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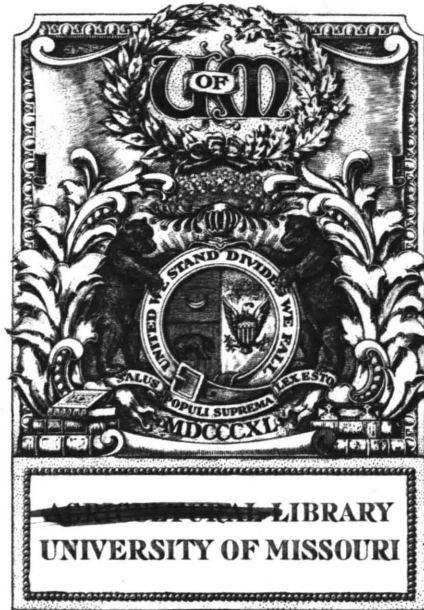


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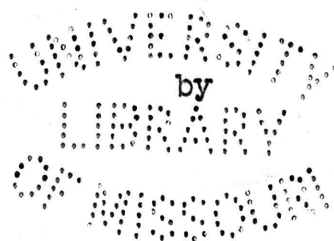


- I. STUDIES WITH RED CLOVER SEED AS RELATED TO COLOR.
- II. STUDIES WITH THE IMPURITIES FOUND IN RED CLOVER AND ALFALFA SEED.

Presented as a Thesis for the degree of

Master of Science

(In Agriculture)



Harold DeMott Hughes.

University of Missouri.

1908.





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## I.

### INTRODUCTION.

The question of color in red clover seed is a matter to which practical farmers have come to attach some importance as an indication of the relative value of different samples. However, all do not hold the same opinion in regard to this. Many farmers believe that a sample of clover seed which has a great deal of purple color, is better than a sample which contains more yellow. On the other hand there are men equally observing and thoughtful, who maintain that the sample with the highest percent of yellow seed is the most viable and valuable.

So far as we are aware no accurate and conclusive work has ever been carried on in an attempt to determine the comparative value of clover seed of different colors. Believing that some definite knowledge on this subject might be of value this work is undertaken in an attempt to determine if possible whether there is any real basis for one or the other of these varying opinions, and if so, what some of the causes for these differences may be.

If seed of one color are more valuable than those of another it must be because of one or more different physical characteristics. Some of these qualities



which are possessed in varying degrees may be due to inherent power which the seeds possess, while others will no doubt be due to different environmental conditions under which the plant grew and the seed was produced. It may be that plants grown under the most ideal conditions for seed production as the plant food supply, texture of the soil, temperature, rainfall, etc., produce seeds which contain a greater percent of purple color. It is the opinion of Dean Davenport, Professor of Thremmatology, in the University of Illinois, that it is altogether possible that the color may be varied by these influences. If this were true we might expect that those which were produced under the most ideal conditions, and which therefore contain the greatest percetn of purple seed, would contain seed which were possibly larger and more perfectly formed than those produced under more adverse conditions. We might also expect that these seeds would germinate most vigorously. Should color be influenced by the maturity of the plant we might expect to find a difference in the protein content and in the specific gravit. Still other influences, such for example as the age of the seed may have some effect on the color. Some of these differences and others not considered may owe their existence to inherent powers which the seed of the different



colors possess. The imperviousness of the seed coat might come under this class.

In making these studies an attempt has been made, carefully to compare purple and yellow seed for possible differences. In doing this the following comparisons have been made.

1. A comparison of the viability as indicated by the total germination.
2. A comparison of the viability as indicated by the rapidity of germination.
3. A comparison of the imperviousness of the seed coat.- Comparison of the percent of the so-called "hard" seed.
4. A comparison of the protein content.
5. A comparison of the percent of purple and of yellow seeds found in samples of clover grown on soils differing in fertility.
6. A comparison of the weight.





1. A comparison of the total germination of purple and yellow red clover seed.

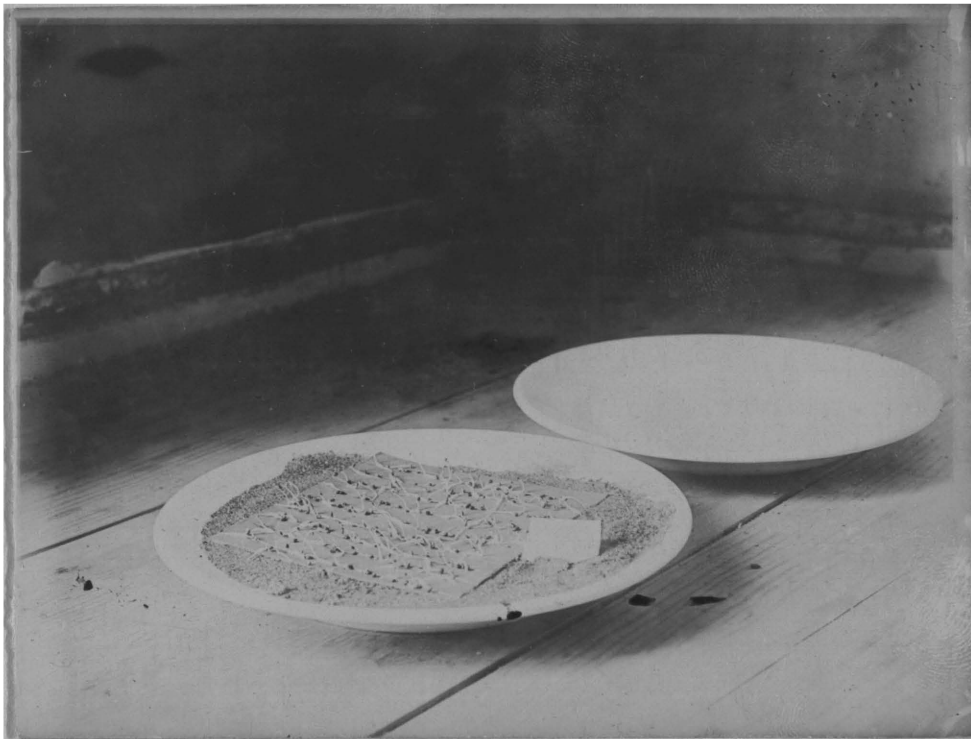
Five hundred purple and five hundred yellow seed were separated by hand from each of fifteen samples.

Only those seed which were of a deep purple or a bright yellow color were used, and all were of good appearance and as uniform as possible. In order to secure perfectly uniform and equal conditions for germination the seeds were placed on plotting paper on plates of sand which had been thoroughly saturated with water. 200 seeds were placed on each plate, - 100 purple and 100 yellow, - and covered with the second plate which was inverted to prevent too rapid evaporation.

The first set (Set I) of 5000 seeds was germinated in a seed tester in which a uniform temperature of 90 degrees F. was maintained. Sets II and III of 5000 seeds each were germinated in a temperature which was not uniform but which varies from 75 degrees F. to 90 degrees F.



Illustrating the arrangement of the seed on the blotters and the method of recording the data.



Set II, Sample I, Plate 3.

Date	18,	20,	22,	24,	26,	28,	Total	18,	20,	22,	24,	26,	28,	Total
Row. No.	P.							Y.						
1	10	9	0	0	0	0	9	10	9	0	1	0	0	10
2	10	8	1	2	0	0	10	10	8	1	0	0	1	10
3	10	6	2	2	0	0	10	10	5	3	1	0	0	9
4	10	7	2	1	0	0	10	10	6	2	1	0	0	9
5	10	5	3	0	0	1	10	10	8	1	1	0	0	10
6	10	7	0	1	0	0	8	10	8	0	2	0	0	10
7	10	7	2	0	0	0	9	10	6	1	1	1	1	10
8	10	6	2	1	0	0	9	10	4	3	2	0	0	9
9	10	5	2	1	0	0	8	10	5	0	1	1	2	9
10	10	8	1	1	0	0	10	10	8	1	1	0	0	10
							ger. $\frac{93}{100}$ %							ger. $\frac{96}{100}$ %



TABLE 1.

Set. 1.

GERMINATION TEST.

Sample	Plate	Percent purple	Percent yellow	Sample	Plate	Percent purple	Percent yellow
I	I	2	10	II	I	75	60
	II	34	34		II	45	33
	III	68	51		III	76	72
	IV	7	8		IV	60	41
	V	<u>47</u>	<u>33</u>		V	<u>70</u>	<u>67</u>
	Total	158	136			326	279
III	I	38	22	IV	I	61	53
	II	58	63		II	22	27
	III	60	46		III	40	47
	IV	70	80		IV	21	28
	V	<u>60</u>	<u>62</u>		V	<u>35</u>	<u>40</u>
	Total	286	<del>273</del>			179	185
V	I	74	77	VI	I	158	136
	II	73	72		II	326	279
	III	88	78		III	286	273
	IV	73	80		IV	179	185
	V	<u>87</u>	<u>81</u>		V	<u>395</u>	<u>389</u>
	Total	395	389			1344	1262

Samples	Grand totals.
I	158 136
II	326 279
III	286 273
IV	179 185
V	<u>395</u> <u>389</u>

Summary.

	Purple	Yellow	Total
Total number seeds tested	2500	2500	5000
Number seeds germinated	1344	1262	2606
Percent germinated	53.76	50.48	52.12



TABLE II.

Set 11.

GERMINATION TEST.

Sample	Plate	Percent purple	Percent yellow	Sample	Plate	Percent purple	Percent yellow
I	I	96	95	II	I	93	92
	II	93	97		II	98	93
	III	98	96		III	98	94
	IV	97	98		IV	92	95
	V	<u>95</u>	<u>93</u>		V	<u>95</u>	<u>93</u>
Total		479			476	467	
III	I	95	92	IV	I	82	82
	II	90	90		II	81	89
	III	83	91		III	88	79
	IV	86	86		IV	82	87
	V	<u>87</u>	<u>83</u>		V	<u>85</u>	<u>87</u>
Total		441			418	424	
V	I	98	93	VI	I	478	479
	II	98	96		II	476	467
	III	99	97		III	441	452
	IV	96	95		IV	418	424
	V	<u>92</u>	<u>97</u>		V	<u>483</u>	<u>478</u>
Total		483			2297	2300	

	Purple	Yellow	Total
No of seed tested	2500	2500	5000
No. of seeds germinated	2297	2300	4597
Percent of seed germinated	91.88	92.00	91.94





TABLE III.

Set III.

GERMINATION TEST.

Sample	Plate	Percent purple	Percent yellow	Sample	Plate	Percent purple	Percent. yellow
I	I	89	96	II	I	92	97
	II	96	93		II	93	96
	III	93	96		III	96	97
	IV	94	97		IV	96	93
	V	<u>99</u>	<u>93</u>		V	<u>90</u>	<u>95</u>
Total		470	472			467	478
III	I	87	94	IV	I	94	96
	II	94	90		II	97	95
	III	85	90		III	94	98
	IV	93	90		IV	95	97
	V	<u>95</u>	<u>90</u>		V	<u>96</u>	<u>93</u>
Total		454	454			476	479
V	I	92	92	Samples		Grand totals	
	II	89	92	I	470	472	
	III	93	95	II	467	478	
	IV	91	95	III	454	454	
	V	<u>94</u>	<u>90</u>	IV	476	479	
Total		459	464	V	<u>459</u>	<u>464</u>	
				Total		2326	2374

	Purple	Yellow	Total
Number of seed tested	2500	2500	5000
Number of seeds germinated	2326	2347	4673
Percent of seeds germinated	93.04	93.88	93.47



TABLE IV.

SUMMARY.

Test of 15000 seeds.

Set	Seeds used	Seeds germ. Total	Seeds germ. Purple	Seeds germ. Yellow	Percent germ. Total	Percent germ. Purple	Percent germ. Yellow
I	5000	2606	1344	1262	52.12	53.76	50.48
II	5000	4597	2297	2300	91.94	91.88	92.00
III	5000	4673	2326	2347	93.27	93.04	93.88
Total	15000	11876	5967	5909	79.11	79.56	78.78

From this test we must conclude that, comparing purple and yellow red clover seed there is no difference in the viability so far as total germination can indicate. In comparing the total percent germination of 2500 purple seed with a like number of yellow seed we find a difference of less than one percent.



A COMPARISON OF THE RELATION BETWEEN THE PERCENT OF  
PURPLE SEED PRESENT AND THE TOTAL GERMINATION.

One hundred and twenty different samples of clover seed in which the percent of purple and yellow seed present was known, were tested for germination. In making this test 200 seeds were placed on blotting paper on plates of wet sand, as in the preceding test, and covered with a second plate which was inverted.

If purple seed are more viable than yellow, or the reverse, there should be some correlation between the total percent germination and the percent of seed of the different colors which the sample contains. In the following table will be found the comparison of the twenty samples giving the highest percent germination and the twenty giving the lowest percent germination as regards the percent of purple seed found in each.



The plates in the germinating room.



A COMPARISON OF THE PERCENT PURPLE SEED IN THE TWENTY SAMPLES GIVING THE HIGHEST GERMINATION AND THE TWENTY GIVING THE LOWEST GERMINATION.

TABLE V..

Twenty samples giving highest percent germination.      Twenty samples giving lowest percent germination.

Sample No.	Percent germination	Percent purple seeds	Sample No.	Percent germination	Percent purple seeds
2	90	49	6	66	24
3	86	39	13	62	49
4	87	43	14	67	34
8	88	40	16	63	38
9	89	41	18	28	40
10	89	35	26	62	47
25	88	42	34	58	42
33	90	41	36	61	59
50	87	32	39	62	32
53	89	60	43	53	52
56	88	37	48	64	51
61	88	48	55	66	53
64	88	48	57	62	56
74	88	49	60	62	44
77	86	38	62	53	44
98	87	35	79	57	57
104	96	38	84	79	57
107	91	53	88	57	45
108	93	53	99	66	41
	88.9	43.2		60.5	51.0





From this it will be seen that there is apparently no correlation between the percent of purple seed in a sample and its value as indicated by the total germination. In fact it appears that the samples which give the lowest total germination contain a greater percent of purple seed than those with the highest germination. This may be accounted for however, by the fact that those samples with the greatest amount of purple seed contain the greatest percent of so-called "hard" seed, as shown in Table , page . These seed cannot be placed in the same class as those which do not have the power of germination no matter what the condition- dead seed,- for they are viable, and give a vigorous germination when the right conditions are given, as shown in Table page



2. A comparison of the rapidity of germination of purple and red clover.

In making the test for total germination with the 15000 seed in Sets I, II and III the number of seed which germinated was recorded every second day, in order to compare the seed of the different colors as regards the time required for germination. The number which germinated each second day is shown in the following table.



TABLE VI.

A Comparison of the Time Required for Purple  
and Yellow seeds to Germinate.

Set I.

	Number germi- nated 2nd day	Number germi- nated 4th day	Number germi- nated 6th day	Number germi- nated 8th day	Number germi- nated 10th day	Total Number germinated in 10 days Total
Sample I.						
Purple	2	128	17	11	0	158
Yellow	3	114	15	3	1	136
Sample II.						
Purple	34	240	26	22	4	326
Yellow	33	189	24	22	2	279
Sample III.						
Purple	51	210	19	6	0	286
Yellow	72	179	17	17	2	273
Sample IV.						
Purple	101	59	13	2	0	179
Yellow	116	54	13	2	0	185
Sample V.						
Purple	93	235	29	34	4	395
Yellow	147	192	33	15	2	389
Total						
Purple	285	872	104	75	8	1344
Yellow	371	723	102	59	7	1262



TABLE VII.

A Comparison of the Time Required for Purple and Yellow seeds to Germinate.

Set II.

	Number germi- nated 2nd day	Number germi- nated 4th day	Number germi- nated 6th day	Number germi- nated 8th day	Number germi- nated 10th day	Total number germi- nated in 10 days Total
Sample I.						
Purple	335	28	0	0	0	479
Yellow	351	26	3	2	2	479
Sample II.						
Purple	440	32	4	0	0	476
Yellow	484	73	7	2	1	467
Sample III.						
Purple	209	182	46	0	4	441
Yellow	183	205	59	3	2	452
Sample IV.						
Purple	228	154	29	1	6	418
Yellow	214	182	27	4	7	424
Sample V.						
Purple	23	341	113	2	4	483
Yellow	26	331	110	7	4	478
Total						
Purple	1349	739	192	3	14	2297
Yellow	1243	827	196	18	16	2300





TABLE VIII.

A Comparison of the Time Required for Purple and Yellow Seeds to Germinate.

Set 111.

	Number germi- nated	Number germi- nated	Number germi- nated	Number germi- nated	Number germi- nated	Total Number germi- nated in 10 days Total
	2nd day	4th day	6th day	8th day	10th day	
Sample I.						
Purple	368	78	14	8	2	470
Yellow	324	104	20	13	11	472
Sample II.						
Purple	403	34	14	15	1	467
Yellow	382	56	19	15	2	478
Sample III.						
Purple	402	40	11	1	0	454
Yellow	386	38	10	0	0	454
Sample IV.						
Purple	379	75	15	6	1	476
Yellow	405	61	11	1	1	479
Sample V.						
Purple	359	68	29	3	0	459
Yellow	379	54	29	2	0	464
Total						
Purple	1911	293	83	33	4	2326
Yellow	1876	333	89	31	14	2347



TABLE IX.

A Comparison of the time required for Purple and Yellow Seeds to Germinate.

## SUMMARY.

	Number germi- nated	Number germi- nated	Number germi- nated	Number germi- nated	Number germi- nated	Total number germi- in 10 days Total
	2nd day	4th day	6th day	8th day	10th day	
Set I.						
Purple	285	872	104	75	8	1344
Yellow	371	728	102	59	7	1262
Set II.						
Purple	1347	739	192	3	14	2298
Yellow	1233	827	196	18	16	2300
Set III.						
Purple	1911	295	83	33	4	2326
Yellow	1876	333	89	31	14	2347
Total						
Purple	3543	1906	379	111	16	5967
Yellow	3480	1883	387	108	37	5909

Rapidity of germination compared in percents.

Purple	47.2	25.4	5.05	1.04	.2	79.56
Yellow	46.4	25.1	5.16	1.04	.5	78.788



It will be seen that the rapidity of germination was effected to a noticeable extent by the temperature maintained. In Set I in which a uniform temperature of 95 degrees F. was maintained the yellow seed germinated much more rapidly than the purple, during the first two days, tho by the end of the second two days they were about equal. In Sets II and III where the temperature was not uniform but varied from 70 degrees F. to 85 degrees F. the purple germinated most rapidly, so there was not such a decided difference as was found in Set I. The extremely <sup>high</sup> temperature under which Set I was germinated seems however, to have injured a good many of the seed as only about fifty percent of them germinated, as compared with over ninety per cent in Sets II and III. Taking this fact into consideration, we should no doubt give Sets II and III the greater credence. Taking all three sets of seed into consideration the rapidity of germination is not great, though the purple germinated the greatest percent during both the first two and the second two days. Should we leave Set I out of consideration this difference would be greater.



3. A COMPARISON OF PURPLE AND YELLOW RED CLOVER SEED AS  
REGARDS DIFFERENCES IN THE SEED COAT.

It is a well known fact to those who have given any attention to the germination of red clover seed, that in practically every sample there are some seed which, no matter how long they may be left ~~up~~ under ideal condition for germination take up no water of germination, but remain "hard". The number of hard seed differs greatly in different samples, some samples containing a great many of them while others contain none, or very few. The number seems to differ with the season in which they were grown and with their age. L. Hiltner and W. Kinzel have observed that older seed contain a greater percent of these than new seeds. Also that seed of different seasons varies greatly. Of the clover seed produced in 1895 many samples were found with as high as 60 percent of hard seed. This is taken as an indication that weather conditions at the time of ripening have a great influence on the texture of the seed coat. Samples of clover seed, which had been stored for eight years contained 81.9 percent of "hard" seed.

In order to compare purple seed with yellow in





regard to the percent of hard seed in each, the percent purple was determined in 110 samples and then 200 seeds from each placed under proper conditions for germination. At the end of seven days the number of hard seed in each sample and their color was determined as follows:



TABLE X.  
TABLE SHOWING THE NUMBER OF HARD SEED AND THEIR COLOR  
IN 110 SAMPLES OF RED CLOVER SEED.

Sample number	Percent germination	Number P	Number "hard" Y	Number mouldy	Percent purple in sample
1	68	8	5	23	49
2	90	5	0	6	49
3	86	7	4	7	39
4	87	11	6	2	43.5
5	71	9	4	8	35.75
6	66	2	4	28	23.75
7	71	30	16	2	41.5
8	88	10	5	5	40.
9	89	10	3	8	41
10	89	3	3	6	35
11	74	5	5	67	50.5
12	85	10	6	5	35.
13	62	37	13	9	49.5
14	67	6	3	8	33.7
15	70	5	4	9	37.5
16	63	4	2	9	38.5
17	78	20	20	11	42.7
18	28	1	0	162	40.5
19	43	3	2	36	25.
20	85	3	2	7	37.5
21	80	17	6	3	45.2
22	79	3	3	12	35.
23	76	17	9	4	37.
24	82	4	5	3	32.5
25	88	3	2	2	42.
26	62	21	4	12	47
27	70	13	5	2	47
28	75	7	4	5	49
29	82	11	3	7	53
30	82	12	6	3	31
31	90	14	6	10	45.
32	83	14	6	10	49.5
33	90	9	3	6	40.5
34	58	5	3	11	42.
35	74	11	2	4	36
36	61	55	21	1	53.5
37	75	18	12	1	46
38	78	4	2	24	43
39	62	0	1	85	32.5
40	73	3	1	6	37.5
41	70	18	7	5	34.5
42	79	11	9	6	25.
43	53	15	10	10	52.5
44	73	6	3	7	56.7
45	84	16	6	9	39



TABLE X (con't)

Sample number	Percent germination	Number P	"hard" Y	Number mouldy	Percent purple in sample
46	76	13	4	10	53
47	86	8	8	16	37
48	64	36	7	16	50.5
49	80	8	3	21	33.75
50	87	4	8	10	32.
51	78	11	48	3	43.5
52	76	16	14	8	35.7
53	87	8	2	3	60
54	81	6	3	11	39.5
55	66	18	4	3	53.5
56	88	5	2	28	37.5
57	62	25	1	7	56
58	72	7	4	5	40.25
59	54	22	12	2	39.
60	62	17	7	5	44
61	88	3	1	23	41.5
62	53	12	5	12	44.5
63	80	10	2	9	35.
64	88	3	1	5	48
65	81	14	14	7	41.2
66	84	3	1	10	36.5
68	78	13	12	4	43.75
69	72	13	5	7	43.75
70	74	6	4	13	43.
71	60	19	8	12	61.5
72	83	7	3	3	53.7
73	80	3	3	15	49.7
74	88	6	4	4	49.
75	84	6	1	1	52.2
76	80	11	4	5	45.5
77	86	3	4	6	38.5
78	82	9	4	3	43.
79	57	55	7	9	57.5
80	72	3	2	8	31.
81	83	9	8	0	54.
82	78	11	8	3	54.
83	75	13	7	6	48.7
84	54	17	15	0	57.5
85	77	22	5	0	52.2
86	82	10	5	4	52.
87	83	9	5	1	50.2
88	57	38	32	0	84.7
90	80	2	1	14	33
91	79	22	5	1	55.
92	81	3	2	2	37.7



TABLE X (con't)

Sample number	Percent germination	Number P	Number "hard" Y	Number mouldy	Percent purple in sample
93	73	7	2	13	42.5
94	84	10	3	8	43.5
95	85	11	6	0	54.
96	81	11	4	1	45.
97	70	7	2	4	37.5
98	87	1	1	9	34.7
99	66	9	8	9	41.5
100	82	5	2	6	60.5
101	81	6	2	0	40.
102	62	22	5	2	45.5
103	73				
104	96	0	2	11	37.7
105	80	2	2	9	46.5
106	75	0	0	2	42.5
107	91	2	0	3	53.5
108	93	29	0	0	53.
109	95	29	7	1	42.5
110	67	14	9	14	38.7

Total number of seed tested 110 X 200 - 22,000

Percent of the 22,000 seed which were purple, 43.5

Percent of the 22,000 seed which were yellow, 56.5

Number of yellow seed tested, 22,000 X .565 - 12413

Number of purple seed tested, 22000 X .435 - 9570

Number of hard purple seed in the 22,000 - 1250

Number of hard yellow in the 22,000, - 605

Percent of purple seed remaining hard,  $125000 \div 970 - 13.05$

Percent of yellow seed remaining hard,  $60500 \div 12430 - 4.8$

Avg. percent of "hard" seed in 110 samples - - - - - 8.3





Of the 22000 seed tested for germination 1855,- 8.3 percent,- failed to take up any moisture but remained "hard",- in the same condition as when placed in the tester. Of these 1855 seed which remained "hard" 1250 were purple, while only 605 were yellow in color. Of the 22000 seed tested 43.5 percent, or 9570, were purple, and 12430 were yellow. From this it will be seen that 13.8 percent of the purple seed remained "hard" as compared with 4.8 percent of the yellow. This seems to indicate quite clearly that for one reason or another the purple seed have a great tendency to become "hard".

To make a still further test in regard to this, however, 2500 purple and 2500 yellow seed were separated by hand from a sample in which 237 seed remained "hard" out of 2400 seed tested,- 9.8 percent. These seeds were placed under the proper conditions for germination for ten days. The percent of the purple and of the yellow which remained hard at the end of that time is shown in the following table:



TABLE XI.

A COMPARISON OF THE PERCENT OF "HARD" SEED IN PURPLE  
AND YELLOW RED CLOVER.

No. of seed tested	Color	No. of "hard" seed	Percent "hard" seed
1000	Purple	141	14.1
1000	Yellow	91	9.1
1500	Purple	160	10.6
1500	Yellow	113	7.5
Average Purple			12.35
Average Yellow			8.3

It will be noted that in this as in the former test the purple seed in every case contains the greatest percent of "hard" seed. The purple seed in this case containing on an average 12.35 percent as compared with the yellow seed which contains only 8.3 percent, - a difference of 4 percent.



The fact having been established that there is a decided difference between purple and red yellow red clover seed in regard to the percent of "hard" seed which they contain, it yet remains to be determined as to what this difference may be due.

Six sets of hard seed which were secured from the general samples tested were treated with acids of varying strengths and for varying lengths of time with results as shown in the following table:

TABLE XII

"HARD" SEED TREATED WITH DIFFERENT ACIDS, AND FOR VARYING LENGTHS OF TIME.

Sample No.	No. of seeds treated	Treatment	Length of treatment	No. germinated in 12 hrs.	No. germinated in 18 hrs.	No. germinated in 24 hrs.
1	200	1/2 Con. H <sub>2</sub> SO <sub>4</sub> 1/2 H <sub>2</sub> O	1 hr.	1	all other killed	
2	130	Con. H <sub>2</sub> SO <sub>4</sub>	2 hrs.	98	102	108
3	163	Con. HNO <sub>3</sub>	1 hr.	0	1	2
4	135	Con. HNO <sub>3</sub>	2 hrs.	0	1	1
5	144	Con. HCl	2 hrs.	0	1	1
6	112	1/2 Con. HNO <sub>3</sub> 1/2 Con. HCl	1 hr.	0	0	1



From this we see that when the seed coat is once softened most of the seeds are exceedingly viable. The condition known as "hard" is evidently due not to lack of viability, but to some peculiar condition of the seed coat. Sample No. 1 was placed in a beaker and then the water and acid added. The heat thus generated rapidly broke down and destroyed most of the seed, all of them being killed. The concentrated sulphuric acid ( $H_2SO_4$ ) when used alone for one hour softened the seed coat to such an extent that 98 seed out of the 130 tested had germinated inside of twelve hours. None of the other acids appear to have had any effect whatsoever on the character of the seed coat. At the end of the stated time that the seeds were treated with acid they were washed thoroughly in water and then dried before a radiator. Whether or not the great attraction which the sulphuric acid has for water and which was supplied during the washing process is the influencing factor which made this acid more active than the others cannot well be determined.





4. A Comparison of the Protein Content of Purple and Yellow Red Clover Seed.

Some differences in protein content have been found in clover and alfalfa seeds of different colors. Professor Snyder of the University of Minnesota, in Bulletin 101 of that Station reported on the comparative protein as follows:

TABLE XIII.

Protein Content of Clover and Alfalfa Seed.

	Dark brown seeds Per cent	Light yellow seeds Per cent
Turkestan alfalfa	34.65	29.99
Grimm alfalfa	39.14	33.61
Clover, medium red	31.43	31.30
Clover, alsike	29.20	28.43
Clover, mammoth red	33.02	31.74
Clover, white	<u>30.67</u>	<u>26.41</u>
Average	33.02	30.08

From this it will be noted that in some of the samples the difference in protein content was quite marked; amounting to as much as five percent.



In comparing the protein content of the dark brown seeds of red clover with the light yellow it will be seen that practically no difference was found.

In order to compare the protein content of dark purple seeds with those of light yellow an analysis of ten samples was made. Samples 1 - 4 inclusive were from the seed separated by hand from a general sample, while 5 - 10 inclusive were composite samples from individual plants with dark and light seeds.

TABLE XIV.

Protein Content of Clover Seed.

Sample No.	Dark purple	Light yellow
	Per cent	Per cent
1 & 2	35.36	35.28
3 & 4	35.06	35.10
5 & 6	31.65	31.71
7 & 8	32.60	32.52
9 & 10	<u>32.38</u>	<u>31.84</u>
Average	33.41	33.29

From these determinations it will be seen that there is practically no difference in the protein content of the seed of the different colors.

It is interesting to note, however, that samples 1 - 4 inclusive, which were picked by hand from seed grown in 1906, averaged about four percent higher in protein content than samples 5 - 10 inclusive, which were from seed grown in 1907. It is possible that the protein content increases with the age of the seed.



5. A COMPARISON OF THE PURPLE AND YELLOW SEED FOUND IN  
SAMPLES OF CLOVER GROWN ON SOILS DIFFERING IN FERTILITY.

Seed of red clover vary in color from a very dark purple to a very light yellow, with a gradual gradation between these two extremes. In this work the greatest difficulty has been to determine what color to call the seed; at just what point in the varying degree of color a seed should cease to be called purple, but would be classed as yellow. In order that my own preconceived ideas might not influence the determination of the color, this work was done by men who had absolutely no idea where the seed came from nor ~~what~~ the purpose of the determination. The color of the seed grown on the plots at Urbana, Illinois, was determined by Mr. George Craig, while those from the plots at Columbia, Missouri were determined by Mr. James Wright. The work was done carefully and uniformly, and I believe fairly represents the percent of purple seed in the different samples.

URBANA PLOTS.

In June 1906 100 heads of clover were taken from each of four fertility plots, 1, 3, 8 and 10, of series 300, just east of Matthews Avenue, Urbana, Illinois. These heads were allowed to become thoroughly dry and then were threshed by hand, each head separately. As these



heads were threshed the number of apparently viable seed and their color was recorded; also the number of immature seed in each head was recorded. All the seed in each head tended to be about the same color, but there was enough variation so that the seed in each head were often divided, some being classed as purple and others as yellow. If the seed of a single head were of a deep purple then there would be no yellow in that head, while if they were of a bright yellow, then there would be no purple. The division was made where the seeds were neither a deep purple nor a light yellow but somewhere between, some showing the purple while others did not.

In this work L. will represent the application of lime; Le., legumes turned under; K., potassium; P., Phosphorus; N., nitrogen and O., no treatment.

TABLE XV.

THE TREATMENT AND THE PERCENT OF PURPLE IN THE SEED FROM PLOTS 1, 3, 8, and 10, SERIES 300, ILLINOIS EXPERIMENT STATION, URBANA, ILLINOIS.

Plot No.	Treatment	Percent of purple seed	Percent of yellow seed
1	O	66	34
3	O	63.9	36.1
8	Le., L, K, P.	71.7	28.3
10	L, P and K.	75.7	24.3





Though the number of seed from these plots is rather limited, there is at least an indication that the supply of plant food may effect to quite a marked extent the color of the seed. On Plots 1 and 3 where no plant food had been applied there was an average of 64.9 percent of purple seed, while on Plots 8 and 10 where an abundant supply of plant food had been applied, there was an average of 73.4 percent of purple seed; - 8.5 percent more purple in the seed from the plots where plant food had been added.

#### COLUMBIA PLOTS.

In October 1907, composite samples of seed were taken from each of the fertility plots 6, 7, 8, 9, 11, 12, 14, and 15, Block J, Experiment Station field, Columbia, Missouri. The clover on plots 6, 7, 8, and 9 was of one season's growth, having been sown in wheat the previous April. That on Plots 11, 12, 14, and 15 was of the second cutting of the second season's growth. These plots were not particularly well adapted to this experiment as they had not been receiving the present fertilizers for any great length of time. Previous to the season of 1905 many of the plots had been receiving



different fertilizers from those which are being applied at the present time. Just what the effect of the fertilizers which were applied under the old plan of treatment may be on the soil at the present time cannot well be determined. In most cases, however, the effect is probably not very great. The percent of purple seed in the sample of seed from each plot is shown in the following tables.

TABLE SHOWING THE RELATIVE AMOUNTS OF PURPLE AND YELLOW SEEDS FOUND IN COMPOSITE SAMPLES TAKEN FROM PLOTS 6, 7, 8, and 9, Block J. (fertility block) Experiment Station field, Columbia, Missouri.

TABLE XVI.

Plot No.	Treatment	Sample No.	Number of purple seed	Number of yellow seed	Percent purple	Percent yellow
6	0 Le.	1	2864	1331	67.66	32.45
		2	2587	829	76.57	23.43
		Average of Plot 6				72.06
7	K.P. Le. L.P.	1	2329	1185	65.20	34.80
		2	1660	600	73.79	26.21
		Average of Plot 7				69.67
8	P.N. 0	1	1524	1287	67.13	32.87
		2	1142	512	69.45	30.55
		Average of Plot 8				68.29
9	0 Le. L.	1	1585	612	74.06	25.94
		2	1008	390	72.30	27.70
		Average of Plot 9				73.18



The seed from these plots show no striking differences. Those from plot 8, however, where no fertilizers were applied, contain a somewhat lower percent of purple seed.

Seventy-five individual plants were taken from each of these plots (6, 7, 8, and 9) and the percent of purple seed in each determined.

TABLE XVII.

TABLE SHOWING THE RELATIVE AMOUNTS OF PURPLE AND YELLOW SEED PRODUCED FROM INDIVIDUAL PLANTS TAKEN FROM PLOTS 6, 7, 8, and 9, BLOCK J. (fertility block) EXPERIMENT STATION FIELD, COLUMBIA, MISSOURI.

Plot No.	Treatment Old	Treatment New	Number of plants	Number of purple seed	Number of yellow seed	Percent purple seed	Percent yellow seed
6	0	Le.	84	2056	1071	64.92	35.08
7	K. P.	Le.L. P.256		4931	2424	68.69	31.31
8	P. N	0	93	2186	1260	64.90	35.10
9	0	Le.L	90	3082	997	74.25	25.75

We find somewhat the same conditions here as in the Urbana plots. Plots 6 and 8 where the least plant



food applied, produced seed which is decidedly lower in percent of purple present than either 7 or 9 where plant food has been applied in more or less abundance.

Taking into consideration both the composite samples and the individual plants taken from plots 6, 7, 8, and 9, we find the percent of purple and yellow seed to be as follows:

TABDE XVIII.

Plot No.	Treatment		Percent purple	Percent yellow
	Old	New		
6	0	Le.	68.49	31.51
7	K. P.	Le. L. P.	69.18	30.82
8	P. N.	0	66.59	33.40
9	0	Le. L.	73.71	26.28

Taking an average of the two determinations we find that the seed from Plot 8, where no plant food had been supplied, it is decidedly lower in percent of purple seed present than that from the other plots.





TABLE XIX.

TABLE SHOWING THE RELATIVE AMOUNT OF PURPLE AND YELLOW SEED FOUND IN COMPOSITE SAMPLES TAKEN FROM PLOTS 11, 12, 14, and 15, BLOCK J, EXPERIMENT STATION FIELD, UNIVERSITY OF MISSOURI.

Plot No.	Treatment Old	Treatment New	Sample No.	Number of purple seed	Number of yellow seed	Percent purple seed	Percent yellow seed
11	Manure	Le.L.P. K.	1	2864	1331	67.55	32.45
			2	2587	829	76.57	23.43
			Average for Plot 11			72.06	27.94
12	0	Le.	1	2329	1185	65.20	34.80
			2	1660	750	68.90	31.10
			Average for Plot 12			67.07	32.93
14	K.M.P.	Le.L.P.	1	1828	1989	67.03	34.97
			2	1142	512	69.45	30.55
			Average for Plot 14			67.24	32.76
15	0	Le. L	1	1585	612	74.06	25.94
			2	1008	390	72.30	27.70
			Average for Plot 15			73.18	26.82

These determination do not show any existing correlation between the fertility of the soil and the percent of purple in the seed produced. The seed from Plot 12 where no plant food has been supplied contains the lowest percent of purple seed, but the difference is so slight as to amount to nothing. Plot No. 14, which according to theory should show the greatest percent of purple really contains next to the least.



TABLE XX.

A TABLE SHOWING THE RELATIVE AMOUNT OF PURPLE AND YELLOW SEED PRODUCED BY INDIVIDUAL PLANTS TAKEN FROM PLOTS 11, 12, 14, and 15, BLOCK J, EXPERIMENT STATION FIELD, UNIVERSITY OF MISSOURI.

Plot No.	Treatment Old	Treatment New	Number of purple seed	Number of yellow seed	Percent purple seed	Percent yellow seed
11	Manure	Le. L. R K	5791	2227	71.36	28.73
12	0	Le.	6742	4203	61.40	38.60
14	K.N.P.	Le. L.P.	4934	1686	74.67	25.33
15	0	Le. L.	4475	3202	58.34	41.56

From these determinations we secure very marked results. Plots 12 and 15 where the least plant food both was applied give seed very low in the percent purple color, averaging 59.37 percent. Plots 11 and 14 to which a greater abundance of plant food had been supplied produced seed of which 73.1 percent were purple in color, - a difference of 13.64 percent.



Taking into consideration both the composite samples and the seed of the individual plants we have the following percent of the different colored seed from plots 11, 12, 14, and 15.

TABLE XXI.

Plot No.	Treatment		Percent purple	Percent yellow
	Old	New		
11	Manure	Le.L.P.K.	71.71	28.29
12	0	Le.	64.23	35.77
14	K. N. P.	Le.L.P.	70.95	29.05
15	0	Le.L.	65.76	34.24

Here again we find the plots which have had the least plant food supplied producing seed with the lowest percent of purple color.



DETERMINATION OF PURPLE SEED IN SAMPLES OF RED CLOVER  
RECEIVED FROM DIFFERENT PARTS OF THE STATE OF MISSOURI  
AND PRODUCED ON SOILS OF DIFFERENT DEGREES OF FERTILITY.

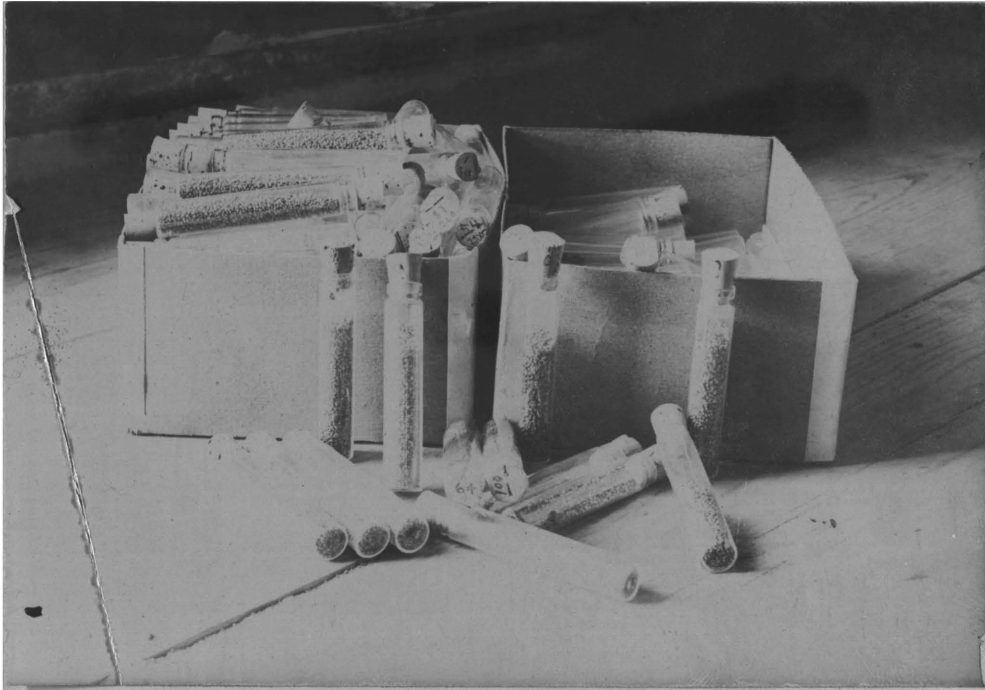
Letters were sent to leading farmers over the State asking for samples of clover which they had grown on their own farm, together with a description of the character of the soil on which the seed was grown. One hundred and twenty-five samples were received in all, but because of one reason or another only thirty-seven of them could be used in studying the relation between the color of the seed and the plant food supply.

As letters with samples of seed were received they were numbered in consecutive order, the sample and letter being given the same number, and the letter at once filed away until after all the data had been secured. In this way there was no possibility of one being prejudiced either for or against samples from different sources, as the source of the seed was absolutely unknown.

In determining the percent of purple seed which the different samples contained, 200 seed were separated out in order as they came and the determinations made from this sample. From three to seven sets of 200 seed were taken in this way from each sample and the number of purple seed in each of these determined.







"As letters with samples of seed were received they were numbered in consecutive order, the sample and the letter being given the same number, .... "



In final calculations the average of these several determinations was taken as the percent for the sample. Considering the fact that there is a constant and gradual gradation of color in clover seed and that for the determination of color one must set a standard and attempt to follow it as uniformly as possible, the determinations run remarkably uniform in most samples. There are some exceptions. Below are given the determinations for the first fifteen samples:

TABLE XXII.

Sample No.	No. of purple seed in 200 seed portions.
1	92 - 105 - 101
2	106 - 98 - 98 - 96
3	85 - 78 - 75 - 73
4	<del>89</del> - 85 - 87
5	67 - 66 - 75 - 80
6	47 - 49 - 44 - 46 - 46.
7	91 - 86 - 81 - 74.
8	80 - 79 - 81 - 78.
9	86 - 81 - 83 - 84.
10	70 - 68 - 72
11	119 - 109 - 85 - 83 - 105 - 109
12	72 - 69 - 70
13	107 - 106 - 92 - 90
14	69 - 69 - 65
15	75 - 77 - 76 - 76

The uniformity of these different counts from different portions of the same sample indicate that an average of these will give a tolerable accurate and fair idea of the percent of purple seed which any given sample contains.



The percent of purple seed which the different samples contained having been determined, the soils on which they had been grown were ranked as accurately as possible according to their supposed fertility. Five divisions were made, the most fertile soils being classed as No. 1, and the poorest as No. 5. In the following table the location and character of the soil and the rank of the different samples is shown:



TABLE XXIII.

THE RANK GIVEN TO THE DIFFERENT SAMPLES ACCORDING TO THE LOCATION AND CHARACTER OF THE SOIL WHERE GROWN.

Sample No.	Location	Character of the soil	Comparative rank in fertility
114	Creighton	Black, sandy.	2
61	Creighton	Bottom land.	1
48	Blairstown	Second bottom.	2
22	Ash Grove	Upland, brown.	2
101	Caledonia	Red clay.	2
109	Olean	Gray loam.	3
111	Versailles	Upland prairie.	3
108	Versailles	Upland prairie.	3
59	Versailles	Bottom land.	2
20	Washington	Brown hill soil.	3
56	Washington	Black sandy upland.	3
118	Eureka	Gray residuary silt.	5
103	Eureka	Clay land.	5
70	Boonville	Leached, loess.	2
52	Boonville	Black upland.	1
50	Boonville	Residuary, limestone.	3
117	Blackwater	Black loam.	1
31	Boonville	Black upland	1
69	Windsor	Prairie loam	3
16	Concordia	Black Prairie	1
15	Marshall	Black prairie	1
17	Salisbury	Gray silt loam	4
32	Salisbury	Black prairie soil	2
65	Salisbury	Black prairie soil	2
105	Hale	Hillside	5
116	Osburn	Black prairie	2
119	Milan	Rich bottom	1
102	Memphis	Loam, hillside	4
121	Arbela	Loam, hillside	3
104	LaGrange	Gray silt loam	2
14	Palmyra	Gray silt loam	4
43	Palmyra	Gray, Trenton limestone	2
49	Palmyra	Gray silt loam	4
30	Clarksville	Trenton limestone	1
42	Hamburg	Loess	2





TABLE XXIV.

PERCENT OF PURPLE SEED IN SAMPLES RANKING AS 1, 2, 3, 4,  
and 5,

Samples from soils ranking as No. 1.		Samples from soils ranking as No. 2.		Samples from soils ranking as No. 3.		Samples from soils ranking as No. 4.		Samples from soils ranking as No. 5.	
Sample No.	Percent purple seed	Sample No.	Percent purple seed	Sample No.	Percent purple seed	Sample No.	Percent purple seed	Sample No.	Percent purple seed
61	41.5	114		109	42.5	17	42.5	103	36.5
52	35.5	48	50.5	111		102	46.5	105	46.5
31	45.	22	36.	108	53.	14	34.0		
16	38.5	101	40.	20	38.	49	34.0		
15	37.5	59	39.	56	37.5				
30	30.	70	43	50	32.				
		32	49.5	69	44				
		104	39.5						
		43	25.						
		42	52.5						
Average	38.0		41.5		41.1		39.2		41.5

These determinations give no indication of any relation between the color of the seed and the fertility of the soil on which the seed was produced. I do not consider these determinations of any value, however, for as we got further into this work, it was soon evidenced that there were so many other influences to take into consideration that the different samples could not be compared with any degree of fairness. The age of the plants, whether of the first or second season's growth, or



even of the first or second cutting of the season, the rainfall, the stage of maturity of the plant when cut, and the erectness of the plants are all influences which make it impossible for us to compare these samples with any degree of fairness. This makes it perfectly evident that to make such a comparison as this the seeds must all be grown and handled under identically the same conditions, the supply of plant food being the only variable factor. As this was the condition under which the seed from the experiment Station field was grown, I believe the results as secured from those determinations are reliable and evidently quite a marked relation exists between the environmental conditions under which the seed was produced and their color.



6. A CAMPARISON OF THE WEIGHT OF PURPLE AND YELLOW RED CLOVER SEED.

If seed of one color are larger than those of another we might expect them to be more viable under adverse conditions, and to give a more vigorous plant. A difference in weight might be due to inherent powers, or to more ideal conditions for seed production, such as plant food supply, temperature, texture of the soil, etc.

In order to determine whether seed of one color were heavier than those of another 500 purple clover seed and a like number of yellow, were separated by hand from each of twenty samples secured from different parts of the State of Illinois. Only those seeds which appeared mature and were of good appearance were used. The weights of the forty samples thus selected are shown in the following table:



TABLE XXV

THE WEIGHT OF TWENTY SAMPLES OF PURPLE COLORED RED CLOVER  
SEED COMPARED WITH A NUMBER OF LIKE SAMPLES OF YELLOW

RED CLOVER SEED.

Set No.	Sample No.	Source	Wt. of 500 purple seed	Wt. of 500 yellow seed
0	1	Busey, Urbana, Ill.	.7000	.6752
0	2	U. of I, Urbana, Ill.	.7250	.6865
0	3	Patomac, Illinois.	.8790	.7560
0	4	Livingston Co., Ill.	.8579	.8034
0	5	E. E. Chester, Champaign, Ill.	.7274	.6750
1	1	Busey, Urbana, Ill.	.6947	.6367
1	2	U. of I, Urbana, Ill.	.7765	.7010
1	3	Patomac, Ill.	.8780	.8105
1	4	Livingston Co., Ill.	.8480	.7892
1	5	E. E. Chester, Champaign	.7312	.7005
II	1	Baird, No. 1, Centralia, Ill.	.8820	.8000
II	2	A B. Moore, Gray's Lake, Ill.	.8200	.8122
II	3	Baird, No. 2, Centralia, Ill.	.7825	.7470
II	4	Baird No. 4, " "	.7320	.6552
II	5	S. N. King, Bloomington, "	.7900	.7490
III	1	U. of I. Urbana, Ill.	.7688	.7256
III	2	U. of I. , Urbana, "	.8180	.7586
III	3	U. of I., Urbana, Ill.	.9320	.8910
III	4	U. of I., Urbana, Ill.	.7637	.7433
III	5	U. of I., Urbana, Ill.	.8389	.7258
		Average	<u>.7987</u>	<u>.7288</u>





From this it will be seen that without exception the purple seed of these samples are decidedly heavier than the yellow. Taking an average of the 2000 seeds weighed, 500 purple seeds weighed .7987 grams, while the yellow seed weighed .7288 grams, a difference between the purple and yellow of .0699 grams. Considering this to be factor alone we might expecter purple seed of greater value than yellow, as larger seed of any plant usually gives the more vigorous product.



A COMPARISON OF THE WEIGHT OF CLOVER SEEDS AS RELATED TO  
THE PERCENT OF PURPLE PRESENT.

In order that a further comparison might be made between the color of the seed the weight of the 125 samples secured from farmers over the State were tested for average weight of the seed and the percent of purple seed present.

In making these determinations samples of 200 seed each were taken from the different samples and weighed carefully.

It would seem that larger samples might give more uniformly satisfactory results, but as 200 seed samples were used for the determination of color the same samples were used in making the determinations of

weight. In order to determine definitely whether several samples of this size from the same batch of seed would run uniform in weight, two and sometimes three samples were taken from a number of different batches of seed, weighed and compared.

The results were as follows:

TABLE XXVI.

Sample No.	Weight of 200 seed	Weight of 200 seed	Sample No.	Weight of 200 seed	Weight of 200 seed	Weight of 200 seed
6	.2592	.2563	31	.3471	.3614	.3300
28	.2810	.2957	64	.2968	.3020	.2979
33	.2802	.2865	66	.2441	.2651	.2611
38	.3171	.3163	70	.3316	.3058	.3275
69	.2627	.2837	76	.2773	.2709	.2720
71	.2900	.3171	98	.2798	.2951	.2708
73	.2860	.2884	99	.2551	.2518	.2615
74	.2932	.2850	102	.2920	.2821	.2875
75	.2941	.2965	78	.2972	.2848	
80	.2888	.2881	81	.3001	.3052	
83	.2977	.2919	84	.3052	.2983	
85	.3587	.3508	87	.2823	.2806	



From these weighings we are assured that a 200 seed sample will on the average give a fairly uniform weight and therefore, that a sample of this size would be satisfactory for determining the average and comparative weights of the different samples.

In the final comparisons where two and three samples were taken from the same batch of seed, the three weights were averaged and the average taken as the weight of the sample.



TABLE XXVII

A TABLE SHOWING THE RELATION BETWEEN WEIGHT AND THE PERCENT OF PURPLE SEED PRESENT IN 120 SAMPLES OF RED CLOVER SEED.

Sample No.	Weight of 200 seeds	Percent purple seed	Sample No.	Weight of 200 seeds	Percent purple seed
1	.3261	50	31	.2462	24.5
2	.3051	49	32		50
3	.2740	39	33	.2834	41
4	.2841	43	34	.2807	42
5	.3100	36	35	.2873	36
6	.2577	24	36	.3032	59
7	.2703	41	37	.2824	46
8	.2833	40	38	.3167	43
9	.2698	41	39	.2859	32
10	.2808	35	40	.2803	37
11	.3152	50	41	.2354	35
12	.3092	35	42	.2467	25
13	.3260	49	43	.2900	52
14	.2958	34	44	.3272	57
15	.2715	37	45	.3221	39
16	.3363	38	46	.3242	53
17	.2776	43	47	.2780	37
18	.3239	40	48	.2953	51
19	.2678	25	49	.2890	34
20	.3015	38	50	.3123	32
21	.2871	45	51	.2986	43
22	.2882	34	52	.3070	36
23	.2512	37	53	.2953	60
24	.2847	32	54	.2627	31
25	.3292	42	55	.3470	53
26	.3068	47	56	.3052	37
27	.2853	47	57	.2976	56
28	.2883	49	58	.3621	40
29		58	59	.2459	39
30	.2776	31	60	.2372	44
61	.3015	48	91	.3565	55
62	.2728	44	92	.2893	38
63	.2733	35	93	.2773	42
64	.2989	48	94	.2714	43
65	.3145	41	95	.3007	54
66	.2568	36	96	.3072	45
67			97	.2831	37
68	.3083	44	98	.2814	35
69	.2732	44	99	.2561	41
70	.3216	43	100	.3172	60
71	.3036	61	101	.2418	40
72	.2960	54	102	.2872	41





TABLE XXVII (con't)

Sample No.	Weight of 200 seeds	Percent purple seed	Sample No.	Weight of 200 seeds	Percent purple seed
73	.2871	50	103	.2529	37
74	.2891	49	104	.3124	38
75	.2953	47	105	.3507	46
76	.2734	45	106	.2816	42
77	.3138	38	107	.3156	53
78	.2910	43	108	.2828	53
59	.3247	57	109	.2603	42
80	.2884	51	110	.2844	39
81	.3026	54	111		47
82	.2973	54	112		39
83	.2948	49	113		49
84	.3018	57	114		46
86	.3548	62	115		52
86	.3140	54	116		43
87	.2815	50	117		31
88	.3068	45	118		34
89	.2967		119		45
90	.2120	33	120		58
			121		49
			122		38

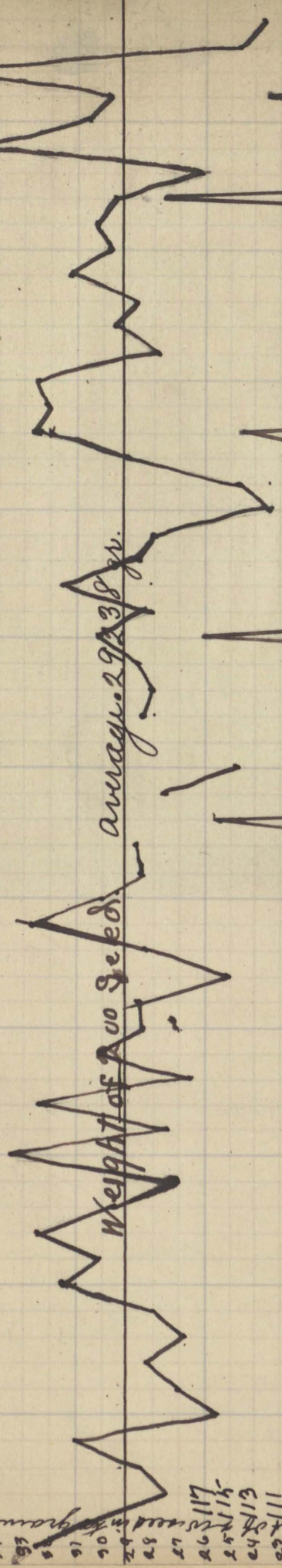


It will be observed that there is a marked relation between the purple seed in a sample and its weight. Those samples which contain a large percent of purple seed are usually much above the average in weight, while those which contain a low percent of purple colored seed are relatively light in weight. On the following pages will be found a diagrammatic representation showing the relation between the color and the weight.

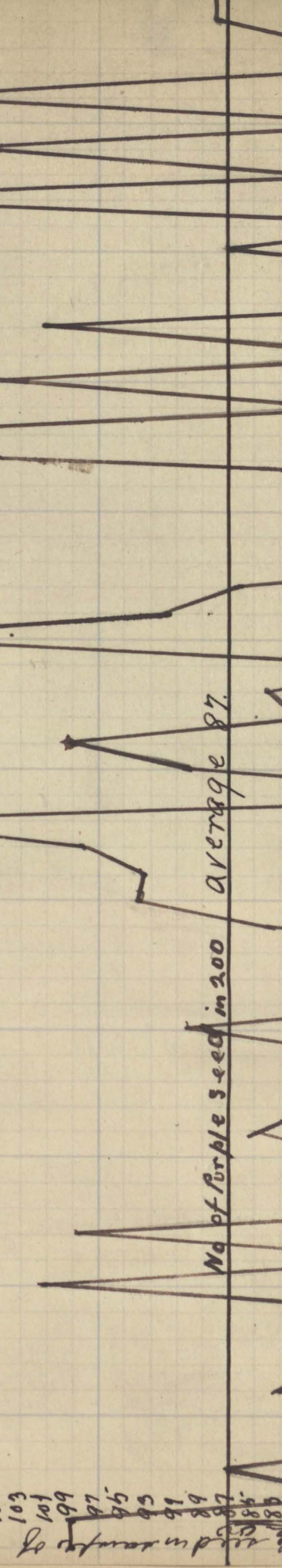


Sample No.

6 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59  
 36 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58



average 29238 g.



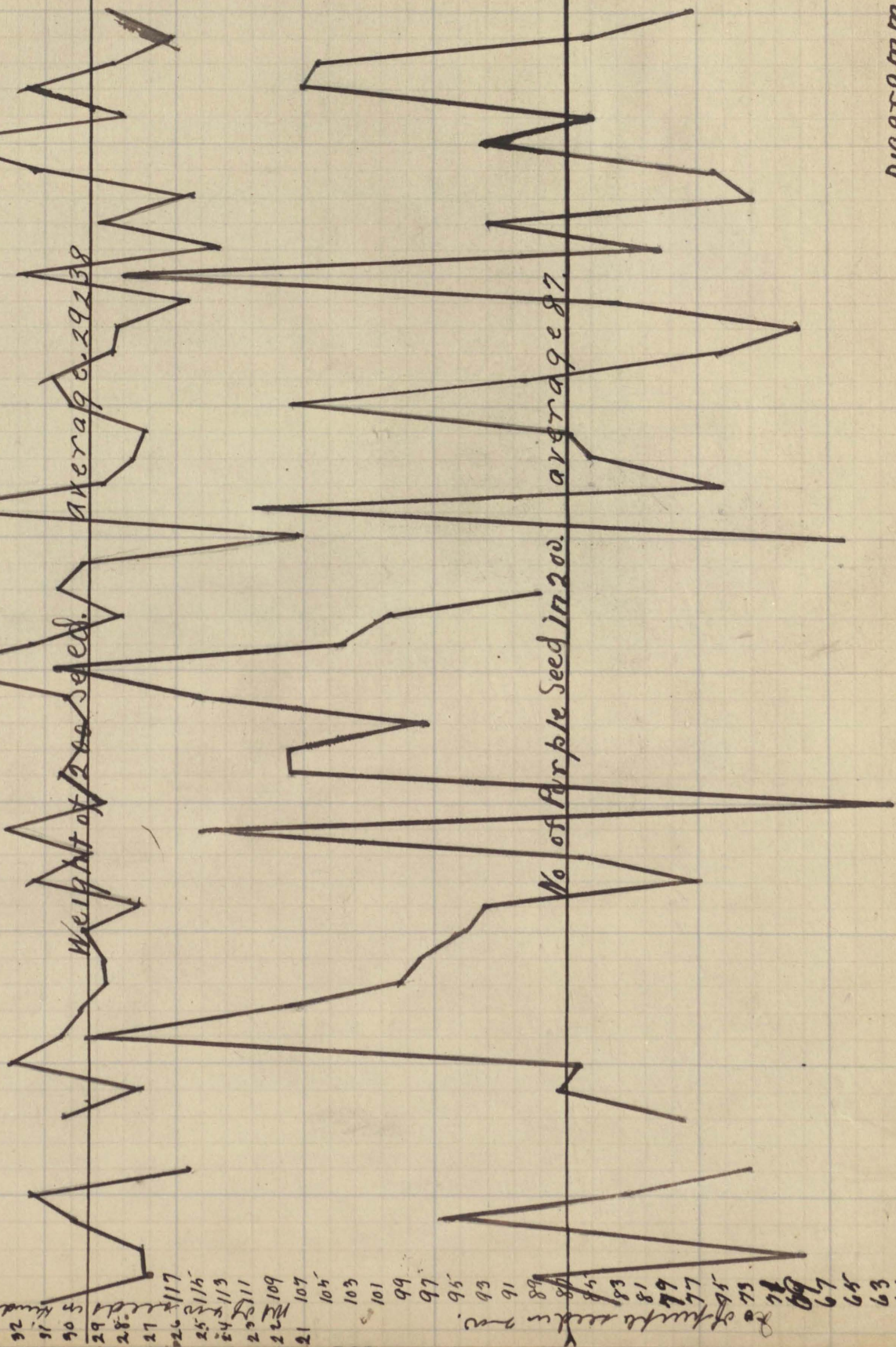
average 87

Diagrammatic presentation of the relation between the color of clover seeds & weight.



Sample No.

57 61 63 64 67 68 70 72 74 76 78 80 82 84 86 88 90 91 92 94 96 98 100 102 104 106 108 110 112 114 116 118 119 120



Diagrammatic presentation of the relation between the color of clover seed & the weight.





TABLE XXVIII.

A TABLE SHOWING THE PERCENT OF PURPLE SEED PRESENT IN THE FIFTEEN HEAVIEST SAMPLES AS COMPARED WITH THE PERCENT OF PURPLE SEED PRESENT IN THE FIFTEEN LIGHTEST SAMPLES.

Sample No.	Weight of 200 seeds	Percent purple seed	Sample No.	Weight of 200 seeds	Percent purple seed
1	.3261	50	6	.2577	24
2	.3051	49	19	.2678	25
13	.3260	49	23	.2512	37
16	.3363	38	31	.2462	45
18	.3239	40	41	.2354	35
25	.3292	42	42	.2467	25
44	.3272	57	54	.2627	38
45	.3221	39	59	.2459	39
46	.3242	53	60	.2372	88
55	.3470	53	66	.2568	36
58	.3621	40	90	.2120	33
79	.3247	57	99	.2561	41
85	.3548	62	101	.2418	40
91	.3565	55	103	.2529	37
105	.3507	46	109	.2603	42
Average	.3344	48.8		.2487	35.8

In making a comparison of the samples with the heaviest seed with those having the lightest seed we find that the samples with the heaviest seed have a much higher percent of purple. The fifteen samples with the heaviest seed, in which 200 seed gave an average weight of .3344 grams, contained an average of 48.8 percent of purple seed.



On the other hand the fifteen samples, which of all the 125 samples considered had the smallest seed and in which 200 seeds weighed on the average only <sup>.2487</sup> grams, contained an average of 35.8 percent of purple seed; a difference in percent of purple seed present between the purple and the yellow of 13 percent.



1.

SUMMARY.

1. There is no difference in the viability of purple and yellow red clover seed so far as total germination can indicate. In comparing the total germination of 7500 purple seed with a like number of yellow seed we find a difference of only .78 percent.

2. Purple seed averaged a little greater rapidity of germination than yellow seed though the difference in this is not large.

3. Purple seed are much more liable to be hard than are yellow seed. In testing 22,000 seeds 13.8 percent of the purple seed remained "hard" as compared with 9.8 percent of the yellow.

4. There is practically no difference in the protein content of purple and yellow red clover seed.

5. Red clover grown under conditions where an abundance of plant food is supplied produce a greater percent of purple colored seed than plants grown under the same conditions with the exception that the supply of plant food is more limited.



6. Purple colored seed are heavier than yellow. As an average of 20,000 seed weighed 500 purple weighed .7987 grams, while 500 yellow weighed .7288 grams, a difference in the weight of 500 seed of .0699 grams.





## II.

### INTRODUCTION.

On practically every farm the labor expended each year in weed eradication is a considerable item of expense. The majority of all farmers take some pride in the general appearance and condition of their fields. This fact alone makes it necessary that a continuous warfare be carried on with weedy plants. These plants moreover, if allowed to multiply unchecked would soon be so abundant and prevalent, that economic farm crops could not be produced profitably. Weed seeds are scattered and introduced into new localities in a number of ways. Many of these methods of seed distribution are either entirely or largely beyond the farmers' control. For example, when plants which have a feathery attachment to the seed, which makes it possible for them to float in the air are allowed to produce seed on adjoining land we have no method under our control by which we can prevent the wind from scattering these seeds at will over large areas. We find that such seeds as the thistle, the wild lettuce, etc., are scattered in this way. This is only one of the numerous methods which the farmer cannot wholly control. Many weedy plants, however, are introduced into new localities, altogether unintentionally yet



by methods which can easily be remedied or eliminated.

Altogether too little attention is paid by the majority of farmers to the purity of the seed which they sow on their lands. This is particularly true no doubt, with clover, alfalfa and grass seeds, as they carry <sup>on</sup> an average a greater number of particularly obnoxious weed seeds than most of our other crops. New and troublesome weeds are often first observed in clover meadows, and it has often been noted that clover fields contain a great number of different weedy plants. The weeds found in different fields varies greatly, depending very often on the character of the seed which has been sown on the field from year to year. It is a well known fact that a very large number of our most obnoxious and troublesome weeds are those which have been introduced into this country through the agency of economic farm seeds purchased from European and other foreign markets. Through this agency, - our economic farm seeds, - seeds of weedy plants are not only carried long distances and introduced into new localities, but they are often dispersed locally, being carried from one farm to another and fields hitherto free from troublesome weedy plants are infested.



In order to secure some data in regard to the number and character of the weeds disbursed in this way in Missouri, samples of clover seed were secured from farmers throughout the State and from retail and wholesale seed merchants who supply more or less foreign seed to Missouri farmers. In all one hundred and twenty-five samples were secured. Forty-three of these came from large retail and wholesale houses, eleven from farmers who had secured their seed from local seed dealers, or who had ordered from some seed company, and seventy-one from farmers who produced their own seed, and many of whom sold more or less seed to neighbors. A number of these samples which come direct from the farm where produced had not been re-cleaned, so often contained weed seeds which could have been quite easily separated out. This seed, however, was sown in this condition and was sold to other farmers who scattered it over their fields without attempting to remove any of the weed seeds. The following table shows the percent of the different weed seeds which were present in each sample. Many weed seeds were found in the samples which though scarce in number were of such a troublesome nature in some cases that it was of the utmost importance that their presence be noted. Whenever



seeds of a weedy plant were found in a sample, amounting in number to less than one percent, the fact was recorded in the following table by inserting the letter t. (trace)























Trash  
 Duck Horn  
 Practed Plant  
 Broad L. Plant  
 Crab Grass  
 Small C. Grass  
 Sprouting C. Grass  
 Yellow Fox Tail  
 Green Fox Tail  
 Broomly Sid  
 Curly Dock  
 Bull Nettle  
 Barn Yd. Grass  
 Old Witch Grass  
 Pig. Wood  
 Lambs Quarters  
 Ladys Thumb  
 Alsike Clover  
 Dodder  
 Timothy  
 Red Top  
 Small Ray Weed  
 Large Rag Weed  
 Whorled Fox Tail  
 Clover Paddock  
 Sorrel  
 Canada Thistle  
 Butter + Egg  
 Portulaca  
 Wild Oat Grass  
 Large Mary  
 Millet  
 Large Paddock  
 Chick Weed  
 Field Thistle  
 Alfalfa  
 Russian Thistle  
 White Clover  
 UNKNOWN

81	C.E. Hubbard	Topeka. Kans.	T	TTZ2	T	I			
82	J.H. Smith	Clearwater Neb.		T I			T	I	I
83	J. Smalley.	McPherson Kans.	T	TT	II	T		T	T
84	W.A. Laften	Madison Neb. 3		TTT	I	T		T	I
85	Nebraska Seed Co.	Omaha. Neb.	PURE						
86	" " "	" "		TT		T		T	I
87	Manglesdorf Bros	Atchison Kans.		T	TI	T		I	
88	Griswold Seed Co.	Lincoln Neb.		TT	T		T		
89	Peter F. Bubb	Fort Leavenworth. Kan. 1						9	
90	Stewart's Seed Store	Omaha Neb. 33	T	T		T		T	T T 4
91	" " "	" "	PURE						
92	Griswold Seed Co	Lincoln. Neb.		T			T		
93	Funk Bros	Bloomington. Ill. 2			T				I
94	J.G. Peppard.	Kansas City. Mo. 2			I				
95	Iowa Seed Co.	Des Moines. Ia.			T				
96	Simonds Shields Co.	Kansas City Mo.			T		T I	T	
97	Melcherhill Bros	St. Joseph. Mo. 21		TTT		TT			
98	Mo. Seed Co.	Kansas City Mo.	I	T	ITT	TTT		T	T
99	Schlister Corneli.	St. Louis. Mo.	6	I	TI	IT		T	
100	D.M. Terry + Co.	Detroit. Mich	PURE						

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TABLE XXIX.

## PERCENT OF IMPURITIES FOUND IN 115 SAMPLES OF CLOVER SEED.

Sample No.	Percent impurities	Sample No.	Percent impurities	Sample No.	Percent Impurities	Sample No.	Percent impurities
11	60.5	38	10	98	4.5	74	1
27	40.0	4	9.5	43	4.0	75	1
16	33.5	5	9.5	64	4.0	86	1
112	33.0	101	9.5	68	4.0	88	1
63	26.0	99	9.0	83	4.0	92	1
59	25	106	8.5	28	3.5	107	1
12	24	24	8.5	72	3.5		
80	22	62	8.5	82	3.5	44	0.5
13	21	66	8.0	9	3.0	49	.5
105	18.5	71	8.0	18	3.0	53	.5
69	18.	77	8.0	34	3.0	3	pure
46	17.5	14	7.5	58	3.	10	pure
61	17.	45	7.5	87	3.	29	pure
122	17.	48	7.5	93	3.	67	pure
110	16	84	7.	94	3.	85	pure
42	16.	104	7.	113	3.	91	pure
60	15.5	121	7.	114	3.	100	pure
50	15.	15	6.5	30	2.5		
35	15	32	6.5	31	2.5		
33	14	26	6.	36	2.5		
39	14	26	6.	56	2.5		
22	14	81	6.	57	2.5		
7	13.5	109	6.	19	2.		
17	13.5	115	6.	47	2.		
52	13.	117	6.	76	2.		
65	13.	25	5.5	79	2.		
90	12.	41	5.5	111	2.		
40	11.5	51	5.5	116	2.		
108	11.	103	5.5	37	1.5		
118	11.	123	5.	55	1.5		
119	11.	102	5.	96	1.5		
73	10.5	6	5.	1	1.0		
89	10.			2	1.0		
70	10.						
54	10.						





A very great difference in the percent of impurities was noted. Only seven of the samples were absolutely free from weed seeds. A number of other samples had less than two percent of impurities. Considering all of the samples examined, however, - and I believe them to represent fairly the character of the clover seed sown on most of the farms of Missouri, - the amount of impurities is dangerously large, as by far the larger number of our farmers have not yet come to realize the importance of using none but the purest seed for their fields, nor have they familiarized themselves with the characteristics of the weed seed in order that they may distinguish them when they are present.

For example, sample No. 11, with over sixty percent of impurities was sent in for examination with this inquiry, "what are the seeds which are mixed with this clover. The man I bought it from said it was pure, but after I got it home and had looked at it more closely I came to the conclusion that some of the seed were not those of red clover. Can you tell me what they are?" The sample referred to contained forty percent of prickly sida (*Sida spinosa*), seven percent of yellow foxtail (*Chaetochloa glauca*, L.) and thirteen percent of trash, largely in the form of small clods of dry clay about the same size as the clover seed,



together with a trace of lady's thumb (*Polygonum Persicaria*, L.), small rag weed (*Ambrosia Artemisiaefolia*, L) and whorled foxtail (*Chaetochloa Verticellata*, L.). All of these weed seed can very easily be distinguished from the clover seed, and the most of them could with the proper machinery be separated out.

Sample No. 12 was sent by a very progressive farmer from Glasgow, Missouri with the statement that he had bought the seed to sow in the spring of 1908 and would like to know if it contained any bad weed seed. I reported that the sample contained thirteen different kinds of weed seed, amounting to twenty-four percent of the sample. The correspondent at once replied saying <sup>weed</sup> that he had no idea that the sample contained so much seed and that he would not use it, but enclosed a sample of some new seed which he had bought and used. On examination this second sample (sample 13) was found to contain twenty-one percent of impurities, comprised of trash and six different kinds of weed seed.

These examples are quite representative of many others.

In all thirty-seven kinds of foreign seed were found. Some of these were present in a great many of the samples while others in only a few. Also some of them when present were in very limited numbers, while others were the reverse. The kinds of seed found and the percent of samples containing them is shown on the following page.



TABLE XXX

## A REPORT OF THE EXAMINATION OF 125 SAMPLES OF RED CLOVER SEED.

Kind of seed found and percent of samples containing them.

1	Crab grass.	<i>Syntherisma Sanguinalis</i> , L.	57.6
2	Yellow fox tail.	<i>Chaetochloa Glauca</i> , L.	46.4
3	Small crab grass.	<i>Syntherisma Linearis</i> .	45.6
4	Buckhorn.	<i>Plantago Lanceolata</i> , L.	39.2
5	Bracted plantain.	<i>Plantago Aristata</i> , Michx.	36.8
6	Green fox tail.	<i>Chaetochloa Viridis</i> , L.	30.4
7	Sprouting crab grass.	<i>Panicum Proiferium</i> , Lam.	29.6
8	Broad leaved plantain.	<i>Plantago Major</i> , L.	28.8
9	Whorled fox tail.	<i>Chaetochloa Verticillata</i> , L.	25.6
10	Pig weed.	<i>Amaranthus Retroflexus</i> , L.	19.2
11	Prickly sida.	<i>Sida Spinosa</i> , L.	18.4
12	Timothy.	<i>Phleum Pratense</i> , L.	18.4
13	Lady's Thumb	<i>Polygonum Persicaria</i> , L.	13.6
14	Curly dock.	<i>Rumex Crispus</i> , L.	12.
15	Small rag weed.	<i>Ambrosia Artemisiaefolia</i> , L.	11.2
16	Lamb's quarter.	<i>Chenopodium Album</i> , L.	10.4
17	Old witch grass.	<i>Panicum Capillare</i> , L.	9.6
18	Alsike clover.	<i>Trifolium Hybridum</i> , L.	8.8
19	Horse nettle.	<i>Selanum Carolinense</i>	8.0
20	Tear thumb.	<i>Polygonum Saggitalum</i> , L.	6.4
21	Clover dodder.	<i>Cuscuta Epithymum</i> , Murr.	5.6
22	Sorrel.	<i>Rumex Ascetosella</i> , L.	4.0
23	Chick weed	<i>Alsine Media</i> , L.	4.0
24	Smart-weed dodder.	<i>Cuscuta Polygonorum</i> Engelm.	4.0
25	Barnyard grass.	<i>Echinochloa Crusgari</i> , L.	4.0
26	Ivy-leaved morning glory.	<i>Ipomoca hederacea</i> , Jacq.	3.2
27	Alfalfa	<i>Medicago Sativa</i> , L.	2.4
28	Redtop grass.	<i>Agnostis Alba</i> , L.	2.4
29	Large rag weed.	<i>Ambrosia Trifida</i> , L.	2.4
30	Wild oat grass	<i>Avena Fatua</i> , L.	1.6
31	Canadian thistle.	<i>Cardeus Avensus</i> , L.	1.6
32	Millet	<i>Panicum Miliaceau</i> , L.	1.6
33	Field thistle.	<i>Cardnus Lancelatus</i> , L.	1.6
34	Butter and eggs.	<i>Linaria Linaria</i> , L.	.8
35	Large dodder.	<i>Cuscuta Arvensis</i> Beyrich.	.8
36	Russian thistle.	<i>Salsola Tragus</i> , L.	.8
37	White clover	<i>Trifolium ripens</i> , L.	.8



A DETERMINATION OF WEED SEED FOUND IN FIFTY SAMPLES OF  
ALFALFA (MEDICAGO SATIVA L.) RECEIVED FROM SEED MERCHANTS  
IN DIFFERENT PARTS OF THE COUNTRY.

A great deal of alfalfa seed has been sold to Missouri farmers in the past few years and no doubt this amount will increase annually as the crop has come to stay. As no seed of this plant can be produced under our climatic conditions, all of it must be introduced from other States. Most of this seed is no doubt quite pure, but that all of it is not, is evidenced by various letters received at the Experiment Station, making complaint that alfalfa seed sown had introduced some troublesome weed,- particularly dodder.

In order to ascertain the quality of the alfalfa seed which is being offered for sale samples were secured from fifty seed firms and tested for purity and for germination. That most of the samples do not contain weed seeds in any great abundance is shown by the following table.





Trash  
 Green Fox Tail  
 Buck Horn  
 Sweet Clover  
 Lamb's Quarter  
 P.e. Weed  
 Burr Clover  
 Red Clover  
 Crab Grass  
 Whorled Fox Tail  
 Dodder  
 Broad Dock  
 Curly Dock  
 Pich. by Side  
 Small Crab Grass  
 Turnip Weed  
 Sprouting  
 Crab Grass  
 Alsike Clover  
 Russian Thistle  
 Barn Yard Grass  
 Old Witch Grass  
 Timothy  
 Ladys Thumb  
 Chickweed  
 Field Thistle  
 Small Ray Weed  
 Yellow Fox Tail

1	Missouri Seed Co	Kansas City. Mo.	T						
2	J.E. Wingt Bros	Mechanicsburg. Ohio.		2					
3	Ross Bros	309 E. Douglas Wichita. Kans.	T		T				
4	T.W. Woods	Richmond Va.	T				TT	T	
5	Barteldes Seed Co.	Lawrence. Kans	T	1		T		TTTT	
6	N.L. Willit Drug Co.	Augusta. Geo.	T	1		T			
7	Blackman + Griffin	Ogden Utah	PURE						
8	Wm Rennie	Toronto Can.	1	T		T			
9	Griswold Seed Co.	Lincoln Neb 1101-1117 W. 8th	TT			T			
10	J.G. Pippard	Near Santa Fe St. K.C. Mo.	5	1					
11	Barteldes Seed Co	Lawrence Kans	T						
12	" " "	" " "			T				
13	Mitchellhill Bros	St. Joseph Mo.				T			
14	Barteldes Seed Co	Lawrence Kans.	1	1		T			T
15	Schister Cornell Seed	St. Louis Mo. 36 Cortlandt. St.	T	1		T			
17	J.M. Thorburn + Co.	New York N.Y.	1						
18	Barteldes. Seed Co.	Lawrence. Kans.	3						
19	Archia Seed Store	Sedalia Mo.	T		T				
20	Ross Bros	309 E. Douglas Wichita Kans	1		T			T	
21	" "	" "	2	T					T

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Trash  
 Green Fox Tail  
 Sweet Clover  
 Lambs Quarter  
 Pig Weed  
 Burr Clover  
 Red Clover  
 Crab Grass  
 Withered Fox Tail  
 Dodder  
 Broad Dock  
 Curly Dock  
 Prickly Side  
 Sm. Crab Grass  
 Turn of the Weed  
 Sprt. Crab Grass  
 Alsike Clover  
 Russian Thistle  
 Barn Yard Grass  
 Old Witch Grass  
 Timothy  
 Ladies Thumb  
 Chick Weed  
 Field Thistle  
 Sm. Rag weed.

42	Missouri Seed Co.	Kansas City. Mo.	PURE						
43	Iowa Seed Co.	Des Moines Ia.	PURE						
44	Griswold Seed Co.	Lincoln Neb.	PURE						
45	Missouri Seed Co.	Kansas City. Mo.	T					T	T
46	I. T. Wood & Sons.	Richmond Va.	T			T			
47	W. T. Wilkinson	Eureka Mo.	T						
48	D. M. Terry & Co.	Detroit. Mich.			T				
49	Oren Parker Co.	Corington Ky.	T	T				T	T
50	Barteldes Seed Co.	Lawrence Kans.	T			T	T		

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From the preceding table it will be noted that twenty percent of all the samples tested were absolutely free of any weed or other foreign seeds. Thirty-one percent of the samples contained less than one percent of seeds of any one weedy plant. Some of the samples, however, should be classed as dangerous. In the fifty samples examined seed of some twenty-seven foreign plants were found. The following table gives some idea of the percent of samples which contained the various weed seeds.





TABLE XXXI.

## REPORT UPON THE EXAMINATION OF FIFTY SAMPLES OF ALFALFA SEED.

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 Kinds of seed found and the percent of samples containing them.
 

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Green foxtail.	<i>Chaetochloa Virides</i> , L.	54.0
Red clover.	<i>Trifolium Pratense</i> , L.	32.0
Buckhorn.	<i>Plantago Lanceolata</i> , L.	30.0
Sweet clover.	<i>Medicago Denticulata</i> , Willd.	20.0
Pig weed.	<i>Amaranthus Retroflexus</i> , L.	12.00
Sprouting crabgrass.	<i>Panicum Proiferium</i> , Lam.	8.0
Curly dock.	<i>Rumex Crispus</i> , L.	6.0
Dodder.	<i>Cuscuta Epithymum</i> .	6.0
Crabgrass.	<i>Syntherisma Sanguinalis</i> , L.	4.0
Whorled foxtail.	<i>Chaetochloa Verticillata</i> , L.	4.0
Broad Dock.	<i>Rumex obtusifolius</i> , L.	4.0
Prickly Sida.	<i>Sida Spinosa</i> , L.	4.0
Small crabgrass.	<i>Syntherisma Linearis</i> , L.	4.0
Alsike clover.	<i>Medicago Hybridus</i> , L.	4.0
Russual thistle.	<i>Salsola Tragus</i> , L.	4.0
Barnyard grass.	<i>Echinochloa Crusgari</i> , L.	4.0
Timothy.	<i>Phleum Praetense</i> , L.	4.0
Lady's thumb.	<i>Polygonum Persicaria</i> , L.	4.0
Small rag weed	<i>Ambrosia Artenisiaefolia</i> , L.	4.00
Yellow foxtail.	<i>Chaetochloa Glauca</i> , L.	2.0



Chick weed	Alsine Media, L.	2.0
Old Witch grass	Panicum Capillare, L.	2.0
Tumble weed.	Aramanthus Spinosa, L.	2.0
Burr clover.		2.0
Lambs Quarter.	Chenopodium Album, L.	2.0



TABLE XXXII.

## A GERMINATION TEST OF FIFTY SAMPLES OF ALFALFA SEED

RECEIVED DURING THE YEAR 1907 AND THE SPRING OF 1908

FROM SEED MERCHANTS IN MISSOURI AND NEIGHBORING STATES.

Sample No.	Source	Date received	Percent germination
1	Missouri Seed Co., Kansas City, Mo.	Apr. 08	80
2	J. E. Wing & Bros., Mechanicsburg, O.	Feb. 08	86 1/2
3	Ross Bros. Wichata, Kas.	Dec. 07	85
4	P. W. Wood & Sons, Richmond, Va.	Jan. 08	79
5	Barteldes Seed Co., Lawrence, Kas.	Jan. 08	79 1/2
6	N. L. Willit Drug Co., Augusta, Ga.	Jan. 08	80
7	Blackman & Griffin, Ogden, Utah.	Mar. 08	99
8	Wm. Rennie, Toronto, Canada.	Mar. 08	92
9	Griswold Seed Co., Lincoln, Neb.	Mar. 08	90
10	J. G. Peppard, Kansas City, Mo.	Nov. 07	88
11	Barteldes Seed Co., Lawrence, Kas.	Jan. 08	87 1/2
12	Barteldes Seed Co., Lawrence, Kas.	Jan. 08	83
13	Mitchell Bros. St. Joseph, Mo.	Jan. 08.	86
14	Barteldes Seed Co., Lawrence Kas.	Feb. 07	76
15	Schisler & Cornelli, St. Louis, Mo.	Feb. 07	76
16	F. M. Thorburn & Co., New York City.	Feb. 07	80
17	Barteldes Seed Co., Lawrence, Kas.	Feb. 07	90
18	Archias Seed Store, Sedalia, Mo.	Feb. 07	90
19	Barteldes Seed Co., Lawrence, Kas.	Feb. 07	89 1/2



Sample No.	Source	Date received	Percent germination
20	Ross Bros. Wichita, Kas.	Jan. 07	83 1/2
21	Ross Bros., Wichita, Kas.	Feb. 07	69 1/2
22	Springfield Seed Co., Springfield, Mo.	Feb. 07	68
23	Springfield Seed Co., Springfield, Mo.	Feb. 07	74
24	Missouri Seed Co., Kansas City, Mo.	Feb. 07	86
25	Mitchell Bros., St. Joseph, Mo.	Feb. 07	89
26	Barteldes Seed Co., Lawrence, Kas.	Feb. 07	82
27	J. W. Wing & Bro., Mechanicsburg, O.	Jan. 07	80
28(choice)	Griswold Seed Co., Lincoln, Neb.	Feb. 07	90
29(fancy)	Griswold Seed Co., Lincoln, Neb.	Feb. 07	92
30(Turkestand)	" " " " "	Feb. 07	93
31	Plant Seed Co., St. Louis, Mo.	Sept. 07	86
32	Ross Bros. Wichata, Kas.	Mar. 08	96
33	J. A. Everett, Indianapolis, Ind.	Mar. 08	86
34	J. M. Thorburn & Co., New York City.	Mar. 08	72 1/2
35	Springfield Seed Co., Springfield, Mo.	Mar. 08	77
36	Archias Seed Store, Sedalia, Mo.	Mar. 08	86
37	Ross Bros. Wichita, Kas.	Mar. 08.	84
38	Ross Bros. Wichita, Kas.	Mar. 08	83
39 (sunflower)	Barteldes Seed Co., Lawrence, K.	Mar. 08	85
40 (choice)	" " " "	Mar. 08	88
41 (fancy)	" " " "	Mar 08.	64 1/2
42 (gain)	Missouri Seed Co., Kansas City, Mo.	Mar. 08	90
43	Iowa Seed Co., Des Moines, Iowa.	Mar. 08	69 1/2
44(fancy)	Griswold Seed Co., Lincoln, Neb.	Jan. 08	87
45 (gain)	Missouri Seed Co., Kansas City, Mo.	Feb. 08	74 1/2





Sample No.	Source	Date received	Percent germination
46 (aiken)	T. W. Wood & Sons, Richmond, Va.	Apr. 08	92.1/2
47	T. W. Wilkeson, Eureka, Mo.	Apr. 08	86 1/2
48	D. M. Ferry & Co., Detroit, Mich.	May 08	65
49	Orene Parker Co., Covington, Ky.	Apr. 08	86.1/2
50	Barteldes Seed Co., Lawrence, Kas.	Mar. 08	<u>88</u>
Average of all samples tested			80.3

In the germination test it will be noted that there is a considerable difference in value of the samples tested. For example, the two samples 35 and 15 germinated 96 percent of the total, while samples 22 and 41 each germinated less than 65 percent of the total. An average of all of the samples gave a test of 80.3 percent. This is considerably below what might reasonably be expected from what we would call "good" seed. A good sample of alfalfa should germinate at least 95 percent of the total. Alfalfa seed is generally considered to maintain its vitality well. In this test it will be noted that samples 14 to 30 inclusive which were received in the spring of 07, and which we might reasonably expect to be older on the average than the samples received in the spring of 1908, gave an average of 82 percent germina-



tion which is 2 percent above the average of the whole number tested. We would not conclude from this that the older seeds are on the average more viable, but it does indicate that we need not be particularly anxious as regards the viability of alfalfa seed which we have had for one or two years, provided it gave a strong germination when first secured.



## II.

### SUMMARY.

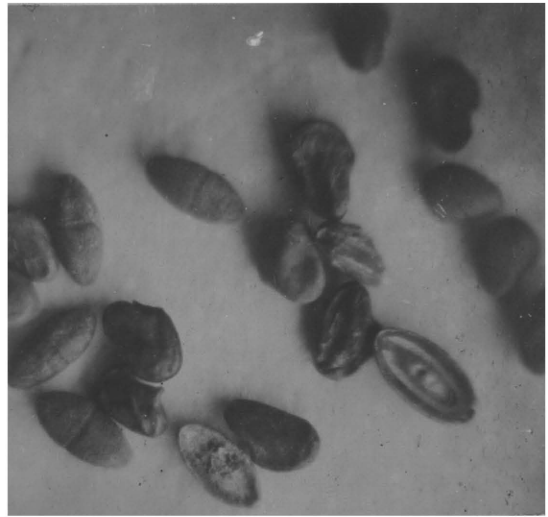
1. In examining 125 samples of clover seed thirty-seven different kind of foreign weeds were found. The amount of impurities which the samples contained varied from over sixty percent to nothing. Only 5.6 percent of the samples were free from weed seed.

2. In the examination of fifty samples of alfalfa twelve percent were found to be absolutely free from weed seed; thirty-one percent of the samples contained less than one percent of the seeds of any one weedy plant. In all seed of twenty-seven foreign plants were found. Green foxtail was by far the most abundant, being found in fifty-four percent of the samples. The percent germination of the fifty samples ranged from 96 percent to 65 percent, with an average of 80.3 percent.





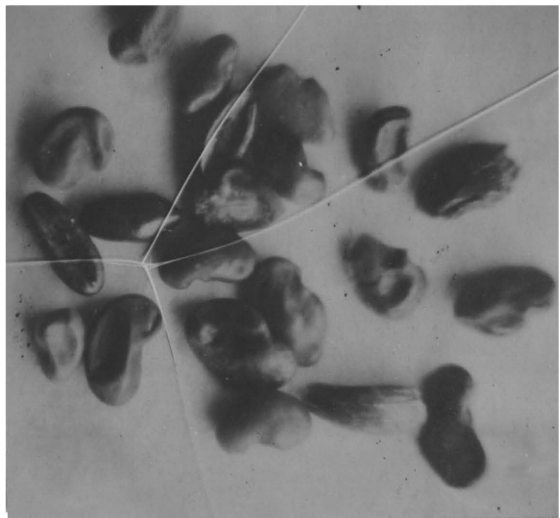
1. Good Seed - Red Clover



2. Foul Poor Quality Clover.



3. Good Seed - Alfalfa.



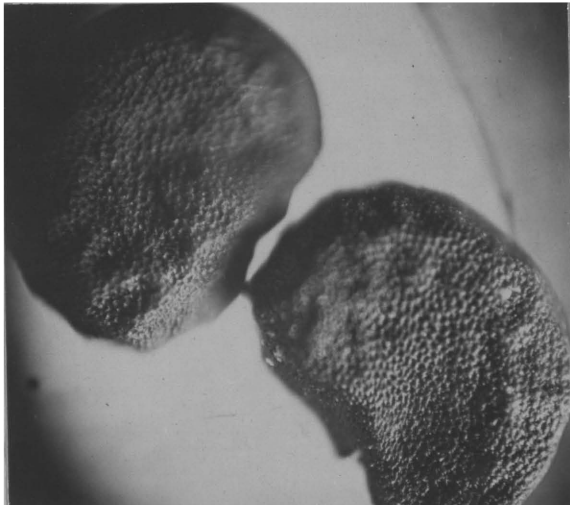
4. Foul - Poor Quality - Alfalfa



5. Good Seed Alsike







6. Jamestown Weed  
*Datura Stramonium* L.



7. Butter Bur  
*Petasetes Petasetes* (L.) Karst



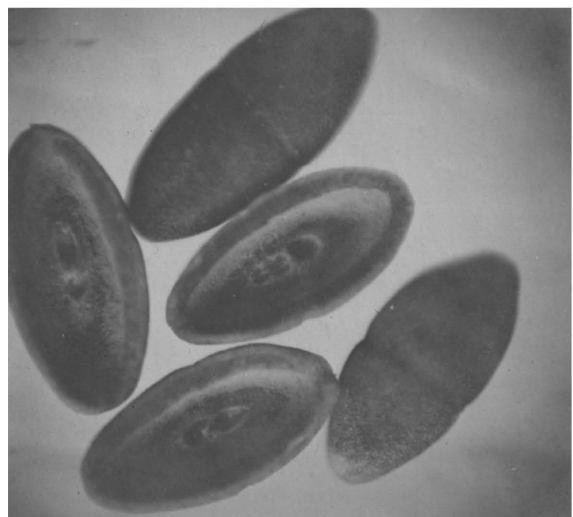
8. Green Foxtail  
*Chamaeraphis viridis* (L.) Portes



9. Yellow Foxtail  
*Chamaeraphis glauca* (L.) Kuntze

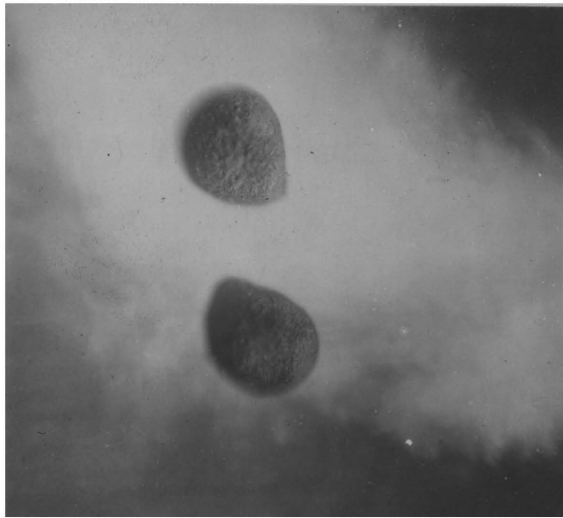


10. Bracted Plantain

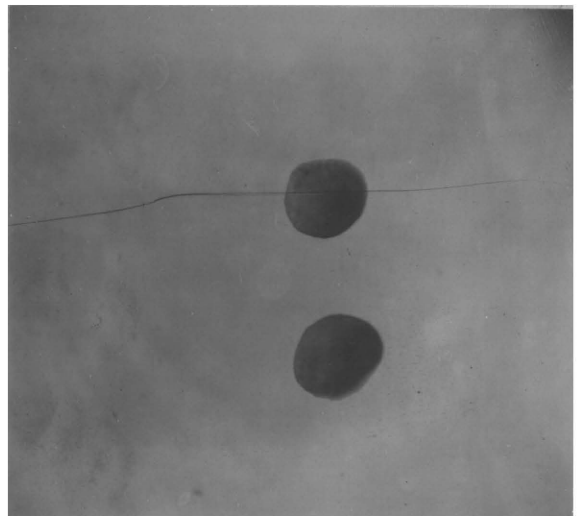


11. Bracted Plantain  
*Plantago Aristato* Michx

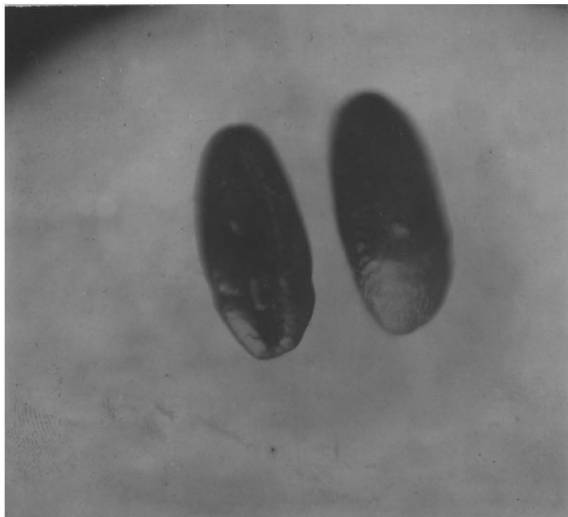




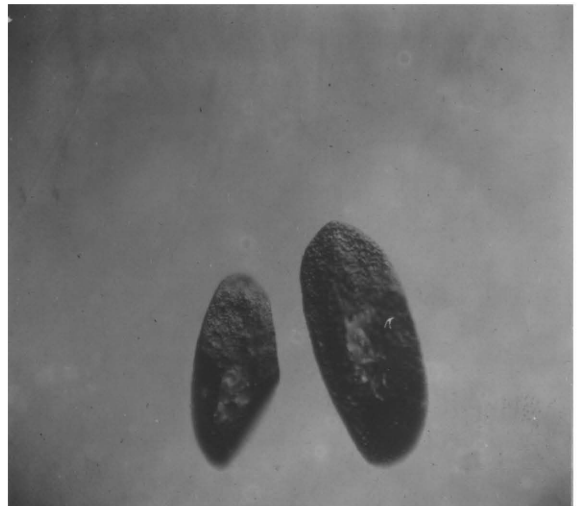
12. Field Dodder  
*Cuscuta Arvensis*, Beysich



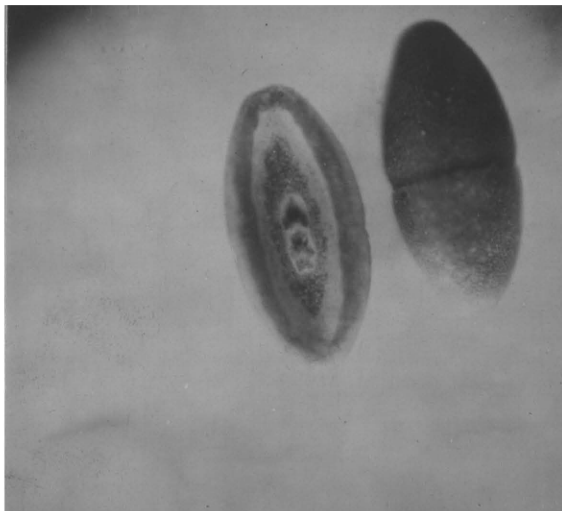
13. Clover Dodder  
*Cuscuta Epithimum*, Murr.



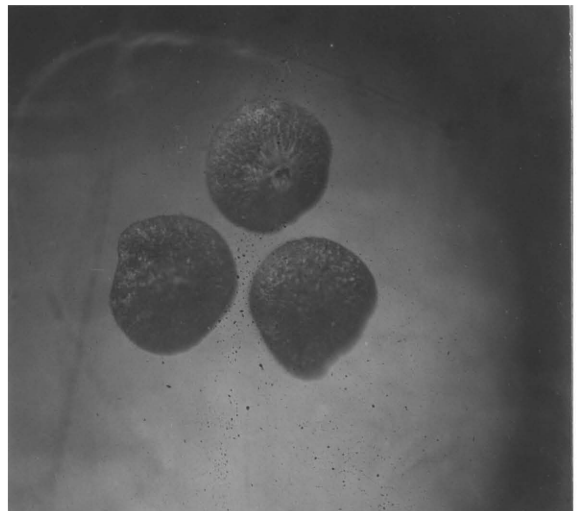
14. Buck Plantain  
*Plantago Lancelata* L.



15. Broad Plantain  
*Plantago Major* L.

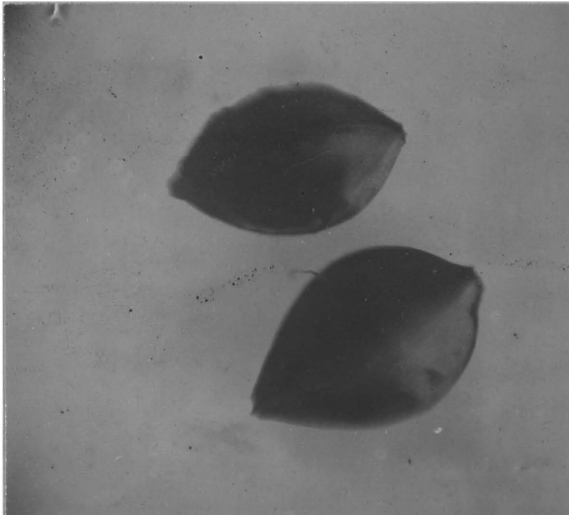


16. Bracted Plantain  
*Plantago Aristota*, Michx

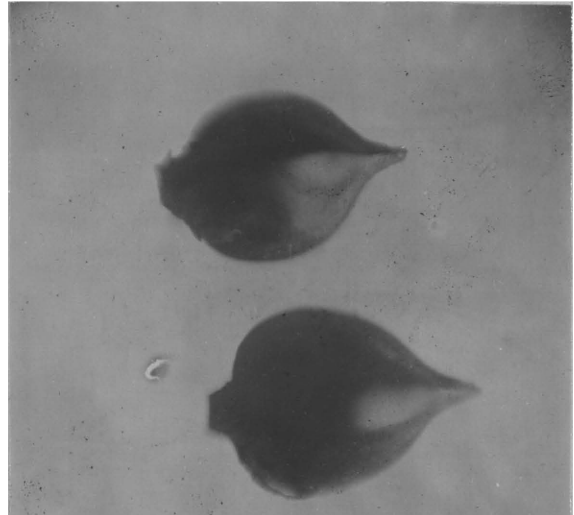


17. Lambsquarter  
*Chenopodium Album* L.

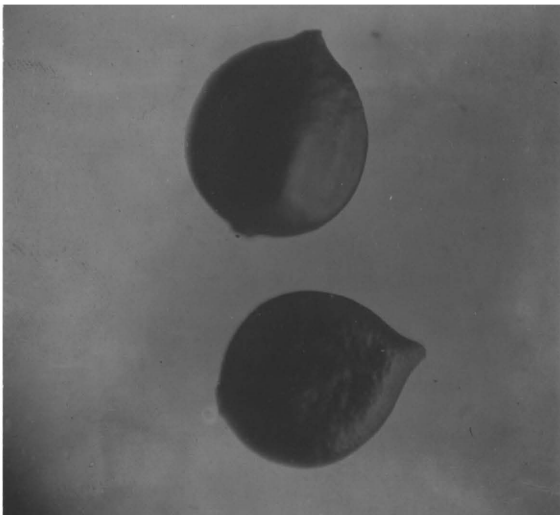




18. Curley Dock  
*Rumex crispus*



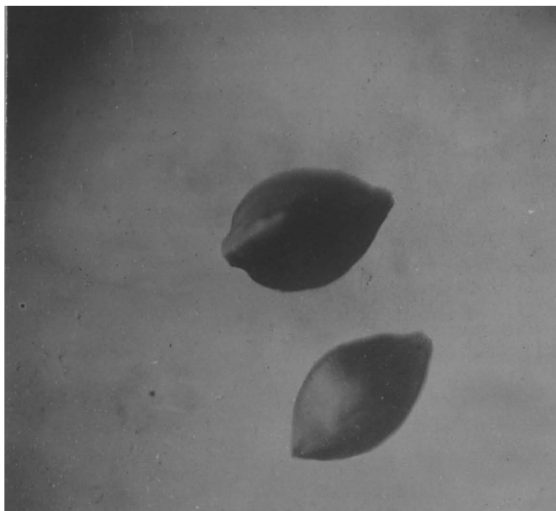
19 Pennsylvania Smartweed  
*Polygonum pennsylvanicum* L.



20. Tear Thumb  
*Polygonum arifolium* L.



21. Lady's Thumb  
*Polygonum persicaria* L.

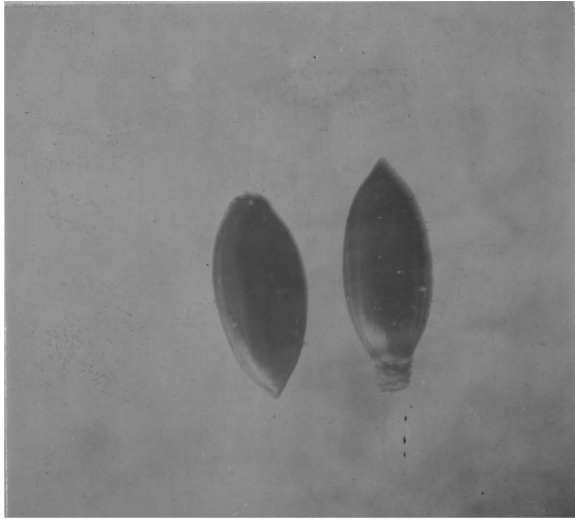


22. Horse Sorrel  
*Rumex acetosella* L.

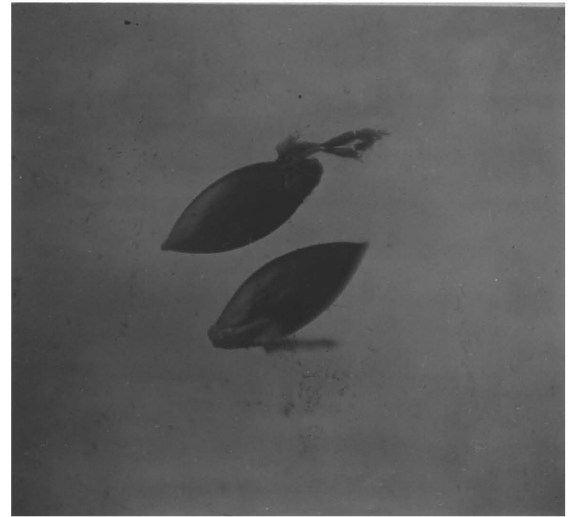


23. Prickly Sida  
*Sida spinosa* L.

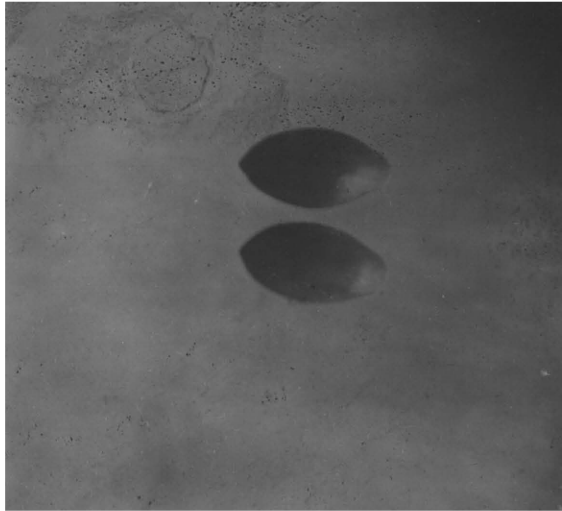




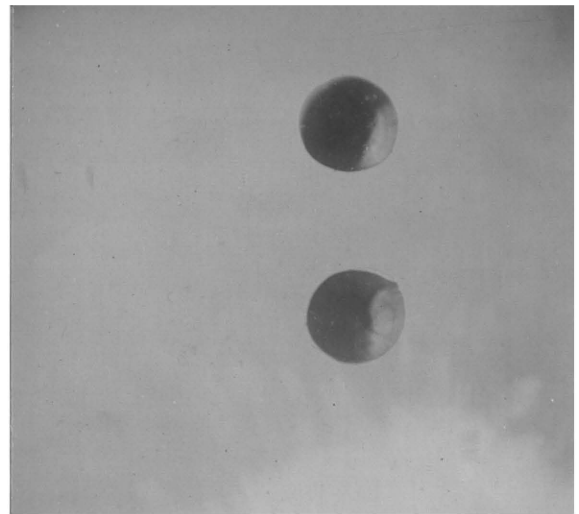
24. Sprouting Crab Grass  
*Panicum Proliferum* L



25. Small Crab Grass  
*Syntherisma Linarius* (K) Nash



26. Old Witch Grass  
*Panicum Capillare* L.



27 Pig Weed  
*Amaranthus hybridus* L.















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~~This thesis is never to leave this room.~~

~~Neither is it to be checked out overnight.~~

