

VARIATION IN RATE OF GERMINATION AT LOW TEMPERATURE AS A BASIS FOR SELECTION IN SUNFLOWERS

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Sunflowers grown under dry land conditions in the south of Spain are usually sown in March or April. By the time they have flowered and are setting seeds, the weather is hot, little or no rain falls, and they are dependent on limited supplies of moisture stored in the soil. If the crop could be sown six weeks to two months earlier, it would enjoy more favorable temperatures and better moisture supplies during the critical period from flowering to ripening.

Night temperatures often drop to 0°C or lower in January and February, and frosts may occur in March. In order to advance the sowing date appreciably without suffering losses from frost in some years, it is necessary to have sunflower varieties which are resistant to cold and to light frosts in their first stages of development.

This paper reports on the first stages of a programme to select such cold and frost-resistant sunflowers.

MATERIALS AND METHODS

Three hundred and forty one breeding lines and varieties, most of them open-pollinated, were used in these studies. Forty seeds of each sample were placed in petri dishes on filter paper moistened with water at 3°C and containing fungicide. The dishes were incubated in refrigerators maintained between 3° and 5°C for two months. Counts of germination were made every three days. Seeds were considered to have germinated when the radicle reached approximately 0.7 cm long.

RESULTS AND DISCUSSION

All lines and varieties were grouped into four groups as follows : Group 1, average germination time less than 30 days ; Group 2, average germination time 30 to 40 days ; Group 3, average germination time 40 to 50 days ; Group 4, average germination time more than 50 days. The modal period for germination was between 30 and 50 days.

Within each group there was a considerable difference among lines and varieties in the variation around the mean germination time. Four sub-groups were recognized within each group as follows: A, deviation from the mean less than 5; B, deviation from the mean greater than 5 and less than 8; C, deviation from the mean greater than 8 and less than 11; D, deviation from the mean greater than 11. The number of samples in each group and subgroup is given in table 1.

Table 1

Frequency distribution of 341 sunflower lines and varieties for ability to germinate at low temperatures

Deviation from the mean	Mean germination time in days			
	Group 1	2	3	4
	Under 30	31—40	41—50	Over 50
a) Under 5	12	22	11	7
b) 5—8	21	66	55	13
c) 8—11	14	49	31	5
d) Over 11	2	16	13	4

The lines and varieties in sub-group 1A are of the greatest interest in selecting material with resistance to low temperature. These lines seem to have this type of resistance, and appear to be relatively homogeneous for the character. Sub-groups 1B, 1C, and 1D also seem to have resistance to low temperatures, but as they are variable for this characteristic, only those individuals which germinate rapidly at low temperatures should be selected within each line.

The lines and varieties of sub-groups 2B and 3D are also of interest. Although the mean germination time for these samples is higher, because of their high variability it may be possible to select for cold resistance within these populations too.

All seeds which germinated within 20 days were transplanted to pots and were grown to maturity in the greenhouse. Plants of the same lines were sib-crossed, to study the heritability of germination at low temperatures.

Five of the twelve samples in sub-group 1A were selections from the variety Peredovik, four came from Morocco, and the other three were of other Russian origin. The 29 samples in category 4, which averaged more than 50 days to germinate at low temperature, were of various origins, including 5 from Morocco, 2 from Germany, 2 from Bulgaria, and 1 from the U.S.A.

The extreme variability in speed of germination at low temperature encountered in this study suggests that this character may be controlled by one or more genes. To determine the heritability of this character and its susceptibility to environmental influence, it will be necessary to study the progeny within each sub-group for several generations. This work is now in progress at Córdoba.