

NOTE ON EXPERIMENTS WITH FLAX AT THE JOHN INNES HORTICULTURAL INSTITUTION.

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IN connexion with Dr Eyre's paper the following note of our experience with flax may be of interest. In 1911 Mrs Ryan of Fort William suggested to me that an improved strain of flax might be of value to the agriculture of Ireland and of the Scottish Highlands. As I had long intended to make experiments on heterostyly in flax I obtained some samples of seed. My interest in the subject was especially concerned with the possibility of crossing the homostyled *L. usitatissimum* with some heterostyled species such as *perenne*. Except in the style-structure and habit (*usitatissimum* being strictly annual) there is no noticeable distinction between the two species. Nevertheless all attempts to cross them, however made, have failed with us. In this respect there is nothing more to report. I may mention that I used the method of emasculation described by Dr Eyre, namely bodily removal of corolla with adherent anthers, very successfully in the case of the *short-styled perenne*, but did not find it applicable to any other forms.

Many samples of seed of *usitatissimum* were kindly sent by Messrs Vilmorin. I also received others (through Dr Hinchcliff of the Department of Agriculture for Ireland) from Mr Ghekiere and from Mr de Zeeuw. Among the Irish samples was one that was said to have been saved for length of stem.

The plants in each sample were irregular in height, being obviously a mixture of several types. In most samples a few very tall plants occurred, reaching to about 4 feet, whereas the majority were about 3 feet high. I covered the flowers of one such tall plant in the sample sent by Vilmorin as "Courtrai," and fearing that there might be self-sterility I also put into one bag the heads of two such plants which

were growing close together. The event showed that flax is perfectly self-fertile. The seeds of the three tall plants gave in 1912 rows of plants most of which were of the 4 foot class. Many plants of course did not reach this height and there were several small plants, but I have little doubt that the smaller plants were merely prevented from reaching their full development by crowding. The subject seemed to be unsuitable for accurate investigation without very elaborate precautions to ensure uniformity of conditions and it was treated simply as a matter of economic interest. The height reached varies greatly with the nature of the soil and the spacing. In 1913 the seeds from the tall strain (bagged) gave plants averaging 4 ft. 6 in. with individuals 5 feet high, but this increase was obviously due to the ground chosen having suited them better; for the 1914 crop, similarly raised from them, was grown on inferior land and for the most part did not fully reach 4 feet. The 1915 crop, similarly raised from these, put on the land used in 1911 gave a very level crop 4 feet high.

The seed from the plants of 1914 which were *not* covered was collected in mass and sent to Mr F. K. Jackson, of the Leeds University Flax Experiment Station at Selby. In his Report for 1915 he says that after rain came at the end of June this flax "began to grow vigorously, and in a fortnight had outstripped all other varieties in the field, so that by harvest it was from 9 to 12 inches taller and much superior in quality." The weight of crop with the seed on was reckoned at 1 ton 13 cwt., that of the next best flax on the same land being 1 ton 8 cwt. 1 qr.

Evidently many points of genetic importance could be studied in this case by accurate methods. In 1915 Miss M. R. Michell began such work here, making crosses between plants of various heights, etc. Meanwhile it is to be noted that, as the result of our experience, the raising of a tall strain of flax is a very easy matter, and can be done by simple selection of materials already existing in common crops. I may add that at Selby in an ordinary crop growing on agricultural land I saw several individual plants clearly belonging to the tall strain, reaching about 4 feet.

To what extent crossing takes place under natural conditions I cannot say. Most seed presumably is the result of self-fertilisation. I saved seed from a white flowered variety not covered, growing between rows of blue flax, and all the plants except one came white. (There was *some* reason also for suspecting that even this one was a stray from the next row; for the plant agreed with that row, which

was of a peculiar type.) As white is recessive to blue in flax, these plants were probably from self-fertilised seed. In another case a curious dwarf form with dark blue flowers, about 1 ft. 10 in. high, was similarly tested. It had appeared originally as a single plant among crimson *L. grandiflorum*. Presumably this came from a stray seed. In general appearance this type somewhat resembled the oil flaxes of India. A quantity of seed of this variety, gathered from uncovered plants growing beside the other flaxes, came perfectly true to type. It is therefore to be presumed that the *usitatissimum* varieties are habitually self-fertilising, at least in England. On the other hand I cannot explain the fact that the seed sent from Ireland as saved for tallness did not give a crop in any way remarkable for height.

How many genetically distinct heights exist cannot be said. Besides the oil flaxes which are about 1 ft. 9 in. high we have had certainly three heights: (1) our own tall strain, about 4 feet; (2) several ordinary blue and also white forms, about 3 feet; (3) a dark blue, true-breeding type, about 2 ft. 6 in. Each of these is genetically pure, almost beyond question, and the rows of the several types standing side by side were each in general appearance strikingly level and uniform at their respective heights.