# TEMPERATURE EFFECTS on vegetative growth and oil quality of FLAX

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**Differential temperatures before flowering did affect vegetative development of flax in tests at Riverside, but did not cause changes in the quality of linseed oil produced. However, the same temperature treatments after flowering caused major changes in composition of the linseed oil.**

EXPERIMENTS IN CALIFORNIA have indicated that when flax and safflower are grown under cool climatic conditions in the coastal areas or in the Antelope Valley, they produce oil with a higher degree of unsaturation than when grown under higher temperatures at Davis or Riverside. Similar differences, but smaller in magnitude, have been observed between oil samples from early and late plantings of these crops even in the same location. Differences in temperature during the growing season have been considered the main cause of these changes in the chemical composition of the seed oil. Other environmental factors, like photoperiod, light intensity and light quality could also affect oil quality, however.

Experiments reported here were conducted at the University of California at Riverside to investigate the effects of temperature on the quality of linseed oil and to determine the stage of plant development at which these effects attain their maximum expression. Single plants were used from the Dakota and Cawnpore varieties of seed flax (neither is grown commercially in California) which differ widely in degree of unsaturation of their oil. Ten plants from each variety were grown in each of four growth chambers kept at constant temperatures of 50°, 60°, 70° and 80°F. Upon flower initiation, these plants were transferred from the growth chambers into a greenhouse where temperatures ranged between 60° and 80°F. Concurrently, 50 plants from each variety were grown in the same greenhouse. At flower initiation, 10 of these plants from each variety were moved into each of the four growth chambers, and the remaining 10 plants of each variety were left to mature in the greenhouse. All plants in the growth chambers were exposed to a uniform 16-hour light period of 1,500 foot candles intensity. The seed was harvested at maturity and fatty-acid analyses were conducted by gas-liquid chromatography.

## Fatty-acid composition

The differential temperatures applied prior to flowering had no effect on composition of the oil of either variety as shown in the table. The temperatures applied after flowering, however, changed the fatty-acid composition of the oil quite drastically.

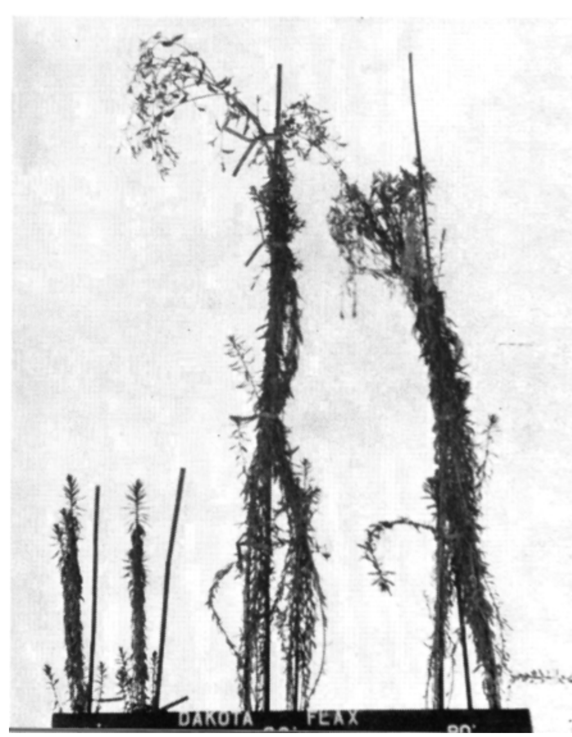
In the variety Dakota, the seed oil from the 50° F post-flowering treatment had the highest linolenic and the lowest oleic acid content. As post-flowering temperatures increased to 80° F, linolenic acid decreased from 57% to 41% and oleic acid increased from 18% to 34%. The other three major fatty acids remained at about the same level in all treatments.

In Cawnpore, the changes in oil composition could not be studied over the same range of post-flowering temperatures because no seed was produced in the 70° and 80°F chambers. The oil from the 50° and 60°F treatment, however, had a significantly higher proportion of linolenic and a lower proportion of oleic acid than that from the greenhouse seed.

## Vegetative growth

Pre-flowering temperatures caused significant differences in vegetative development among treatments, as shown in the photo. Plants grew most vigorously with normal leaf size and color, and the largest number of lateral branches in the 60°F chamber. As pre-flowering temperatures increased to 80°F, plants grew more spindly, with smaller and lighter-green leaves. Plants in the 50°F chamber showed the most striking difference, however. While plants in the other chambers flowered within 10 to 13 weeks from germination, it took twice as long for plants in the 50°F chamber to flower. At that stage, the 50°F plants were half as tall as the plants in the 60°F chamber and had few lateral branches and a rosette type of growth at the top due to short, telescoped internodes.

It is common knowledge that field plantings of flax, made several days or weeks apart, start blooming within very few days of each other. The fact that pre-flowering temperatures do not affect fatty




Dakota flax plants grown at 50°, 60° and 80°F constant pre-flowering temperatures.

FATTY-ACID COMPOSITION OF THE SEED OF THE DAKOTA 48–94 AND CAWNPORE PRODUCED UNDER DIFFERENT TEMPERATURES

| Before flowering | After flowering | Dakota 48–94 Palmitic | Stearic | Oleic | Linoleic | Linolenic | Cawnpore 1150 Palmitic | Stearic | Oleic | Linoleic | Linolenic |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature | | Per cent | | | | | | | | | |
| Greenhouse* | Greenhouse | 6 | 2 | 24 | 15 | 53 | 5 | 2 | 36 | 15 | 42 |
| 60 | " | 7 | 2 | 25 | 15 | 51 | 5 | 2 | 36 | 16 | 41 |
| 70 | " | 7 | 2 | 24 | 15 | 52 | 5 | 2 | 36 | 15 | 42 |
| 80 | " | 7 | 2 | 25 | 15 | 51 | 5 | 2 | 36 | 15 | 42 |
| Greenhouse | 50 | 8 | 2 | 18 | 15 | 57 | 9 | 3 | 24 | 16 | 48 |
| " | 60 | 7 | 2 | 20 | 15 | 54 | 7 | 2 | 32 | 16 | 43 |
| " | 70 | 7 | 2 | 28 | 15 | 48 | | | | | |
| " | 80 | 7 | 3 | 34 | 15 | 41 | | | | | |
| L.S.D. .05 | | 0.8 | N.S. | 1.6 | N.S. | 2.5 | 0.9 | N.S. | 1.5 | N.S. | 2.0 |

* Greenhouse temperatures ranged from 60 to 80°F.

acid composition means that a flax grower has considerable freedom in choosing the most suitable date of planting—without fearing that this might have adverse effects on oil quality.

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