"ASTEROID"

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PERSISTENCY IN CRESTED DOGSTAIL. ITS RELATION TO ORIGIN, FLOWERING DATE, SEED COLOUR AND GERMINATION CAPACITY OF NEW ZEALAND SEED SAMPLES.

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INTRODUCTION.

Crested dogstail is a valuable pasture grass, and is sown under a wide range of soil conditions. It is essentially a bottom grass. It is very palatable to sheep and thrives well under conditions of continuous close grazing. It does not, however, feature to any large extent in dairying land. It shows very great powers of re-establishment by seeding even under adverse seed-bed conditions, and it is this re-establishment which enables it to persist in a pasture for a number of years. Such re-establishment should not occur each Autumn after the plants have seeded and died or are so low in vitality that they remain only as worthless vestiges. This is a weakness of crested dogstail which it is desirable to eliminate. What it requires is a vigorous turf which will, on the advent of Autumn rains, spring into a highly productive sward vigorous enough to check any inferior grasses or weeds which may attempt to gain a footing.

Much crested dogstail seen on the New Zealand market is produced under a system of arable farming. In ~~North~~ Sandon and Southland, the two main crested dogstail seed producing areas in New Zealand, crested dogstail leys will not maintain a pure clean sward for more than about two years if a seed crop is taken in the first harvest year. The area will become overrun with weeds and inferior grasses as the dogstail dies out. However older fields in both districts are shut up for a period of four to six weeks and the seed taken with a stripper. It seems possible theoretically that stripped seed would eventually give an improved product where stripping is continued yearly, as the more annual plants would not be permitted to re-seed while the more perennial forms would continue to contribute after the others had died out. As the main permanent pastures are produced from these short-lived strains stripped samples cannot immediately be expected to show an improvement on them.

Crested dogstail although a grass producing a high proportion of stem to leaf has given relatively good yields of leaf in the third and fourth harvest years. From Aberystwyth records (Series H. No. 10) we obtain the following figures showing the proportion of leaf present in the crested dogstail herbage :-

1st year	26% leaf.
2nd year	51% leaf.
3rd year	78% leaf
4th year	61% leaf.

These figures strongly suggest that leafiness is related to permanency, and also that the excessive amount of stalk in many old pastures largely dominated by crested dogstail is primarily due to abundant self seeding and thus to the presence each year of a large number of first harvest plants.

If the value of crested dogstail is to be enhanced it is essential that reasonably permanent strains be employed in permanent pasture sowings. In the trial subsequently described the technique was such that no re-seeding was permitted so that the trial was well designed to test the various samples for persistency.

In view of the marked differences in persistency shown by different samples of crested dogstail the investigation was undertaken to ascertain the relative merits of seed produced in the main seed producing areas in New Zealand. At the same time data relative to the same samples have been analysed statistically to discover any correlations that might exist and which might prove of value in the seed trade.

TECHNIQUE.

Of the samples of crested dogstail seed submitted during 1927-1929 to the Seed Testing Station, Department of Agriculture, to be tested for germination some were subsequently sown in the Massey Agricultural College experimental plots in Areas 5 and 8. The represent seed from all districts in New Zealand.

Area 5 was sown down in the Spring of 1929 on ground that had laid dormant over winter. Area 8 was sown in April 1930 following potatoes.

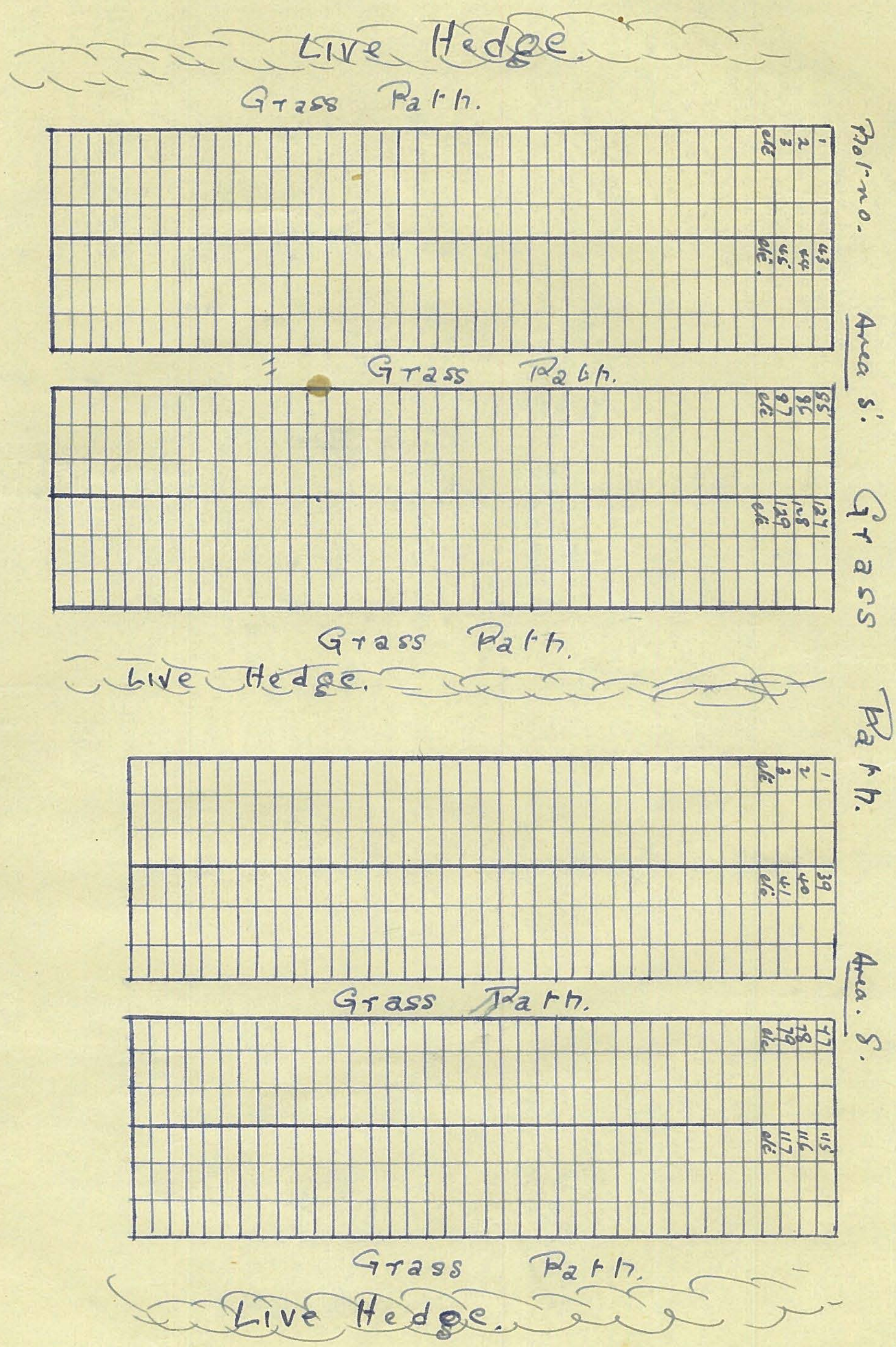
Each area was subdivided into a number of plots 1/500 acre in extent and in each was sown 18.1 grammes of seed (equivalent to 20 pounds per acre). No manure was applied at the time of sowing nor to the previous crop.

The unused portion of the seed sample was set aside for later reference. (See section dealing with seed colour in relation to germination).

The layout of the plots was such that in both Areas 5 and 8 there were four rows of plots. Two rows were adjacent to one another and the two double rows were separated by a grass strip. The double rows were surrounded by mown grass paths. Figure 1 represents the layout of Areas five and eight. Each plot was marked off and subdivided into three by timothy drills which persisted throughout the experiment and served to delineate the plots. All lines in Figure 1 represent these Timothy drills.

Each of the three sub-plots has been submitted to one of three treatments. The two adjacent ones of each double row of plots have been cut each week throughout the year, a treatment to represent continuous sheep grazing. The outside sub-plots of each row have been mown each week but a hay crop has been taken. The remaining sub-plots have been cut every third week to represent rotational grazing. The mowings were made with an ordinary type hand lawn mower cutting to about one inch from ground and the cut

Figure 1


Live Hedge.
Grass Path.
Plot no.
1 2 3 etc
43 44 45 etc.
Area S.
Grass Path.
85 86 87 etc
127 128 129 etc
Grass Path.
Live Hedge.
Grass Path.
1 2 3 etc
39 40 41 etc
Area S.
Grass Path.
77 78 79 etc
115 116 117 etc
Grass Path.
Live Hedge.

herbage was collected and removed. No stock was permitted onto the area.

The hay was cut with a scythe about the end of the third week in December at the flowering time of the crested dogstail but before any of its seed had a chance to ripen and fall.

The live hedges were closely trimmed to about two feet from the ground.

Applications of 2 cwt. of ammoniated superphosphate were applied to both areas before closing up for hay, in the years previous to 1931.

Method of Sowing and Samples Sown.

The two Areas were suvdivided into plots by garden lines and the samples were sown broadcast within the areas so marked off. When all samples had been sown a Planet Junior sowing a drill of Timothy seed was run along the lines so that the different plots would be marked off by Timothy drills. In addition each plot was subdivided into three by two Timothy drills running the whole length of each row of plots. Such planting was done under supervision of the Department of Agriculture.

Area 5 contained thirty-three commercial Sandon and one hundred and twenty-eight commercial Southland together with seven commercial miscellaneous samples, and a Sandon and Southland sample was sown alternately so long as the Sandon samples remained with the exception that Plots 2 and 3 were Sandon and in Plots 1, 9 and 25 a miscellaneous sample replaced a Sandon sample. Also Plots 145, 152, 153 and 154 were miscellaneous commercial samples. (See Appendix, Table 4).

In Plot 8 sixteen commercial Sandon, ninety-eight commercial Southland, and thirty-eight miscellaneous commercial and experimental samples were sown. (See Appendix, Table 4). A row of thirty-eight plots including twenty Southland, six Sandon and twelve miscellaneous plots was duplicated. The remaining seventy-six plots were not duplicated nor were the Southland and Sandon samples planted alternately.

Method of Counting Crested Dogstail Plants.

The method of counting crested dogstail plants in the parts of the plots under different treatment is to count all crested dogstail plants within an area of twelve inches by three inches, the area ~~area~~ enclosed by wires suspended in a wooden frame, which, when pressed to the ground is held there by four spikes. Five of such areas, taken more or less at random, are counted to each sub-plot so that crested dogstail plants are counted on $1\frac{1}{4}$ square feet. All reference to plot counts thus refers to this $1\frac{1}{4}$ square foot area, the total of the five counts. $1\frac{1}{4}$ square feet represent rather more than 1/25 of the total of each sub-plot so should be a reliable indication of the number of plants present.

Discussion of Lawnmower Treatments.

Constant mowing, always cutting to the same level and non-selective, undoubtedly results in a botanical composition different ~~to~~ from that produced under grazing conditions. However with crested dogstail being more of a bottom grass than certain other grasses, notably perennial rye and cocksfoot, it should not be so severely pruned by the mowings as these grasses. The reduction in numbers should be caused more by the inherent condition of non-persistency, as well as by the competition with other species, than by the constant cutting.

Since a pure sowing of crested dogstail was made it is the non-persistent samples which have permitted the greater development of volunteer growth. The lawn-mower treatments, in addition to cutting the herbage at different stages of growth, have facilitated invasion by volunteers, and of these especially white clover. The different lengths and densities of growth under the different treatments have afforded varying amounts of competition to the remaining crested dogstail plants. Under such treatment only the more persistent plants will survive. Hence the lawnmower treatment is well suited to select these out.

Early in the introduction it was stated that crested dogstail was essentially a grass for close-grazed sheep pasture land and that it did not feature to any large extent on dairying land. The average counts from the plots do not entirely substantiate these statements. These average figures are given in Table 1. They show that the average counts of the Sandon and Southland plots mown every third week are intermediate between the counts under weekly mowing and hay treatments in Area 5; but in Area 8 such does not hold. The greatest number of plants persist under the 3-weekly mowing treatment, that is under conditions of longer growth. This anomalous condition might be explained by differences in the density of white clover in the two areas. Thus in Area 8 under the weekly-mowing treatment the growth of white clover has been very dense while that under the 3-weekly-mowing treatment has not been so dense. It may be that the crested dogstail plants under the weekly-mowing treatment suffered greater competition from the short dense growth than the plants subjected to the 3-weekly mowing treatment did from the longer growth. In Area 5 on the other hand the growth of white clover on the weekly-mown plots was not so dense as that under similar treatment in Area 8. Had sheep grazing replaced the weekly-mowing in Area 8 no doubt the growth of white clover would never have been allowed to become so aggressive and the crested dogstail plants under such conditions would have maintained their numbers better.

We can safely conclude that the results of the three lawn mower treatments will not be truly indicative of those of the grazing conditions they are supposed to represent. Hence we cannot conclude that the treatments do represent animal grazing: rather do they offer crested dogstail different amounts of competition under which the more persistent plants will survive. It is very probable that more crested dogstail plants would have persisted had stock been allowed to graze on the area. The treading by their feet and the return of excreta to the soil would have helped to thicken the sward and grazing would have tended to limit the aggressiveness of the white clover - all 3 factors would have helped to maintain the numbers of crested dogstail plants.

Whatever the disadvantages of the lawnmower treatment one point in its favour is that the treatment can be uniform and that it makes possible the number of different treatments on so small an area. Stock grazing was impracticable in view of the small extent of the two Areas devoted to the trial and the number of different treatments involved. The lawnmower remained as the only method of removing the weekly and 3-weekly growth.

RESULTS.

THE RELATIVE PERSISTENCY OF SANDON AND SOUTHLAND SAMPLES.

During December 1931 and January and early February 1932 counts were made of the crested dogstail plants in 1¼ square feet of the three treatments of each plot in Areas 5 and 8 (See Appendix, Table 1). Statistics were applied to these figures and the average counts of crested dogstail plants in the three treatments of Sandon and Southland plots in both Areas 5 and 8 are given in Table 1. The origin of the various samples is given in Table 4 of the Appendix.

TABLE 1.

~~Plot~~ Area No.	Origin	Average Counts Under :-		
		Weekly mowing	3-weekly mowing	Hay Treatment
5	Southland	21.391 ± 0.741	12.820 ± 0.495	4.153 ± 0.418
5	Sandon	15.606 ± 1.237	10.152 ± 0.896	2.606 ± 0.530
8	Southland	24.667 ± 0.617	30.031 ± 0.878	19.439 ± 0.730
8	Sandon	10.688 ± 0.290	21.875 ± 0.114	7.625 ± 0.677

The differences in average counts for Sandon and Southland sub-plots are all significant in Area 8 in favour of Southland sub-plots: while in Area 5 the difference is significant only in the case of the weekly-mowing treatment. The number of plants in the counts is taken as representing the relative persistency of the samples.

Discussion.

Since Area 8 was more recently sown than Area 5 (the counts of Area 8 in Table 1 were made approximately twenty months after sowing and those for Area 5 approximately twenty-seven months after sowing) it is apparent that in the earlier stages Southland samples produce the greater number of plants under all treatments; but that at later stages (Area 5 which has survived one harvest year more than Area 8) while the difference maintains its significance under weekly mowing conditions it fails to do so under 3-weekly and hay treatments. This is partly confirmed by counts made by Jacques in February, March and April of 1931 about fifteen months after sowing (unpublished results - see Appendix, Table 2). Statistics were applied to these counts and the average figures, given in Table 2, show that weekly and 3-weekly differences are significant in favour of Southland samples but no significant difference is shown in the hay treatments.

TABLE 2.

Plot No.	Origin	Average Counts Under :-		
		Weekly mowing	3-weekly mowing	Hay treatment.
5	Southland	102.38 ± 3.53	36.20 ± 2.38	25.07 ± 1.96
5	Sandon	89.27 ± 5.18	25.48 ± 2.41	23.36 ± 2.01

It is intended to obtain further counts from Area 8 to see if this initial difference in favour of Southland samples is normal, and to see if at later stages the difference only maintains its significance under close mowing conditions.

If this is the normal trend it would appear that for permanent sheep pastures Southland is the better seed and that for rotational grazing land (Dairy) Southland samples have an initial advantage over Sandon samples, but that at later stages the two are indistinguishable.

There is reason to believe that foreign seed when grown in New Zealand gives better results than the local product. Of the number of samples employed in this trial two were of Kentish origin and while one gave counts under weekly and 3-weekly-mowing treatments considerably higher than the average for Southland and Sandon samples the other was far and away the best plot in its counts and in addition had more vigorous and robust plants than any other plot examined. This sample was tested in duplicate in Plots 88 and 141 of Area 8 while the other Kentish sample was sown in plot 34 of the same area (See Appendix, Table 1). The better Kentish sample was dressed from perennial ryegrass seed and contained a large proportion of perennial rye and Yorkshire fog seeds of which grasses the plot contained considerable amounts. Hence the plot did not receive the amount of crested dogstail seed the other plots received and in addition suffered this extra amount of competition. This still further enhances its performance. A sample of Russian origin has given very promising indications, but was not sown in the areas used in this trial so figures of its performance are not available. No samples of Irish origin have been tested, nor have any from other parts of the world.

The New Zealand samples sown in Area 5 and for which counts over a period of thirty months are available show a very rapid fall in numbers of plants per plot with time. The first count of this series was made by Jacques (unpublished results) between the 10th. and 16th. December 1929 when the plants were about one inch above ground. These counts together with subsequent counts of the same plots and several others counted under the weekly mowing treatment are given in Table 3. The counts of 5th. March - 5th. April, 1931 were also made by Jacques. Counts of the 27th. May - 4th. June 1932 are taken from the Appendix, Table 3. These latter counts were made to indicate the rapid fall in numbers since the plot was previously counted.

TABLE 3.

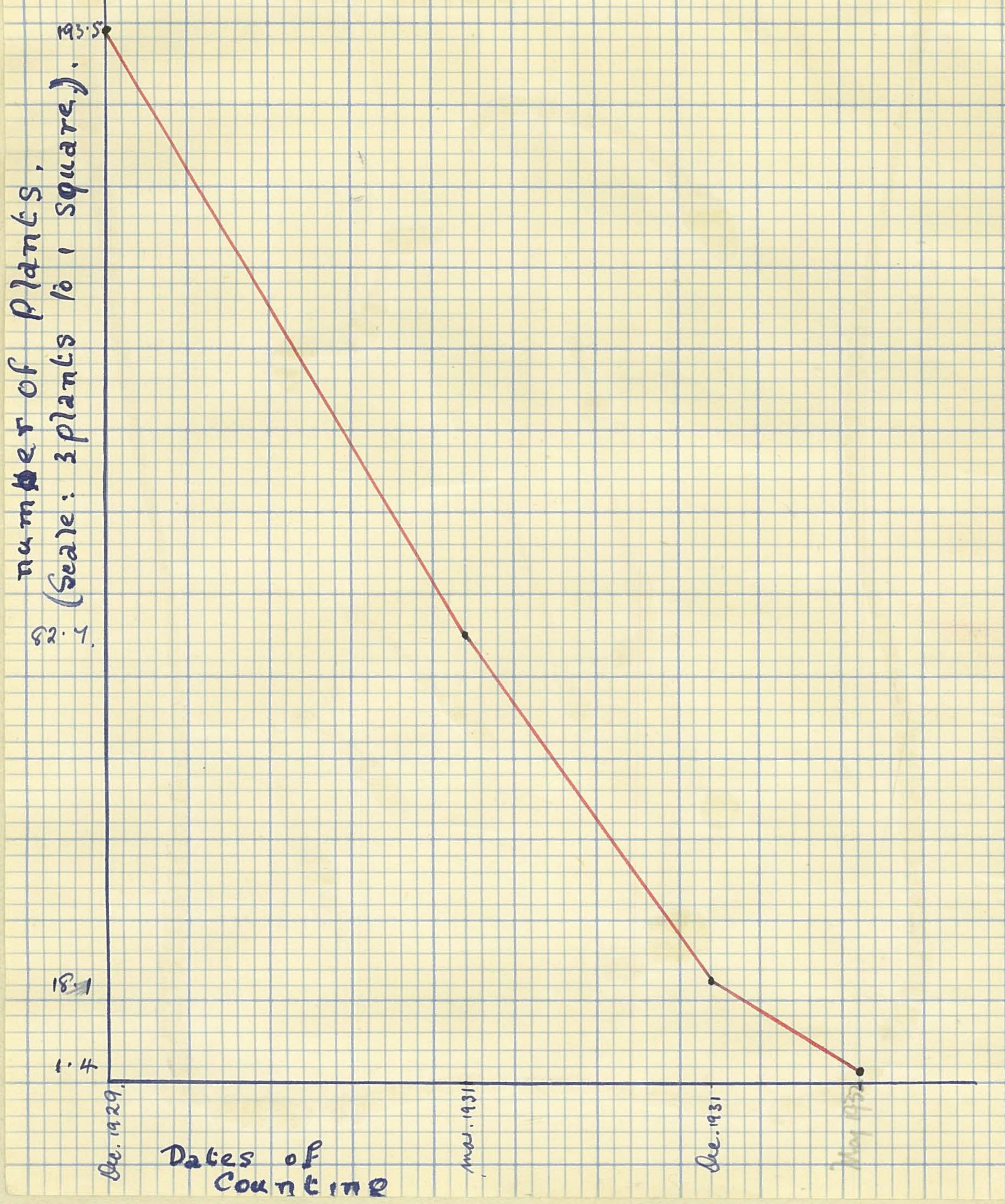
Plot No.	Dates of Counting			
	Dec. 10-16 1929	Mch. 5 - Apl. 5 1931	Dec. 17 - Jan. 6 1932	May 27 - June 4 1932
1	219	95	29	-
2	299	187	42	-
3	339	136	38	-
26	179	91	16	-
27	57	22	3	-
28	146	58	12	-
29	134	27	3	-
30	249	165	14	-
31	140	58	2	-
32	189	91	11	-
33				
34				
35	61	59	5	-
36	153	52	19	-
37	30	9	2	-
38	118	77	19	-
39	347	70	24	-
40	209	62	25	-
43	279	104	23	-
44	225	100	30	-
45	242	123	17	-
64	-	-	9	0
65	-	-	7	2
66	-	-	14	1
67	-	-	16	1
68	162	89	10	2
69	229	75	12	3
70	175	70	13	1
71	115	-	11	-
72	192	-	8	-
73	264	-	2	-
74	220	-	7	1
75	-	-	0	0
76	-	-	3	0
77	152	-	3	-
78	203	-	4	-
79	326	-	5	-
80	198	-	5	-
81	217	-	9	-
82	223	-	3	-
85	-	-	24	1
86	-	-	20	2
87	-	-	15	1
88	-	-	38	1
89	-	-	27	5
90	-	-	46	4
91	-	-	32	0
92	-	-	27	1
93	-	-	17	1
94	-	-	23	0

TABLE 3. Continued.

Plot No.	Dates of Counting			
	Dec. 10-16 1929	Mch. 5 - Apl. 5 1931	Dec. 17 - Jan. 6 1932	May 27 - June 4 1932
125	160	-	15	-
126	150	-	8	-
144	-	-	36	1
145	-	-	20	1
146	-	-	43	0
147	-	-	30	1
148	-	-	27	0
149	-	-	36	3
150	-	-	20	0
151	-	-	38	0
152	-	-	25	1
153	-	-	43	3
154	-	-	17	5
168	162	-	22	-

This table serves to show that there has been a considerable falling off in numbers, till in June 1932 very few plants remained. The trend of the average figures of table 3 as indicated in figure 2 which shows a very rapid decline from a high initial figure to a very low figure thirty months later. This graph shows the trend of the average plot counts for the different stages in development but takes no account of individual sample performance or that of seed produced in the different seed growing districts. It shows, however, that the New Zealand samples under short mowing conditions are extremely non-persistent:-

Figure 2.



Some plots have maintained their numbers better than others but nevertheless there has been a rapid falling off in numbers in all the plots shown in Table 3 and this will serve to show that selection of particular samples is going to be of little use, that one will have to resort to individual selection and from a few individual plants to build up a persistent strain of crested dogstail. Before such work is undertaken, however, it would be wise to obtain samples from different parts of the world and test them along with local samples to see if any of them show greater persistency, and productivity than New Zealand samples.

DATE OF FLOWERING IN RELATION TO PERSISTENCY.

It was thought that if any correlation could be discovered between date of flowering and persistency of crested dogs-tail samples it would be of great value to the seed trade in two ways. Firstly, if types flowering about a certain day were shown to be more persistent than others then flowering date would afford a ready means of identification of the better strains. Secondly, superior strains flowering about certain days would not suffer cross pollination by inferior plants flowering on other days and hence would remain reasonably pure.

An endeavour was made to determine as near as possible the date of early maximum flowering of each hay plot by direct observation. The date of early maximum flowering was taken to be the earliest date of December 1931 on which most of the inflorescences of the hay plots of Areas 5 and 8 showed a maximum development of anthers. It was not difficult to determine this date, for in the different plots it extended over a period of ten days. The development of anthers was observed about 10 a.m. each day after the flowers had opened. (See Appendix Table 4 for dates of maximum flowering).

No correlation could be discovered between date of maximum flowering and the counts in the weekly mown treatment in Areas 5 or 8 nor in the hay sub-plots of Area 8. This result was not to be expected in view of several of the highest counting weekly mown plots being the latest to flower and some of the lowest counting plots flowering early.

THE RELATIONSHIP BETWEEN GERMINATION OF SAMPLES AND THE NUMBER OF PLANTS PRESENT UNDER A WEEKLY MOWING SYSTEM.

The 8 and 18-day percentage germination figures of the commercial samples sown have been obtained from the Government Seed Testing Station Records. These figures (See Appendix, Table 4) have been analysed statistically to discover any correlation between them and number of plants in weekly mown plots of Areas 5 and 8. Such correlations are :-

Between Final Germination and Counts
of Area 8, .201 $\pm$ .067 and of Area 5, .287 $\pm$ .051;

and Between Interim Germination and Counts
of Area 8, .181 $\pm$ .067 and of Area 5, .374 $\pm$ .048.

Discussion.

These correlation figures for Area 8 are not at all marked; but for Area 5, which is older established, the correlations are higher, but not significantly different from one another and show that number of surviving plants bears a close relationship ~~and~~ to germination figures.

These figures also serve to show that better correlation exists between the counts of the older plot and the germination figures so that it appears that high germinating seed may produce relatively a greater number of more persistent plants than low germinating seed. It is hoped, at some future date, to obtain further counts from Area 8 to see if this tendency is normal.

Correlations between Jacques' counts of the plants in the weekly mown treatment of Area 5 and Final and Interim Germination percentages of + .158 $\pm$ .082 and + .268 $\pm$ .078 are not so high as they are a year later. When Area 8 is older established it is very probable that the correlation coefficients between

Interim and Final germination figures, on the one hand, and number of plants present under a weekly mowing system will be higher than the figures given above. If this is found to be so it will be further evidence for the hypothesis that high germinating seed produces relatively a greater number of more persistent plants than low germinating seed - that high germination percentage of seed is a better indication of permancy than low germination percentage.

THE RELATION BETWEEN GERMINATION CAPACITY AND ORIGIN OF SEED.

The germination figures of the Southland and Sandon samples (See Appendix Table 4) were analysed statistically and the average germination figures from the two districts were found to be :-

Southland	94.66 ± .32%
Sandon	92.636 ± .94%

Such a difference is not significant. Had the number of Sandon samples been greater than thirty-three the probable error might have been reduced somewhat so that the difference might have proved significant. The question of the difference in the average germination capacity of the samples from the two districts will be discussed further when dealing with sample colour.

SEED SAMPLE COLOUR IN RELATION TO GERMINATION.

The balance of the samples of seed set aside after sowing has been graded according to sample colour into nine groups represented by the letters A - I. The group colours ranged from canary yellow (A) to very dark brown ~~and~~ or almost black (I). Nine samples of seed were selected to represent these colour groups. They were arranged on a large piece of black velvet. Each sample as it was taken up was compared with these, as standard colours, and graded accordingly. Such grading, to ensure uniformity, was done in bright diffused daylight, direct sunlight being avoided. Difficulty was frequently experienced in grading the darker samples which frequently contained light coloured seeds in varying proportions. Apparently such seed had been added to give the sample a brighter appearance. In such cases the sample was allocated to the group of which it contained the largest proportion of seeds. Thus there is present the danger of the germination percentage figure of a sample, or of the average germination percentage figure of a colour group being modified by such blending.

Results.

The colour grouping of the various samples along with the percentage germination figures of the same samples, is given in Table 4 of the Appendix. Statistics were applied to these figures.

Table 4 gives a summary of the average percentage germination figures for the different colour groups:-

TABLE 4.

Sample Colour.	Percentage Germination			
	Interim		Final	
A	73.431	± 2.841	91.9861	± 1.037
B	89.163	± .7764	96.231	± .336
C	91.27008	± .8005	96.458	± .299
D	88.3	± .9141	94.625	± .5178
E	88.2353	± .9554	95.0882	± .5758
F	88.136	± 1.270	95.$\dot{6}\dot{3}$	± .5550
G	79.$\dot{2}$	± 3.386	90.94	± 1.702
H	80.3	± 3.215	90.00	± 1.655
I	73.$\dot{6}\dot{3}$	± 3.309	82.18	± 3.004

The average final germination figures of colours B to F are not significantly different from one another. This shows that similar germination capacity extends over a considerable range of sample colour excluding the palest samples and the darkest samples respectively.

In the average Interim germination figures while a difference only just significant is shown between groups C and D and C and E none is shown between C and F so that the same range from B to F may be regarded as of similar 8-day germination capacity.

Figure 3 shows in graphical form the average germination figures for the different colour groups and shows how the 8-day and 18-day percentages run roughly parallel to one another. Such a graph was prepared using the mean average germination figures of Table 4 and without their probable errors:-

Figure 3.

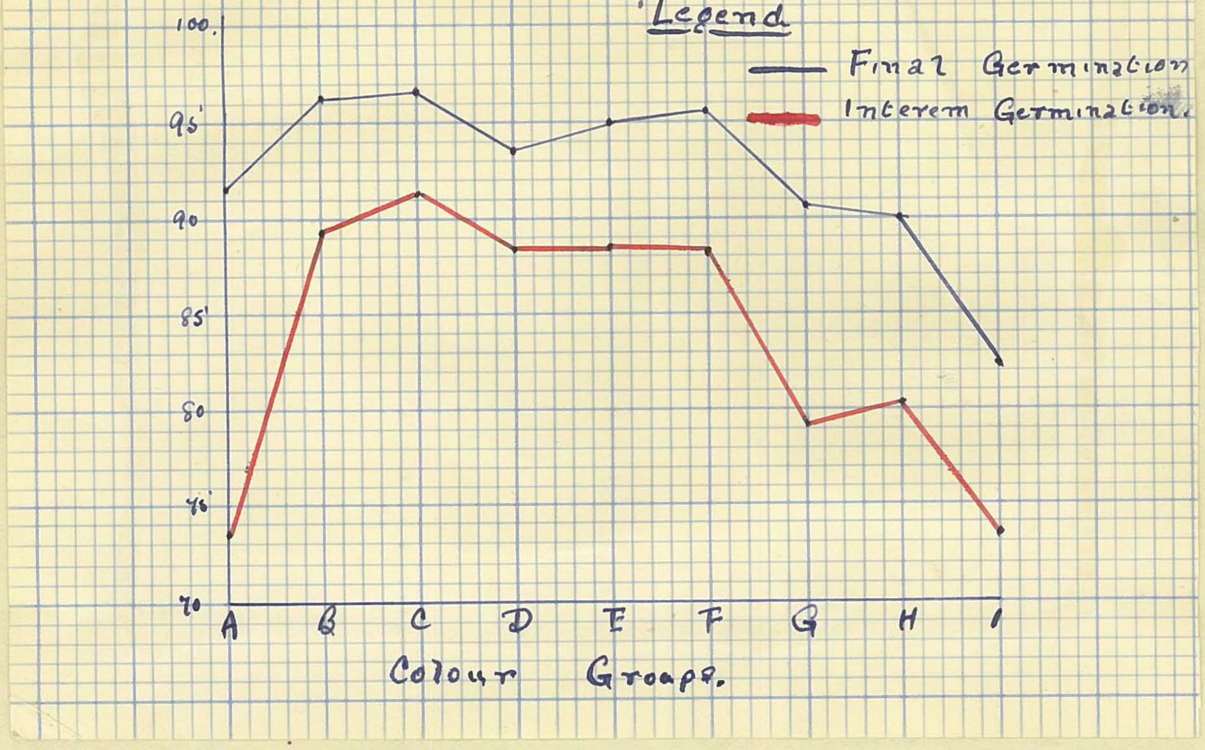


Figure 4.

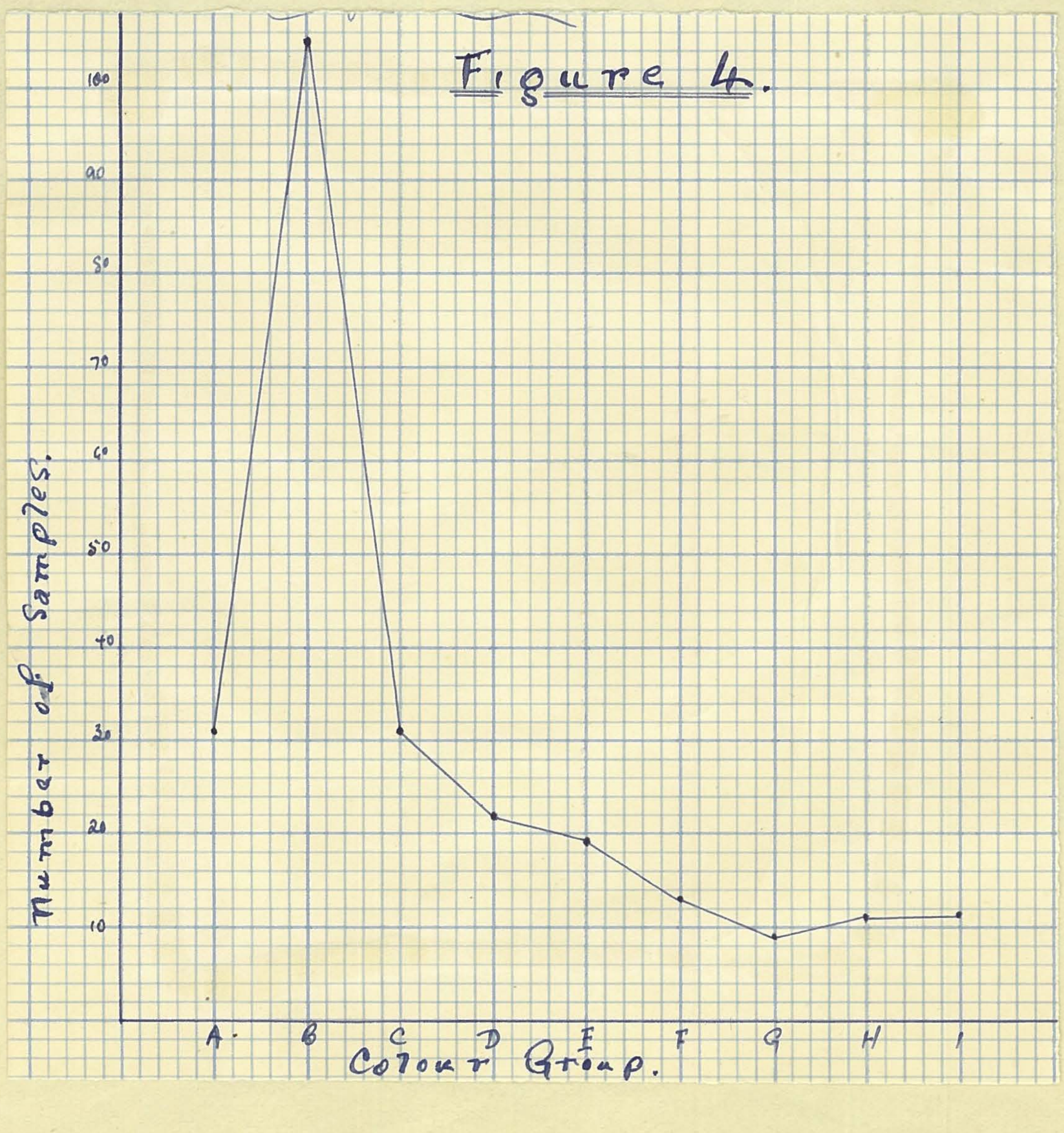


Table 5 gives the total number of samples in the nine colour groups. It will be seen that approximately 75% are contained within the range of B to F. Figure 4 shows this trend graphically. Both Table 5 and Figure 4 show a large number of pale samples and a lesser number of samples in the darker groups.

TABLE 5.

Sample Colour	Number of Samples.
A	31
B	105
C	31
D	22
E	19
F	13
G	9
H	11
I	11

Sample germination percentage figures and sample colours were analysed to discover any correlation between them. Absence of correlation (.088 $\pm$ .045) was found between interim germination percentage and seed colour; but a fair correlation (.329 $\pm$ .040) was discovered between final germination percentage and seed colour. Such a correlation figure shows that there is a relation between final germination percentage and sample colour and that the relation is quite significant.

Discussion.

The difference in germination capacities of different colour groups may readily be explained on a maturity basis. (See Jacques and Corkill: New Zealand Journal of Science and Technology Volume 13, page 224). In the groups of colour A containing the palest samples there is little doubt but that the samples were harvested in an immature condition. They were not given the opportunity to attain a higher degree of vitality which would have been imparted by better maturity and which would have resulted in a deeper sample colour. Hence their vitality and germination capacity are low. The darkest samples, on the other hand, were probably over-mature. According to Jacques and Corkill as colour of seed deepens so also does the maturity and that coincident with this there is a greater vitality and better germination. Their work also shows that in some cases a fall in vitality and germination occurs after a certain degree of maturity has been attained.

The work, here described, employs sample colour instead of individual seed colour and indicates that there is a considerable range of sample colour, that from colours B to F, over which vitality and germination capacity are at a maximum. The palest samples are obviously immature while the depression in germination capacity of the darker samples is much greater than that shown by Jacques and Corkill's figures so that factors other than loss of vitality due to over-maturity must be involved. Such undoubtedly is heating due to bad harvesting or storage conditions.

Assuming the average Interim germination figure of a group of samples to be a measure of the average energy of germination of that group we see from Figure 3 that in the group of samples of colour A this germination figure is low compared with that of the colours B to F; and that the difference between the 8-day and 18-day figures for this group is greater than that for the groups B to F. Hence we can definitely conclude that the pale samples of colour A while significantly lower in ~~sward~~ germination capacity than samples of colours B to F are also lower in average vitality.

The average final germination figures of the colours G and H are practically identical with that of the samples of colour A. The average interim germination figures of the samples of colours G and H just fail to be significantly higher than that of the samples of colour A. Figure 3 would indicate that the difference was a real one. It is the large probable errors of these figures due probably to the small number of samples in the groups and not a high standard deviation which makes these figures not significantly different. In view of these large probable errors and the appearance of the graph and the fact that the figures only just failed to be significant we might, with reserve, say that samples of colour G and H show greater vitality or energy of germination than the average samples of colour A and hence are superior to it.

Samples of colour I are inferior to those of colour A in 18-day germination capacity and approximately equal to it in 8-day germination percentage. Hence these darkest coloured samples are the poorest of all.

Jacques and Corkill concluded, from a study of individual crested dogstail seeds, that the colour darkens with weight of seed until a maximum weight is reached after which in most cases there is a slight decrease which may be due directly or indirectly to loss of moisture. This fall in seed weight is responsible for a loss of vitality and a lowered germination capacity. Also dark colour may be imparted to seed as a result of heating in the sack, stripped seed, from its method of harvesting and drying in bags strung over a fence, being very liable to be damaged in this respect unless special precautions are taken to ensure that it dries rapidly and uniformly. Bad harvest conditions may lead to the same result. Thus any sample that is over-mature and has lost weight and vitality through being over-ripe, or any sample that has darkened through being badly harvested or stored and has heated, should naturally have its germination capacity reduced. Small wonder then that the average germination capacities of the samples in the three darkest colour groups (G. H. and I.) show a falling off when compared with those of mature well-harvested samples.

THE RELATION BETWEEN SEED COLOUR AND PLOT COUNTS.

The seed colour of the samples (See Appendix, Table 4) and the number of plants in the plots sown of the same samples (See Appendix, Table 1) were analysed statistically but no correlation (.015) was found between seed colour and number of crested dogstail plants under a weekly mowing treatment in Area 5. Similar figures for Area 8 were not analysed in view of the low figure found for Area 5.

This does not mean that there is no relation between seed colour and number of plants. The relation will be indirect such that seed colour and germination are related as also are germination and plant number.

SEED COLOUR IN RELATION TO ORIGIN OF SAMPLES.

Results.

Seed colour and origin of samples are given in the Appendix, Table 4.

No significant difference in colour is indicated between Southland and Sandon samples although on the average Sandon samples are deeper coloured than the Southland samples. The average colours are :-

Sandon $C + .878 \pm .261$

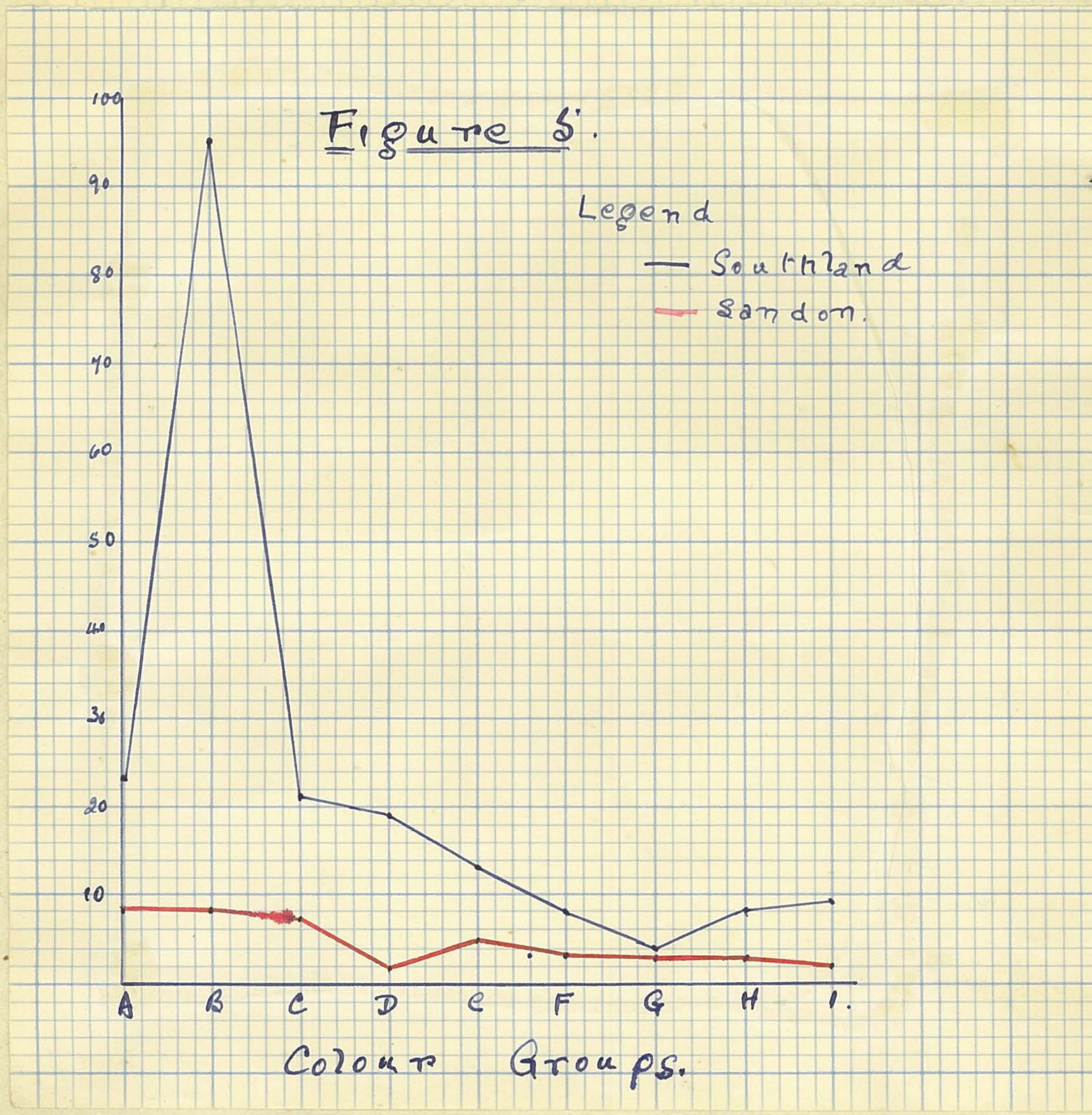
Southland $C + .114 \pm .096$

This undoubtedly shows better maturity of the Sandon samples and were not the number of available Sandon samples so restricted the difference might have been significant.

Table 6 gives the number of samples in the nine colour groups for Sandon and Southland. The trend of the figures is shown graphically in Figure 5.

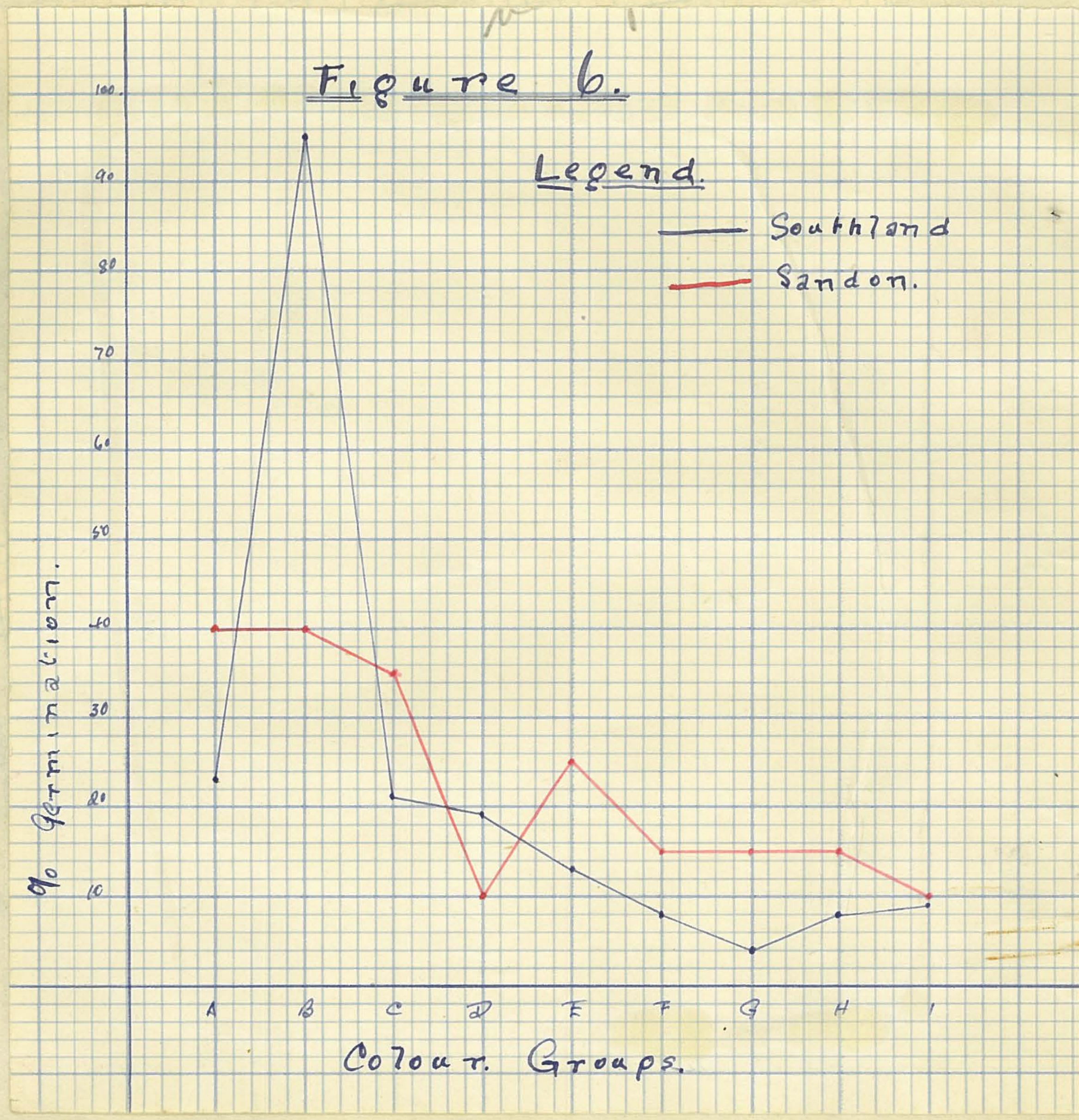
TABLE 6.

Sample Colour	Number of Samples	
	Sandon	Southland
A	8	23
B	8	95
C	7	21
D	2	19
E	5	13
F	3	8
G	3	4
H	3	8
I	2	9



Such figures as those of Table 6 and such a graph as that of Figure 5 show that in Southland samples there are a large number of pale coloured samples while the Sandon figures show no such peak but a more even trend from pale to dark sample colour.

Since there are only forty-one Sandon samples and two hundred Southland samples in Table 6 Figure 6 was prepared . The Sandon curve is on a scale five times that of the Southland curve. The two curves now show the proportions of colours in the two districts. This figure clearly shows that Sandon seed is the darker coloured seed and that Southland has a large proportion of pale samples.



Discussion.

The difference in sample colour of the two districts suggests a difference in the harvesting practices. According to Stapledon (Journal of the Ministry of Agriculture. Volume 43 page 516) in the Southland district the bright yellow colour is an outcome of too early cutting and of premature ripening in the stook which is much aggravated by dry conditions at harvesting time. In Sandon, according to this authority, the crop is not harvested so early so that the seed takes on a deeper colour. Such figures as these presented above bear out Stapledon's conclusion that Sandon seed is better matured than Southland seed.

Strange it seems that in view of the Sandon samples being darker in colour than the Southland samples the average Southland germination figure should be larger than the Sandon figure. It will be remembered, however, that this difference was not significant.

~~Strange it seems that in view of the Sandon samples being darker in colour than the Southland samples the average Southland germination figure should be larger than the Sandon figure. It will be remembered, however, that this difference was not significant.~~

The reason no doubt is that the samples of colour B have a high average germination capacity and one significantly higher than those of colours G. H. and I. (see Table 5). This high proportion of samples of colour B and the low proportion of the darker groups give the Southland samples the higher average figure.

This page surely misplaced — should be under germination

SEED COLOUR IN RELATION TO HARVESTING PRACTICES.

The methods of harvesting crested dogstail seed in New Zealand result in differences in colour of samples. These methods are three in number. Firstly, seed may be stripped from permanent pasture. A machine known as a stripper separates the seed from the standing inflorescences as it moves over the field. Secondly, crested dogstail may be grown along with perennial ryegrass and a double crop of seed taken. Thirdly, special leys of crested dogstail may be grown and harvested with a self-binder. Under favourable conditions it remains about three weeks in stook and is thrashed from the stook. Stacking is not practised unless unavoidable. A brief discussion of these three methods will show how different harvesting practices may result in samples of different colour.

Stripping of seed is practised in both Sandon and Southland. For the seed to separate from the inflorescence readily it must be more mature than when harvested and threshed as is normally done. Such additional maturity results in a darker sample colour. The seed when stripped is collected into sacks and later is strung over fences in half-sacks to dry. This gives it ample opportunity to heat somewhat and such is reputed to darken the samples still further.

Crested dogstail grown along with perennial ryegrass makes possible the production of a double seed crop. The ryegrass seed, however, ripens before that of the crested dogstail and as it is usually the more important crop, is harvested when ready so that the crested dogstail seed is harvested in an immature condition. The resulting sample will be pale in colour and of low germination capacity and vitality.

The special crop of crested dogstail plants grown for seed is harvested at varying stages of maturity so that the samples range from pale to fairly dark colour. If weather conditions at harvesting time do not produce a rapid drying in the stook the samples will darken still further due to continued development and possibly heating. Under good drying conditions they will dry fairly rapidly and the seed colour will not darken appreciably.

With this brief outline of the methods of seed production we are in a position to compare the seed colours of seed produced under different harvesting conditions. The facts presented above strongly suggest that the stripped seed will be of the darkest colour, that seed grown and harvested with ryegrass will be the palest in colour, and that that harvested as a special crop will be of intermediate yet variable colour. This latter seed probably will not include the palest and the darkest samples - those of poorest germination capacity and lowest vitality. If such is the case it seems justifiable to conclude that the practices of stripping seed and of harvesting seed along with perennial ryegrass, are detrimental to the quality of the seed. If these two methods of harvesting seed are to remain in use they should be so modified that extreme sample colours are avoided.

This theory can not be proved by figures. It is not possible to separate the samples into three groups according to the methods of harvesting for data relative to the harvesting practices are not available. An attempt was made to do this at the same time as the samples were graded according to colour. It was discontinued however as no clear cut distinction was shown between samples harvested by the different methods. Thus stripped seed was assumed to be dark seed which might also contain pale coloured seed added to give it a bright appearance. It was impossible to make a complete separation as it was not known how pale stripped seed might be. Similarly seed grown with perennial ryegrass was assumed to be pale coloured with frequently ryegrass seeds present, but there was nothing to indicate how dark a sample might be and yet still be grown with perennial ryegrass. No distinguishing criterion was available for seed threshed from the stook. Thus as the samples range from pale colour to dark colour without any marked differences according to the method of harvesting mere observation could not give a complete and accurate separation.

range from pale colour to dark colour without any marked differences according to the method of harvesting mere observation could not give a complete and accurate separation.

SEED COLOUR IN RELATION TO ABILITY OF SAMPLES TO WITHSTAND PROLONGED STORAGE.

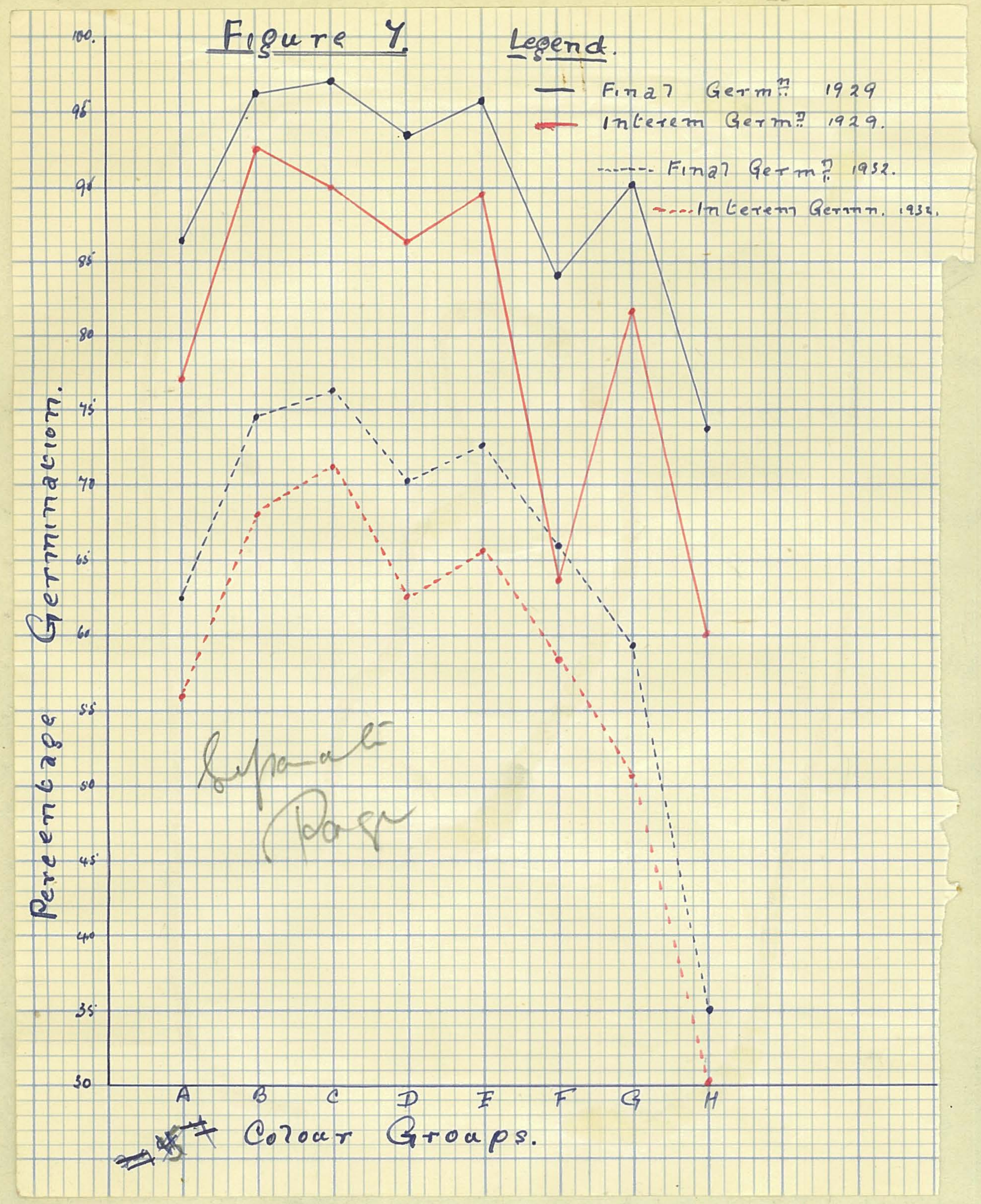
In order to ascertain the ability of the different colour groups to withstand prolonged storage forty-three samples representative of the colour groupings and previously tested for germination in 1929 were tested for germination in April 1932. (See Appendix, Table 5). The two sets of average percentages germination figures of the colour groups of these forty-three samples are set out in Table 7. Figure 7 shows these average figures in graphic form.

TABLE 7.

SUMMARY OF 1929 AND 1932 GERMINATION FIGURES.

Colour	1929				1932			
	Interim		Final		Interim		Final	
A	77.2	± 3.97~~7~~	86.2	± 4.35~~7~~	56.0	± 2.42~~0~~	62.4	± 2.78~~6~~
B	92.6	± 1.32~~9~~	96.2	± .904~~8~~	68.0	± 2.50~~9~~	74.4	± 1.99~~7~~
C	90.0	± 2.27~~3~~	97.0	± .73~~89~~	71.2	± 3.73~~6~~	76.2	± 2.49~~6~~
D	86.12~~5~~	± 1.42~~6~~	93.25	± 2.49~~0~~	62.62~~5~~	± 3.02~~3~~	70.2	± 3.33~~0~~
E	89.5	± 1.32~~2~~	95.875	± 1.01~~6~~	65.62~~5~~	± 4.21~~7~~	72.75	± 3.25~~5~~
F	63.7	± 3.68~~5~~	84.0	± 3.61~~2~~	58.3	± 8.91~~5~~	66.0	± 8.60~~4~~
G	81.7	± 2.70~~9~~	90.3	± 1.95~~8~~	50.83~~4~~	± 4.49~~8~~	59.3	± 4.65~~8~~
H	60.0	± 6.91~~1~~	73.77	± 8.21~~0~~	30.3	± 0.03	35.0	± 9.60~~5~~

~~Discussion.~~



DISCUSSION.

Such a graph would lead one to assume that for the two 18-day germination percentage lines the trend is similar from groups A to E, that in these groups the fall in germination percentage for the three years has been approximately similar in amount being from 20 - 24%. Such a depression of germination percentage is more serious in the low germinating group A than in the four remaining higher germinating groups. The difference of 18% for group F might indicate that this group maintains its germination capacity better than the previous groups. But as the average 1929 figure of the few samples retested is low for group F.

(See Table 4) the 18% fall in germination must be regarded as fairly heavy. If the germination figure had been normal for the group such a depression of germination in three years would be of less consequence.

The Interim germination percentage lines show a similar trend to those of the 18-day figures with the difference that the 1929 average figure for Group F is very low compared with what it is for the whole group.

From the few figures available the conclusion may be drawn that the colour groups of high average germination capacity maintain the germination percentages better than those of poorer germination capacity.

SUMMARY AND CONCLUSIONS.

The position of crested dogstail as a pasture grass is outlined and its better qualities are shown to be closely realted to permanency.

The lawnmower treatments while not truly representative of grazing conditions give crested dogstail plants varying amounts of competition and under these treatments the more persistent plants survive.

Southland samples are shown to be superior to Sandon samples in number of plants per $1\frac{1}{4}$ square feet area. Such a difference in the early stages is significant under different mowing treatments but at later stages is significant only under constant short-mowing treatment.

Evidence is submitted which indicates that foreign samples are more persistent than New Zealand samples. The method of growing New Zealand seed leads to the production of a short-lived type. Figures are presented which show a very rapid fall in number of plants over a period of thirty months.

No relation is shown between early maximum flowering date and number of plants in the plots.

A fair correlation is shown between germination percentages (8 and 18-day) and number of plants in closely mown plots. The correlation between the counts of the 8-day germination percentage figure is higher but not significantly different from that of the 18-day figure. The higher correlation between germination percentage and number of plants in the older Area indicates that higher germinating seed produces relatively a greater number of more persistent plants than low germinating seed.

Significantly similar average germination capacity is shown over a range of five sample colour groups excluding the palest group of samples and the three darkest groups respectively. In explanation Jacques and Corkill's conclusion, from work on individual seeds, that pale seed has low germination capacity due to immaturity and dark seed a low germination capacity due to over-maturity, was found to be only partly applicable to average sample colour. It is shown that the germination figures of the darker samples show a greater falling off than Jacques and Corkill's work indicates so that heating due to bad harvest and storage conditions has played a very considerable part.

Interim germination figure is assumed to be a measure of seed vitality or energy of germination. Similar high vitality is shown over the same range of colour as the high 18-day germination capacity and lower vitality is shown in the poorer germinating samples.

The germination capacity of Southland seed is higher than that of the Sandon seed although the average colour of Sandon seed is darker than that of Southland seed. Neither of these differences are significant. There is a higher proportion of pale samples, yet samples of high germination capacity, and a lower proportion of dark and lower germinating samples in Southland than Sandon seed.

Approximately 75% of the samples of Sandon and Southland origin are present in these higher germinating groups; and in Southland seed approximately 17% more than in Sandon seed.

A fair correlation (.329 ± .040) is shown between seed colour and germination capacity, but none is shown between seed colour and number of plants in the plots. However the relation between seed colour and germination capacity, and between germination capacity and number of plants, is such that there will be a relation between seed colour and number of plants, although the correlation figure did not show it.

A brief discussion of the harvesting methods is given and the conclusion drawn that the practices of stripping seed, and of growing crested dogstail with perennial ryegrass and harvesting the two seed crops together, are detrimental to the quality of the seed. If these two methods of harvesting seed are to remain in use they should be so modified that extreme sample colours are avoided. A number of samples representative of the colour groups were retested for germination after three years. The colour groups of high average germination capacity maintain their germination capacity better than low germinating groups. The trend for the average figures of the samples in the different colour groups is roughly parallel for the two testings the greatest fall in germination taking place in the second darkest group, none of the samples in the darkest group being retested.

APPENDIX.

TABLE 1.

Counts made of crested dogstail plants in 1½ square feet of the weekly mowing, 3-weekly mowing and weekly mowing with hay treatments of the pl of Areas 5 and 8 in the period between the 4th December 1931 and the 5t February 1932.

Area 5.

Plot Number	Hay treatment	Mown 3-weekly	Mown weekly	Mown weekly	Mown 3-weekly	Hay treatment	Plot Number
1	5	11	29	23	9	1	43
2	18	29	42	30	21	4	44
3	17	36	38	17	18	0	45
4	6	14	25	43	17	6	46
5	11	9	27	24	13	0	47
6	3	29	19	13	13	3	48
7	3	4	16	17	10	0	49
8	1	23	19	23	8	1	50
9	2	13	15	17	5	0	51
10	5	20	37	34	9	5	52
11	2	6	9	6	4	2	53
12	4	16	28	35	18	2	54
13	0	3	8	27	15	1	55
14	4	10	27	46	22	10	56
15	2	15	29	32	12	6	57
16	0	16	21	11	22	4	58
17	1	12	12	19	17	9	59
18	6	14	32	24	23	2	60
19	2	10	6	17	12	2	61
20	6	6	32	13	20	3	62
21	0	6	25	5	18	0	63
22	0	6	14	9	4	1	64
23	1	2	9	7	3	1	65
24	1	8	18	6	14	1	66
25	0	2	11	16	7	1	67
26	0	2	16	10	6	0	68
27	0	0	3	12	2	0	69
28	1	4	12	13	3	1	70
29	0	10	3	11	10	4	71
30	1	10	14	8	7	0	72
31	2	4	5	2	26	0	73
32	0	2	11	7	30	4	74
33	0	3	4	0	16	11	75
34	0	2	9	3	2	3	76
35	1	5	5	3	6	0	77
36	0	15	19	4	3	0	78
37	0	7	2	5	11	0	79
38	0	22	19	5	7	2	80
39	2	12	24	9	17	0	81
40	2	12	25	3	7	0	82
41	1	17	9	5	10	1	83
42	1	7	10	4	16	0	84

Plot Number	Hay treatment	Mown 3-weekly	Mown weekly	Mown weekly	Mown 3-weekly	Hay treatment	Plot Number
85	0	10	24	21	15	3	127
86	3	11	20	31	21	4	128
87	3	26	15	40	36	3	129
88	4	22	38	33	14	0	130
89	10	26	27	34	5	6	131
90	5	20	46	25	8	2	132
91	8	23	32	36	3	5	133
92	8	10	27	39	5	2	134
93	7	11	17	20	8	2	135
94	5	17	23	35	5	2	136
95	2	10	19	56	7	7	137
96	3	9	17	27	5	5	138
97	0	10	33	43	21	9	139
98	2	18	15	34	17	7	140
99	0	11	33	42	14	5	141
100	2	10	38	46	13	13	142
101	1	6	24	39	7	5	143
102	1	8	34	36	26	3	144
103	2	11	21	20	9	10	145
104	0	3	11	43	19	17	146
105	3	3	15	30	26	44	147
106	1	1	3	27	23	53	148
107	0	3	4	36	15	30	149
108	6	3	8	20	39	10	150
109	1	9	9	38	36	8	151
110	2	0	18	25	15	8	152
111	0	4	9	43	6	3	153
112	0	3	5	17	1	5	154
113	0	2	8	25	6	1	155
114	0	8	7	27	11	1	156
115	1	14	10	23	4	5	157
116	4	12	15	22	6	2	158
117	1	22	5	22	11	3	159
118	20	23	10	43	5	7	160
119	6	8	14	34	7	8	161
120	0	2	12	46	4	7	162
121	1	13	7	19	12	6	163
122	0	8	16	20	11	7	164
123	0	10	20	28	20	8	165
124	4	29	22	16	17	3	166
125	2	14	15	19	25	0	167
126	6	28	8	22	7	1	168

<u>AREA 8.</u>

TABLE 1. (Continued).

Plot Number.	Hay treatment	Mown - 3 weekly	Mown weekly	Mown weekly	Mown 3 - weekly	Hay treatment	Plot Number.
1	13	11	23	28	34	18	39
2	11	26	31	16	25	20	40
3	7	18	11	22	25	28	41
4	21	28	9	21	22	7	42
5	21	30	42	22	21	20	43
6	18	20	32	24	40	20	44
7	14	10	27	27	30	15	45
8	27	32	18	19	29	8	46
9	14	19	12	25	28	31	47
10	17	26	28	25	26	25	48
11	20	15	20	34	20	21	49
12	35	45	18	50	48	10	50
13	48	25	47	18	20	11	51
14	25	41	35	22	41	26	52
15	18	43	23	43	41	40	53
16	10	30	10	42	29	38	54
17	19	29	17	27	28	26	55
18	11	40	17	31	28	42	56
19	26	48	31	25	28	14	57
20	28	37	37	49	37	29	58
21	7	28	25	32	44	9	59
22	3	23	20	19	28	22	60
23	10	20	36	30	23	25	61
24	7	9	22	25	55	39	62
25	9	17	20	30	47	31	63
26	3	17	8	38	50	38	64
27	5	26	11	50	63	28	65
28	8	14	26	21	29	34	66
29	15	24	18	14	19	3	67
30	10	22	17	8	22	3	68
31	6	16	14	8	23	10	69
32	10	22	27	15	24	5	70
33	10	43	36	20	36	2	71
34	8	57	36	18	35	8	72
35	1	26	12	36	20	4	73
36	5	28	32	31	25	17	74
37	8	27	20	22	3	6	75
38	9	49	50	30	13	6	76

Plot Number.	Hay treatment	Mown 3 - weekly	Mown weekly	Mown weekly	Mown 3 - weekly	Hay treatment	Plot Number.
77	18	33	26	20	16	6	115
78	16	40	29	20	33	7	116
79	12	35	26	23	50	3	117
80	3	14	6	22	45	8	118
81	10	29	13	19	26	5	119
82	17	18	16	19	29	16	120
83	6	12	9	23	46	13	121
84	7	19	18	24	55	15	122
85	7	19	13	13	34	13	123
86	32	19	37	31	37	28	124
87	45	46	35	9	28	10	125
88	41	57	80	20	37	10	126
89	31	18	24	27	27	11	127
90	45	35	34	24	27	33	128
91	36	42	22	27	34	22	129
92	53	39	20	24	45	8	130
93	53	47	30	29	35	27	131
94	19	31	21	33	59	23	132
95	25	34	15	24	73	33	133
96	23	23	18	16	64	49	134
97	29	16	15	14	39	17	135
98	12	18	16	29	46	9	136
99	30	21	24	14	21	11	137
100	25	33	23	25	47	9	138
101	30	28	34	25	39	21	139
102	33	30	36	25	17	48	140
103	21	29	42	63	70	47	141
104	17	19	21	38	67	40	142
105	17	20	17	18	69	29	143
106	12	21	18	6	23	10	144
107	36	15	33	8	24	6	145
108	10	17	26	5	13	7	146
109	18	9	17	13	33	14	147
110	37	8	19	11	30	11	148
111	19	20	21	5	13	4	149
112	18	22	25	10	41	29	150
113	22	22	26	21	23	29	151
114	6	15	15	13	19	30	152

TABLE 2.

Counts made by Jacques of the crested dogstail plants in 1¼ squar feet of the three treatments of some of the plots of Area 5 durin the period February - April 1931.

Plot Number	Hay treatment	Mown 3-weekly	Mown weekly	Mown weekly	Mown 3-weekly	Hay Treatment	Plot Number					Mown weekly	Mown 3-weekly	Hay treatment	Plot Number
1	50	5	95	104	43	21	43								
2	66	48	187	100	65	13	44								
3	65	34	136	123	55	26	45								
4	23	15	136	143	55	15	46								
5	40	30	143	175	42	43	47								
6	36	55	122	88	20	27	48								
7	49	18	56	96	32	24	49								
8	58	36	126	89	38	21	50								
9	20	20	123	121	13	35	51								
10	46	53	126	123	27	43	52								
11	46	23	124	63	14	25	53								
12	30	39	113	93	36	21	54								
13	17	6	37	117	32	19	55								
14	55	14	130	96	58	33	56								
15	18	35	106	149	44	22	57								
16	46	54	159	106	65	54	58								
17	41	24	82	89	40	27	59								
18	40	47	96	107	56	47	60	-	-	-	-	163	64	8	144
19	26	17	37	158	39	26	61	-	-	-	-	102	40	21	145
20	26	22	132	128	77	32	62	-	-	-	-	116	54	40	146
21	9	13	99	103	101	28	63	-	-	-	-	-	-	-	-
22	13	11	77	49	23	15	64	-	-	-	-	-	-	-	-
23	9	4	75	42	8	6	65	-	-	-	-	-	-	-	-
24	4	8	154	52	36	11	66	-	-	-	-	87	83	53	150
25	8	9	50	66	23	13	67	-	-	-	-	80	97	53	151
26	5	6	91	89	1	18	68	-	-	-	-	67	17	24	152
27	13	3	22	75	9	16	69	-	-	-	-	72	15	17	153
28	2	6	58	70	18	16	70	-	-	-	-	79	9	10	154
29	1	6	27	-	33	12	71	-	-	-	-	128	36	15	155
30	2	7	165	-	20	5	72	-	-	-	-	-	-	-	156
31	8	4	58	-	58	24	73								
32	2	7	91	-	58	82	74								
33	7	5	55	-	12	127	75								
34	0	6	69	-	15	36	76								
35	5	10	59	-	-	1	77								
36	8	42	52	-	-	2	78								
37	9	6	9	-	-	5	79								
38	19	31	77	-	-	6	80								
39	8	20	70	-	-	0	81								
40	2	31	62	-	-	12	82								
41	1	45	82	-	-	30	83								
42	9	7	50	-	-	23	84								

176
84
20

TABLE 3.

Counts made of several of the Plots of Area 5 during the period 27th - 4th June, 1932.

Plot Number				Mown weekly	Mown 3-weekly	Hay treatment	Plot Number	Plot Number	Hay treatment	Mown 3-weekly	Mown weekly	Mown weekly	Mown 3-weekly	Hay treatment	
1	-	-	-	-	-	-	43	85	0	0	1	-	-	-	127
2	-	-	-	-	-	-	44	86	0	0	2	-	-	-	128
3	-	-	-	-	-	-	45	87	1	2	1	-	-	-	129
4	-	-	-	-	-	-	46	88	2	6	1	-	-	-	130
5	-	-	-	-	-	-	47	89	0	3	5	-	-	-	131
6	-	-	-	-	-	-	48	90	2	5	4	-	-	-	132
7	-	-	-	-	-	-	49	91	1	1	0	-	-	-	133
8	-	-	-	-	-	-	50	92	0	0	1	-	-	-	134
9	-	-	-	-	-	-	51	93	0	0	1	-	-	-	135
10	-	-	-	-	-	-	52	94	1	0	0	-	-	-	136
11	-	-	-	-	-	-	53	95	-	-	-	-	-	-	137
12	-	-	-	-	-	-	54	96	-	-	-	-	-	-	138
13	-	-	-	-	-	-	55	97	-	-	-	-	-	-	139
14	-	-	-	-	-	-	56	98	-	-	-	-	-	-	140
15	-	-	-	-	-	-	57	99	-	-	-	-	-	-	141
16	-	-	-	-	-	-	58	100	-	-	-	-	-	-	142
17	-	-	-	-	-	-	59	101	-	-	-	-	-	-	143
18	-	-	-	-	-	-	60	102	-	-	-	1	0	1	144
19	-	-	-	-	-	-	61	103	-	-	-	1	0	0	145
20	-	-	-	-	-	-	62	104	-	-	-	0	2	8	146
21	-	-	-	-	-	-	63	105	-	-	-	1	6	20	147
22	-	-	-	0	-	-	64	106	-	-	-	0	4	32	148
23	-	-	-	2	-	-	65	107	-	-	-	3	5	20	149
24	-	-	-	1	-	-	66	108	-	-	-	0	4	1	150
25	-	-	-	1	-	-	67	109	-	-	-	0	5	2	151
26	-	-	-	2	-	-	68	110	-	-	-	1	3	1	152
27	-	-	-	3	1	-	69	111	-	-	-	3	0	0	153
28	-	-	-	1	1	-	70	112	-	-	-	5	0	0	154
29	-	-	-	-	-	-	71	113	-	-	-	-	-	-	155
30	-	-	-	-	-	-	72	114	-	-	-	-	-	-	156
31	-	-	-	-	-	-	73	115	-	-	-	-	-	-	157
32	-	-	-	1	1	0	74	116	-	-	-	-	-	-	158
33	-	-	-	0	1	0	75	117	-	-	-	-	-	-	159
34	-	-	-	0	1	0	76	118	-	-	-	-	-	-	160
35	-	-	-	-	-	-	77	119	-	-	-	-	-	-	161
36	-	-	-	-	-	-	78	120	-	-	-	-	-	-	162
37	-	-	-	-	-	-	79	121	-	-	-	-	-	-	163
38	-	-	-	-	-	-	80	122	-	-	-	-	-	-	164
39	-	-	-	-	-	-	81	123	-	-	-	-	-	-	165
40	-	-	-	-	-	-	82	124	-	-	-	-	-	-	166
41	-	-	-	-	-	-	83	125	-	-	-	-	-	-	167
42	-	-	-	-	-	-	84	126	-	-	-	-	-	-	168

TABLE 4.

Plot number, seed origin, germination percentage figures, seed sample colour, and date of early maximum flowering of the different samples sown in Areas 5 and 8. The blanks in the origin column represent miscellaneous commercial and experimental samples.

Area 5.

Plot No.	Origin	Interim Percentage germination.	Percentage final germination.	Colour grouping.	Maximum flowering date of December 1931.
1	-	-	-	F.	20
2	Sandon	-	-	C.	17
3	Sandon	-	-	B.	20
4	Southland	-	-	B.	17
5	Sandon	-	-	B.	17
6	Southland	-	-	B.	17
7	Sandon	-	-	A.	18
8	Southland	-	-	C.	17
9	-	-	-	F.	20
10	Southland	-	-	B.	17
11	Sandon	-	-	C.	18
12	Southland	75	94	E.	17
13	Sandon	-	-	A.	20
14	Southland	94	96	B.	17
15	Sandon	96	99.5	B.	17
16	Southland	95.5	97.5	B.	17
17	Sandon	96	96.5	C.	18
18	Southland	99	100	B.	17
19	Sandon	87.5	90	C.	18
20	Southland	93.5	97	A.	17
21	Sandon	78.5	91	D.	20
22	Southland	96	98	B.	17
23	Sandon	94.5	95.5	E.	17
24	Southland	98.5	99	B.	
25	-	64.5	93	G.	14
26	Southland	-	-	E.	14
27	Sandon	29	92	A.	18
28	Southland	96	97.5	E.	17
29	Sandon	85.5	93.5	F.	19
30	Southland	96	99	B.	18
31	Sandon	81.5	92.5	A.	20
32	Southland	88.5	91.5	D.	14
33	Sandon	91.5	93	E.	17
34	Southland	76	81	I.	19
35	Sandon	25.5	77	A.	17
36	Southland	96	97	D.	17
37	Sandon	12.5	89.5	A.	18
38	Southland	88.5	94	H.	17
39	Sandon	82	96.5	B.	17
40	Southland	92.5	96.5	E.	17
41	Sandon	80	90.5	B.	19
42	Southland	91.5	98	B.	17

TABLE 4. Continued.

Area 5.

Plot No.	Origin.	Interim percentage germination.	Percentage final germination.	Colour grouping.	Maximum flowe ing date of D ember 1931.
43	Sandon	94.5	95	C.	17
44	Southland	82	84.5	E.	20
45	Sandon	97	98	G.	18
46	Southland	87.5	94.5	I.	19
47	Sandon	89.5	99.5	E.	17
48	Southland	64	75.5	I.	18
49	Sandon	90.5	97	F.	17
50	Southland	90.5	94.5	E.	17
51	Sandon	83	95	A.	17
52	Southland	89.5	95	B.	17
53	Sandon	91	97	C.	20
54	Southland	-	-	C.	20
55	Sandon	87.5	92	I.	20
56	Southland	89	93	B.	20
57	Sandon	95.5	96	G.	19
58	Southland	95.5	98	B.	17
59	Sandon	43	76	H.	19
60	Southland	52.5	75	B.	17
61	Sandon	92.5	98.5	H.	20
62	Southland	33	90	B.	18
63	Sandon	93.5	95	B.	17
64	Southland	94	98.5	B.	17
65	Sandon	94	95.5	G.	17
66	Southland	87.5	97	B.	17
67	Sandon	87	92	I.	17
68	Southland	81.5	98	B.	17
69	Sandon	88	98	F.	17
70	Southland	93	98	B.	17
71	Southland	-	-	D.	17
72	Southland	84.5	95.5	B.	18
73	Southland	63	93	B.	17
74	Southland	56	90.5	B.	17
75	Southland	82	90.5	D.	18
76	Southland	79	95	B.	17
77	Southland	90	97.5	D.	17
78	Southland	44	78.5	A.	19
79	Southland	50	89	A.	19
80	Southland	55	90.5	B.	17
81	Southland	63.5	93.5	A.	17
82	Southland	71.5	92.5	A.	17
83	Southland	64	95	A.	17
84	Southland	67.5	90	A.	17

TABLE 4. Continued.

Area 5.

Plot No.	Origin	Interim percentage germination	Percentage final germination.	Colour grouping	Maximum flowering date of December 1931.
85	Southland	68.5	95.5	A.	17
86	Southland	97	98	B.	17
87	Southland	98.5	100	B.	19
88	Southland	97.5	99	B.	20
89	Southland	88.5	98	B.	17
90	Southland	91.5	98	B.	17
91	Southland	91	97	C.	18
92	Southland	94	97.5	B.	18
93	Southland	76	93	B.	17
94	Southland	95	97.5	B.	17
95	Southland	86	99	B.	17
96	Southland	93	96.5	B.	18
97	Southland	81	90.5	G.	17
98	Southland	97	99	B.	17
99	Southland	95.5	96	A.	19
100	Southland	-	-	E.	19
101	Southland	95.5	97	B.	18
102	Southland	92.5	96	-	17
103	Southland	97.5	98	I.	20
104	Southland	94.5	97.5	B.	17
105	Southland	89.5	93.5	G.	20
106	Southland	95.5	96.5	A.	17
107	Southland	63	66.5	I.	20
108	Southland	86	93	F.	18
109	Southland	92.5	94	B.	17
110	Southland	97.5	99	C.	18
111	Southland	89.5	90.5	H.	17
112	Southland	94.5	97	D.	18
113	Southland	93.5	98	D.	17
114	Southland	73	94	A.	18
115	Southland	69	92	B.	19
116	Southland	87	97.5	B.	17
117	Southland	80	96	A.	17
118	Southland	93.5	96	B.	17
119	Southland	90.5	97.5	A.	18
120	Southland	89	92.5	B.	18
121	Southland	90	95.5	B.	17
122	Southland	84.5	94	D.	18
123	Southland	92	97.5	B.	17
124	Southland	97	99.5	A.	15
125	Southland	90	97.5	B.	17
126	Southland	95.5	98	D.	17

TABLE 4. Continued.

Area 5.

Plot No.	Origin	Interim percentage germination.	Percentage final germination.	Colour grouping.	Maximum flo ing date of ember 1931.
127	Southland	93.5	99.5	E.	17
128	Southland	97.5	98.5	B.	18
129	Southland	90.5	98.5	A.	17
130	Southland	95	96.5	B.	19
131	Southland	90	93	B.	18
132	Southland	95.5	98.5	A.	18
133	Southland	92.5	98.5	C.	19
134	Southland	93.5	98.5	C.	17
135	Southland	91	98.5	F.	20
136	Southland	92.5	96	B.	19
137	Southland	85.5	95.5	C.	17
138	Southland	86.5	99	D.	17
139	Southland	95.5	99	D.	17
140	Southland	96	98	B.	17
141	Southland	-	-	D.	17
142	Southland			B.	18
143	Southland	96	96	B.	15
144	Southland	69	90	A.	19
145		98.5	99.5	E.	18
146	Southland	98	99.5	C.	17
147	Southland	94	98	C.	17
148	Southland	95.5	99.5	B.	17
149	Southland	95	97.5	B.	17
150	Southland	95.5	98.5	B.	17
151	Southland	95.5	98.5	B.	17
152		89.5	95.5	C.	18
153		89	98	B.	17
154		95.5	98	C.	17
155	Southland	95	98	B.	17
156	Southland	93	98.5	B.	17
157	Southland	90	97.5	B.	17
158	Southland	87	96	F.	17
159	Southland	96	97	F.	17
160	Southland	94.5	97.5	C.	17
161	Southland	92.5	97	D.	17
162	Southland	91.5	98.5	B.	17
163	Southland	95	97.5	B.	17
164	Southland	-	-	B.	17
165	Southland	83.5	92.5	E.	17
166	Southland	92	95.5	B.	17
167	Southland	-	100	B.	18
168	Southland	-	97.5	B.	17

TABLE 4. Continued.

Area 8.

Plot No.	Origin	Interim percentage germination.	Percentage final germination.	Colour grouping.	Maxium fl… ing date … ember 193…
1	Southland	89	97	B.	17
2	do	-	-	C.	17
3	do	-	-	H.	17
4	do	95	96.5	B.	17
5	do	-	-	-	17
6	do	53	71	G.	17
7	do	74.5	89	F.	17
8	do	92	95.5	B.	17
9	do	91.5	96	C.	18
10	do	76	93	C.	18
11	do	81	98.5	-	18
12	do	86.5	96	B.	17
13	do	90.5	97	E.	17
14	do	85	93	C.	17
15	do	94.5	98	F.	17
16	do	68	84	I.	17
17	do	76	89	B.	17
18	do	66	86	I.	17
19	do	85	97	H.	17
20	do	90.5	97	B.	17
21	do	81	94	F.	18
22	do	86	90.5	D.	17
23	do	80.5	88.5		17
24	do	91.5	97	B.	18
25	do	79.5	88	A.	17
26	do	84.5	91	B.	17
27	do	95.5	97.5	F.	17
28	do	83	90.5	D.	17
29	do	95	97.5	C.	17
30	do	90.5	95	B.	17
31	-	75	90	D.	17
32	-	76	92	G.	17
33	-	95	97.5	C.	17
34	-	-	-	-	17
35	-	-	-	-	17
36	-	-	-	-	22
37	-	-	-	-	23 *
38	-	-	-	-	23 *
39	Southland	93	96	B.	17
40	do	93	97	C.	17
41	do	61.5	89	G.	17
42	do	94.5	96	B.	17
43	do	94.5	96	B.	18
44	do	90	95	B.	17
45	do	92.5	97	B.	17
46	do	78.5	86	-	17
47	do	95	98	B.	17

* Probably flowering dates (Hay cut 22nd).

TABLE 4. Continued.

Area 8.

Plot No.	Origin	Interim percentage germination.	Final percentage germination.	Colour grouping.	Maximum flowe ing date of I ember 1931.
48	Southland	90	96	D.	19
49	do	79	92	A.	19
50	do	84.5	96	A.	19
51	do	35.5	44	I.	18
52	do	83.5	96.5	E.	17
53	do	76	90.5	H.	17
54	do	87	93.5	D.	17
55	do	78	90.5	I.	18
56	do	80	93.5	B.	17
57	do	70	84	H.	18
58	do	83	92	E.	18
59	do	93.5	98	C.	18
60	do	-	-	C.	18
61	do	96.5	98	B.	17
62	do	93	96.5	D.	18
63	do	90	94.5	H.	18
64	do	91.5	94	E.	18
65	do	94	97	B.	18
66	-	92	97.5	B.	17
67	Southland	89	93	B.	17
68	Sandon	79	93.5	E.	20
69	do	75	94.5	C.	17
70	do	-	-	-	17
71	do	97	97	H.	20
72	-	-	-	-	17
73	-	-	-	-	20
74	-	-	-	-	19
75	-	-	-	-	18
76	-	-	-	-	25 *
77	-	-	-	-	19
78	-	-	-	-	17
79	-	-	-	-	24 *
80	Sandon	-	-	-	22
81	do	94	97	E.	20
82	do	-	-	B.	18
83	do	-	-	B.	19
84	do	80.5	89	D.	20
85	do	52	58	A.	18
86	-	-	-	-	19
87	-	-	-	-	19
88	-	-	-	-	24 *
89	-	-	-	-	24 *
90	-	-	-	-	18
91	-	-	-	-	20
92	-	-	-	-	18
93	-	-	-	-	18
94	-	-	-	-	17
95	Southland	-	-	C.	17
96	do	88.5	96.5	B.	17
97	do	90.5	97	A.	18
98	do	97.5	99.5	B.	18
99	do	-	-	B.	17

* Probable flowering dates.

TABLE 4. Continued.

Area 8.

Plot No.	Origin	Interim percentage germination.	Final percentage germination.	Colour grouping.	Maximum flowing date of December 193
100	Southland	-	-	B.	17
101	do	93	97.5	B.	18
102	do	87.5	94	B.	18
103	do	90	97	A.	17
104	do	-	-	B.	18
105	do	-	-	B.	18
106	do	71.5	78	H.	17
107	do	92	98	B.	17
108	do	94	96.5	A.	18
109	do	-	-	-	17
110	do	93	96	C.	17
111	do	-	-	B.	18
112	do	94	97.4	D.	20
113	do	93	97	C.	17
114	do	94.5	100	B.	17
115	do	94.5	100	B.	17
116	do	93	97	C.	17
117	do	94	97.5	D.	18
118	do	-	-	B.	17
119	do	93	96	C.	19
120	do	-	-	-	17
121	do	94	96.5	A.	17
122	do	92	98	B.	17
123	do	71.5	78	H.	17
124	do	-	-	B.	17
125	do	-	-	B.	18
126	do	90	97	A.	18
127	do	87.5	94	B.	18
128	do	93	97.5	B.	17
129	do	-	-	B.	17
130	do	-	-	B.	18
131	do	97.5	99.5	B.	18
132	do	90.5	97	A.	17
133	do	88.5	96.5	B.	17
134	do	-	-	C.	17
135	-	-	-	-	18
136	-	-	-	-	20
137	-	-	-	-	19
138	-	-	-	-	18
139	-	-	-	-	20
140	-	-	-	-	22
141	-	-	-	-	24 *
142	-	-	-	-	19
143	-	-	-	-	20
144	Sandon	52	58	A.	22
145	do	80.5	89	D.	20
146	do	-	-	B.	18
147	do	-	-	B.	17
148	do	94	97	E.	18
149	do	-	-	-	20
150	-	-	-	-	20
151	-	-	-	-	22
152	-	-	-	-	17

* Probable flowering date.

TABLE 5.

Samples tested for germination in 1929 (unless otherwise stated) and in April 1932. In both cases 8 and 18 day figures are given. Also included is the plot number of the samples (all of Plot 8).

Sample Colour.	Plot No.	Percentage Germination tested 1929		Percentage Germination tested 1932	
		Interim	Final	Interim	Final
A.	49	79	92	66	74
	25	79.5	88	50	53
	144	52	58	55	61
	50	84.5	96	64	71
	126	90	97	45	53
B.	26	84.5	91	52	59
	65	94	97	73	81
	30	90.5	95	72	76
	131	97.5	99.5	75	81
	47	95	98	68	75
C.	69	75	94.5	47	58
	59	93.5	98	73	78
	29	95	97.5	81	84
	40	93	97	79	80
	116	93	97	76	81
D.	145	80.5	89 (1928)	56	65
	31	75	90	36	49
	22	86	90.5	66	70
	62	93	96.5 (1928)	54	65
	117	94	97.5 (1928)	71	76
	28	83	90.5	78	82
	54	87	93.5	74	81
	48	90	96 (1928)	66	72
E.	52	83.5	96.5	73	82
	148	94	97	85	87
	13	90.5	97	64	70
	58	83	92	46	60
	64	91.5	94	69	69
	21	81	94	30	52
	15	94.5	98	84	88
	27	95.5	97.5	74	78
F.	41	61.5	89 (1928)	61	68
	32	76	92	85	92
	6	53	71 (1928)	29	38
G	123	71.5	78	26	30
	53	76	90.5	65	73
	57	70	84	45	61
	71	97	97	73	79
	19	85	97	37	45
	63	90	94.5 (1928)	59	68
H.	18	66	86	19	31
	51	35.5	44	6	7
	55	78	90.5	66	[illegible]