Flowering Pattern of Flax (Linum usitatissimum L.)

J. Davidson and D. M. Yermanos

FLAX (Linum usitatissimum L.) has been an important oil crop in California’s agriculture for over 20 years though economic factors have caused the acreage to fluctuate from year to year. Since 1950 the California flax acreage has never amounted to more than 2% of the national flax acreage. The average yield in the state, however, has been relatively high, ranging between 25 and 40 bushels per acre, as compared with a national average of under 10 bushels per acre.

Flax growers in the Imperial Valley believe that one of the reasons for the high yields obtained in California is related to the pattern of flowering of flax. They report that with proper management flax may exhibit more than one successive period of bloom and that, therefore, harvest is delayed until a second, or even a third, set of flowers and capsules have appeared. Thus, the high flax yields in the Imperial Valley are assumed to be partly due to the yield increments resulting from these additional periods of flowering, which do not occur in the flax growing areas of the Great Plains, probably because of the shorter growing season. The present study was undertaken with the following objectives: (1) to confirm the existence of recurring periods of blooming in flax, (2) to determine whether these periods are genetically controlled or induced by managerial or environmental factors, (3) to detect differences in the flowering pattern among varieties, and (4) to observe the pattern of flowering when the flowers are continuously removed.

REVIEW OF LITERATURE

Some investigators have reported the appearance of “late” or “secondary” blooms in flax but no experimental data have been published to confirm the visual observations and to describe its pattern of blooming. Howard and Khan (8) discussed the appearance of “secondary flowering” of flax in India and postulated that this was correlated with a deep root system and depended on the amount of soil moisture available. They suggested that this phenomenon was either connected with the upward movement of the subsoil water or with the moisture requirements of the plant, i.e., when the first set of capsules ripened off and ceased to require water, the small amount of moisture obtainable by the few active roots was sufficient for growth to resume.

Some investigators, e.g., Tammes (12), Fleischmann (6), Tari- man (13), and Wricke (14), have used the terms “first”, “second”, “third”, etc. to classify flax flowers. This grouping, however, referred to the order of flower succession and position on the plant and not to the above-mentioned phenomenon of recurrent blooming.

Dillman (3) studied the daily increase in oil content of flax seed. He referred to “early” and “late” flowers but did not present any data indicating the existence of more than one blooming period. His study was conducted in the greenhouse, which did not allow the plants to experience the natural conditions that influence the pattern of flowering. An extensive discussion of the flowering pattern of flax was presented by Kadam and Patel (9), however, did not include observations on the pattern of flowering.

The effects of flower removal have been studied in cotton crops. Dale (2) continuously removed the buds from cotton for up to 23 and 35 weeks after planting and found an increase in the total number of flowers produced. The number of buds produced per cotton plant was 280-764 in 35 weeks. Control plants produced 112-241 buds per plant in 23 and 35 weeks, respectively. The plants were taller and produced more dry weight than the treated plants. The data showed a decline in the production of new plants at the end of the experiment. The treated plants failed to set bolls. He stated that this is in part due to the classical theory that maturation of bolls uses reserve food previously used for growth and fruiting.

The removal of squares from cotton was studied by Dunnam et al. (4). They found that this treatment resulted in a reduction proportional to the percentage of squares removed. The treatment of flax in experiments conducted by Dunnam and co-workers had opposite effects, i.e., treatment caused increased growth and more branches, greater pollen dispersal, a longer period of time, and greater seed production. The contradiction might be due to the fact that Dunnam’s plants had a chance to recover, resume growth, produce seed in great abundance.

McKinlay and Geering (10) and Coaker (1) reported the appearance of flowering bodies due to insect attacks that did not result in the production of fruiting bodies in early-planted cotton. Late season growth enabled the plants to set bolls and compensate for early losses provided they did not suffer from moisture stress or low soil fertility.

MATERIAL AND METHODS

The flowering pattern of flax was studied on the following 7 varieties: 'Imperial' (C.I. 1114), 'Punjab 47' (C.I. 1115), 'Cawnpore' (C.I. 1359), 'New River' (C.I. 1912), 'Abyssinian Yellow' (C.I. 300), and 'Punjab 47' (C.I. 766).

These varieties provide a wide spectrum of differences in terms of height, root system, flowering habit, and seed characteristics. They are characterized by their different seed flax varieties. Imperial and Punjab 47 are short varieties. Cawnpore is a medium variety from Punjab (C.I. 20). Cawnpore is a large seed cotton introduction with large seed and low iodine value. It is a major commercial variety in California derived from a cross between Punjab 47 and B5128 (C.I. 908). 'New River' is a variety from Argentina. Argentine (C.I. 379) is a major commercial variety in California. It is a large variety with yellow seed and low iodine value. 'Abyssinian Yellow' is a variety from the Abyssinia region with small yellow seed and low iodine value. 'Punjab 47' (C.I. 766) is a fiber flax introduction from Holland.

Two tests were conducted, 1 in the greenhouse and 1 in the field. Each test included two treatments. In the field, the plants were tagged and recorded daily as soon as the calyx appeared. A dated stringed jewelry tag was tied to each plant indicating the date on which the first flower pedicel was determined (Figure 1). This provided a complete record of daily flowering for each treatment.