A STUDY OF THE INFLUENCE OF STAGE OF MATURITY AT TIME OF HARVEST UPON THE QUALITY OF ALFALFA SEED

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THESIS

- A C K N O W L E D G M E N T -

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Introduction and Object of the Work

Alfalfa, for many years the leading hay crop of the west, has only recently come into prominence in Michigan. Within the last twenty years it has risen from an almost unknown crop to one of the leading forage crops in the state.(6) Farmers are finding that with proper management and by using adapted, northern grown seed, alfalfa becomes a very dependable source of nitrogenous feed as well as a good cash crop.(1) The following statistics show the increase in acreage and production in Michigan from 1899 to 1927:(2, 10, 11)

Year	Acreage	Total Tonnage of Hay
1899	1,000	1,000
1909	7,000	14,000
1919	74,000	148,000
1920	95,000	218,000
1921	143,000	322,000
1922	246,000	578,000
1923	338,000	710,000
1924	350,000	833,000
1925	399,000	804,000
1926	479,000	1,078,000
1927	513,000	1,103,000

It has been estimated that in maintaining our present acreage and allowing for an increased acreage, between 200,000 and 300,000 acres are seeded to alfalfa each year.(3, 5) This requires from two to

three million pounds, or about 50,000 bushels of alfalfa seed per year, with a value approaching a million dollars.

This high consumption of valuable seed has stimulated considerable interest in seed production among Michigan farmers, and during the last few years there has been a constantly increasing production of home grown alfalfa seed. The seed crop in Michigan has been rather uncertain. Frosts and fall rains often catch the late seed crop and as a result, there are many fields with a high percentage of immature or frosted seed. Thus questions are often asked by farmers as to how immature, and how late in the fall, a crop may be harvested, and still be of value for seed.

This problem was conducted for the purpose of securing information concerning the influence of stage of maturity, color of pod, and freezing in the field, upon the quality of the seed produced, with a view of helping answer these important questions. Any information which can be obtained with regard to the factors influencing the quality of the alfalfa seed produced under Michigan conditions, will be of great benefit to the farmers of the state.

Review of Literature

As far as the writer has been able to determine, no other work has been done regarding the influence of maturity upon the quality of alfalfa seed. Some work has been done in testing the germination of heavy and light seeds, and seeds of different shades of color, but these seeds were all taken from commercial lots rather than from pods at different stages of maturity, and have little

bearing on the writer's work.

In 1901, Miller and Pammel[4] conducted a number of experiments in which plants of alfalfa and other legumes were grown from large and small seeds. Their results showed that plants grown from large seeds made greater top and root development than plants grown from small seeds. Their data were too meager to be considered conclusive, however.

Roberts and Freeman[7] conducted experiments in which commercial samples of alfalfa seed were separated into two classes: seeds which were bright and apparently viable; and seeds which were brown, blackened, or green and immature and apparently not viable. In the apparently viable lot the germination averaged 85% in twenty-one tests. Fourteen percent remained hard at the close of the experiment. In the seeds apparently not viable, 47% germinated while 53% remained hard at the close of the experiment.

Stewart[8] conducted some germination tests in which samples of commercial alfalfa seed were separated into seven color fractions. Tests made in July, 1922, showed the following germination percentages: True color (bright yellow with a tint of olive-green) - 68.8; light green - 65.8; light brown - 59.1; dark brown - 53.4; dark green - 50.7; shriveled green - 28.4; and shriveled brown - 21.0.

True and his co-workers[9] came to the following conclusion in germinating different qualities of alfalfa seed: "Our experiments show that a germinator test will show little difference in the number of sprouts between normal alfalfa seed and that which is styled abnormal - the brown or green seed". "The sprouts from many of these so-called

abnormal seeds were weak." "The presence of either brown or green seeds lessens the value of a seed from a commercial standpoint." "Our tests go to show that the frosted grain is low in germination, and that it is an important matter to mature seeds without injury by frost."

In all of the work reviewed above, the experiments were conducted with commercial seed. Hence, the results are not strictly comparable to those obtained by the writer, since most of the small seeds and many of the shriveled seeds are removed from commercial seed in the process of cleaning, whereas in the samples used by the writer, all of the small and shriveled seeds were included in the tests.

Statement of the Problem

The "Study of the Influence of Stage of Maturity at Time of Harvest upon the Quality of Alfalfa Seed" resolved itself into two phases.

The first phase included the collecting of 1000 alfalfa pods at each ten stages of maturity. These stages are as follows:

A - Pods Very Immature,

B - Pods Beginning to Fill,

C - Pods Becoming Plump,

D - Pods Plump (Green),

E - Pods Light Brown (Mature),

F - Pods Medium Brown (Mature),

G - Pods Dark Brown (Mature),

AA - Pods Immature-Frozen,

BB - Pods Plump Green-Frozen, and

CC - Pods Mature-Frozen.

Various data were obtained for each of the above stages after the pods had become dry. By far the largest percentage of the work was done on this phase.

The second phase included the picking of the mature pods from a number of plants every third day throughout the ripening period in order to determine whether there was any variation in average weight during this period. The total weight and average weight of seed were also obtained from each group thus secured.

Definitions

Sample - A group of 100 pods, or the seed from 100 pods of a given stage of maturity.

Class - Ten samples taken together, all samples being of the same stage of maturity.

Brown Seed - Dark or discolored seed, regardless of size or weight.

Small Seed - Bright seed (Brown seed removed) capable of passing through a slotted wire screen, having 20 wires per inch.

Plump Seed - Bright seed (Brown seed removed) not capable of passing through a slotted wire screen, 20 wires per inch.

Potential Viability - The sum total of hard and germinated seeds.

Method of Procedure - Phase I

Work on the project was begun in the fall of 1927, the first part of the work, that of collecting material, being done from the middle of October until early in November, at which time a series of heavy freezes occurred.

The great bulk of the material was collected from the alfalfa plants growing in the young orchard bordered on the northeast by Grand River Avenue and on the south by the College Orchard.

Since it was desired to find the relation that exists between the stage of maturity of the pod and the condition or quality of the seed, a large number of pods were collected during the period mentioned above. These pods were collected at random, without regard to the size or the stage of maturity. After being picked, the pods were immediately sorted into seven classes, depending upon the stage of development of the pod. This sorting was done immediately in order to eliminate error due to the drying of the pods.

Classification of Pods

The seven classes or stages of maturity are as follows: A - Pods Very Immature - flat and apparently empty; B - Pods Beginning to Fill - sides beginning to bulge slightly; C - Pods Becoming Plump - fairly well filled; D - Pods Plump (Green) - filled tightly, and fat and round in cross section; E - Pods Light Brown - dry and very light in color when picked; F - Pods Medium Brown - intermediate in color between Light and Dark Brown; G - Pods Dark Brown - very dark or black in color. The

above classes were, of course, selected arbitrarily, since the pods grade continuously from one class to the other.

Pods were collected until there were at least 1000 pods of each class on hand. The pods of each class were then poured out into a pile, and the pile mixed to secure uniformity. Each class was then divided into ten samples containing 100 pods each. In this way the data was replicated nine times in an effort to reduce error. Each sample was put into an envelope and the envelope carefully labeled with the name and letter of the class and the number of the sample. Each of the seven classes received similar treatment.

After the heavy freezes occurred, another group of pods was collected, and this time sorted into three classes as follows: AA - Immature-Frozen Pods; BB - Plump (Green) - Frozen Pods; and CC - Brown-Frozen Pods. Each of these classes was divided into ten samples of 100 pods each as in the case of the unfrozen pods. Thus by the latter part of November, the writer had collected ten classes of pods, ranging from very immature to dark brown, mature pods. Each of these classes contained ten duplicate samples of 100 pods each, or 1000 pods in all. The entire lot was stored away to dry.

At the time the frozen pods were collected, the majority of the plants were wilted as a result of freezing. The green pods of these plants were also somewhat wilted and dried so that there was some difficulty in sorting the pods into their proper classes.

Threshing and Separating

After being allowed to cure thoroughly, the pods were threshed

by rubbing between leather covered blocks. The seed was screened out by means of a 2.007 mm. round screen. The material remaining on the screen was carefully examined, and any seeds still remaining in the pods were removed by hand rubbing. The seed and fine material were again screened out and the coarse material discarded. The seed and chaff were then run over a 1.016 mm. screen, thus removing dust and other fine material. Young developing ovules which were able to pass through this screen were considered too small to be of value, and were discarded with the other fine material.

After screening, many small pieces of pod and chaff still remained with the seed. This was largely removed by placing the seed with the foreign material on a canvas covered board designed for the purpose. This board, when inclined, allowed the seeds to roll off into a pan but retained most of the foreign material, the latter adhering to the rough canvas. Any seeds adhering to the canvas were removed by hand. The foreign material was discarded. After repeating this process several times, the seeds were found to be fairly clean. Any foreign material still remaining in the seed was subsequently removed by hand picking. Each sample was, of course, threshed and cleaned separately, and was kept carefully labeled at all times.

Classifying the Seed

The seed from each sample was divided into three groups, namely, plump, brown, and small seeds. All dark and discolored seed, regardless of size, was removed by hand from the sample. These dark and discolored seeds, which comprise the brown group, were then placed in an envelope and labeled "Brown Seed".

After removing the brown seed, each sample was run over a slotted wire screen having twenty wires per inch. Any seed passing through this screen was placed in an envelope, properly labeled and designated as "Small Seed". The seed remaining on the screen in each case was designated as "Plump Seed". The seeds in each of the three hundred groups thus obtained were counted and weighed to the fourth decimal place on an analytical chain balance.

Germination

A definite number of seeds from each group were tested for germination, readings being taken in five and one-half days. These readings gave the number of seeds germinated, number of dead seeds, and number of hard seeds.

Calculation of Data

From the basic data for each sample obtained above, namely, Dry Weight of Pods; Number of Plump, Brown, and Small Seeds; Weight of Plump, Brown, and Small Seeds; Number of Seeds tested for germination; and Number of Germinated Seeds, Hard Seeds, and Dead Seeds in each of the plump, brown, and small groups, the following additional data were calculated: Total Number of Seeds; Total Weight of Seeds; Average Number of Seeds per Pod; Average Number of Plump Seeds per Pod; Percent Total Potential Viability; Percent Total Viability of Plump Seeds; Comparative Weight of Plump Seeds; Average Weight of Plump Seeds, of Brown Seeds, of Small Seeds, and of All Seeds combined; Percent of Total Weight and Percent of Total Number for the plump, brown, and

small seed groups; and Percent Germination, Percent Hard, Percent Dead, Calculated Total Germination, Calculated Total Hard, and Calculated Total Dead Seeds for each of the three groups.

The data from each of the ten samples comprising each class were combined, and the totals or averages used for the class as a whole. This combined data was compiled into a Master Chart. This Master Chart is found in Tables 1 to 6.

Determination of Probable Error

In order to determine whether or not there were significant differences between Classes E, F, and G, the probable error was worked out for the Total Weight of Seed, Total Number of Seeds per Pod, Percent Total Potential Viability, and Plump Seeds per Pod. The data from the ten duplicate samples in each of these classes were used as a basis for these determinations. These data are found in Tables 11, 12 and 13. The formulae used for determining the probable error of the mean and the probable error of the difference are as follows:

$$\text{Probable error of the mean } (P.E._m) = \frac{.6745 \times S.D.}{\sqrt{N}}$$

$$\text{Probable error of the Difference } (P.E._{dif.}) = \sqrt{P.E._{m_1}^2 + P.E._{m_2}^2}$$

The results are found in Tables 67 and 68.

Method of Procedure - Phase II

The material for this phase of the work was obtained from three plants of Hardigan, one plant of Ladeau, and one plant of Grimm alfalfa located in the Curiosity Plats in the area directly south of the Farm Crops Barn. Beginning October 15, all dry pods were picked from these plants every third day at 9:30 A. M. The pods from each variety and for each day's pick were kept separate. Since freezing weather on November 5th and 6th caused the tops of the plants to wilt and die, all pods remaining on the plants were picked on November 8th.

The pods were allowed to cure thoroughly and were then threshed and cleaned in the same manner as the pods in Phase I.

Each lot of seed was separated into two groups, bright and brown, all dark or discolored seed being included in the latter group. The seeds in each group were counted and weighed, and from this data the average weight of seeds for each variety and for each day's total pick were determined. The total weight of seed and the percentage of bright seed for each day's pick were also determined. The data for Phase II will be found in Tables 69 and 70.

The high and low daily temperatures for October and November were obtained from the local United States Weather Bureau. These were plotted to see whether or not there was any relation between temperature and average weight of seed and between temperature and percentage of plump seed.

Explanation of Data - Phase I

Each of the ten classes consisted of 1000 pods, and the data for each class was based on this number of pods, or on the seed from the number of pods. All weights are given in grams.

The weight of dry pods ranged from approximately 11 grams in the very immature pods to over 21 grams in plump green and dark brown classes. The increase in weight is rapid up to Class D, which surpasses Classes E and F and nearly equals Class G. Classes C and E are closely parallel while Class F lies between Classes E and G as well as between Classes C and D. The weight of the Dark Brown pods is approximately 129% that of the Light Brown pods. It will be noted in Graph 1 that the increase in weight of the pods after seed formation begins is practically all due to the increase in the weight of the seed, rather than any increase in the weight of the pod itself. Table 1.

The total number of seeds in 1000 pods rises rapidly between Classes A and B, but after Class B there is but little increase, being approximately 600 seeds between Classes B and C. This seems to indicate that all the seeds are formed in the pod at about the same time, and that this formation of seed takes place early in the life of the pods. The total number of seeds in Class G exceeds the total number in Class E by 703 or 12.6%. Table 1. Graph 2.

The increase in the total weight of seed follows much the same lines as the increase in the total weight of pods, with the high points lying in Class D and G, and Classes C and E closely comparable.

Class G surpasses Classes E and F by 46% and 28% respectively. Thus Class G has a total yield approximately 1½ times that of Class E. Table 1. Graph 4.

The average number of plump seeds per pod is extremely low in the first two stages of development, but in Class C where the pods are becoming plump, the number jumps to 2.7 seeds per pod. This number is also found in Class E. Thus it may readily be supposed that development of the seed might cease at Class C, the resulting pods being light brown in color and thus falling into Class E. Pods reaching the development found in Class D would be dark brown in color when matured and would thus fall into Class G. The total potential viability seems to be closely correlated with the average number of plump seeds per pod, since both follow much the same curve. This is further borne out by the fact that the potential viability of the plump seeds is nearly perfect in every case. The potential viability of the plump frozen is slightly higher than that of the unfrozen plump seed, probably due to the discoloration (and subsequent elimination) of the weak seed by freezing. Table 1. Graph 8.

The Comparative Weight of Plump Seed is based on the weight of the plump seed of each class as compared to the weight of the plump seed in Class G, the latter being taken as 100%. It will be noted that the numbers are very small in Classes A and B, but jump to nearly 50% in Class C. Class D surpasses Classes E and F by 25% and 12% respectively, while Class G surpasses Classes E and F by 44% and 31% respectively. Table 1. Graph 10.

The average weights of plump seed range from about .0016 grams to .0020 grams. The lower limit of the plump seed seems to be about .0016 grams. In the first three classes there is little deviation from this weight, but beginning with Class D, there is a constant rise to Class G which is the highest in average weight. This seems to indicate that the seeds in Class D have not yet become completely filled, in spite of their plump character. It also shows that the greater weight of Class D over Classes E and F is due to greater number of seeds rather than to greater average weight of seeds. Table 2. Graph 11.

The average weight of small seed ranges from about .0005 grams nearly up to the lower limits of the plump seed. It will be noted that the potential viability is fairly low in the small seed until the seeds reach an average weight of about .0008 to .0009 grams. At this time the potential viability is about 70%. It is only when the average weight of the small seed rises to .0010 or above, that any appreciable increase in potential viability may be expected. There are four such classes of small seed with average weight of .0010 or over. The potential viability of these classes is as follows: Class D - .0010, 83%; Class F - .0011, 84%; Class G - .0013, 90%; and Class CC - .0011, 88%. Thus there seems to be a very close connection between the average weight of seed and their ability to germinate. Seeds that have reached one-half their full development seem to be capable of germinating in about four out of five cases. Tables 2 and 6. Graphs 11 and 17.

The viability of brown seed is extremely low. The potential viability of brown seed never rises above 32% except in the frozen seeds,

and then not above 45%. In every case, the germination of the brown frozen seed is higher than the brown seed of other classes. This indicates that while seed may be discolored and darkened by freezing, the seeds are not necessarily killed. Table 5. Graph 16.

It will be noted in Table 3 that the plump seeds at first comprise only a small percentage of the total weight while the small seeds comprise a large percentage of the total weight. This situation is gradually reversed, however, until in Class G there is only slightly over one percent of small seed. This shows a gradual filling and development of the seeds throughout the growing period. The brown seeds comprise from 28 to 37% of the total number and from 21 to 27% of the total weight of seed in the three mature classes. Before that period only 7 to 16% of the total number and 7 to 14% of the total weight of seeds are brown. There is some indication that many seeds were injured or arrested in their development just before they became mature. The brown seed in Class G comprise 21% of the total weight, while in Class E the brown seed comprise 26.7% of the total weight. Although the percentage of brown seed in Class E is higher than in Class G, the total weight of seed is less. Thus the total amount of valuable seed in Class E is cut down still more. The last column in Table 1 shows that the amount of plump seed in Class E is only 55.9% that of Class G. Graphs 12, 13 and 14.

Throughout the tables, the three classes, E. F. and G, should be compared, as these classes were all mature, dry pods when picked, and any differences noted are those correlated with the color

of the pod, whether light, medium, or dark brown. It will also be noted that Class D, consisting of Plump Green Pods, often surpasses Classes E and F, sometimes even rising parallel to or above Class G. The writer believes that the reason for this is that only a small percentage of the pods ever reach a condition comparable to Class D, but that many of the pods become brown and dry, or mature, immediately following the Class C stage. This theory is borne out by the fact that Classes C and E are comparable in many instances.

The data in Tables 67 and 68 show that the differences between Classes E and G are significant. In the Total Weight of Seed, the difference between the classes, divided by the probable error of the difference, gives a result of 21.4 while the number required to show significance is only 3.5. The results for Total Number of Seeds per Pod, Percent Total Potential Viability, and Number of Plump Seeds per Pod, between Classes E and G, are 5.55, 14.3, and 17.5 respectively. With these results, there is sufficient reason for believing that the differences between Classes E and G are not merely due to chance.

Explanation of Data - Phase II

Graph 18 shows the average weight of the seeds for each variety. It will be noted that the average weights of Hardigan and Labeau seed run fairly close together while the Grimm seed fluctuates. This fluctuation is probably due to the small amount of seed used. Tables 69 and 70.

Graph 19 shows the average weight of all bright seeds for

each day's pick. It will be noted that there is a constant drop from October 15 to October 30, after which the average weight again rises. Graph 22 shows that there was a fall in temperature from October 2 to October 20 and then a rise from October 20 to November 1. It is possible that the influence of the temperature on the developing seed did not become apparent until about 10 days after such temperature change occurred. Tables 69 and 70.

A comparison of Graphs 20 and 22 seems to show a relation between temperature and amount of seed ripened within a given period. A comparison of Graphs 21 and 22 also seems to show some connection between the percentage of plump seed and the temperature.

In working with the alfalfa pods and seeds in this experiment, the writer was led to believe that, to a certain extent at least, the production of Dark Brown pods by an alfalfa plant is a hereditary factor. This is indicated by the fact that certain plants tend to have almost all of their pods dark brown or black, while other plants have no dark brown pods. If this factor is hereditary, it should be possible, by proper selection and breeding, to produce plants, or strains of plants, whose pods would all be dark brown or black in color. A pure strain of such plants should be capable of producing seeds of higher average weight and in much greater quantity than ordinary strains of alfalfa, since the work carried on in this experiment showed that pods selected on the basis of color alone, were heavier, more prolific in seed production, produced heavier seeds, and contained a lower percentage of brown seeds than did the lighter colored pods. Hence, the more

nearly the majority of the pods in the field approach the dark brown stage, the greater will be the quantity and the higher the quality of the seed produced.

Summary

1. Classes E, F, and G, though apparently differing only in color of of pod, vary greatly in many respects.
    a. Total weight of seed in Classes E, F, and G, was 7, 9, and 11 grams respectively.
    b. Total number of seeds in Classes E, F, and G, was 5558, 5701, and 6281 respectively.
    c. The average number of plump seed per pod in Classes E, F, and G, was 2.7, 3.2, and 4.3 respectively.
    d. Total potential viability in Classes E, F, and G, was 64.7, 69.5, and 76.4 respectively.
    e. Comparative weight of plump seed in Classes E, F, and G, was 55.9, 69.0, and 100 percent respectively.
    f. The average weight of plump seed in Classes E, F, and G, was .0018, .0019, and .0020 respectively.
    g. The plump seeds of Classes E, F, and G, were about equal in potential viability.
2. The seeds are formed early in the development of the pod. All seeds are probably formed at nearly the same time.
3. The pods may turn brown and become mature at any time after the Class C (Becoming Plump) stage is reached. This is shown by the close comparison between Classes C and E.

4. Only the most hardy of the unripe seed will survive freezing without discoloration. This is shown by the fact that every plump bright seed picked after freezing was capable of germinating.
5. Seeds having an average weight of .0008 grams may be expected to have a potential viability of about 70%. From .0008 to .0016 the potential viability will rise until at the latter weight it will range from 95 to 100 percent. Seeds under .0008 grams are very low in potential viability.
6. The potential viability of the plump seed ranges from 96 to 100 percent.
7. The germination of brown seeds is very low, ranging from 2 to 23 percent in unfrozen seed and from 30 to 45 percent in the frozen seeds.
8. There is a significant difference between Classes F and G in the Total Weight of Seed, in the Total Number of Seeds per Pod, in the Percent of Total Viability, and in the Number of Plump Seeds per Pod.
9. There is some indication that the average weight of seeds is lowered by decreased temperatures, the change becoming apparent in about ten days.
10. The rate of ripening seed seems to be lowered by decreased temperatures.

Conclusions

From this work on Alfalfa Seed Maturity, the following conclusions may be drawn:-

1. Any agency or factor increasing the percentage of Dark Brown pods in a field will increase the yield, total number of seeds, total viability, and average weight of seed.
2. Seeds that have reached a weight of .0009 to .0010 grams, or

about one-half the weight of mature seeds, may be expected to have a potential viability of 65 to 85 percent.

3. Brown seeds may be considered worthless except in the case of seed harvested after freezing. One-third to two-thirds of the frozen brown seeds may be expected to be viable, and could be used by the farmer in planting his own fields if other seed was not available.
4. Pods may turn brown, or become ripe, at any time after the Class C, or Becoming Plump stage is reached.
5. From 95 to 100 percent of plump bright seed having an average weight of .0016 or over, may be expected to be viable.
6. Seed may be harvested when a large percentage of the pods have reached the Becoming Plump stage, if there is possibility of injury by frost or other agencies. Seed harvested at this stage will have a fairly high viability.
7. There is a significant difference between Classes E and G in the Total Weight of Seed, Total Number of Seeds per Pod, Percent Total Potential Viability, and Number of Plump Seeds per Pod.
8. There is some indication that the average weight of seeds and the rate of ripening of seeds are lowered by decreased temperatures.

Immature seed may be harvested with the expectation of having a high percentage of viable seed, if the majority of the pods have reached or passed the Becoming Plump stage. Harvesting at this time will often allow farmers to escape injury to their crop by frost. In threshing seed in immature stages, it would be advisable to use a screen small enough to

retain seeds that have reached at least half their full development.

The small amount of work done on Phase II seems to indicate that some valuable work might be done in studying the relation of temperature to maturity of alfalfa seed.

Table 1

TOTAL NUMBER AND WEIGHT OF SEEDS - VIABILITY - ETC

CLASS MASTER CHART

Class	No. Pods	Dry Wt. of Pods	Total No. of Seeds	Total Wt. of Seeds	Av. No. Seeds Per Pod	Av. No. Plump Seeds Per Pod	% Total Potential Viability	% Potential Viability of Plump Seeds	Comparative Wt. of Plump Seed (%)
A - Very Immature	1000	10.998	2545	1.4291	2.5	.09	12.7	98.7	1.8
B - Beginning to Fill	1000	13.428	4865	3.6971	4.8	.62	38.7	96.6	11.0
C - Becoming Plump	1000	16.242	5475	6.8993	5.4	2.7	77.6	96.2	49.7
D - Plump (Green)	1000	21.423	6886	10.1582	6.8	4.2	84.6	98.5	81.1
E - Light Brown	1000	16.772	5558	7.8869	5.5	2.7	64.7	96.6	55.9
F - Medium Brown	1000	18.189	5701	9.0654	5.7	3.2	69.5	98.1	69.0
G - Dark Brown	1000	21.632	6261	11.7079	6.2	4.3	76.4	97.9	100.0
AA- Immature-Frozen	1000	15.305	4079	4.3687	4.0	.10	32.8	100.0	2.2
BB- Plump Green-Frozen	1000	22.526	6411	8.9457	6.4	.32	48.4	100.0	6.5
CC- Brown-Frozen	1000	19.806	6027	9.7025	6.0	2.8	68.2	99.1	62.1

Table 2

AVERAGE WEIGHT OF SEED

CLASS Master Chart

Class	Plump Seeds	Brown Seeds	Small Seeds	All Seeds
A - Very Immature	.001692	.000779	.000488	.000561
B - Beginning to Fill	.001603	.000753	.000625	.000759
C - Becoming Plump	.001624	.000922	.000880	.001260
D - Plump (Green)	.001721	.001081	.001060	.001475
E - Light Brown (Mature)	.001853	.001034	.000893	.001419
F - Medium Brown (Mature)	.001920	.001148	.001124	.001590
G - Dark Brown (Mature)	.002086	.001376	.001328	.001869
AA- Immature-Frozen	.001883	.001063	.000765	.001071
BB- Plump Green-Frozen	.001832	.001379	.000972	.001395
CC- Brown-Frozen	.001984	.001284	.001136	.001609

Each Class Represents 1000 Pods

Table 3

NUMBER AND WEIGHT OF SEEDS

CLASS MASTER CHART

Class	PLUMP SEED				BROWN SEED				SMALL SEED			
	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.
A - Very Immature	95	3.7	.1608	11.2	249	9.8	.1940	13.6	2201	86.5	1.0743	75.2
B - Beginning to Fill	625	12.8	1.0019	27.1	339	7.0	.2554	6.9	3901	80.2	2.4398	66.0
C - Becoming Plump	2752	50.3	4.4718	64.8	702	12.8	.6477	9.4	2021	36.9	1.7798	25.8
D - Plump Green	4282	62.2	7.3736	72.6	1114	16.2	1.2052	11.9	1490	21.7	1.5794	15.5
E - Light Brown	2744	49.4	5.0850	64.5	2035	36.6	2.1062	26.7	779	14.0	.6957	8.8
F - Medium Brown	3270	57.4	6.2802	69.3	2134	37.4	2.4512	27.0	297	5.3	.3340	3.7
G - Dark Brown	4359	69.6	9.0962	77.7	1788	28.6	2.4603	21.0	114	1.8	.1514	1.2
AA-Immature-Frozen	106	2.6	.1997	4.6	3784	92.8	4.0243	92.1	189	4.6	.1447	3.3
BB- Plump Green-Frozen	322	5.0	.5901	6.6	5978	93.2	8.2477	92.2	111	1.7	.1079	1.2
CC- Brown-Frozen	2845	47.2	5.6473	58.2	2960	49.1	3.8030	39.2	222	3.7	.2522	2.6

Each Class Represents 1000 pods

Table 4

GERMINATION RECORD

CLASS— MASTER CHART

Class	PLUMP SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
A - Very Immature	79	16	62	1	20.2	78.5	1.3	21	73	1
B - Beginning to Fill	275	21	245	9	7.6	89.0	3.3	44	561	20
C - Becoming Plump	1000	78	884	38	7.8	88.4	3.8	218	2439	105
D - Plump (Green)	1000	84	901	15	8.4	90.1	1.5	358	3860	64
E - Light Brown	1000	120	846	34	12.0	84.6	3.4	323	2330	91
F - Medium Brown	1000	130	851	19	13.0	85.1	1.9	424	2787	59
G - Dark Brown	1000	109	870	21	10.9	87.0	2.1	478	3790	91
AA- Immature-Frozen	106	10	96	0	9.4	90.6	0.0	10	96	0
BB- Plump Green-Frozen	160	22	138	0	13.75	86.25	0.0	46	276	0
CC- Brown-Frozen	1000	159	832	9	15.9	83.2	0.9	450	2369	26

Each Class Represents 1000 Pods

Table 5

GERMINATION RECORD

CLASS— MASTER CHART

Class	BROWN SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
A - Very Immature	148	3	1	144	2.0	.7	97.3	5	2	242
B - Beginning to Fill	190	12	4	174	6.3	2.1	91.6	21	8	310
C - Becoming Plump	425	33	52	340	7.8	12.2	80.0	52	85	565
D - Plump (Green)	500	93	65	342	18.6	13.0	68.4	202	150	762
E - Light Brown	1000	136	77	787	13.6	7.7	78.7	281	154	1600
F - Medium Brown	1000	119	112	769	11.9	11.2	76.9	258	243	1633
G - Dark Brown	1000	106	123	771	10.6	12.3	77.1	187	222	1379
AA- Immature-Frozen	1000	279	22	699	27.9	2.2	69.9	1052	87	2645
BB- Plump Green-Frozen	1000	382	68	550	38.2	6.8	55.0	2280	410	3288
CC- Brown-Frozen	1000	232	143	625	23.2	14.3	62.5	681	427	1852

Each Class Represents 1000 Pods

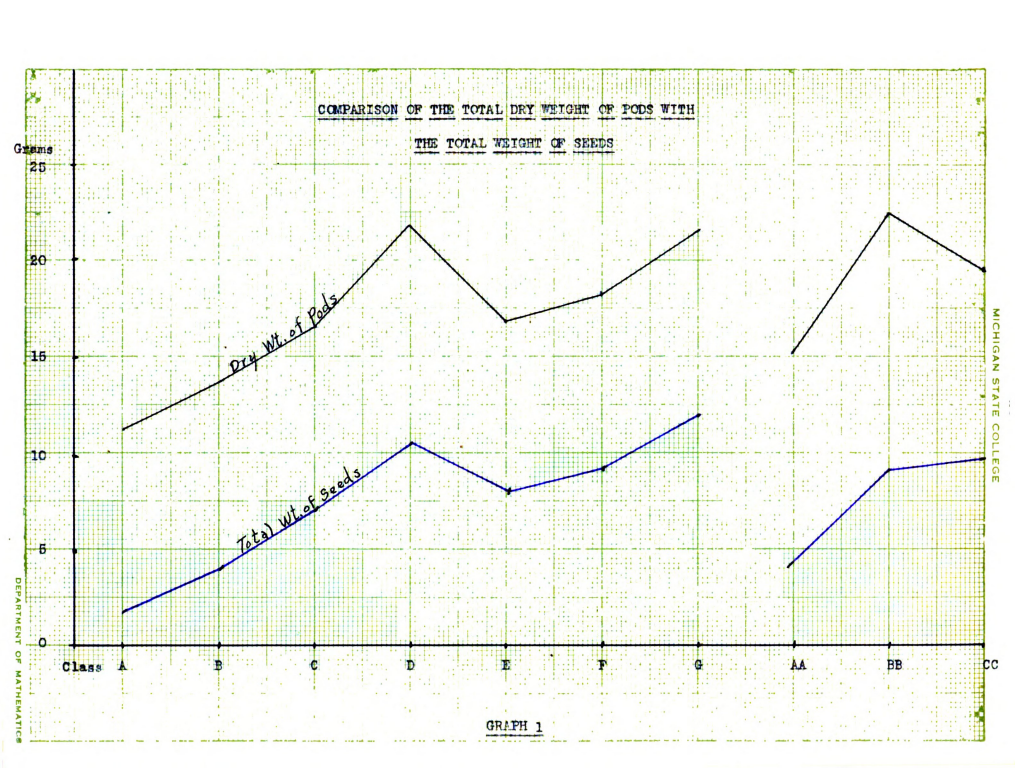
Table 6

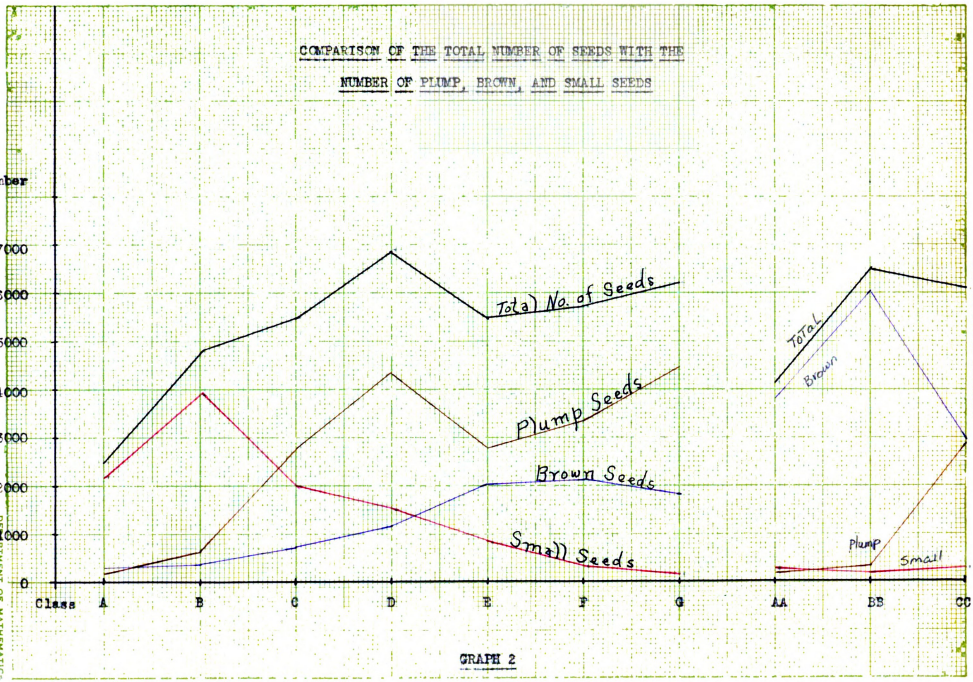
GERMINATION RECORD

CLASS— MASTER CHART

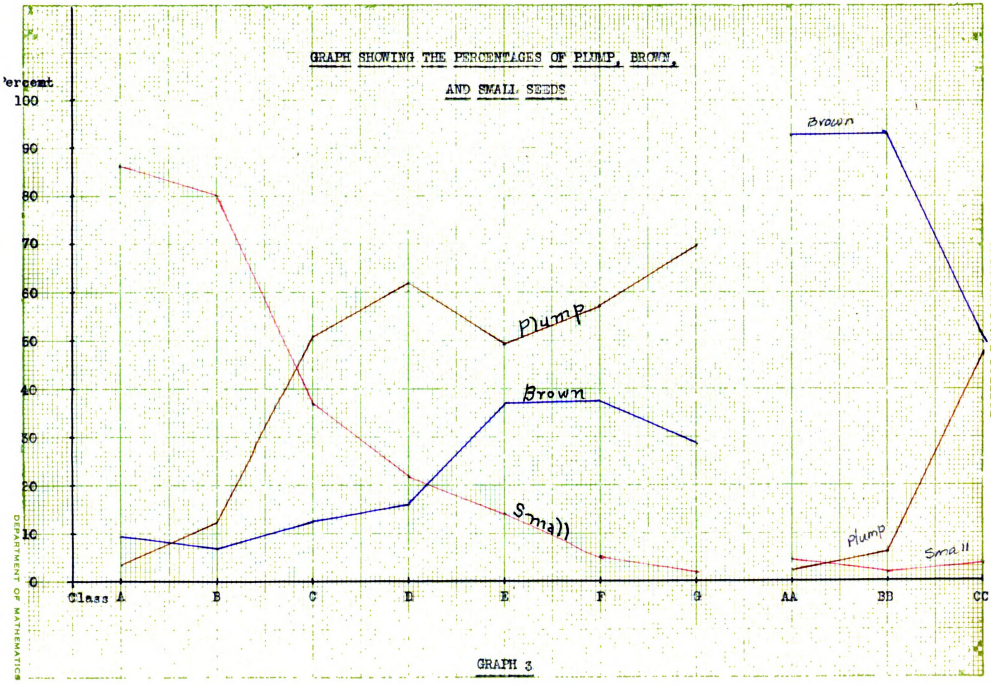
Class	Small Seed									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
A - Very Immature	1000	88	15	897	8.8	1.5	89.7	193	33	1975
B - Beginning to Fill	1000	207	114	679	20.7	11.4	67.9	807	440	2654
C - Becoming Plump	950	314	376	260	33.0	39.6	27.4	672	784	565
D - Plump (Green)	850	215	496	139	25.3	58.3	16.4	374	879	237
E - Light Brown	450	111	179	160	27.7	39.8	35.5	200	308	271
F - Medium Brown	171	55	89	27	32.2	52.0	15.8	95	158	44
G - Dark Brown	99	26	63	10	26.3	63.6	10.1	30	73	11
AA- Immature-Frozen	146	37	36	73	25.3	24.6	50.0	47	45	97
BB- Plump Green-Frozen	102	36	50	16	35.3	49.0	15.7	39	54	18
CC- Brown-Frozen	143	40	86	17	28.0	60.1	11.9	56	129	26

Each Class Represents 1000 Pods

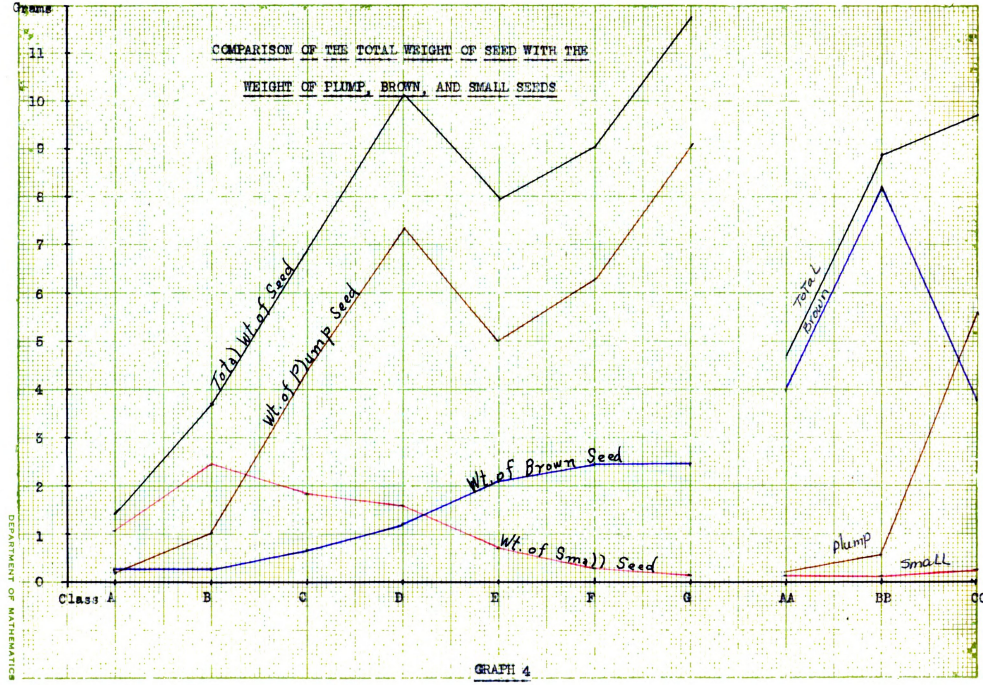

COMPARISON OF THE TOTAL DRY WEIGHT OF PODS WITH
THE TOTAL WEIGHT OF SEEDS
Grams
25
20
15
10
5
0
Dry Wt. of Pods
Total Wt. of Seeds
Class
A
B
C
D
E
F
G
AA
BB
CC
GRAPH 1
DEPARTMENT OF MATHEMATICS
MICHIGAN STATE COLLEGE



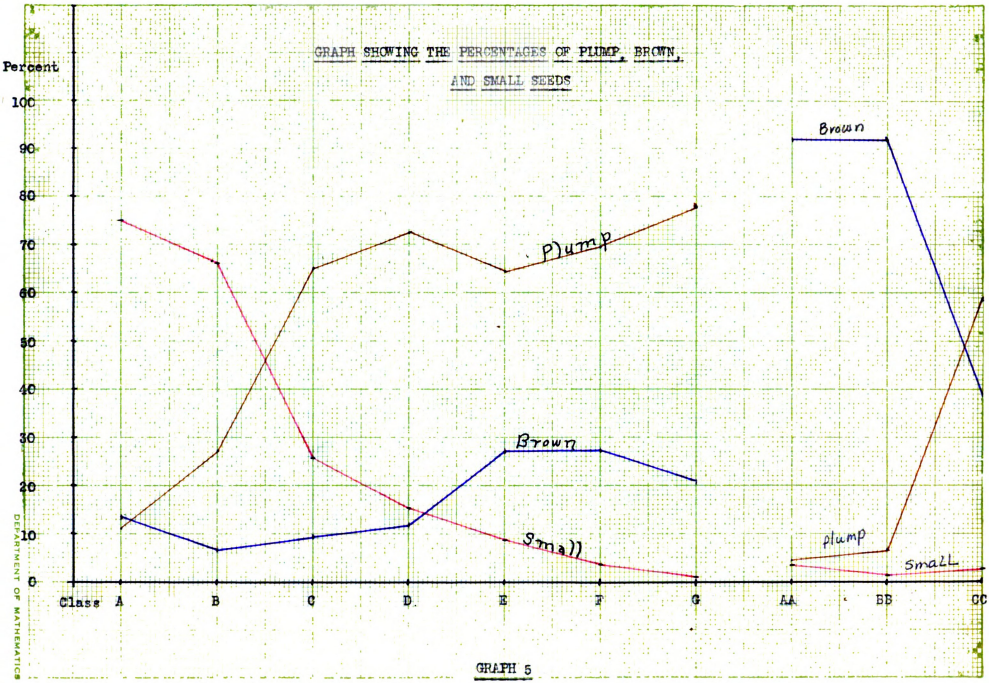
GRAPH 2



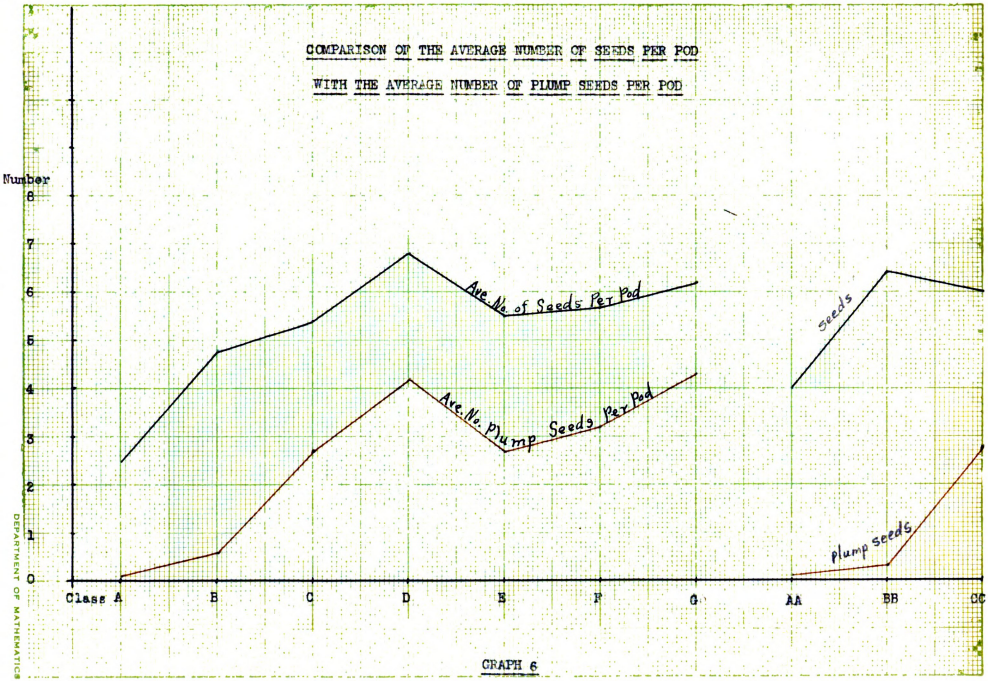
GRAPH 3



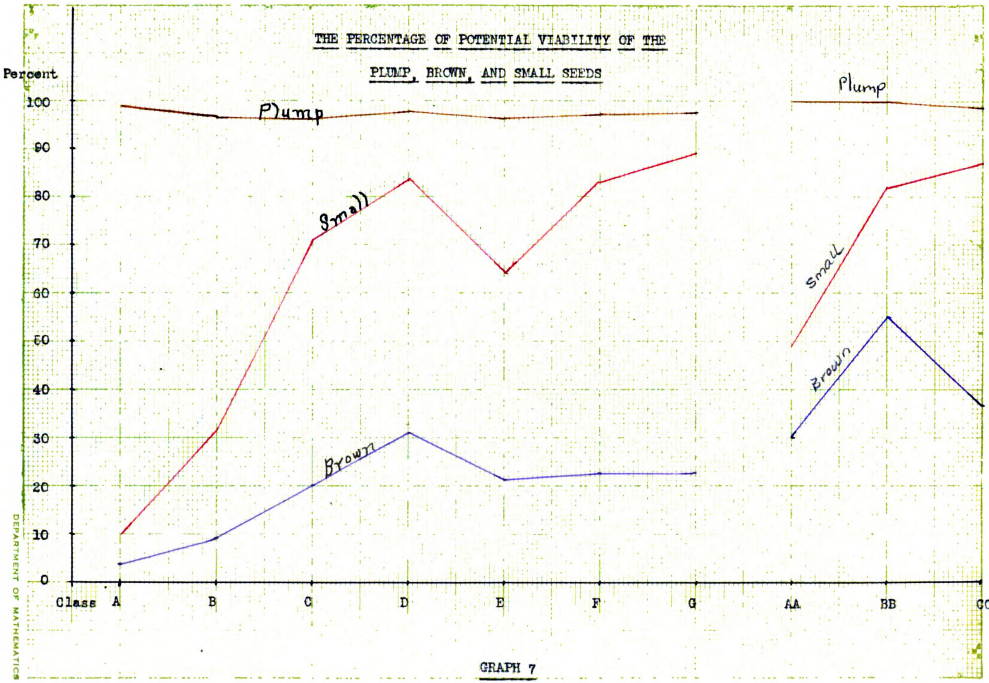
GRAPH 4



GRAPH 5

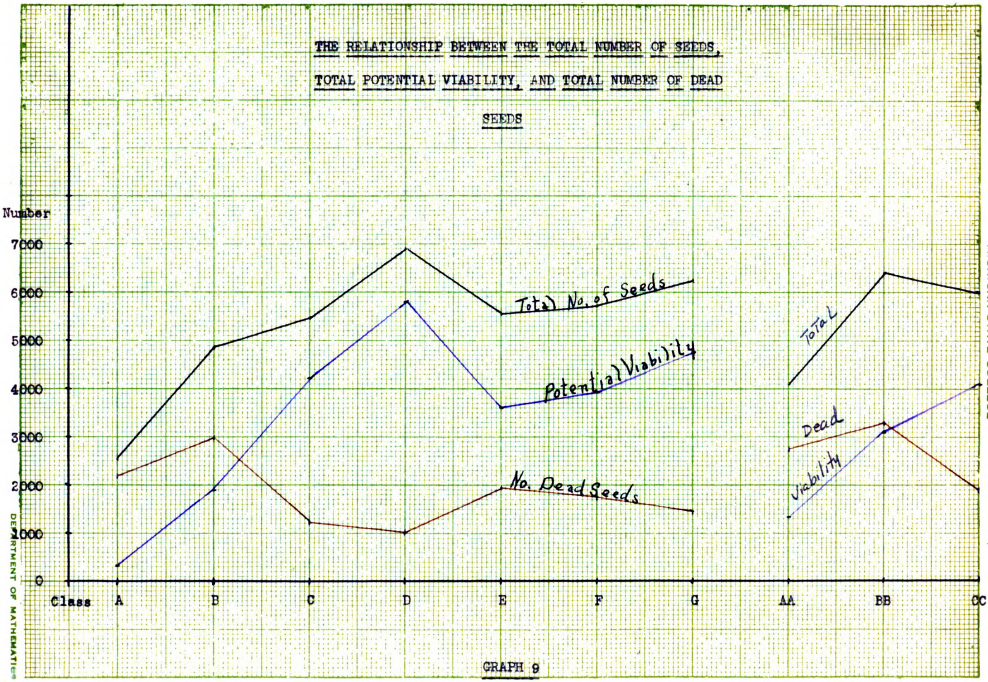


GRAPH 6

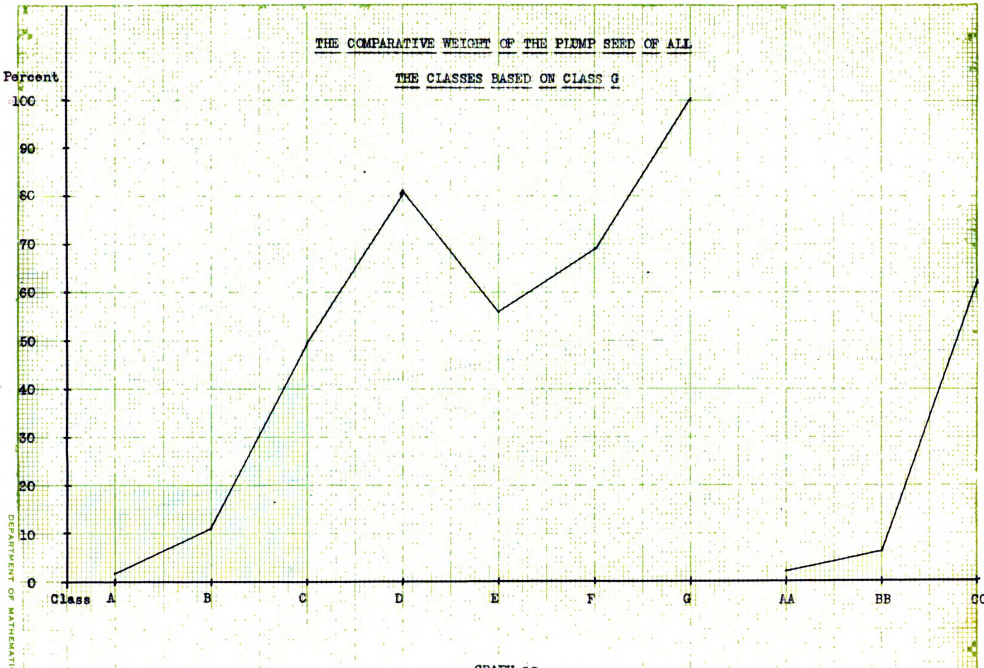


GRAPH 7

GRAPH 8

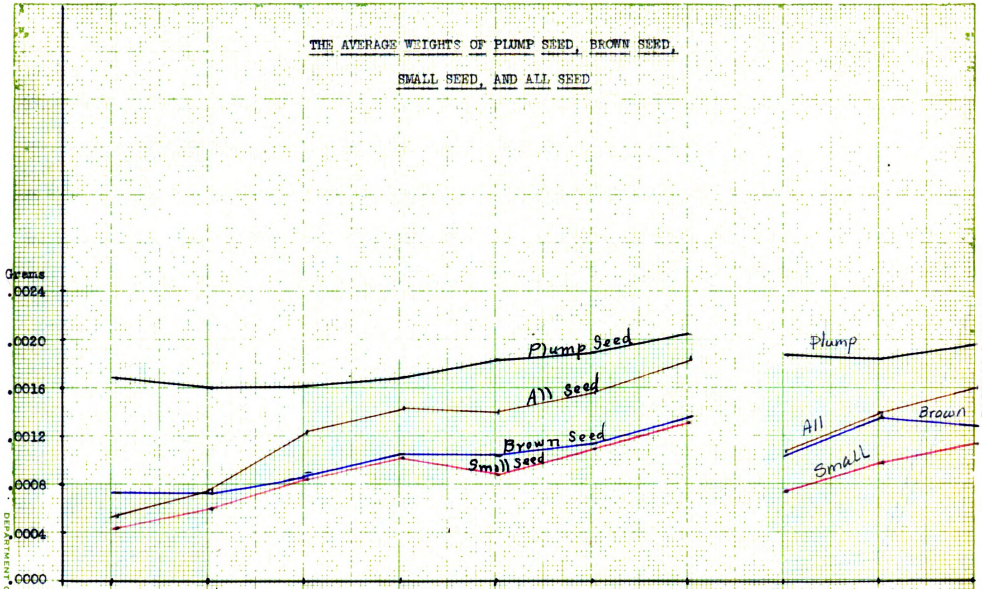


GRAPH 9

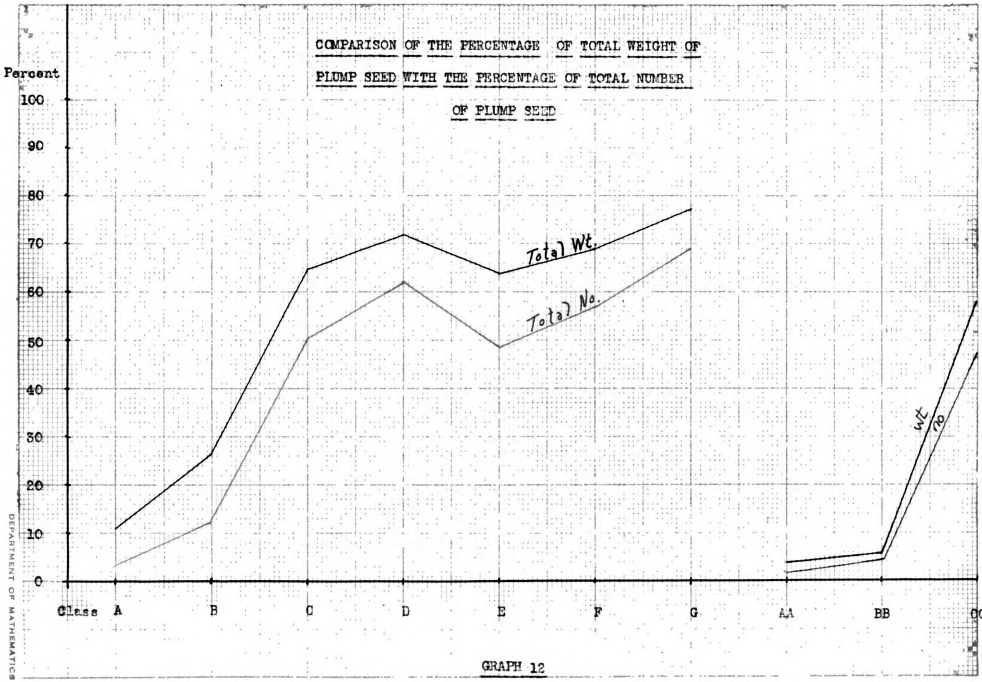


GRAPH 10

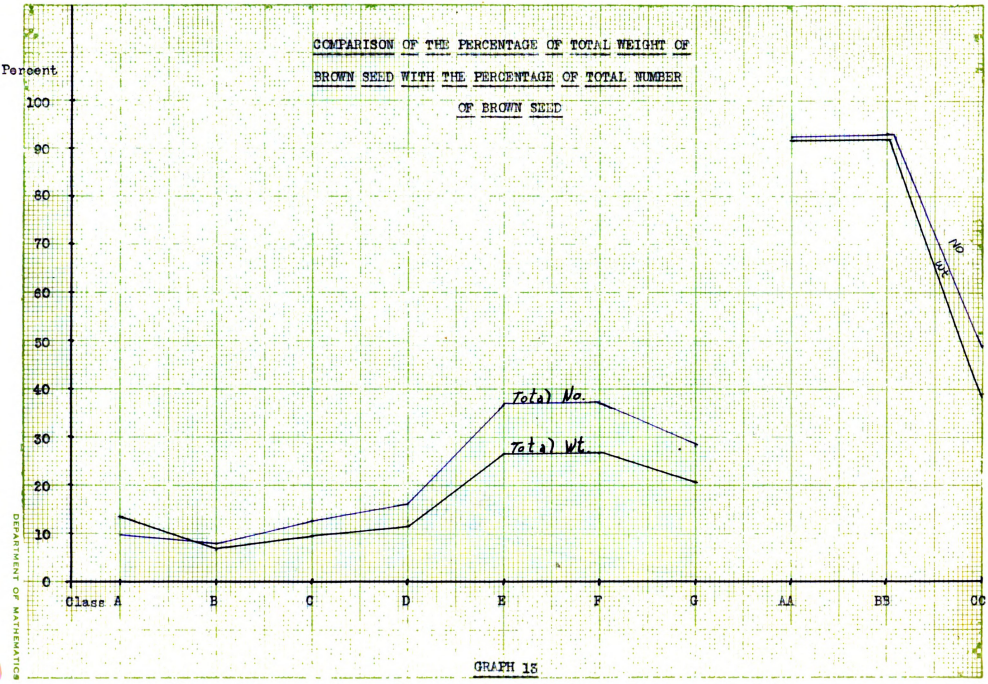
THE AVERAGE WEIGHTS OF PLUMP SEED, BROWN SEED, SMALL SEED, AND ALL SEED



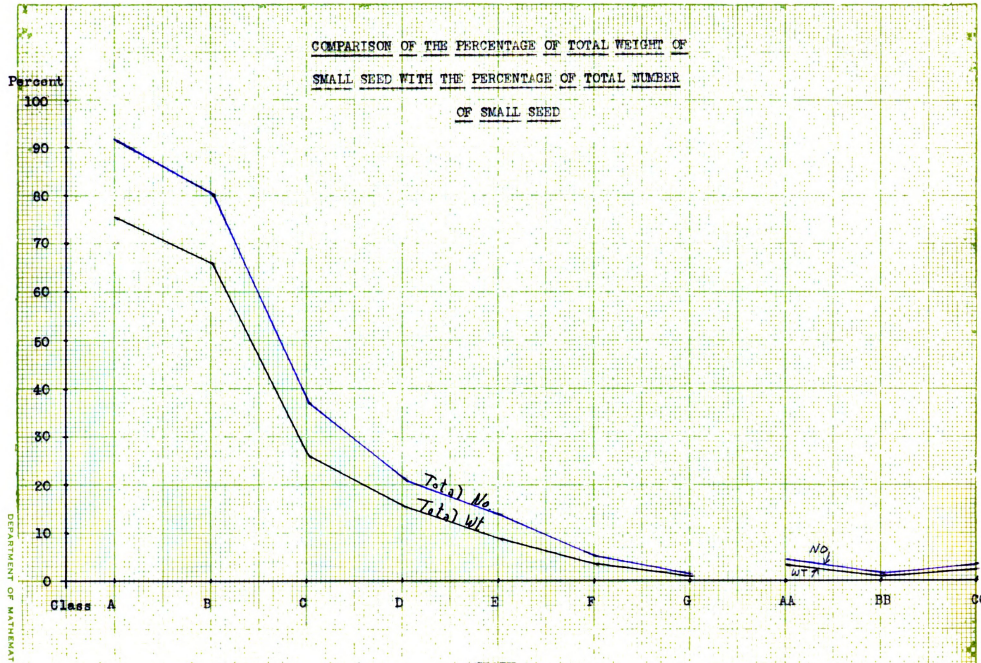
GRAPH 11



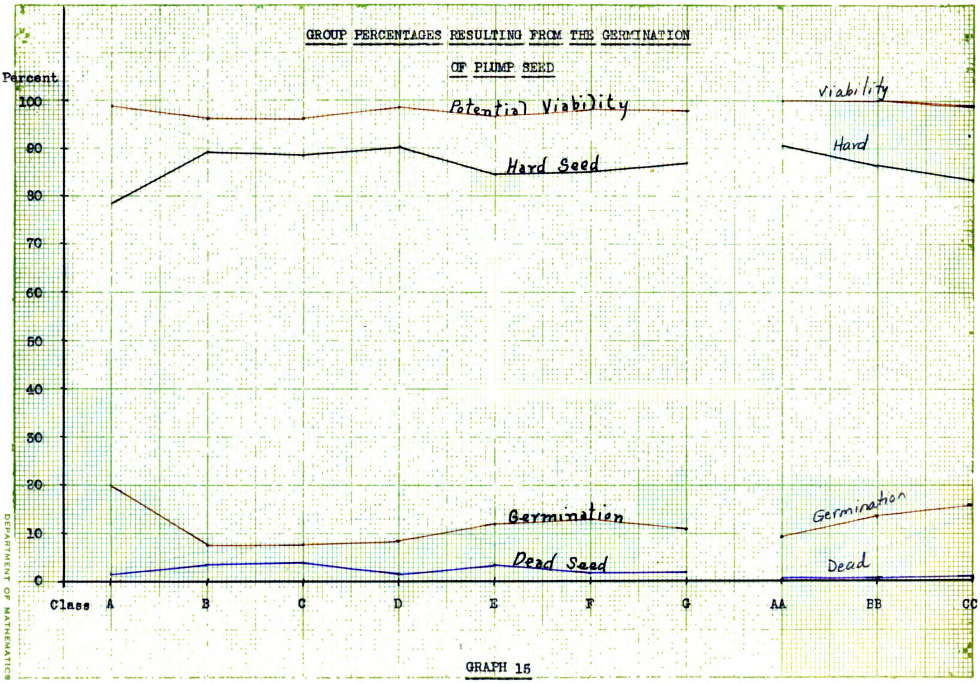
GRAPH 12



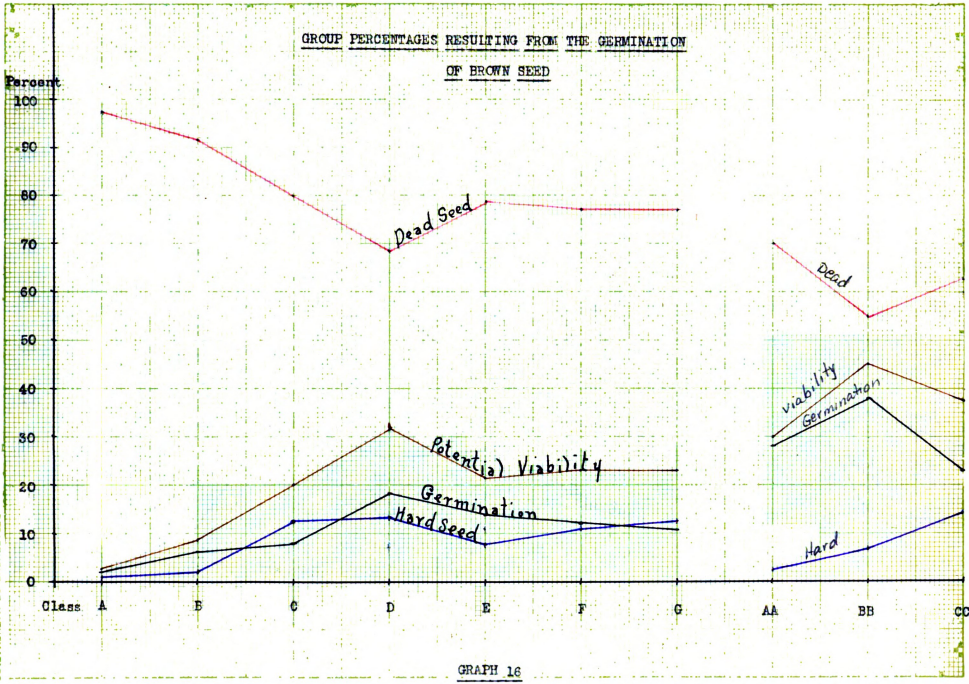
GRAPH 15



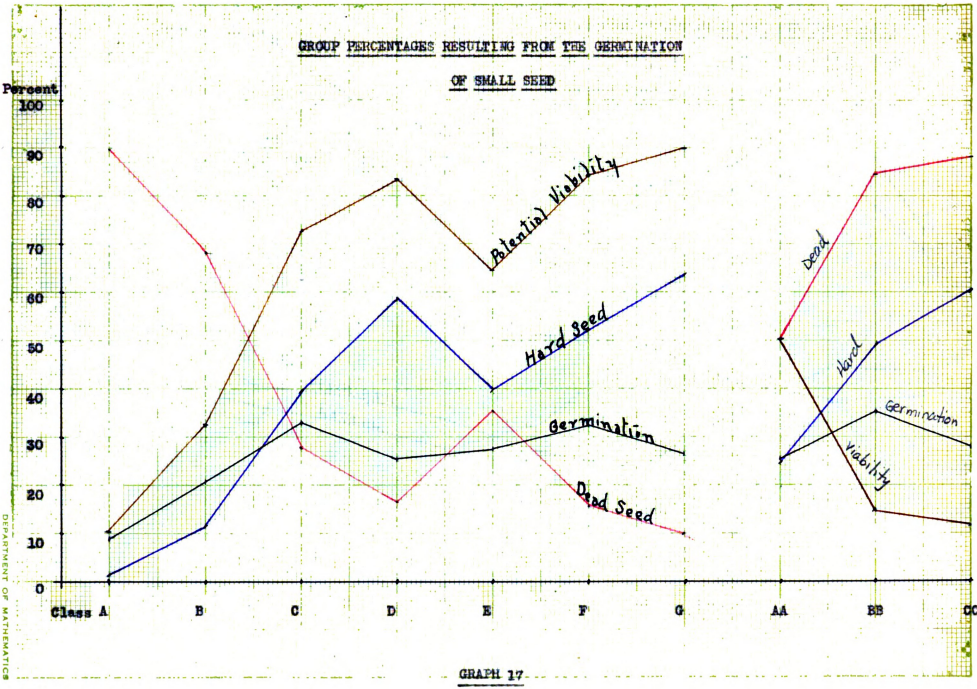
GRAPH 14



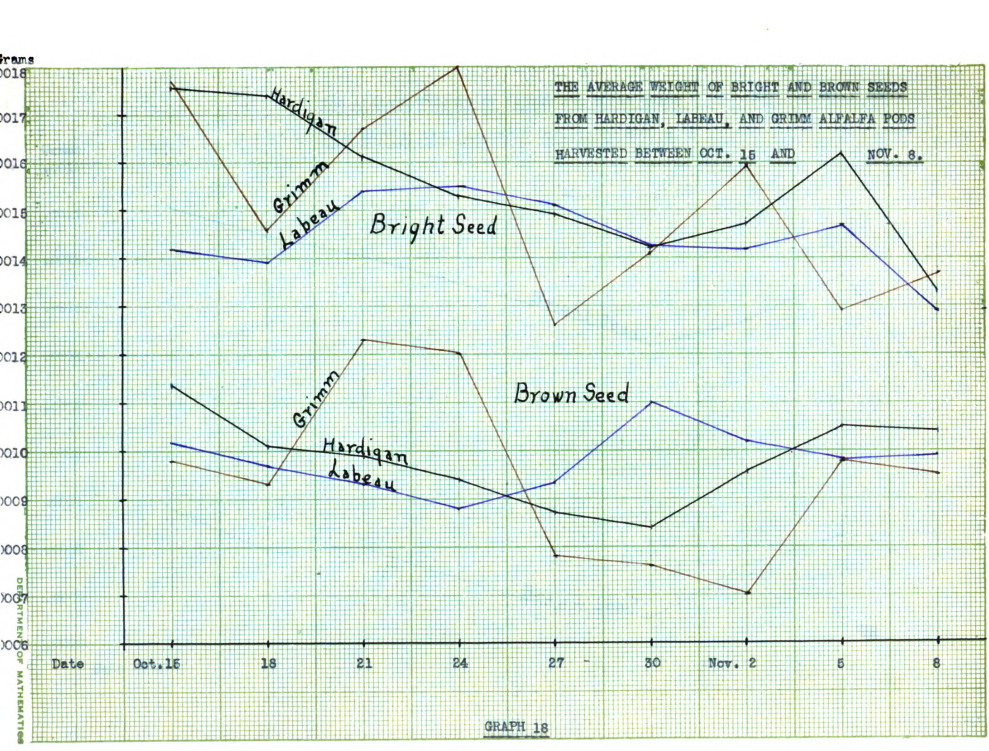
GRAPH 15



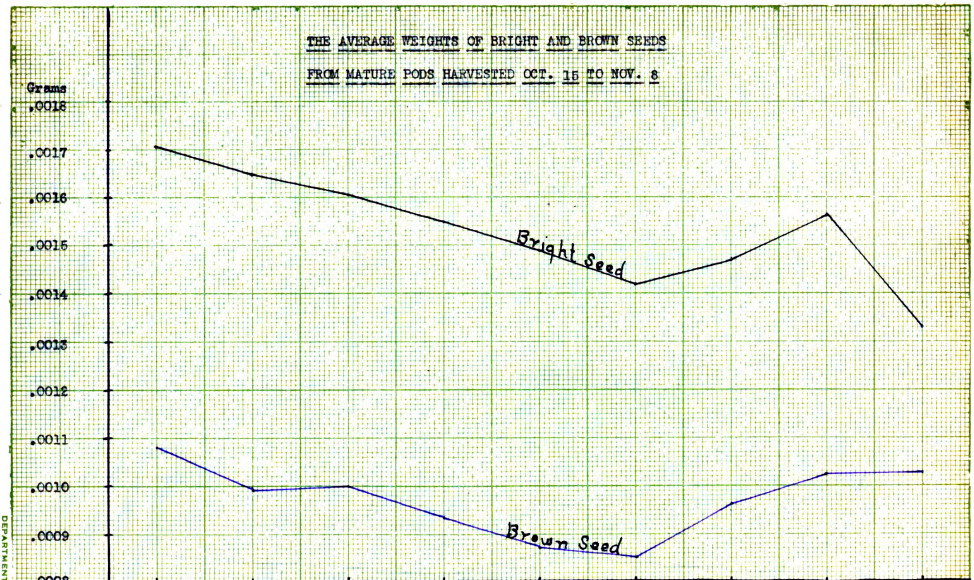
GRAPH 16



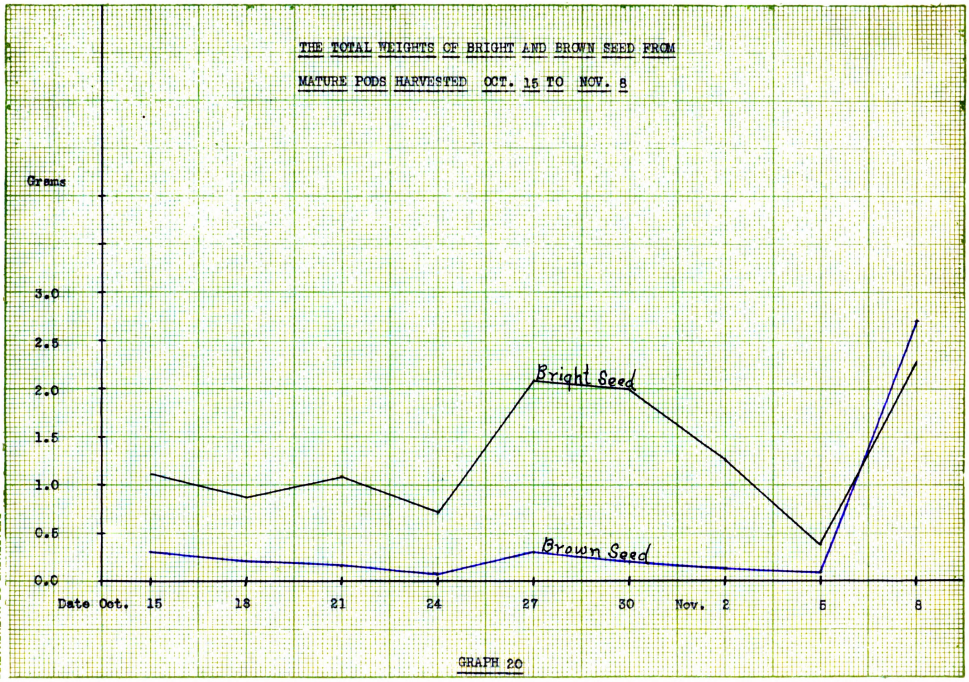
GRAPH 17


THE AVERAGE WEIGHT OF BRIGHT AND BROWN SEEDS
FROM HARDIGAN, LABEAU, AND GRIMM ALFALFA PODS
HARVESTED BETWEEN OCT. 15 AND NOV. 8.
Bright Seed
Hardigan
Grimm
Labeau
Brown Seed
Grimm
Hardigan
Labeau
Date
Oct. 15
18
21
24
27
30
Nov. 2
5
8
MICHIGAN STATE COLLEGE
DEPARTMENT OF MATHEMATICS

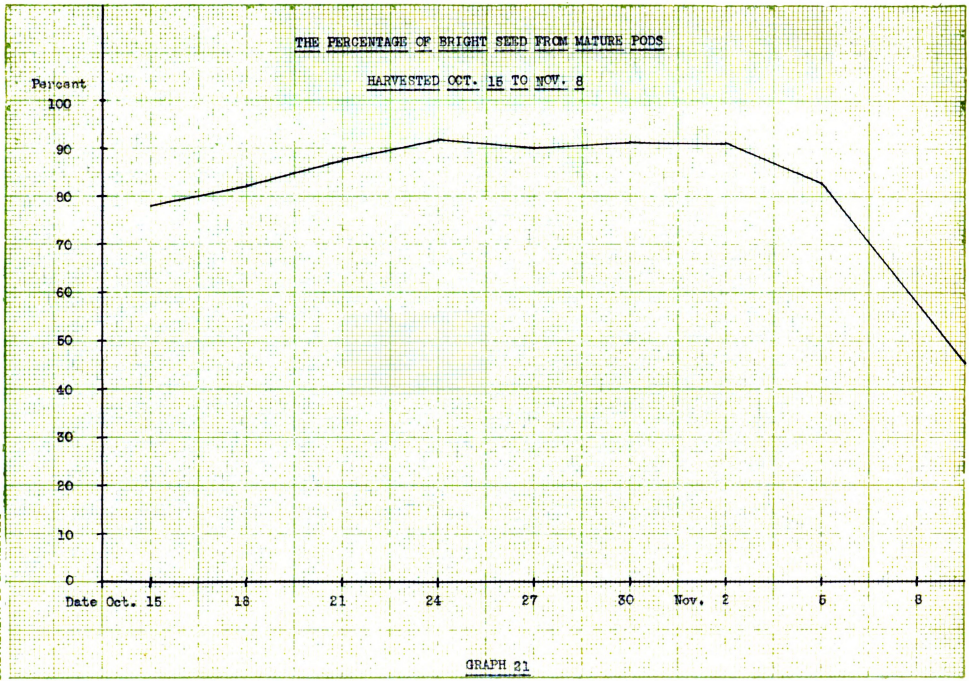
GRAPH 18



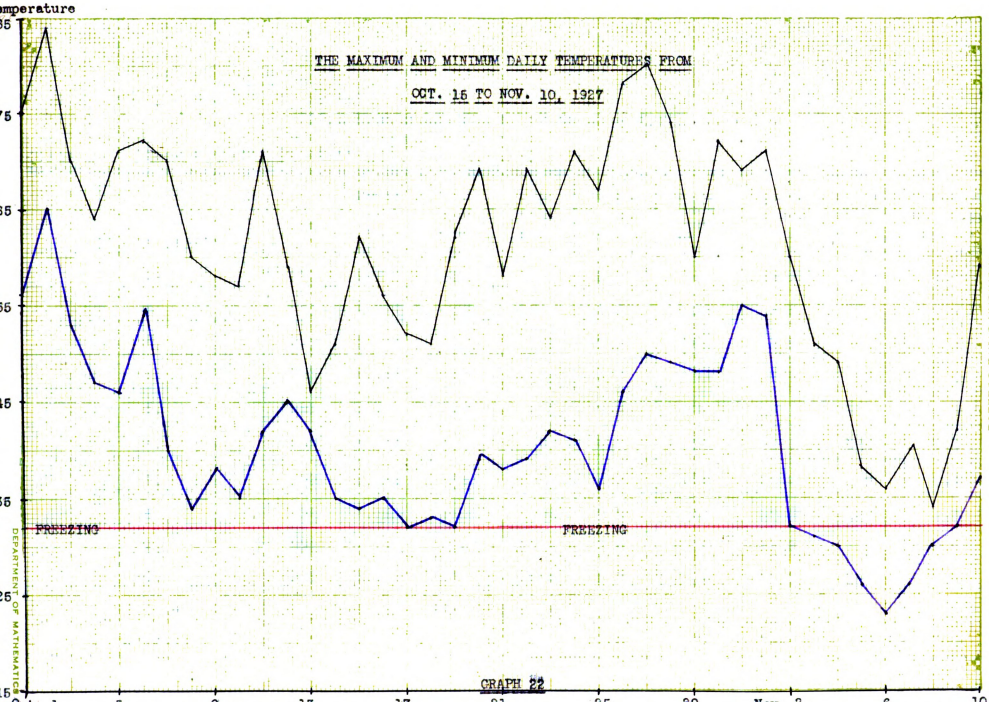
GRAPH 19



GRAPH 20



GRAPH 21


mperature
35
75
65
55
45
35
25
15
THE MAXIMUM AND MINIMUM DAILY TEMPERATURES FROM
OCT. 15 TO NOV. 10, 1927
FREEZING
FREEZING
Oct. 1
5
9
13
17
21
25
29
Nov. 2
6
10
DEPARTMENT OF MATHEMATICS
MICHIGAN STATE COLLEGE

GRAPH 22

Table 7

TOTAL NUMBER AND WEIGHT OF SEEDS - VIABILITY - ETC

CLASS Class A - Very Immature

No. of Sample	No. Pods	Dry Wt. of Pods	Total No. of Seeds	Total Wt. of Seeds	Av. No. Seeds Per Pod	Av. No. Plump Seeds Per Pod	% Total Potential Viability	% Potential Viability of Plump Seeds	Comparative Wt. of Plump Seed (%)
1.	100	1.226	216	.1366	2.1	.01	20.8	100	3.5
2.	100	1.089	263	.1264	2.6	.05	6.8	100	.9
3.	100	1.043	224	.1275	2.2	.09	14.3	89	1.7
4.	100	1.041	208	.1093	2.0	.03	5.8	100	.5
5.	100	1.106	247	.1265	2.4	.06	10.1	100	.9
6.	100	1.025	293	.1657	2.9	.07	11.6	100	1.1
7.	100	1.079	294	.1711	2.9	.16	17.0	100	2.7
8.	100	1.094	264	.1604	2.6	.14	17.0	100	2.8
9.	100	1.111	265	.1563	2.6	.12	12.5	100	2.2
10.	100	1.184	271	.1493	2.7	.06	11.1	100	1.3
Totals	1000	10.998	2545	1.4291					
Averages					2.5	.09	12.7	98.7	1.8

Table 8

TOTAL NUMBER AND WEIGHT OF SEEDS - VIABILITY - ETC

CLASS Class B - Pods Beginning to Fill

No. of Sample	No. Pods	Dry Wt. of Pods	Total No. of Seeds	Total Wt. of Seeds	Av. No. Seeds Per Pod	Av. No. Plump Seeds Per Pod	% Total Potential Viability	% Potential Viability of Plump Seeds	Comparative Wt. of Plump Seed (%)
1.	100	1.437	495	.3898	4.9	.73	35.8	96	13.4
2.	100	1.322	495	.3695	4.9	.49	41.0	88	7.9
3.	100	1.339	510	.3781	5.1	.63	33.5	100	11.3
4.	100	1.390	500	.3634	5.0	.63	31.2	96	10.9
5.	100	1.313	485	.3675	4.8	.68	40.6	96	11.8
6.	100	1.333	443	.3670	4.4	.64	48.8	100	11.7
7.	100	1.235	470	.3414	4.7	.60	38.9	100	10.2
8.	100	1.310	464	.3511	4.6	.58	35.1	100	10.5
9.	100	1.338	466	.3546	4.6	.50	37.3	100	9.0
10.	100	1.411	537	.4147	5.3	.77	44.9	92	13.3
Totals	1000	13.428	4865	3.6971					
Averages					4.8	.62	38.7	96.6	11.0

Table 9

TOTAL NUMBER AND WEIGHT OF SEEDS - VIABILITY - ETC

CLASS Class C - Pods Becoming Plump

No. of Sample	No. Pods	Dry Wt. of Pods	Total No. of Seeds	Total Wt. of Seeds	Av. No. Seeds Per Pod	Av. No. Plump Seeds Per Pod	% Total Potential Viability	% Potential Viability of Plump Seeds	Comparative Wt. of Plump Seed (%)
1.	100	1.847	593	.7409	5.9	2.7	70.3	96	51.2
2.	100	1.657	555	.6986	5.5	2.7	68.6	92	48.3
3.	100	1.599	557	.6544	5.5	2.6	78.3	97	43.6
4.	100	1.514	510	.6686	5.1	3.1	74.9	94	55.1
5.	100	1.651	545	.7251	5.4	3.1	86.4	97	56.1
6.	100	1.701	585	.7432	5.8	3.0	78.5	98	55.3
7.	100	1.515	521	.6700	5.2	2.5	75.6	97	48.1
8.	100	1.502	536	.6138	5.3	2.0	78.7	99	36.5
9.	100	1.512	520	.6362	5.2	2.4	77.7	93	42.3
10.	100	1.744	553	.7485	5.5	2.9	85.7	99	55.1
Totals	1000	16.242	5475	6.8993					
Averages					5.4	2.7	77.6	96.2	49.7

Table 10

TOTAL NUMBER AND WEIGHT OF SEEDS - VIABILITY - ETC

CLASS Class D - Plump (Green) Pods

No. of Sample	No. Pods	Dry Wt. of Pods	Total No. of Seeds	Total Wt. of Seeds	Av. No. Seeds Per Pod	Av. No. Plump Seeds Per Pod	% Total Potential Viability	% Potential Viability of Plump Seeds	Comparative Wt. of Plump Seed (%)
1.	100	2.205	691	1.0202	6.9	4.0	73.4	96	77.3
2.	100	2.112	676	.9843	6.7	3.8	83.9	99	72.6
3.	100	2.198	680	1.0314	6.8	4.5	86.9	98	86.6
4.	100	2.068	671	.9756	6.7	3.8	81.8	98	73.0
5.	100	2.176	695	1.0287	6.9	4.1	87.3	100	80.8
6.	100	2.127	730	1.0253	7.3	4.4	89.9	100	80.6
7.	100	2.124	691	1.0303	6.9	4.4	80.5	97	82.9
8.	100	2.099	691	.9931	6.9	4.2	85.5	100	79.7
9.	100	2.200	686	1.0666	6.8	5.0	86.9	98	96.0
10.	100	2.114	675	1.0027	6.7	4.2	89.3	99	81.2
Totals	1000	21.423	6886	10.1582					
Averages					6.8	4.2	84.6	98.5	81.1

Table 11

TOTAL NUMBER AND WEIGHT OF SEEDS - VIABILITY - ETC

CLASS Class E - Light Brown Pods

No. of Sample	No. Pods	Dry Wt. of Pods	Total No. of Seeds	Total Wt. of Seeds	Av. No. Seeds Per Pod	Av. No. Plump Seeds Per Pod	% Total Potential Viability	% Potential Viability of Plump Seeds	Comparative Wt. of Plump Seed (%)
1.	100	1.675	539	.7793	5.3	2.7	67.9	97	56.5
2.	100	1.740	588	.8055	5.8	2.6	60.7	98	55.5
3.	100	1.642	550	.7774	5.5	2.6	65.5	98	54.2
4.	100	1.550	522	.7173	5.2	2.2	58.4	95	44.6
5.	100	1.594	508	.7311	5.0	2.6	66.1	98	54.0
6.	100	1.635	538	.7729	5.3	2.8	62.6	94	57.4
7.	100	1.689	585	.8201	5.8	2.7	66.8	98	55.1
8.	100	1.681	565	.7677	5.6	2.4	57.0	94	49.5
9.	100	1.702	555	.8083	5.5	2.8	69.0	97	59.0
10.	100	1.864	608	.9073	6.0	3.5	72.2	97	73.2
Totals	1000	16.772	5558	7.8869					
Averages					5.5	2.7	64.7	96.6	55.9

Table 12

TOTAL NUMBER AND WEIGHT OF SEEDS - VIABILITY - ETC

CLASS Class F - Medium Brown Pods

No. of Sample	No. Pods	Dry Wt. of Pods	Total No. of Seeds	Total Wt. of Seeds	Av. No. Seeds Per Pod	Av. No. Plump Seeds Per Pod	% Total Potential Viability	% Potential Viability of Plump Seeds	Comparative Wt. of Plump Seed (%)
1.	100	1.867	607	.9563	6.0	3.4	73.0	99	73.7
2.	100	1.846	580	.9403	5.8	3.2	68.8	99	69.1
3.	100	1.816	585	.9139	5.8	3.4	69.4	96	71.2
4.	100	1.668	507	.8120	5.0	3.0	69.0	97	64.0
5.	100	1.786	554	.8742	5.5	2.9	68.8	97	62.7
6.	100	1.984	624	.9728	6.2	3.1	63.8	97	69.1
7.	100	1.819	555	.9227	5.5	3.5	70.3	100	75.1
8.	100	1.721	539	.8302	5.3	2.9	66.0	98	60.1
9.	100	1.792	551	.8768	5.5	3.1	71.1	98	66.7
10.	100	1.890	599	.9662	5.9	3.7	75.1	100	78.7
Totals	1000	18.189	5701	9.0654					
Averages					5.7	3.2	69.5	98.1	69.0

Table 13

TOTAL NUMBER AND WEIGHT OF SEEDS - VIABILITY - ETC

CLASS Class G - Dark Brown Pods

No. of Sample	No. Pods	Dry Wt. of Pods	Total No. of Seeds	Total Wt. of Seeds	Av. No. Seeds Per Pod	Av. No. Plump Seeds Per Pod	% Total Potential Viability	% Potential Viability of Plump Seeds	Comparative Wt. of Plump Seed (%)
1.	100	2.076	612	1.1611	6.1	4.5	79.9	98	103.2
2.	100	2.123	638	1.1500	6.3	4.2	73.2	99	95.7
3.	100	2.069	604	1.1220	6.0	4.3	77.5	99	98.1
4.	100	2.305	651	1.2204	6.5	4.7	80.5	97	106.0
5.	100	2.274	642	1.1871	6.4	4.3	74.0	95	99.8
6.	100	2.162	636	1.1450	6.3	4.4	75.8	99	98.4
7.	100	2.265	624	1.2007	6.2	4.6	80.0	99	106.2
8.	100	2.045	615	1.1108	6.1	4.1	75.6	97	93.0
9.	100	2.156	623	1.1150	6.2	4.0	71.6	98	89.7
10.	100	2.157	616	1.2958	6.1	4.0	75.6	98	109.9
Totals	1000	21.632	6261	11.7079					
Averages					6.2	4.3	76.4	97.9	100.0

Table 14

TOTAL NUMBER AND WEIGHT OF SEEDS - VIABILITY - ETC

CLASS Class AA - Immature-Frozen

No. of Sample	No. Pods	Dry Wt. of Pods	Total No. of Seeds	Total Wt. of Seeds	Av. No. Seeds Per Pod	Av. No. Plump Seeds Per Pod	% Total Potential Viability	% Potential Viability of Plump Seeds	Comparative Wt. of Plump Seed (%)
1.	100	1.547	450	.4399	4.5	.09	31.1	100	1.8
2.	100	1.414	392	.3781	3.9	.02	24.5	100	.3
3.	100	1.457	387	.3941	3.8	.03	29.5	100	.8
4.	100	1.576	460	.5005	4.6	.10	30.7	100	2.4
5.	100	1.335	354	.3463	3.5	.11	37.9	100	2.2
6.	100	1.535	393	.4359	3.9	.20	30.8	100	5.1
7.	100	1.532	367	.4335	3.6	.10	33.5	100	1.8
8.	100	1.541	405	.4428	4.0	.12	34.8	100	2.2
9.	100	1.576	410	.4673	4.1	.10	37.8	100	2.0
10.	100	1.792	461	.5303	4.6	.19	37.3	100	3.4
Totals	1000	15.305	4079	4.3687					
Averages					4.0	.10	32.8	100	2.2

Table 15

TOTAL NUMBER AND WEIGHT OF SEEDS - VIABILITY - ETC

CLASS Class BB - Plump (Green) Frozen

No. of Sample	No. Pods	Dry Wt. of Pods	Total No. of Seeds	Total Wt. of Seeds	Av. No. Seeds Per Pod	Av. No. Plump Seeds Per Pod	% Total Potential Viability	% Potential Viability of Plump Seeds	Comparative Wt. of Plump Seed (%)
1.	100	2.252	669	.8760	6.6	.19	41.1	100	3.6
2.	100	2.321	653	.9125	6.5	.32	44.4	100	6.6
3.	100	2.372	676	.9362	6.7	.33	45.9	100	6.0
4.	100	2.198	635	.8988	6.3	.21	48.0	100	3.9
5.	100	1.983	594	.7658	5.9	.24	32.5	100	5.0
6.	100	2.337	670	.9593	6.7	.22	56.3	100	4.3
7.	100	2.446	657	.9580	6.5	.37	51.8	100	8.0
8.	100	2.151	605	.8568	6.0	.48	49.6	100	10.2
9.	100	2.122	608	.8628	6.0	.37	63.8	100	7.1
10.	100	2.344	644	.9195	6.4	.49	49.7	100	10.1
Totals	1000	22.526	6411	8.9457					
Averages					6.4	.32	48.4	100	6.5

Table 16

TOTAL NUMBER AND WEIGHT OF SEEDS - VIABILITY - ETC

CLASS Class CC - Brown-Frozen

No. of Sample	No. Pods	Dry Wt. of Pods	Total No. of Seeds	Total Wt. of Seeds	Av. No. Seeds Per Pod	Av. No. Plump Seeds Per Pod	% Total Potential Viability	% Potential Viability of Plump Seeds	Comparative Wt. of Plump Seed (%)
1.	100	2.230	652	1.0757	6.5	3.6	72.7	99	79.1
2.	100	2.087	614	1.0498	6.1	3.2	75.1	98	73.0
3.	100	2.024	598	.9259	5.9	2.5	62.0	100	55.8
4.	100	1.906	602	.9629	6.0	2.9	68.3	99	63.4
5.	100	1.893	539	.8745	5.3	2.1	66.4	99	46.8
6.	100	1.876	594	.9180	5.9	2.3	63.6	99	49.7
7.	100	1.882	579	.9299	5.7	2.6	70.3	99	56.1
8.	100	1.919	612	.9700	6.1	3.0	69.6	100	64.5
9.	100	1.850	583	.9335	5.8	2.8	69.0	99	62.7
10.	100	2.139	654	1.0623	6.5	3.1	66.5	99	69.9
Totals	1000	19.806	6027	9.7025					
Averages					6.0	2.8	68.2	99.1	62.1

Table 17

AVERAGE WEIGHT OF SEED

CLASS ..... Class A - Very Immature Pods .....

No. of Sample	Plump Seeds	Brown Seeds	Small Seeds	All Seeds
1.	.001853	.000690	.000518	.000632
2.	.001560	.000622	.000453	.000480
3.	.001755	.000677	.000505	.000524
4.	.001533	.000768	.000488	.000525
5.	.001433	.000600	.000484	.000512
6.	.001471	.000848	.000489	.000565
7.	.001525	.000725	.000499	.000582
8.	.001842	.000865	.000474	.000607
9.	.001658	.000748	.000498	.000591
10.	.002066	.000888	.000479	.000550
Averages	.001692	.000779	.000488	.000561

Each Sample Represents the Seed from 100 Pods

Table 18

AVERAGE WEIGHT OF SEED

CLASS ..... Class B - Pods Beginning to Fill

No. of Sample	Plump Seeds	Brown Seeds	Small Seeds	All Seeds
1.	.001674	.000791	.000619	.000787
2.	.001471	.000604	.000673	.000746
3.	.001631	.000655	.000614	.000741
4.	.001568	.000727	.000597	.000726
5.	.001583	.000645	.000621	.000757
6.	.001657	.000848	.000667	.000828
7.	.001548	.000725	.000594	.000726
8.	.001651	.000865	.000602	.000756
9.	.001644	.000748	.000644	.000760
10.	.001575	.000888	.000623	.000772
Averages	.001603	.000753	.000625	.000759

Each Sample Represents the Seed from 100 Pods

Table 19

AVERAGE WEIGHT OF SEED

CLASS Class C - Pods Becoming Plump

No. of Sample	Plump Seeds	Brown Seeds	Small Seeds	All Seeds
1.	.001699	.000947	.000843	.001249
2.	.001599	.000914	.000930	.001258
3.	.001509	.000821	.000890	.001174
4.	.001594	.000802	.000892	.001310
5.	.001625	.000985	.000915	.001330
6.	.001644	.000998	.000810	.001270
7.	.001694	.000991	.000854	.001285
8.	.001588	.000862	.000861	.001143
9.	.001565	.000975	.000884	.001223
10.	.001710	.000948	.000952	.001353
Averages	.001624	.000922	.000880	.001260

Each Sample Represents the Seed from 100 Pods

Table 20

AVERAGE WEIGHT OF SEED

CLASS Class D - Plump Green Pods

No. of Sample	Plump Seeds	Brown Seeds	Small Seeds	All Seeds
1.	.001727	.001172	.001076	.001476
2.	.001733	.001103	.001093	.001456
3.	.001727	.001044	.001126	.001516
4.	.001716	.001146	.001052	.001453
5.	.001761	.001131	.001020	.001480
6.	.001642	.000970	.001065	.001404
7.	.001710	.001144	.001057	.001491
8.	.001701	.000943	.001068	.001437
9.	.001746	.001075	.001010	.001554
10.	.001754	.001046	.001035	.001485
Averages	.001721	.001081	.001060	.001475

Each Sample Represents the Seed from 100 Pods

Table 21

AVERAGE WEIGHT OF SEED

CLASS Class E - Light Brown Pods

No. of Sample	Plump Seeds	Brown Seeds	Small Seeds	All Seeds
1.	.001889	.001025	.000915	.001445
2.	.001875	.000973	.000865	.001369
3.	.001868	.001035	.001001	.001413
4.	.001780	.001095	.000942	.001374
5.	.001875	.001001	.000900	.001439
6.	.001830	.001068	.000794	.001436
7.	.001821	.001047	.000972	.001401
8.	.001832	.001055	.000805	.001358
9.	.001875	.001057	.000923	.001456
10.	.001866	.001037	.000848	.001492
Averages	.001853	.001034	.000893	.001419

Each Sample Represents the Seed from 100 Pods

Table 22

AVERAGE WEIGHT OF SEED

CLASS Class F - Medium Brown Pods

No. of Sample	Plump Seeds	Brown Seeds	Small Seeds	All Seeds
1.	.001921	.001118	.001023	.001575
2.	.001926	.001232	.001200	.001621
3.	.001882	.001085	.001238	.001562
4.	.001909	.001139	.001116	.001601
5.	.001907	.001206	.001075	.001577
6.	.001988	.001118	.001112	.001558
7.	.001946	.001175	.001161	.001662
8.	.001854	.001174	.001034	.001540
9.	.001938	.001137	.001125	.001591
10.	.001924	.001091	.001144	.001613
Averages	.001920	.001148	.001124	.001590

Table 23

AVERAGE WEIGHT OF SEED

CLASS Class G - Dark Brown Pods

No. of Sample	Plump Seeds	Brown Seeds	Small Seeds	All Seeds
1.	.002045	.001397	.001828	.001897
2.	.002058	.001297	.001345	.001802
3.	.002056	.001363	.001163	.001857
4.	.002047	.001441	.001300	.001874
5.	.002077	.001362	.001344	.001849
6.	.002019	.001300	.001200	.001800
7.	.002085	.001460	.001400	.001924
8.	.002019	.001354	.001250	.001806
9.	.002014	.001373	.001343	.001789
10.	.002456	.001442	.001057	.002103
Averages	.002086	.001376	.001328	.001869

Each Sample Represents the Seed from 100 Pods

Table 24

AVERAGE WEIGHT OF SEED

CLASS Class AA - Immature-Frozen Pods

No. of Sample	Plump Seeds	Brown Seeds	Small Seeds	All Seeds
1.	.001811	.000979	.000761	.000977
2.	.001500	.000981	.000619	.000964
3.	.002366	.001012	.000911	.001018
4.	.002140	.001067	.000780	.001088
5.	.001809	.000953	.000871	.000978
6.	.002340	.001057	.000753	.001109
7.	.001640	.001193	.000791	.001181
8.	.001650	.001097	.000713	.001093
9.	.001780	.001147	.000722	.001139
10.	.001642	.001139	.000864	.001150
Averages	.001883	.001063	.000765	.001071

Each Sample Represents the Seed from 100 Pods

Table 25

AVERAGE WEIGHT OF SEED

CLASS Class BB - Plump Green-Frozen Pods

No. of Sample	Plump Seeds	Brown Seeds	Small Seeds	All Seeds
1.	.001736	.001307	.000922	.001309
2.	.001909	.001374	.001150	.001397
3.	.001663	.001376	.001100	.001384
4.	.001700	.001409	.000960	.001415
5.	.001687	.001269	.000875	.001289
6.	.001772	.001429	.000585	.001431
7.	.001969	.001443	.000921	.001458
8.	.001927	.001374	.001075	.001416
9.	.001754	.001408	.000900	.001419
10.	.001873	.001398	.001138	.001427
Averages	.001832	.001379	.000972	.001395

Each Sample Represents the Seed from 100 Pods

Table 26

AVERAGE WEIGHT OF SEED

CLASS Class CC - Brown-Frozen Pods

No. of Sample	Plump Seeds	Brown Seeds	Small Seeds	All Seeds
1.	.001984	.001240	.001158	.001649
2.	.002035	.001254	.001071	.001709
3.	.002028	.001215	.001074	.001548
4.	.001935	.001273	.001172	.001599
5.	.002026	.001368	.001222	.001622
6.	.001923	.001316	.001117	.001545
7.	.001955	.001338	.001111	.001606
8.	.001955	.001233	.001146	.001584
9.	.001975	.001236	.001192	.001601
10.	.002018	.001261	.001164	.001624
Averages	.001984	.001264	.001136	.001609

Each Sample Represents the seed from 100 Pods

Table 27

NUMBER AND WEIGHT OF SEEDS

CLASS Class A - Very Immature Pods

No. of Sample	PLUMP SEED				BROWN SEED				SMALL SEED			
	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.
1.	17	7.9	.0315	23.0	11	5.1	.0076	5.6	188	87.0	.0975	71.4
2.	5	1.9	.0078	6.2	9	3.4	.0056	4.4	249	94.7	.1130	89.4
3.	9	4.0	.0158	12.4	18	8.0	.0122	9.6	197	88.0	.0995	78.0
4.	3	1.4	.0046	4.2	16	7.7	.0123	11.3	189	90.9	.0924	84.5
5.	6	2.4	.0086	6.8	10	4.1	.0060	4.7	231	93.5	.1119	88.5
6.	7	2.4	.0103	6.2	43	14.7	.0365	22.0	243	82.9	.1189	71.8
7.	16	5.4	.0244	14.3	35	11.9	.0254	14.8	243	82.7	.1213	70.9
8.	14	5.3	.0258	16.1	41	15.5	.0355	22.1	209	79.2	.0991	61.8
9.	12	4.5	.0199	12.7	41	15.5	.0307	19.7	212	80.0	.1057	67.6
10.	6	2.2	.0121	8.1	25	9.2	.0222	14.9	240	88.6	.1150	77.0
Totals	95		.1608		249		.1940		2201		1.0743	
Averages		3.7		11.2		9.8		13.6		86.5		75.2

Each Sample Represents the Seed from 100 Pods

Table 28

NUMBER AND WEIGHT OF SEEDS

CLASS Class B - Pods Beginning to Fill

	PLUMP SEED				BROWN SEED				SMALL SEED			
No. of Sample	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.
1.	73	14.7	.1222	31.3	35	7.1	.0277	7.1	387	78.2	.2399	61.5
2.	49	9.9	.0721	19.5	42	8.5	.0254	6.9	404	81.6	.2720	73.6
3.	63	12.4	.1028	27.2	20	3.9	.0131	3.5	427	83.7	.2622	69.3
4.	63	12.6	.0988	27.2	26	5.2	.0189	5.2	411	82.2	.2457	67.6
5.	68	14.0	.1077	29.3	31	6.4	.0200	5.4	386	79.6	.2398	65.3
6.	64	14.4	.1061	28.9	43	9.7	.0365	9.9	336	75.8	.2244	61.1
7.	60	12.8	.0929	27.2	35	7.4	.0254	7.4	375	79.8	.2231	65.3
8.	58	12.5	.0958	27.3	41	8.8	.0355	10.1	365	78.7	.2198	62.6
9.	50	10.7	.0822	23.2	41	8.8	.0307	8.6	375	80.5	.2417	68.2
10.	77	14.3	.1213	29.3	25	4.7	.0222	5.3	435	81.0	.2712	65.4
Totals	625		1.0019		339		.2554		3901		2.4398	
Averages		12.8		27.1		7.0		6.9		80.2		66.0

Each Sample Represents the Seed from 100 Pods

Table 29

NUMBER AND WEIGHT OF SEEDS

CLASS Class C - Pods Becoming Plump

	PLUMP SEED				BROWN SEED				SMALL SEED			
No. of Sample	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.
1.	274	46.2	.4656	62.8	61	10.3	.0578	7.8	258	43.5	.2175	29.4
2.	275	49.5	.4393	62.9	75	13.5	.0686	9.8	205	36.9	.1907	27.3
3.	263	47.2	.3969	60.7	74	13.3	.0616	9.4	220	39.5	.1959	30.0
4.	314	61.6	.5008	74.9	79	15.5	.0634	9.5	117	22.9	.1044	15.6
5.	314	57.6	.5103	70.4	48	8.8	.0473	6.5	183	33.6	.1675	23.1
6.	306	52.3	.5033	67.7	73	12.5	.0729	9.8	206	35.2	.1670	22.5
7.	288	49.5	.4373	65.3	58	11.1	.0575	8.6	205	39.3	.1752	26.1
8.	209	39.0	.3320	54.1	77	14.4	.0664	10.8	250	46.6	.2154	35.1
9.	246	47.3	.3851	60.5	85	16.3	.0839	13.2	189	36.3	.1672	26.3
10.	293	53.0	.5012	67.0	72	13.0	.0683	9.1	188	34.0	.1790	23.9
Totals	2752		4.4718		702		.6477		2021		1.7798	
Averages		50.3		64.8		12.8		9.4		36.9		25.8

Each Sample Represents the Seed from 100 Pods

Table 30

NUMBER AND WEIGHT OF SEEDS

CLASS Class D - Plump Green

	PLUMP SEED				BROWN SEED				SMALL SEED			
No. of Sample	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.
1.	407	58.9	.7031	68.9	119	17.2	.1395	13.7	165	23.9	.1776	17.4
2.	381	56.4	.6605	67.1	134	19.8	.1478	15.0	161	23.8	.1760	17.9
3.	456	67.0	.7877	76.4	105	15.4	.1097	10.6	119	17.5	.1340	13.0
4.	387	57.7	.6643	68.1	132	19.7	.1513	15.5	152	22.7	.1600	16.4
5.	417	60.0	.7346	71.4	94	13.5	.1064	10.3	184	26.5	.1877	18.2
6.	446	61.1	.7327	71.5	102	14.0	.0990	9.7	182	24.9	.1936	18.9
7.	441	63.8	.7541	73.2	136	19.7	.1557	15.1	114	16.5	.1205	11.7
8.	426	61.6	.7248	73.0	118	17.1	.1113	11.2	147	21.3	.1570	15.8
9.	500	72.9	.8731	81.9	85	12.4	.0914	8.6	101	14.7	.1021	9.6
10.	421	62.4	.7387	73.7	89	13.2	.0931	9.3	165	24.4	.1709	17.0
Totals	4282		7.3736		1114		1.2052		1490		1.5794	
Averages		62.2		72.6		16.2		11.9		21.7		15.5

Each Sample Represents the Seed from 100 Pods

Table 31

NUMBER AND WEIGHT OF SEEDS

CLASS Class E - Light Brown Pods

	PLUMP SEED				BROWN SEED				SMALL SEED			
No. of Sample	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.
1.	272	50.5	.5140	66.0	189	35.1	.1939	24.9	78	14.5	.0714	9.2
2.	269	45.7	.5044	62.6	231	39.3	.2249	27.9	88	15.0	.0762	9.5
3.	264	48.0	.4933	63.5	225	40.9	.2230	28.7	61	11.1	.0611	7.9
4.	228	43.7	.4059	56.6	224	42.9	.2454	34.2	70	13.4	.0660	9.2
5.	262	51.6	.4915	67.2	180	35.4	.1802	24.6	66	13.0	.0594	8.1
6.	285	53.0	.5218	67.5	183	34.0	.1955	25.3	70	13.0	.0556	7.2
7.	275	47.0	.5009	61.1	238	40.7	.2492	30.4	72	12.3	.0700	8.5
8.	246	43.5	.4507	58.7	240	42.5	.2534	33.0	79	14.0	.0636	8.3
9.	286	51.5	.5363	66.3	176	31.7	.1861	23.0	93	16.8	.0859	10.6
10.	357	58.7	.6662	73.4	149	24.5	.1546	17.0	102	16.8	.0865	9.5
Totals	2744		5.0850		2035		2.1062		779		.6957	
Averages		49.4		64.5		36.6		26.7		14.0		8.8

Each Sample Represents the Seed from 100 Pods

Table 32

NUMBER AND WEIGHT OF SEEDS

CLASS Class F - Medium Brown Pods

No. of Sample	PLUMP SEED				BROWN SEED				SMALL SEED			
	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.
1.	349	57.5	.6707	70.1	228	37.6	.2549	26.7	30	4.9	.0307	3.2
2.	326	56.2	.6281	66.8	228	39.3	.2810	29.9	26	4.5	.0312	3.3
3.	344	58.8	.6476	70.9	210	35.9	.2279	24.9	31	5.3	.0384	4.2
4.	305	60.2	.5824	71.7	177	34.9	.2017	24.8	25	4.9	.0279	3.4
5.	299	54.0	.5702	65.2	227	41.0	.2739	31.3	28	5.0	.0301	3.4
6.	316	50.6	.6285	64.6	276	44.2	.3087	31.7	32	5.1	.0356	3.7
7.	351	63.2	.6832	74.0	186	33.5	.2186	23.7	18	3.2	.0209	2.3
8.	295	54.7	.5469	65.9	221	41.0	.2595	31.3	23	4.3	.0238	2.9
9.	313	56.8	.6066	69.2	199	36.1	.2263	25.8	39	7.1	.0439	5.0
10.	372	62.1	.7160	74.1	182	30.4	.1987	20.6	45	7.5	.0515	5.3
Totals	3270		6.2802		2134		2.4512		297		.3340	
Averages		57.4		69.3		37.4		27.0		5.3		3.7

Each Sample Represents the Seed from 100 Pods

Table 33

NUMBER AND WEIGHT OF SEEDS

CLASS Class G - Dark Brown Pods

	PLUMP SEED				BROWN SEED				SMALL SEED			
No. of Sample	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.
1.	457	74.7	.9384	80.8	141	23.0	.1971	17.0	14	2.3	.0256	2.2
2.	423	66.3	.8706	75.7	204	32.0	.2646	23.0	11	1.7	.0148	1.3
3.	434	71.9	.8924	79.5	159	26.3	.2168	19.3	11	1.8	.0128	1.1
4.	471	72.4	.9645	79.0	155	23.8	.2234	18.3	25	3.8	.0325	2.7
5.	437	68.1	.9079	76.5	196	30.5	.2671	22.5	9	1.4	.0121	1.0
6.	443	69.7	.8947	78.1	187	29.4	.2431	21.2	6	.9	.0072	.6
7.	463	74.2	.9658	64.4	158	25.3	.2307	19.2	3	.5	.0042	.3
8.	419	68.1	.8463	76.2	186	30.2	.2520	22.7	10	1.6	.0125	1.1
9.	405	65.0	.8158	73.2	207	33.2	.2843	25.5	11	1.8	.0149	1.3
10.	407	66.1	.9998	77.2	195	31.7	.2812	21.7	14	2.3	.0148	1.1
Totals	4359		9.0962		1788		2.4603		114		.1514	
Averages		69.6		77.7		28.6		21.0		1.8		1.2

Each Sample Represents the Seed from 100 Pods

Table 34

NUMBER AND WEIGHT OF SEEDS

CLASS Class AA - Immature-Frozen

	PLUMP SEED				BROWN SEED				SMALL SEED			
No. of Sample	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.
1.	9	2.0	.0163	3.7	402	89.3	.3939	89.5	39	8.7	.0297	6.8
2.	2	.5	.0030	.8	369	94.1	.3621	95.8	21	5.4	.0130	3.4
3.	3	.8	.0071	1.8	367	94.8	.3715	94.3	17	4.4	.0155	3.9
4.	10	2.2	.0214	4.3	445	96.7	.4752	94.9	5	1.1	.0039	.8
5.	11	3.1	.0199	5.7	336	94.9	.3203	92.5	7	2.0	.0061	1.8
6.	20	5.1	.0468	10.7	356	90.6	.3763	86.3	17	4.3	.0128	2.9
7.	10	2.7	.0164	3.8	335	91.3	.3997	92.2	22	6.0	.0174	4.0
8.	12	3.0	.0198	4.5	371	91.6	.4073	92.0	22	5.4	.0157	3.5
9.	10	2.4	.0178	3.8	378	92.2	.4336	92.8	22	5.4	.0159	3.4
10.	19	4.1	.0312	5.9	425	92.2	.4844	91.3	17	3.7	.0147	2.8
Totals	106		.1997		3784		4.0243		189		.1447	
Averages		2.6		4.6		92.8		92.1		4.6		3.3

Each Sample Represents the Seed from 100 Pods

Table 35

NUMBER AND WEIGHT OF SEEDS

CLASS Class BB - Plump Green-Frozen

	PLUMP SEED				BROWN SEED				SMALL SEED			
No. of Sample	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.
1.	19	2.8	.0330	3.8	632	94.5	.8264	94.3	18	2.7	.0166	1.9
2.	32	4.9	.0601	6.6	615	94.2	.8455	92.7	6	.9	.0069	.8
3.	33	4.9	.0549	5.9	629	93.0	.8659	92.5	14	2.1	.0154	1.6
4.	21	3.3	.0357	4.0	609	95.9	.8583	95.5	5	.8	.0048	.5
5.	24	4.0	.0453	5.9	562	94.6	.7135	93.2	8	1.3	.0070	.9
6.	22	3.3	.0390	4.1	641	95.7	.9162	95.5	7	1.0	.0041	.4
7.	37	5.6	.0729	7.6	601	91.5	.8676	90.6	19	2.9	.0175	1.8
8.	48	7.9	.0925	10.8	553	91.4	.7600	88.7	4	.7	.0043	.5
9.	37	6.1	.0649	7.5	559	91.9	.7871	91.2	12	2.0	.0108	1.3
10.	49	7.6	.0918	10.0	577	89.6	.8072	87.8	18	2.8	.0205	2.2
Totals	322		.5901		5978		8.2477		111		.1079	
Averages		5.0		6.6		93.2		92.2		1.7		1.2

Each Sample Represents the Seed from 100 Pods

Table 36

NUMBER AND WEIGHT OF SEEDS

CLASS Class CC - Brown-Frozen

	PLUMP SEED				BROWN SEED				SMALL SEED			
No. of Sample	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.	No. of Seeds	% of Total No.	Wt. of Seeds	% of Total Wt.
1.	362	55.5	.7193	66.9	249	38.2	.3089	28.7	41	6.3	.0475	4.4
2.	326	53.1	.6637	63.2	274	44.6	.3711	35.3	14	2.3	.0150	1.4
3.	250	41.8	.5072	54.8	317	53.0	.3854	41.6	31	5.2	.0333	3.6
4.	298	49.5	.5768	59.9	293	48.7	.3732	38.8	11	1.8	.0129	1.3
5.	210	39.0	.4256	48.7	320	59.4	.4379	50.1	9	1.7	.0110	1.3
6.	235	39.6	.4521	49.2	325	54.7	.4279	46.6	34	5.7	.0380	4.1
7.	261	45.1	.5103	54.9	291	50.2	.3896	41.9	27	4.7	.0300	3.2
8.	300	49.0	.5865	60.5	297	48.5	.3663	37.8	15	2.5	.0172	1.8
9.	288	49.4	.5699	61.0	269	46.1	.3326	35.6	26	4.5	.0310	3.3
10.	315	48.2	.6359	59.9	325	49.7	.4101	38.6	14	2.1	.0163	1.5
Totals	2845		5.6473		2960		3.8030		222		.2522	
Averages		47.2		58.2		49.1		39.2		3.7		2.6

Each Sample Represents the Seed from 100 Pods

Table 37

GERMINATION RECORD

CLASS— A - Very Immature

No. of Sample	PLUMP SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	10	5	5	0	50	50	0	8	9	0
2.	5	1	4	0	20	80	0	1	4	0
3.	9	0	8	1	0	89	11	0	8	1
4.	3	1	2	0	33	67	0	1	2	0
5.	3	1	2	0	33	67	0	2	4	0
6.	7	3	4	0	43	57	0	3	4	0
7.	10	2	8	0	20	80	0	3	13	0
8.	14	1	13	0	7	93	0	1	13	0
9.	12	2	10	0	17	83	0	2	10	0
10.	6	0	6	0	0	100	0	0	6	0
Totals	79	16	62	1				21	73	1
Averages					20.2	78.5	1.3			

Each Sample Represents the Seed from 100 Pods.

Table 38

GERMINATION RECORD

CLASS— Class B - Pods Beginning to Fill

No. of Sample	PLUMP SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	50	8	40	2	16	80	4	12	58	3
2.	25	2	20	3	8	80	12	4	39	6
3.	25	0	25	0	0	100	0	0	63	0
4.	25	3	21	1	12	84	4	8	53	2
5.	25	0	24	1	0	96	4	0	65	3
6.	25	2	23	0	8	92	0	5	59	0
7.	25	2	23	0	8	92	0	5	55	0
8.	25	2	23	0	8	92	0	5	53	0
9.	25	1	24	0	4	96	0	2	48	0
10.	25	1	22	2	4	88	8	3	68	6
Totals	275	21	245	9				44	561	20
Averages					7.6	89.0	3.3			

Each Sample Represents the Seed from 100 Pods

Table 39

GERMINATION RECORD

CLASS— Class C - Pods Becoming Plump

No. of Sample	PLUMP SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	10	86	4	10	86	4	27	236	11
2.	100	8	84	8	8	84	8	22	231	22
3.	100	12	85	3	12	85	3	32	223	8
4.	100	9	85	6	9	85	6	28	267	19
5.	100	6	91	3	6	91	3	19	286	9
6.	100	11	87	2	11	87	2	34	266	6
7.	100	5	92	3	5	92	3	13	237	8
8.	100	4	95	1	4	95	1	8	199	2
9.	100	5	88	7	5	88	7	12	217	17
10.	100	8	91	1	8	91	1	23	267	3
Totals	1000	78	884	38				218	2429	105
Averages					7.8	88.4	3.8			

Each Sample Represents the Seed from 100 Pods

Table 40

GERMINATION RECORD

CLASS— Class D - Plump Green Pods

No. of Sample	PLUMP SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	10	86	4	10	86	4	41	350	16
2.	100	7	92	1	7	92	1	27	350	4
3.	100	5	93	2	5	93	2	23	424	9
4.	100	8	90	2	8	90	2	31	348	8
5.	100	10	90	0	10	90	0	42	375	0
6.	100	11	89	0	11	89	0	49	397	0
7.	100	8	89	3	8	89	3	35	393	13
8.	100	13	87	0	13	87	0	55	371	0
9.	100	5	93	2	5	93	2	25	465	10
10.	100	7	92	1	7	92	1	30	387	4
Totals	1000	84	901	15				358	3860	64
Averages					8.4	90.1	1.5			

Each Sample Represents the Seed from 100 Pods

Table 41

GERMINATION RECORD

CLASS— Class E - Light Brown Pods

No. of Sample	PLUMP SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	16	81	3	16	81	3	44	220	8
2.	100	6	92	2	6	92	2	16	248	5
3.	100	14	84	2	14	84	2	37	222	5
4.	100	20	75	5	20	75	5	46	171	11
5.	100	12	86	2	12	86	2	32	225	5
6.	100	10	84	6	10	84	6	29	239	17
7.	100	15	83	2	15	83	2	41	228	6
8.	100	10	84	6	10	84	6	24	207	15
9.	100	10	87	3	10	87	3	29	249	8
10.	100	7	90	3	7	90	3	25	321	11
Totals	1000	120	846	34				323	2330	91
Averages					12.0	84.6	3.4			

Each Sample Represents the Seed from 100 Pods

Table 42

GERMINATION RECORD

CLASS— Class F - Medium Brown Pods

No. of Sample	PLUMP SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	20	79	1	20	79	1	70	276	3
2.	100	15	84	1	15	84	1	49	274	3
3.	100	9	87	4	9	87	4	31	299	14
4.	100	14	83	3	14	83	3	43	253	9
5.	100	18	79	3	18	79	3	54	236	9
6.	100	10	87	3	10	87	3	32	275	9
7.	100	12	88	0	12	88	0	42	309	0
8.	100	12	86	2	12	86	2	35	254	6
9.	100	11	87	2	11	87	2	35	272	6
10.	100	9	91	0	9	91	0	33	339	0
Totals	1000	130	851	19				424	2787	59
Averages					13.0	85.1	1.9			

Each Sample Represents the Seed from 100 Pods

Table 43

GERMINATION RECORD

CLASS— Class G - Dark Brown Pods

No. of Sample	PLUMP SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	21	77	2	21	77	2	96	352	9
2.	100	9	90	1	9	90	1	38	381	4
3.	100	7	92	1	7	92	1	31	399	4
4.	100	8	89	3	8	89	3	38	419	14
5.	100	8	87	5	8	87	5	35	360	22
6.	100	12	87	1	12	87	1	53	385	5
7.	100	12	87	1	12	87	1	55	403	5
8.	100	15	82	3	15	82	3	63	344	12
9.	100	11	87	2	11	87	2	45	352	8
10.	100	6	92	2	6	92	2	24	375	8
Totals	1000	109	870	21				478	3790	91
Averages					10.9	87.0	2.1			

Each Sample Represents the Seed from 100 Pods

Table 44

GERMINATION RECORD

CLASS— Class AA - Immature Green - Frozen

No. of Sample	PLUMP SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	9	3	6	0	33	67	0	3	6	0
2.	2	0	2	0	0	100	0	0	2	0
3.	3	0	3	0	0	100	0	0	3	0
4.	10	1	9	0	10	90	0	1	9	0
5.	11	0	11	0	0	100	0	0	11	0
6.	20	2	18	0	10	90	0	2	18	0
7.	10	0	10	0	0	100	0	0	10	0
8.	12	1	11	0	8	92	0	1	11	0
9.	10	2	8	0	20	80	0	2	8	0
10.	19	1	18	0	5	95	0	1	18	0
Totals	106	10	96	0				10	96	0
Averages					9.4	90.6	0			

Each Sample Represents the Seed from 100 Pods

Table 45

GERMINATION RECORD

CLASS— Class BB - Plump Green - Frozen

No. of Sample	PLUMP SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	10	0	10	0	0	100	0	0	19	0
2.	20	3	17	0	15	85	0	5	27	0
3.	20	3	17	0	15	85	0	5	28	0
4.	10	1	9	0	10	90	0	2	19	0
5.	10	4	6	0	40	60	0	10	14	0
6.	10	3	7	0	30	70	0	7	15	0
7.	20	3	17	0	15	85	0	6	31	0
8.	20	0	20	0	0	100	0	0	48	0
9.	20	2	18	0	10	90	0	4	33	0
10.	20	3	17	0	15	85	0	7	42	0
Totals	160	22	138	0				46	276	0
Averages					13.75	86.25	0			

Each Sample Represents the Seed from 100 Pods

Table 46

GERMINATION RECORD

CLASS— Class CC - Brown - Frozen

No. of Sample	PLUMP SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	17	82	1	17	82	1	61	297	4
2.	100	14	84	2	14	84	2	46	274	6
3.	100	19	81	0	19	81	0	48	202	0
4.	100	21	78	1	21	78	1	63	232	3
5.	100	12	87	1	12	87	1	25	183	2
6.	100	24	75	1	24	75	1	57	176	2
7.	100	17	82	1	17	82	1	44	214	3
8.	100	17	83	0	17	83	0	51	249	0
9.	100	8	91	1	8	91	1	23	262	3
10.	100	10	89	1	10	89	1	32	280	3
Totals	1000	159	832	9				450	2369	26
Averages					15.9	83.2	.9			

Each Sample Represents the Seed from 100 Pods

Table 47

GERMINATION RECORD

CLASS— Class A - Very Immature Pods

No. of Sample	BROWN SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	11	0	0	11	0	0	100	0	0	11
2.	9	1	0	8	11	0	89	1	0	8
3.	18	1	1	16	6	5	89	1	1	16
4.	16	1	0	15	6	0	94	1	0	15
5.	10	0	0	10	0	0	100	0	0	10
6.	20	0	0	20	0	0	100	0	0	43
7.	12	0	0	12	0	0	100	0	0	35
8.	23	0	0	23	0	0	100	0	0	41
9.	6	0	0	6	0	0	100	0	0	41
10.	23	0	0	23	0	0	100	0	0	25
Totals	148	3	1	144				3	1	245
Averages					2.0	0.7	97.3			

Each Sample Represents the Seed from 100 Pods

Table 48

GERMINATION RECORD

CLASS— Class B - Pods Beginning to Fill

No. of Sample	BROWN SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	20	2	0	18	10	0	90	3	0	32
2.	20	1	0	19	5	0	95	2	0	40
3.	20	1	0	19	5	0	95	1	0	19
4.	20	0	0	20	0	0	100	0	0	26
5.	20	2	1	17	10	5	85	3	2	26
6.	20	1	1	18	5	5	90	2	2	39
7.	20	2	0	18	10	0	90	3	0	32
8.	20	2	1	17	10	5	85	4	2	35
9.	20	0	0	20	0	0	100	0	0	41
10.	10	1	1	8	10	10	80	3	2	20
Totals	190	12	4	174				21	8	310
Averages					6.3	2.1	91.6			

Each Sample Represents the Seed from 100 Pods

Table 49

GERMINATION RECORD

CLASS— Class C - Pods Becoming Plump

No. of Sample	BROWN SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	25	1	2	22	4	8	88	2	5	54
2.	50	4	6	40	8	12	80	6	9	60
3.	50	7	4	39	14	8	78	10	6	58
4.	50	2	1	47	4	2	94	2	3	74
5.	25	2	4	19	8	16	76	4	8	36
6.	50	1	9	40	2	18	80	2	13	58
7.	25	2	2	21	8	8	84	4	5	49
8.	50	3	8	39	6	16	78	5	12	60
9.	50	6	6	38	12	12	76	10	10	65
10.	50	5	10	35	10	20	70	7	14	51
Totals	425	33	52	340				52	85	565
Averages					7.8	12.2	80.0			

Each Sample Represents the Seed from 100 Pods

Table 50

GERMINATION RECORD

CLASS— Class D - Plump Green Pods

No. of Sample	BROWN SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	50	14	14	22	28	28	44	33	33	53
2.	50	12	3	35	24	6	70	32	8	94
3.	50	9	6	35	18	12	70	19	13	73
4.	50	11	5	34	22	10	68	29	13	90
5.	50	8	4	38	16	8	76	8	15	71
6.	50	11	8	31	22	16	62	23	16	63
7.	50	5	6	39	10	12	78	14	16	106
8.	50	6	4	40	12	8	80	14	10	94
9.	50	7	4	39	14	8	78	12	7	66
10.	50	10	11	29	20	22	58	18	19	52
Totals	500	93	65	342				202	150	762
Averages					18.6	13.0	68.4			

Each Sample Represents the Seed from 100 Pods

Table 51

GERMINATION RECORD

CLASS— Class E - Light Brown Pods

No. of Sample	BROWN SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	18	7	75	18	7	75	34	13	142
2.	100	9	9	82	9	9	82	21	21	189
3.	100	15	6	79	15	6	79	34	13	178
4.	100	11	8	81	11	8	81	25	18	181
5.	100	11	8	81	11	8	81	20	14	146
6.	100	10	8	82	10	8	82	18	15	150
7.	100	22	6	72	22	6	72	52	14	172
8.	100	16	6	78	16	6	78	39	14	187
9.	100	11	12	77	11	12	77	19	21	136
10.	100	13	7	80	13	7	80	19	11	119
Totals	1000	136	77	787				281	154	1600
Averages					13.6	7.7	78.7			

Each Sample Represents the Seed from 100 Pods

Table 52

GERMINATION RECORD

CLASS— Class F - Medium Brown Pods

No. of Sample	BROWN SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	17	14	69	17	14	69	39	32	157
2.	100	7	15	78	7	15	78	16	34	178
3.	100	18	5	77	18	5	77	38	10	162
4.	100	11	8	81	11	8	81	20	14	143
5.	100	12	17	71	12	17	71	27	39	161
6.	100	13	12	75	13	12	75	36	33	207
7.	100	8	5	87	8	5	87	15	9	162
8.	100	13	9	78	13	9	78	29	20	172
9.	100	6	18	76	6	18	76	12	36	151
10.	100	14	9	77	14	9	77	26	16	140
Totals	1000	119	112	769				258	243	1633
Averages					11.9	11.2	76.9			

Each Sample Represents the Seed from 100 Pods

Table 53

GERMINATION RECORD

CLASS— Class G - Dark Brown Pods

No. of Sample	BROWN SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	11	9	80	11	9	80	15	13	113
2.	100	10	8	82	10	8	82	21	16	167
3.	100	8	10	82	8	10	82	13	16	130
4.	100	15	12	73	15	12	73	23	19	113
5.	100	13	13	74	13	13	74	26	25	145
6.	100	6	15	79	6	15	79	11	28	148
7.	100	11	13	76	11	13	76	17	21	120
8.	100	13	14	73	13	14	73	24	26	136
9.	100	6	13	81	6	13	81	12	27	168
10.	100	13	16	71	13	16	71	25	31	139
Totals	1000	106	123	771				187	222	1379
Averages					10.6	12.3	77.1			

Each Sample Represents the Seed from 100 Pods

Table 54

GERMINATION RECORD

CLASS— Class AA - Immature-Frozen

No. of Sample	BROWN SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	27	1	72	27	1	72	109	4	289
2.	100	24	1	75	24	1	75	88	4	277
3.	100	23	3	74	23	3	74	84	11	272
4.	100	29	0	71	29	0	71	129	0	316
5.	100	33	2	65	33	2	65	111	7	218
6.	100	25	1	74	25	1	74	89	4	263
7.	100	29	2	69	29	2	69	97	7	231
8.	100	31	1	68	31	1	68	115	4	252
9.	100	35	1	64	35	1	64	132	4	242
10.	100	23	10	67	23	10	67	98	42	285
Totals	1000	279	22	699				1052	87	2645
Averages					27.9	2.2	69.9			

Each Sample Represents the Seed from 100 Pods

Table 55

GERMINATION RECORD

CLASS— Class BB - Plump Green-Frozen

No. of Sample	BROWN SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	32	6	62	32	6	62	202	38	392
2.	100	33	8	59	33	8	59	203	49	363
3.	100	36	6	58	36	6	58	226	38	365
4.	100	36	10	54	36	10	54	219	61	329
5.	100	27	2	71	27	2	71	152	11	399
6.	100	46	9	45	46	9	45	295	58	288
7.	100	43	5	52	43	5	52	258	30	313
8.	100	38	7	55	38	7	55	210	39	304
9.	100	53	8	39	53	8	39	296	45	218
10.	100	38	7	55	38	7	55	219	41	317
Totals	1000	382	68	550				2280	410	3288
Averages					38.2	6.8	55.0			

Each Sample Represents the Seed from 100 Pods

Table 56

GERMINATION RECORD

CLASS— Class CC - Brown-Frozen

No. of Sample	BROWN SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	25	10	65	25	10	65	62	25	162
2.	100	30	17	53	30	17	53	82	47	145
3.	100	17	13	70	17	13	70	54	41	222
4.	100	21	15	64	21	15	64	62	44	187
5.	100	23	21	56	23	21	56	74	67	179
6.	100	20	15	65	20	15	65	65	49	211
7.	100	32	10	58	32	10	58	93	29	169
8.	100	22	16	62	22	16	62	65	48	184
9.	100	21	13	66	21	13	66	56	35	178
10.	100	21	13	66	21	13	66	68	42	215
Totals	1000	232	143	625				681	427	1852
Averages					23.2	14.3	62.5			

Each Sample Represents the Seed from 100 Pods

Table 57

GERMINATION RECORD

CLASS— Class A - Very Immature Pods

No. of Sample	SMALL SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	15	0	85	15	0	85	28	0	160
2.	100	5	0	95	5	0	95	12	0	237
3.	100	8	3	89	8	3	89	16	6	175
4.	100	4	0	96	4	0	96	8	0	181
5.	100	5	3	92	5	3	92	12	7	212
6.	100	10	1	89	10	1	89	24	3	216
7.	100	13	1	86	13	1	86	32	2	209
8.	100	12	3	85	12	3	85	25	6	178
9.	100	8	2	90	8	2	90	17	4	191
10.	100	8	2	90	8	2	90	19	5	216
Totals	1000	88	15	897				193	33	1975
Averages					8.8	1.5	89.7			

Each Sample Represents the Seed from 100 Pods

Table 58

GERMINATION RECORD

CLASS— Class B - Pods Beginning to Fill

No. of Sample	SMALL SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	27	0	73	27	0	73	104	0	283
2.	100	22	17	61	22	17	61	89	69	246
3.	100	21	4	75	21	4	75	90	17	320
4.	100	15	8	77	15	8	77	62	33	316
5.	100	21	12	67	21	12	67	81	46	259
6.	100	27	17	56	27	17	56	91	57	188
7.	100	20	12	68	20	12	68	75	45	255
8.	100	12	15	73	12	15	73	44	55	266
9.	100	19	14	67	19	14	67	71	53	251
10.	100	23	15	62	23	15	62	100	65	270
Totals	1000	207	114	679				807	440	2654
Averages					20.7	11.4	67.9			

Each Sample Represents the Seed from 100 Pods

Table 59

GERMINATION RECORD

CLASS— Class C - Pods Becoming Plump

No. of Sample	SMALL SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	34	23	43	34	23	43	88	59	111
2.	100	37	18	45	37	18	45	76	37	92
3.	100	28	47	25	28	47	25	62	103	55
4.	50	14	21	15	28	42	30	33	49	35
5.	100	33	51	16	33	51	16	61	93	29
6.	100	36	34	30	36	34	30	74	70	62
7.	100	22	44	34	22	44	34	45	90	70
8.	100	41	38	21	41	38	21	103	95	52
9.	100	37	45	18	37	45	18	70	85	34
10.	100	32	55	13	32	55	13	60	103	25
Totals	950	314	376	260				672	784	565
Averages					33.0	39.6	27.4			

Each Sample Represents the Seed from 100 Pods

Table 60

GERMINATION RECORD

CLASS— Class D - Plump Green

No. of Sample	Small Seed									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	100	20	10	70	20	10	70	33	17	115
2.	100	31	62	7	31	62	7	50	100	11
3.	50	8	39	3	16	78	6	19	93	7
4.	100	23	61	16	23	61	16	35	93	24
5.	100	31	60	9	31	60	9	57	110	17
6.	100	27	67	6	27	67	6	49	122	11
7.	50	12	31	7	24	62	14	27	71	16
8.	100	24	72	4	24	72	4	35	106	6
9.	50	13	30	7	26	60	14	26	61	14
10.	100	26	64	10	26	64	10	43	106	16
Totals	850	215	496	139				374	879	237
Averages					25.3	58.3	16.4			

Each Sample Represents the Seed from 100 Pods

Table 61

GERMINATION RECORD

CLASS— Class E - Light Brown Pods

No. of Sample	SMALL SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	50	21	14	15	42	28	30	33	22	23
2.	50	6	23	21	12	46	42	11	40	37
3.	25	13	9	3	52	36	12	32	22	7
4.	50	13	19	18	26	38	36	18	27	25
5.	25	7	10	8	28	40	32	19	26	21
6.	50	5	21	24	10	42	48	7	29	34
7.	50	9	30	11	18	60	22	13	43	16
8.	50	13	11	26	26	22	52	21	17	41
9.	50	12	23	15	24	46	30	22	43	28
10.	50	12	19	19	24	38	38	24	39	39
Totals	450	111	179	160				200	308	271
Averages					24.7	39.8	35.5			

Each Sample Represents the Seed from 100 Pods

Table 62

GERMINATION RECORD

CLASS— Class F - Medium Brown Pods

No. of Sample	SMALL SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	20	12	5	3	60	25	15	18	8	4
2.	10	2	8	0	20	80	0	5	21	0
3.	20	6	12	2	30	60	10	9	19	3
4.	10	3	5	2	30	50	20	7	13	5
5.	10	5	4	1	50	40	10	14	11	3
6.	20	7	7	6	35	35	30	11	11	10
7.	18	5	10	3	28	55	17	5	10	3
8.	23	5	13	5	22	56	22	5	13	5
9.	20	5	14	1	25	70	5	10	27	2
10.	20	5	11	4	25	55	20	11	25	9
Totals	171	55	89	27				95	158	44
Averages					32.2	52.0	15.8			

Each Sample Represents the Seed from 100 Pods

Table 63

GERMINATION RECORD

CLASS— Class G - Dark Brown Pods

No. of Sample	SMALL SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	14	5	8	1	36	57	7	5	8	1
2.	11	4	7	0	36	64	0	4	7	0
3.	11	1	8	2	9	73	18	1	8	2
4.	10	1	9	0	10	90	0	2	23	0
5.	9	2	7	0	22	78	0	2	7	0
6.	6	2	3	1	33	50	17	2	3	1
7.	3	1	2	0	33	67	0	1	2	0
8.	10	2	6	2	20	60	20	2	6	2
9.	11	4	6	1	36	55	9	4	6	1
10.	14	4	7	3	29	50	21	4	7	3
Totals	99	26	63	10				27	77	10
Averages					26.3	63.6	10.1			

Each Sample Represents the Seed from 100 Pods

Table 64

GERMINATION RECORD

CLASS— Class AA - Immature-Frozen

No. of Sample	SMALL SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	20	5	4	11	25	20	55	10	8	21
2.	21	0	2	19	0	10	90	0	2	19
3.	17	7	9	1	41	53	6	7	9	1
4.	5	1	1	3	20	20	60	1	1	3
5.	7	3	2	2	43	28	29	3	2	2
6.	17	4	4	9	23	24	53	4	4	9
7.	10	1	3	6	10	30	60	2	7	13
8.	22	8	2	12	36	9	55	8	2	12
9.	10	3	1	6	30	10	60	7	2	13
10.	17	5	8	4	29	47	24	5	8	4
Totals	146	37	36	73				47	45	97
Averages					25.3	24.7	50.0			

Each Sample Represents the Seed from 100 Pods

Table 65

GERMINATION RECORD

CLASS— Class BB - Plump Green-Frozen

No. of Sample	Small Seed									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	18	11	5	2	61	28	11	11	5	2
2.	6	1	5	0	17	83	0	1	5	0
3.	14	4	9	1	29	64	7	4	9	1
4.	5	2	2	1	40	40	20	2	2	1
5.	8	1	5	2	13	62	25	1	5	2
6.	7	0	2	5	0	29	71	0	2	5
7.	10	4	4	2	40	40	20	7	8	4
8.	4	2	1	1	50	25	25	2	1	1
9.	12	3	7	2	25	58	17	3	7	2
10.	18	8	10	0	44	56	0	8	10	0
Totals	102	36	50	16				39	54	18
Averages					35.3	49.0	15.7			

Each Sample Represents the Seed from 100 Pods

Table 66

GERMINATION RECORD

CLASS— Class CC - Brown-Frozen

No. of Sample	SMALL SEED									
	No. of Seed Used	No. of Germinated Seed	No. of Hard Seed	No. of Dead Seed	% Germination	% Hard	% Dead	Calculated Total Germination	Calculated Total Hard	Calculated Total Dead
1.	20	2	12	6	10	60	30	4	25	12
2.	14	4	8	2	29	57	14	4	8	2
3.	20	8	9	3	40	45	15	12	14	5
4.	11	2	8	1	18	73	9	2	8	1
5.	9	3	6	0	33	67	0	3	6	0
6.	20	8	10	2	40	50	10	14	17	3
7.	10	2	8	0	20	80	0	5	22	0
8.	15	4	9	2	27	60	13	4	9	2
9.	10	1	9	0	10	90	0	3	23	0
10.	14	6	7	1	43	50	7	6	7	1
Totals	143	40	86	17				56	129	26
Averages					28.0	60.1	11.9			

Each Sample Represents the Seed from 100 Pods

Table 67

PROBABLE ERROR

Total Weight of Seed

Class	Mean	$P.E._m$	$P.E._m^2$	Standard Deviation
E	.7887 ±	.0135	.00018225	.0498
F	.9065 ±	.0108	.00011664	.0509
G	1.1708 ±	.0116	.00013456	.0545

Difference Between Classes

Classes	Difference	$P.E._{dif.}$	$P.E._{dif.}^2$	Diff./$P.E._{dif.}$
E and F	.1178 ±	.0172	.00028889	6.8
F and G	.2643 ±	.0158	.00025120	16.7
E and G	.3821 ±	.0178	.00031681	21.4

Total Number Seeds Per Pod

Class	Mean	$P.E._m$	$P.E._m^2$	Standard Deviation
E	5.5 ±	.062	.003844	.293
F	5.7 ±	.143	.020449	.673
G	6.2 ±	.110	.012100	.519

Difference Between Classes

Classes	Difference	$P.E._{dif.}$	$P.E._{dif.}^2$	Diff./$P.E._{dif.}$
E and F	.2 ±	.156	.024293	1.56
F and G	.5 ±	.180	.032549	2.70
E and G	.7 ±	.126	.015944	5.55

Table 68

PROBABLE ERROR

Percent Total Potential Viability

Class	Mean	P.E.$_m$	P.E.$_m^2$	Standard Deviation
E	64.7 ±	.701	.491401	3.284
F	69.5 ±	.782	.611524	3.667
G	76.4 ±	.416	.173056	1.951

Difference Between Classes

Classes	Difference	P.E.$_{dif.}$	P.E.$_{dif.}^2$	Diff./P.E.$_{dif.}$
E and F	4.8 ±	1.050	1.102925	4.5
F and G	6.9 ±	.885	.784580	7.8
E and G	11.7 ±	.815	.664457	14.3

Number Plump Seeds Per Pod

Class	Mean	P.E.$_m$	P.E.$_m^2$	Standard Deviation
E	2.7 ±	.047	.002209	.221
F	3.2 ±	.094	.008836	.440
G	4.3 ±	.079	.006241	.372

Difference Between Classes

Classes	Difference	P.E.$_{dif.}$	P.E.$_{dif.}^2$	Diff./P.E.$_{dif.}$
E and F	.5 ±	.105	.011045	4.7
F and G	1.1 ±	.122	.015077	9.0
E and G	1.6 ±	.092	.008450	17.3

Table 69

RIPE SEED HARVESTED EVERY THIRD DAY

BROWN SEED

NUMBER AND WEIGHT (GRAMS)

		Oct. 15	Oct. 18	Oct. 21	Oct. 24	Oct. 27	Oct. 30	Nov. 2	Nov. 5	Nov. 8
Labeau	(Number)	28	35	10	19	37	14	9	5	346
Hardigan	(Number)	168	122	135	43	203	193	117	45	2063
Grimm	(Number)	90	30	10	4	23	15	2	24	210
Total Number		286	187	155	66	263	222	128	74	2619
Labeau	(Weight)	.0285	.0341	.0093	.0167	.0345	.0154	.0092	.0049	.3426
Hardigan	(Weight)	.1819	.1236	.1336	.0403	.1759	.1626	.1129	.0474	2.1511
Grimm	(Weight)	.0886	.0279	.0123	.0048	.0179	.0114	.0014	.0236	.1999
Total Weight		.3089	.1856	.1552	.0618	.2283	.1894	.1235	.0759	2.6936
Ave. Wt. Brown Seed		.001080	.000992	.001001	.000936	.000868	.000853	.000964	.001025	.001028

Table 70

RIPE SEED HARVESTED EVERY THIRD DAY

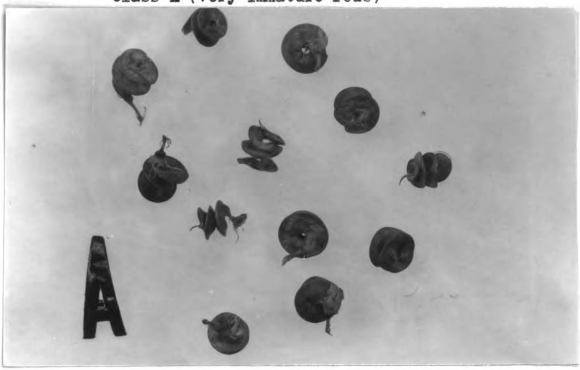
BRIGHT SEED

NUMBER AND WEIGHT (GRAMS)

	Oct. 15	Oct. 18	Oct. 21	Oct. 24	Oct. 27	Oct. 30	Nov. 2	Nov. 5	Nov. 8
Labeau (Number)	100	111	46	74	132	87	124	42	58
Hardigan (Number)	466	374	586	357	1215	1265	712	173	1598
Grimm (Number)	81	39	50	25	42	36	9	20	30
Total Number	647	524	682	456	1389	1388	845	235	1686
Labeau (Weight)	.1418	.1547	.0709	.1148	.1998	.1237	.1765	.0618	.0748
Hardigan (Weight)	.8184	.6511	.9412	.5467	1.8141	1.7957	1.0498	.2797	2.1251
Grimm (Weight)	.1434	.0569	.0830	.0450	.0532	.0508	.0153	.0258	.0413
Total Weight	1.1036	.8627	1.0957	.7065	2.0671	1.9702	1.2416	.3673	2.2412
Ave. Wt. Bright Seed	.001705	.001646	.001606	.001549	.001488	.001419	.001469	.001563	.001329
Total Weight Brown and Bright Seed	1.4125	1.0483	1.2509	.7633	2.2954	2.1596	1.3651	.4432	4.9348
% Bright Seed	78.1	82.3	87.6	91.9	90.0	91.2	90.9	82.9	45.4

AIR-DRY PODS

Class A (Very Immature Pods)



Class B (Pods Beginning to Fill)

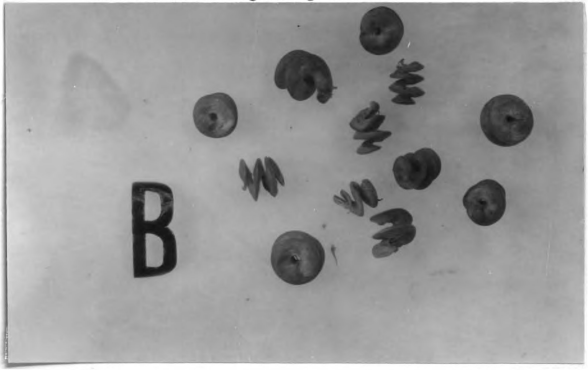
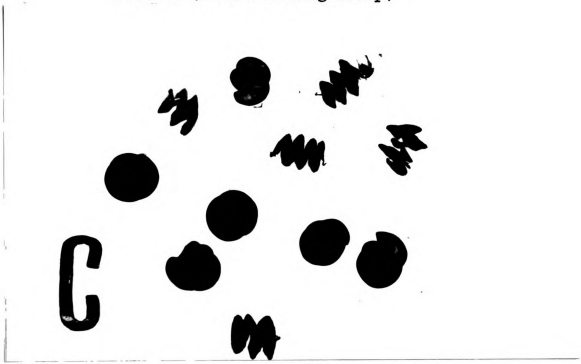


Plate I

AIR-DRY PODS

Class C (Pods Becoming Plump)

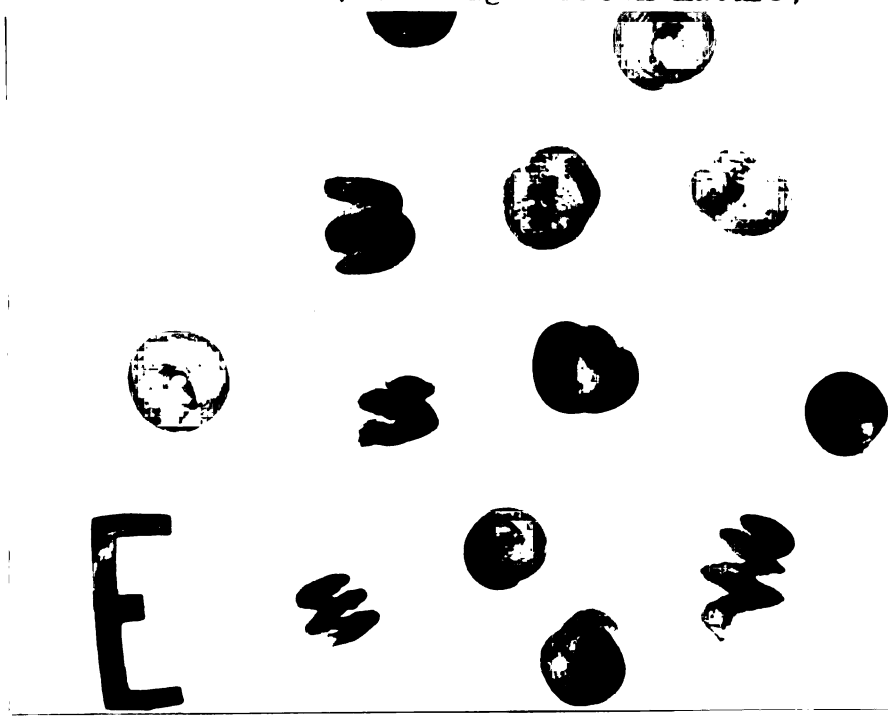


Class D (Plump Green Pods)

Plate II

AIR-DRY PODS

Class E (Pods Light Brown-Mature)



Class F (Pods Medium Brown-Mature)

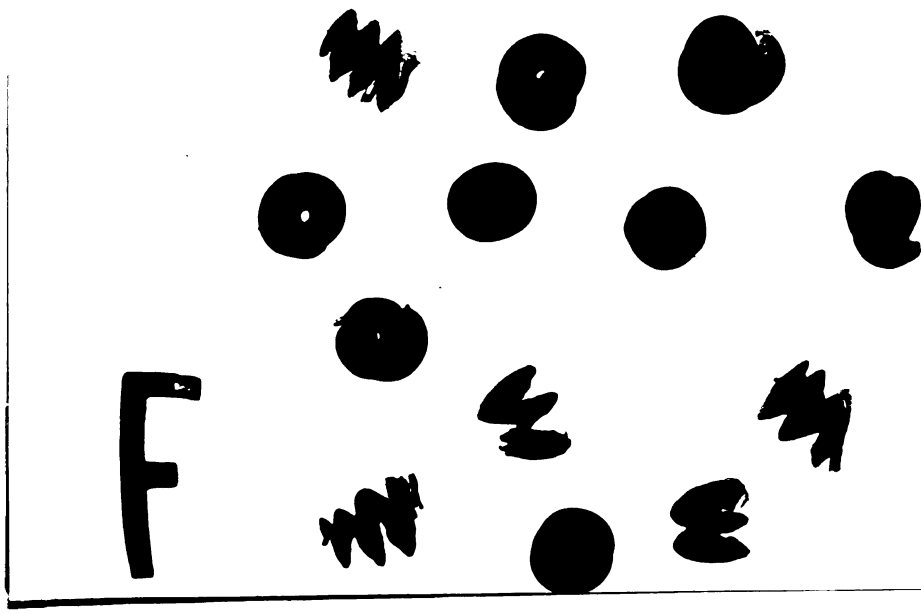
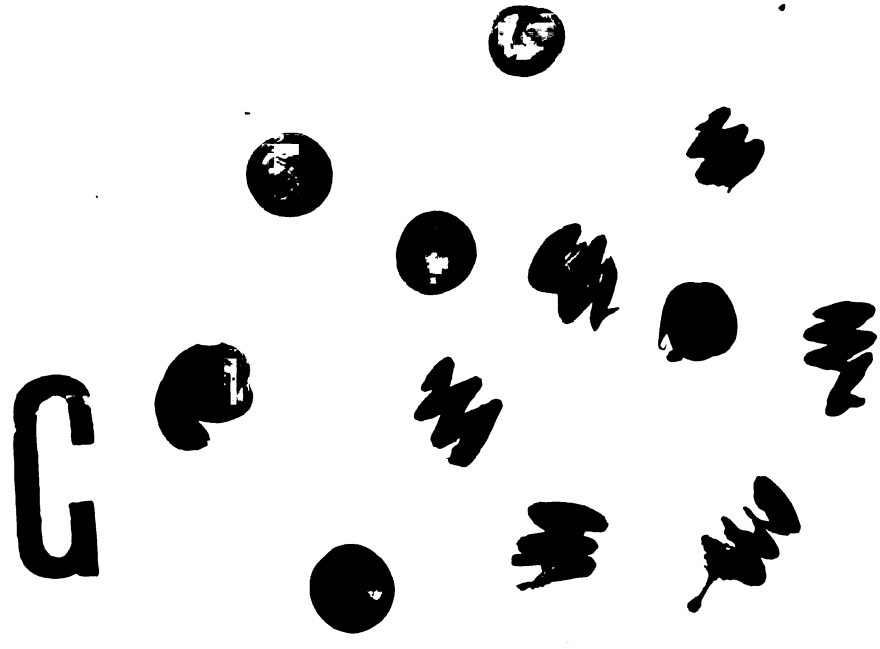


Plate I..

AIR-DRY PODS

Class C (Pods Dark Brown-Mature)



Class AA (Pods Immature-Frozen)

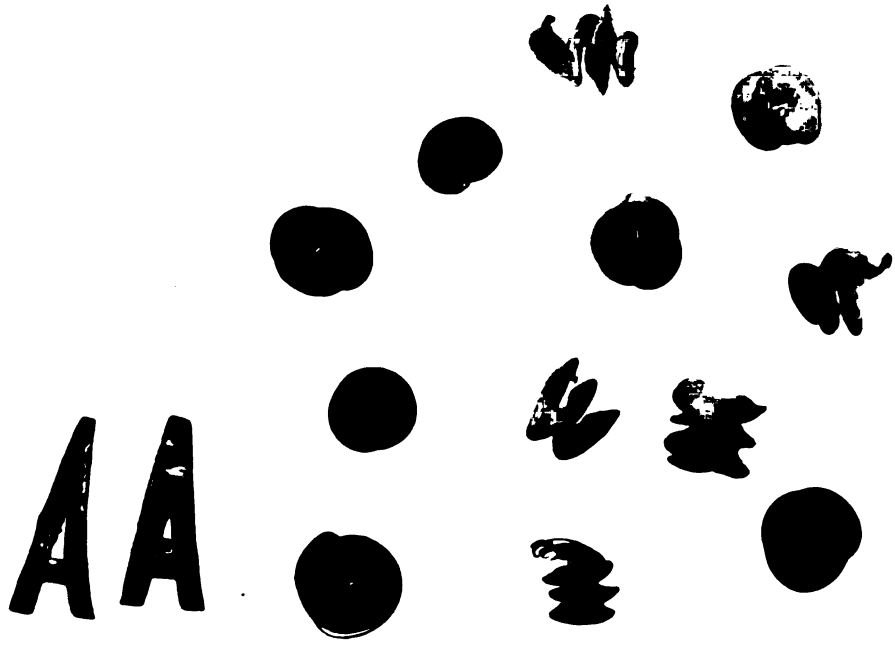
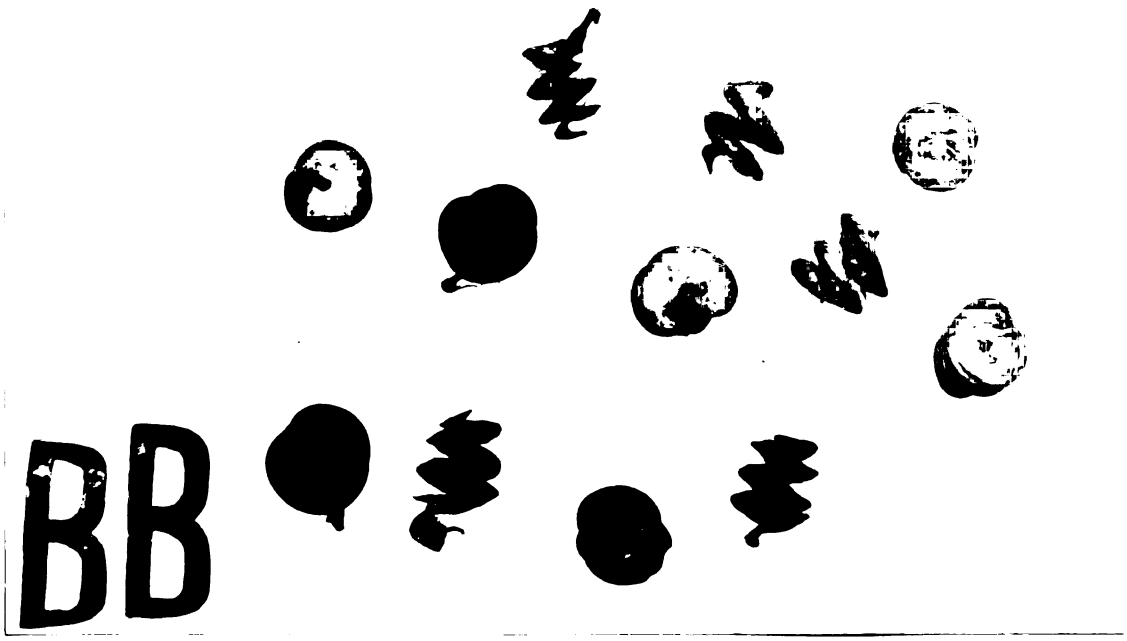


Plate IV

AIR-DRY PODS

Class BB (Pods Plump Green-Frozen)



Class CC (Pods Mature-Frozen)

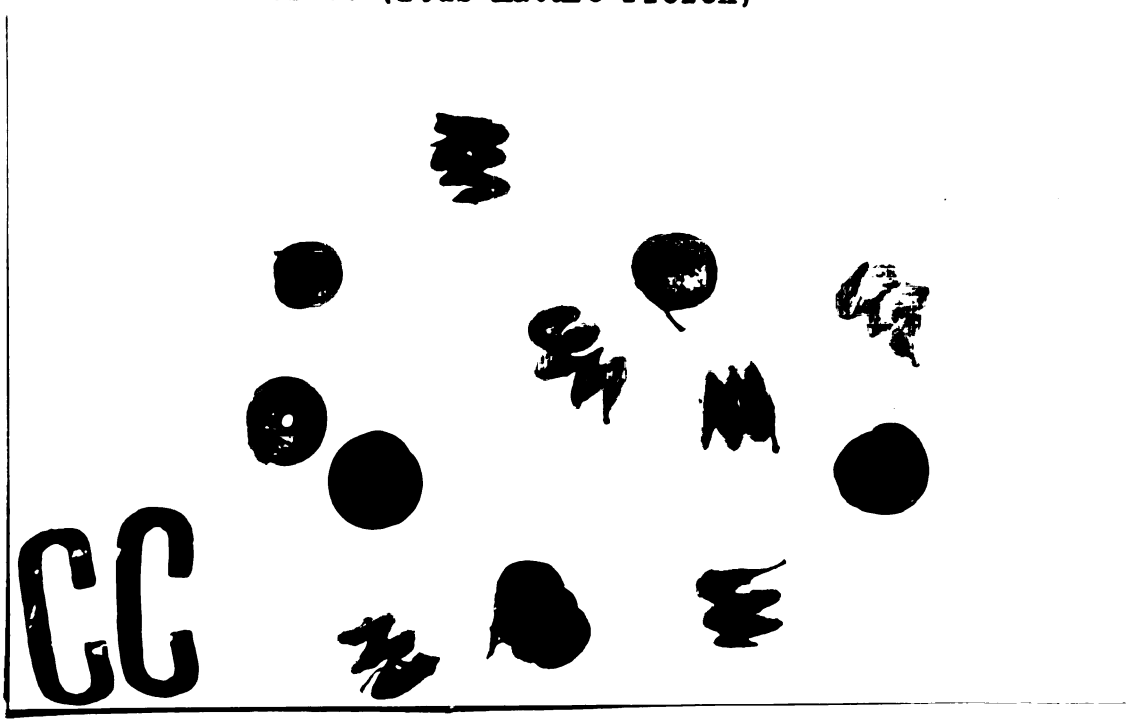
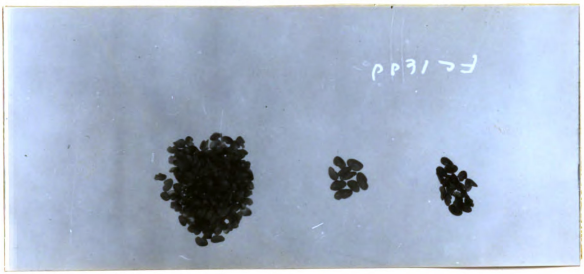


Plate V

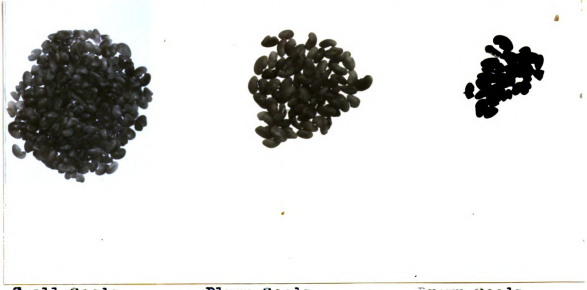
SEED FROM 100 PODS

Class A (Very Immature Pods)



Small Seeds Plump Seeds **Brown Seeds**

Class B (Pods Beginning to Fill)

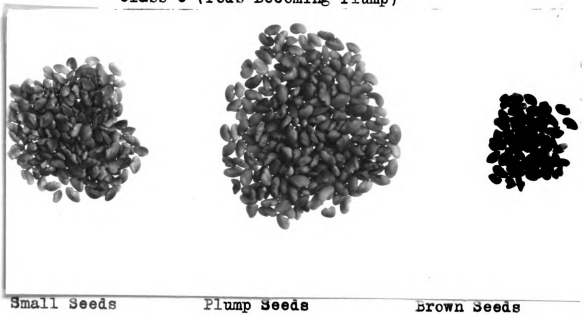


Small Seeds **Plump Seeds** **Brown Seeds**

Plate VI

SEED FROM 100 PODS

Class C (Pods Becoming Plump)



Small Seeds Plump Seeds Brown Seeds

Class D (Plump Green Pods)

Small Seeds Plump Seeds Brown Seeds

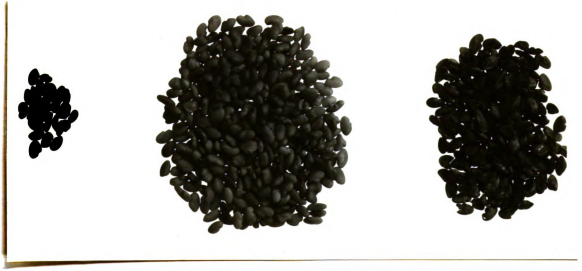
Plate VII

SEED FROM 100 PODS

Class E (Pods Light Brown-Mature)

Small Seeds Plump Seeds Brown Seeds

Class F (Pods Medium Brown-Mature)



Small Seeds Plump Seeds Brown Seeds

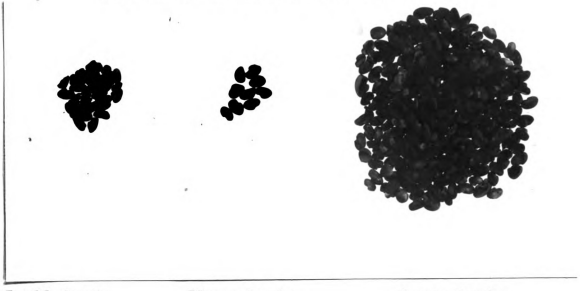
Plate VIII

SEED FROM 100 PODS

Class C (Pods Dark Brown-Mature)

Small Seeds Plump Seeds Brown Seeds

Class AA (Pods Immature-Frozen)

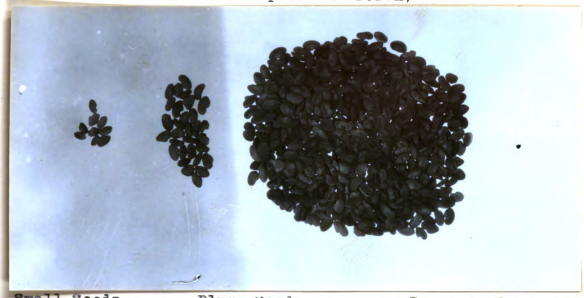


Small Seeds Plump Seeds Brown Seeds

Plate IX

SEED FROM 100 PODS

Class BB (Pods Plump Green-Frozen)



Small Seeds Plump Seeds Brown Seeds

Class CC (Pods Mature-Frozen)

Small Seeds Plump Seeds Brown Seeds

Plate X

- B I B L I O G R A P H Y -

1. Cox, J. F. - "More Alfalfa". Michigan Expt. Station Quarterly Bulletin. Vol. 8, No. 4. May, 1926. p. 170.

2. Church, V. H. - Crop Report for Michigan. 1927. p. 9.

3. Magee, C. R. - Personal Interview.

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7. Roberts, H. F. and Freeman, G. F. - "Alfalfa - Its Adulterants, Substitutes, and Impurities, and their Detection". Kans. Agr. Expt. Sta. Bull. 133. Feb. 1906. pp. 65-68.

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9. True, G. H. - "Germination Tests". Nevada Agr. Expt. Sta. Report for 1913. pp. 23-24.

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