THE RANGE IN COLOUR OF THE FLOWERING GLUME OF CYNOSURUS CRISTATUS L. AND ITS RELATION TO THE GERMINATION CAPACITY OF THE"SEED"*.

by L. Corkhill

Introduction.

It is well known that commercial lines of seed of Crested Dogstail (Cynosurus crestatus L.) often exhibit marked differences in colour, some samples in bulk being canary yellow while others are almost black. There is often great variation within a line in the colour of the individual seeds which may vary from greenish yellow through various shades of yellow, orange, and brown to almost a black colour. In some samples, however, the range in colour is more restricted, such samples naturally exhibiting a more uniform appearance.

It is important to understand at the outset the commercial attitude towards the colour of a sample. Until recently the great demand by farmers was for seed of a bright yellow colour, which, although of a lower bushel weight than darker seed, was nevertheless more attractive in appearance. As a general rule the germination was good so that as far as utilisation in New Zealand was concerned this type was satisfactory.

With an extension of exports it was found that the New Zealand samples, although regarded in England with favour because of their bright clean appearance, were generally of indifferent germination. It was found, moreover, that samples of darker colour could stand transshipment much better than those of lighter colour.

It is known in the trade that a very dark colour may be imparted to seed by heating in the sack, the stripped seed being very liable to this unless care is taken to

* The term "seed" is in this work used in the wide sense meaning "caryopsis".

prevent it. Farmers generally look upon a dark sample with suspicion and prefer the lighter coloured yellow samples.

General observations, however, have shown that there are distinct differences between plants in regard to the colour of the seeds at comparable stages in growth, It was considered that any data which could throw light on colour development and give further facts on its probable utility would be useful.

The investigations recorded in Part 1. were carried out with the object of attempting to ascertain whether the darkness in colour of Crested Dogstail seed is due to maturity alone, or whether there are other factors concerned. The question to which answers have been sought are:-

1. Do fully mature seeds of different plants differ in intensity of colour?

2. Does earliness or lateness of flowering exert any effect on the depth of colour attained by the seeds?

3. Do short period changes in the weather during ripening exert any effect on the ultimate colour of the seeds?

4. Is there any correlation between darkness in colour of fully mature seeds and the presence or absence of pigmentation in such parts of the plant as the flowering stem or sterile spikelets?

In Part 2. of the work (page 49) an attempt has been made to ascertain:-

1. Whether there are differences in the germination capacity of seeds of different colour groups from any single plant.

2. Whether seeds of the same colour group but from different plants exhibit variation in germination capacity.

P A R T 1.

Materials and Methods.

Selection was made from spaced plants nine inches apart grown in rows eighteen inches wide. There was thus ample room for the full development of each plant, competition and the shade factor having been eliminated.

Twenty-eight plants from both commercial and local strains were chosen. Plants were selected over a wide range of date of flowering in order to ascertain whether earliness or lateness of flowering produced any effect on the seed colour. It was noticed that different plants showed wide variation in the amount of purple colouration developed on the seed-stalk, rachis, sterile spikelet, flowering glume, and palea. The selection included plants as diverse as possible in this respect.

The plants were identified by means of numbered pegs.

At flowering time each plant was examined, and those heads which bloomed at approximately the same time were retained while the remainder were clipped off. On a small number of the plants only seven heads remained, but usually it was possible to retain from eight to twelve. By naked eye and with a X12 hand lens a close examination was then made of the stalk, rachis, sterile spikelets, and, where visible, the flowering glume and palea, with special reference to the amount of purple colouration developed. As the amount of purple in the seed-stalks increased with maturity, they were examined at fortnightly intervals, and the amount and position of the colour recorded.

A few days after the completion of blooming

of each plant one of the seed-heads was clipped off, placed in a labelled seed envelope, and taken to the laboratory for further examination. At three-day intervals, one seed-head from each plant was removed and examined. The length of time between collecting the first and last head of a plant ranged from three to five weeks depending on the number of seed-heads. If the selected heads of the same plant bloomed simultaneously, it would naturally be supposed that examination of seeds from heads harvested at three day intervals would serve to show differences due to maturity. The possibility that pronounced changes of weather during the ripening period might exert an effect on the colour of the seed and modify the results of maturity was also kept in mind.

To obviate the effects of any after-ripening, the seed-heads were examined in the laboratory as soon as possible after being removed from the plant. A dissecting microscope with a magnification of twenty diameters was used for these observations which were made in reflected daylight against a white background. As depth of colour depends so much on intensity of light, examinations were made only during uniform and favourable periods of the day. Artificial light was found to be unsuitable for complete differentiation.

Before removing the seeds, the head was examined under the microscope to determine the amount and position of the purple and green pigments in the rachis and sterile spikelets. The seeds were then removed from the head and about two hundred (i.e. usually about one-third to one-half) were examined under the microscope. To expedite examination the seeds were placed in rows

so that there was little likelihood of any escaping observation or being examined more than once. They were placed with the flowering glume* uppermost, and twenty diagrams were painted to depict the range in colour. (See Plates i.ii.and iii, pages 9-11) The number of seeds corresponding to each colour group was noted, enabling the percentage of the differently coloured seeds in the head to be obtained. Each colour diagram was identified by a letter :- a.b.c.etc. These groups are arbitrary but serve the purpose of classifying the seeds. With such a large number of colour groups the majority of the seeds approximated closely to the diagrams.

* When speaking of the colour of the seed reference is strictly being made only to the colour of the flowering glume.

Results:

Of the twenty-eight plants under examination four were omitted from the results because of the very high percentage of undeveloped group y seeds. The figures relating to the remaining twenty-four are given in Tables 1 - 9 (pages 12-21)

The colour groups range in order from the lightest at the top to the darkest at the base of the column. Groups x and y have been separated and placed at the bottom of each table as these seeds must be considered apart from seeds of the other groups. The straw coloured seeds of group y are usually poorly developed, consisting only of "husk", while those of group x, though often well developed, have lost any bright colouration they may have possessed.

Seeds which resembled a colour diagram except that they had two-thirds or more of the area of the flowering glume straw coloured have been identified in the tables by means of an asterisk.

In order to stress any difference in the final colour of the seeds of different plants, graphs have been prepared by plotting the darkest colour group in each head against the maturity of that head (pages 28-36)* The graphs shown in Figs.1 - 7 (pages 28-34) are plotted with mantessae of the same colour groups. Plants A 13, A 16, and A 18(Fig.8, page 35) and A 4. (Fig. 9, page 36) contain some different colour groups and have been plotted separately.

* The darkest colour group comprising at least 5% of the seeds in the head (excluding group y) was used for the construction of the graphs, as figures lower than this were not regarded as significant.

Groups y and x have been omitted from the graphs.

With the exception of Plants A 13, A 16, A 18 and A 4, graphs of plants which flowered at approximately the same time are grouped together, but allowance must be made for the fact that the first heads were not necessarily collected on the same date. At the base of each graph the date when the first head was collected is shown. This grouping does not apply to graphs of Plants A 13, A 16, and A 18 (Fig.8 page 35) which are grouped together as they resemble one another in having certain colour groups not occuring in the other graphs. Furthermore, Plant A 4 has some different graphs from all the foregoing plants and has therefore been plotted separately.

For ease of reference the grouping of the plants in the tables has been made comparable with that of the graphs.