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THE VIABILITY OF FESCUE SEED

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It has long been known that the percentage of germination of fescue seed, particularly Chewings fescue, fell off very rapidly under certain conditions. In other cases this did not occur, so the question naturally was raised as to why there should be these great variations. It was soon recognized that these differences were not merely questions of age or quality of the seed for there were cases where seed of a new crop with a high germination when tested in New Zealand showed a ruinous drop in vitality when it was received in the United States. In other cases after the stock arrived American seedsmen had germination tests made when the seed was first placed in the warehouse and were embarrassed to learn, through the complaints of customers, that an unexplainable drop in the germination percentage had occurred during the short interval of storage.

The work reported here was undertaken several years ago and was conducted over a period of years by the former Division of Seed Investigations, Bureau of Plant Industry. Studies were made on how best to determine the viability of the seed of several species of fescue and on the factors affecting the retention of viability during storage.

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For the study of the germination requirements six kinds of fescue were used: (1) Chewings or New Zealand fescue (*Festuca rubra* var. *commutata*), (2) commercial strains of *Festuca rubra*, (3) Creeping red fescue, a commercial strain of *Festuca rubra*, (4) Hair fescue (*F. capillata*), (5) Reed fescue (*F. elatior* var. *arundinacea*) and (6) Meadow fescue (*F. elatior*). The seed was raised from plantings made at the Arlington Experiment Farm, Arlington, Va., and harvested in 1934, 1935 and 1936.

In determining the optimum conditions for germination, the rate of germination as well as the maximum final germination was considered.

In the studies on the effect of temperature on germination, all tests were made at temperature intervals of 5 degrees on the

OPTIMUM GERMINATION TEMPERATURES FOR FRESH SEED

| Fescues Tested | Temperature |
|---------------------|---|
| Chewings fescue | } 59° to 77° daily alternation |
| Creeping red fescue | |
| Reed fescue | |
| Hair fescue | 50° to 77° daily alternation |
| Meadow fescue | } 59° or 68° continuously 59° to 77° daily alternation |
| Red fescue | |

Centigrade scale, or at 10°, 15°, 20°, 25° and 30° C. A temperature of 10° C. equals 50° F. and an interval of 5 degrees on the Centigrade scale is equivalent to 9 degrees on the Fahrenheit scale. The usual division of 5 degree intervals in the Centigrade scale therefore gives the odd scale of 50°, 59°, 68°, 77° and 86° when converted to the Fahrenheit scale. For the convenience of the reader all temperatures are expressed in degrees Fahrenheit.

When the seed was tested immediately after harvest all kinds of fescue studied required a relatively low temperature for germination. The optimum temperatures for germination of fresh seed of various fescues are given in the table on page 2.

The need of a low temperature for germination was more pronounced when the seed was immature or barely mature at collection than when it was harvested dead ripe. With increase of age after harvest the seed became more tolerant of higher temperatures; a few months after harvest all kinds germinated completely at the comparatively warm alternation 68° to 86° , although even then the rate of germination was slower than at the lower temperatures.

Fresh seed of hair fescue, reed fescue, and creeping red fescue germinated very poorly at any constant temperature. The seed of Chewings fescue differed from the other kinds in the changing response to constant temperature. The best constant temperature for fresh seed was 50° . As the seed aged, the best constant temperature increased to 59° and then to 68° but, contrary to the behavior of other kinds, germination of this older seed of Chewings fescue was lower and also slower at 50° .

When seed of reed fescue and hair fescue was stored dry at a low temperature it maintained its need of low germination temperatures much longer than seed stored at room or higher temperatures. This would probably be true for other fescues also. Hair fescue was the only kind that at optimum temperature responded to exposure to light and to moistening the substratum with dilute potassium nitrate solution. Light and potassium nitrate were beneficial to the other kinds only at temperatures unfavorable for best germination.

The duration of the test necessary for maximum germination at the optimum condition was 14 days for meadow fescue, 21

days for Chewings, creeping red, reed and commercial red fescue and 28 days for hair fescue.

The seed of Chewings fescue was used largely for the work on seed storage. Comparative studies with seed of commercial strains of red fescue gave similar results. The earlier storage studies were made on seed shipped under different conditions from New Zealand. The effect of conditions of shipment on viability on arrival has been discussed by N. R. Foy of the Plant Research Station of New Zealand, as reported on page 59 of this issue.

Later studies were based on seed raised at Arlington, Va., and in Oregon.

Loss of vitality of fescue seed is directly associated with a high moisture content of the seed and with a high temperature. Fescue seed is not necessarily short-lived, as seed with a low moisture content stored at a low temperature showed no loss of viability after 2 years. If temperature of storage is high the moisture content of the seed must be low, or if the moisture content of the seed is high a low temperature must be maintained in order to keep the viability of the seed high.

The advantage of shipping seed overseas in cool storage was lost a few months after arrival in the United States unless the seed was held in subsequent storage at a temperature as low as 36°, or unless it was dried after arrival to a moisture content not exceeding 10 percent. Seed shipped in cool storage tended to have a high moisture content on arrival. There is an indication from this study that seed with a high moisture content (approximately 14 percent) that had been held in cool storage for a few months and then transferred to storage at 68° lost viability more rapidly than seed stored at 68° over the entire period.

Germination of seed artificially dried before shipment over seas and kept dry was as good after storage in the laboratory for 18 to 26 months as that of newly arrived seed shipped without artificial drying.

A number of experiments were carried out with domestic seed stored at different temperatures and with different mois-

APPROXIMATE GERMINATION OF CHEWINGS FESCUE SEED AFTER STORAGE AT DIFFERENT TEMPERATURES AND MOISTURE CONTENTS

| Temperature of storage | Approximate period of storage (months) | Approximate percentage of germination at approximate moisture content of | | | |
|------------------------|--|--|-----|-----|----|
| | | 14% | 12% | 10% | 8% |
| 86° | 0 | 95 | 95 | 95 | 95 |
| | 1 | 65 | 95 | — | — |
| | 4-5 | 0 | 65 | 95 | — |
| | 12 | — | 0 | 65 | — |
| | 15 | — | — | 25 | 95 |
| | 24 | — | — | 0 | — |
| 68° | 4-5 | 95 | — | — | — |
| | 8-10 | 75 | 95 | — | — |
| | 12 | 35 | 90 | — | — |
| | 15 | 10 | 88 | — | — |
| | 18 | 0 | — | — | — |
| | 24 | — | — | 95 | 95 |
| 50° | 12 | 95 | — | — | — |
| | 24 | 70 | — | 95 | — |

ture content. The seed was stored in sealed containers to prevent change of moisture content. The general trend of the deterioration of seed as influenced by temperature and moisture content is shown in the accompanying table which is based on the results obtained in the several experiments.

The following recommendations for the storage of fescue seed for 18 months to 2 years seem justified. If the moisture

content can be kept at 8 percent or lower, the seed can be kept safely even at temperature as high as 86° , but with 12 percent moisture at this temperature viability will begin to fall in a very few months. With 12 percent moisture the viability will begin to fall within a year even at a storage temperature of 68° . Seed with 13 to 14 percent moisture (which is not uncommon with imported seed) will lose its viability in a few weeks at summer temperatures such as 86° and cannot be stored safely longer than a year at 50° . Stated in another way: If the storage temperature approximates 86° the moisture content should not exceed 8 percent; for a storage temperature of approximately 68° moisture should not exceed 10 percent; but if the storage temperature is 50° the moisture may be as high as 12 percent. It must be remembered that seed with a moisture content of 13 to 14 percent when removed from cold storage to high summer temperatures will fall in germination very quickly unless it is dried out. The fall in germination can be checked by drying the seed to a moisture content that is safe for the temperature to which the seed will be exposed. Seed dried before shipment and kept dry can be stored safely at ordinary temperatures for from 18 to 26 months.

It is recognized that the vitamin content of grass leaves is much greater than that of any of the four standard classes into which fruits and vegetables are divided. Generally speaking, grasses contain 10 times as much vitamin B₁ as any of the fruits and vegetables. Recognizing this fact, it might be expected that grasses growing under favorable conditions would not respond as remarkably to applications of this vitamin as do certain other plants, the leaves of which possess less of it.