INTERSPECIFIC AND INTERGENERIC HYBRIDS
IN HERBAGE GRASSES

IX. FESTUCA ARUNDINACEA WITH SOME OTHER FESTUCA SPECIES

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INTRODUCTION

In the original report on the artificial hybridization of grasses (Jenkin, 1924), it was recorded that *Festuca elatior* var. *arundinacea* and *F. rubra* had been successfully intercrossed.

In a subsequent paper (Jenkin, 1933), the claim of the *arundinacea* type to independent specific rank was recognized, partly on considerations of morphology, partly because it had been shown (Evans, 1926) that the *arundinacea* type is a hexaploid while the *pratensis* type is a diploid, and partly also on the breeding interactions of *F. arundinacea*.

In the second paper mentioned it was reported that *F. arundinacea* had also been successfully intercrossed with both *F. pratensis* and *F. gigantea*, and it is the purpose of the present paper to review the results then reported and to present additional data particularly concerning the *F*₁ hybrids and their derivatives. An attempt to intercross *F. arundinacea* with *F. heterophylla* will also be briefly described.

I. FESTUCA ARUNDINACEA WITH F. PRATENSI S

The original crosses between these two species were made in 1924, and the original report (Jenkin, 1933) showed that the cross had been successfully made in both directions.

The results for the individual crosses varied rather widely in respect of both seed-setting and seed germination, and largely irrespective of the direction in which the cross was made. Some caryopses were produced in all the crosses made, but in one cross each in either direction the seeds failed to germinate.

The highest seed-setting recorded was 94.6% with *F. pratensis* as the pistillate parent, but the highest germination, 72%, was obtained in a cross made in the reverse direction.

It therefore seems probable that the production of germinable seed can be influenced by some factor or factors not directly concerned with the intercompatibility of the two species. Even when seed germination was high, the seedlings were initially weak, many of them being very weak, so that about 37% of the seedlings produced failed to become established plants. When a seedling had reached the third leaf stage its developmental difficulties were over, presumably because it had then established an adequate root system of its own. Henceforward, growth and development were quite normal, the *F*₁ hybrid plants becoming of approximately similar vigour to the parental species without showing any definite sign of heterosis.

From the original crosses, a total of forty-four established *F*₁ hybrid plants were obtained. They showed no variation that could be attributed to the direction in which
a particular cross had been made. On the whole, they definitely favoured the *F. arundinacea* parental species in coarseness of leaf and stems and in the branching of the inflorescences. The bristles on the leaf auricle ledges were less developed than in *F. arundinacea*.

If found in nature these plants would almost inevitably be classified as either *F. arundinacea* or as a form of that species.*

Further crosses between *F. arundinacea* and *F. pratensis* were made after the original results were published, but as they revealed nothing new they need not be described.

**Self-fertility in the F₁ hybrids**

These F₁ hybrids were produced in the very early days of the Welsh Plant Breeding Station. At that time a very large number of plants were tested for automatic self-fertility in the open using cotton fabric cages. When these fabrics came to be examined critically (Jenkin, 1931), it was found that even the best of them could not be guaranteed to be pollen-proof under outdoor conditions. After this was realized, the fabrics used were very carefully selected.

Most of the F₁ hybrids at present under discussion were grown in open ground in close association with one another and in close proximity to plants of both parental species, and eleven of these hybrid plants selected at random were tested for automatic self-fertility by the fabric cage method referred to. As the cages were large it was possible to enclose a fairly large number of inflorescences in each container.

At the end of the season, when the inflorescences were ripe, these inflorescences were carefully examined. The number of spikelets per inflorescence was recorded, but the individual florets were not counted. The total number of spikelets examined from the eleven plants was 13,203. If we put the number of florets at four per spikelet (a low estimate) the total number was therefore over 50,000. Yet only in two florets were partially developed caryopses found, and both these seeds failed to germinate.

At no time were dehiscent anthers observed on any of these F₁ hybrids, and it seems very probable that the two caryopses that were found were the result of accidental pollination through the penetration of the cotton fabric by pollen from outside. As this has not been definitely proved, we cannot say definitely that the F₁ hybrids are completely self-sterile, but it is evident that self-sterility from automatic self-pollination is extremely high and probably complete.

**(a) To Festuca arundinacea**

Eleven attempts were made in four seasons (1927–33) to obtain seed from the F₁ hybrids by pollination with *F. arundinacea* pollen. These eleven units represented five different plants available in pots, and they were pollinated from eight different plants. Pollen was generally plentiful, and estimations of expected seed-setting ranged up to 90%.

The eleven units consisted of a total of 3479 florets, but only in one of these was there the slightest sign of ovary stimulation. This caryopsis was described as ‘moderately well filled’ when examined in the dry condition before incubation. This means that it was certainly less perfect than a normal seed of either parent species.

*See specimens in W.P.B.S. herbarium, sheets 275–281, Experiment B143.*