Fe p.p.m.	Mo p.p.m.
1 Top yellowing. (D)	10·6 (h)	10·6 (h)	1·01 (h)	3·26	3·22	0·77	28·6 (h)	63·6 (*l*)	2133 (h)	5·3 (h)
2 Bottom yellowing. (D)	11·09 (h)	25·6 (*h*)	0·70	5·6 (*h*)	3·5	0·64	15·6 (*l*)	130·1	4104 (*h*)	5·5 (h)
3 Yellowing and bronzing. (D)	7·45 (l)	12·77 (h)	0·49 (*l*)	2·4	2·5 (l)	0·54 (l)	25·3 (l)	116·6	2623 (*h*)	2·5 (l)
4 Bronzing	7·7 (l)	8·4 (h)	0·35 (*l*)	2·0	3·1	0·78	25·96 (l)	94·8	1673	1·6 (*l*)
5 Healthy. (D)	9·19	7·6	0·69	2·7	3·5	0·84	31·3	158·5	1914	4·5
6 ,, (H)	9·4	6·1	0·55	1·9	3·6	0·72	34·7	118·4	1536	3·3
7 ,, (H)	8·8	6·1	0·60	3·2	3·3	0·71	36·4	101·6	1350	2·6
8 Average of healthy	9·1	6·6	0·61	2·6	3·5	0·75	34·1	126·2	1600	3·5

Note.—D = Diseased. H = Healthy. * Ash = Ash other than silica.

h and h signify respectively definitely a higher and possibly higher values than those of the healthy plants. and l similarly stand for definitely lower and possibly lower values.

Bottom Yellowing. Boron in diseased plants seems to be very low, being 15·6 p.p.m. while 31·3 to 36·4 p.p.m. have been found for the healthy. The plants contain excess iron, being 4104 p.p.m. for the diseased as compared to

1350 to 1914 p.p.m. for the healthy ones. There is also more ash, silica potash and probably molybdenum in the diseased plants.

Yellowing and Bronzing. These plants have a smaller content of P_2O_5 the figures being 0·49 per cent. for the diseases and 0·55 to 0·69 per cent. for the healthy. CaO and MgO as also Mo contents seem to be less in the diseased than in the healthy but the difference is small. Ash content is less in these samples.

Bronzing. These plants show an unmistakably low content of P_2O_5, the figures being 0·35 per cent. for the diseased and 0·55 to 0·69 per cent. for the healthy. Mo also seems to be deficient in these plants, the figure being 1·6 p.p.m. in the diseased as compared to 2·6 to 4·5 p.p.m. in the healthy ones. Ash content is less and the silica content though more than those of the healthy ones, the difference is not large.

The above observations represent the data obtained in 1947. The results so far obtained from the analysis of similar healthy and diseased samples as above during the year 1948 bear out the above conclusions.

"Bronzing and Yellowing" and "Bronzing" samples show similar low phosphate contents as compared to corresponding healthy ones.

Bronzing 0·46 P_2O_5% Healthy 0·82 P_2O_5%

Yellowing & Bronzing 0·38 ,, Healthy 0·53 ,,

Silica content in plants having the above symptoms also show similar higher figures as in the previous years.

"Top Yellowing" has been found to be associated with low manganese content this year (1948) also. The figures are shown below:

Healthy	96 Mn p.p.m.
Top yellowing	68 Mn p.p.m.

From the data presented above it appears probable that these are different diseases.

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ALKALI-SENSITIVE LINKAGES IN IRRADIATED CELLULOSE

An important development in the chemistry of cellulose in recent years has been the contribution of Davidson[1] on the degradation of certain types of oxidised celluloses by alkaline solutions. The concept of alkali-sensitive linkages *vis-a-vis* the (modified) cellulose molecule had its genesis in this work and has proved to be of great importance in assessing the value of the prevailing test methods for cellulose.[2] Precise information on the mode of sensitisation and removal of sensitive linkages is, however, lacking and this would warrant the need for a systematic study of the subject. In the course of a larger investigation on the mechanism of light attack on cellulose, which is in progress in these Laboratories, some evidence has been obtained on alkali-sensitive linkages in relation to irradiated cellulose, and it is the object of the present note to give a short account of this work and discuss the significance of the results.

Cellulosic material as represented by a piece of fresh, highly scoured cotton fabric was initially freed of any alkali-sensitive moiety by boiling repeatedly for eight hours with 1% sodium hydroxide solution. This was ensured by following up the degree of polymerisation (D.P.) during the process of boiling with alkali. The D.P. was estimated through the intrinsic viscosities of the corresponding nitrocelluloses in acetone solution, by employing the Mosimann[3] function. In a typical experiment, the following values were obtained for the D.P.

Description of treatment	D.P.
1 Fresh fabric ..	2295
2 First boiling with alkali ..	1930
3 Second ,, ,, ..	1805
4 Third ,, ,, ..	1745
5 Fourth ,, ,, ..	1740

A piece of fabric subjected to the action of alkali as above was irradiated *uniformly* by a Hanovia High Alpine Sun Lamp during 24 hours, the fabric being at a distance of 30 cm. from the lamp. Immediately after irradiation, the fabric was divided into three pieces. All the three pieces ("A", "B" and "C") were stored under identical conditions in a cool dark place. Samples were drawn from each piece initially and at intervals and the D.P. of the basic cellulose material was determined. In the case of fabric "A", such determinations were on the samples as they were on these occasions. Immediately after the irradiation and prior to storage, fabric "B" was boiled with 1% sodium hydroxide solution for eight