laboratory methods for routine evaluation of soils and other types of amendments may be justified.

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TABLE 1. TEXTURE OF THREE SOILS COLLECTED FROM NURSERY AREAS IN ORANGE COUNTY AND WATER CONDUCTIVITY VALUES FOR SOIL MIXES USING THE INDICATED AMENDMENTS AT 60% BY VOLUME

Soil Number	13	18	1
Texture:		% by weight	
Sand	75	58	43
Silt	18	25	34
Clay	8	17	23
	Water Conductivity; cm per hour		
Amendment Added:			
None	6	0.2	0.5
Sand	31	20	28
Redwood shavings	14	16	10
Pine shavings	16	9	9
Peat	10	8	4

TABLE 2. A COMPARISON OF BULK DENSITY AND WATER RELEASE VALUES OBTAINED ON LABORATORY COMPACTED SOILS AND SOIL MIXES WITH EQUIVALENT MEASUREMENTS UNDER GREENHOUSE USE IN POTS

Soil No.	Laboratory			Greenhouse Pots		
	13	18	1	13	18	1
Amendment 60% by volume	Bulk Density, gm/cc					
None	1.53	1.45	1.36	1.50	1.32	1.30
Sand	1.56	1.55	1.52	1.58	1.51	1.57
Redwood shavings	.98	.96	.88	.92	.77	.74
Pine shavings	.90	.93	.86	.73	.76	.78
Peat	.88	.78	.79	.80	.68	.65
	Water released from 0 to 10 cb vol. fraction					
None	.18	.10	.16	.12	.10	.08
Sand	.24	.21	.24	.14	.11	.12
Redwood shavings	.26	.20	.21	.22	.19	.17
Pine shavings	.24	.20	.22	.27	.26	.16
Peat	.27	.29	.30	.24	.25	.20

TABLE 3. PHYSICAL PROPERTIES OF SOIL MIXES SHOWING THE EFFECTS OF TWO LEVELS OF AMENDMENTS USING SOIL NO. 1

Amendment and amount by volume	Bulk density	Hydraulic conductivity	Water, released, volume fraction 0–30 cb	30–50 cb
	gm/cc	cm/hr		
None	1.36	0.5	.13	.02
30% Redwood shavings	1.15	2.2	.18	.02
60% Redwood shavings	.88	10	.24	.03
30% Pine shavings	1.12	2.8	.19	.02
60% Pine shavings	.86	9	.22	.03
30% Peat	1.09	0.6	.18	.03
60% Peat	.79	3.8	.29	.05

Cyclic Production Of Capsules in Flax

D. M. YERMANOS · G. F. WORKER, JR.

Experiments in the Imperial Valley confirmed that flax does not produce blooms and capsules continuously but in distinct, successive cycles. Even in a high-yielding field of flax only a small proportion of mature capsules were found to have the full complement of ten seeds.

A MATURING FIELD of flax presents both growers and scientists with questions concerning probable yield, variability of capsule load, and fullness of the capsules. Studies underway at the Department of Agronomy, University of California, Riverside, resulted in some interesting data obtained from an experiment completed last summer regarding the seed setting pattern of flax. Observations in the Imperial Valley have previously indicated that flax flowers do not appear in one continuous bloom but in two or more successive cycles. In fact, flax growers plan fertilization and irrigation practices to stimulate more than one such cycle of blooms.

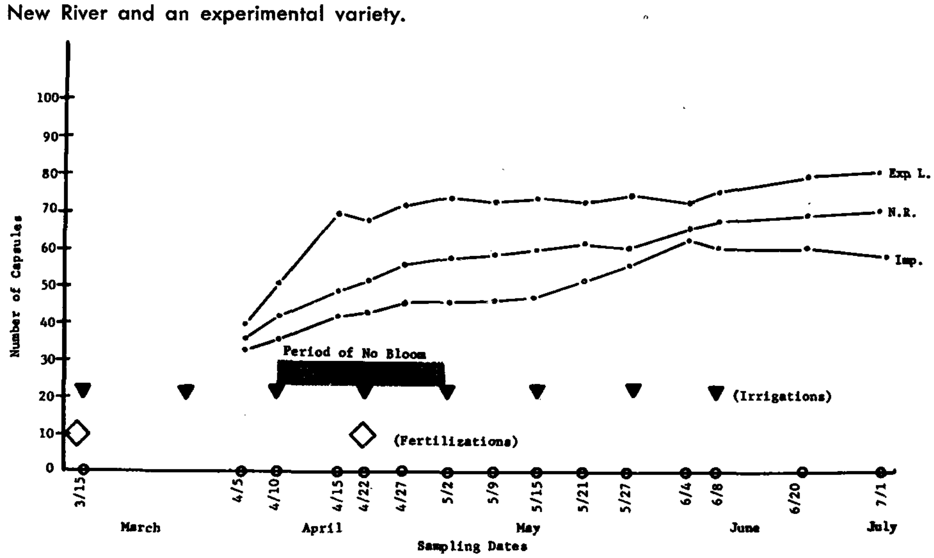
No experimental data has been available, however, to confirm the existence of such bloom and capsule cycles and to assess the magnitude of the yield increments obtained from each one of them. Furthermore, no experimental information is available on whether such bloom cycles can be stimulated by appropriate management practices, or whether this property is under genetic control with variable expression among flax varieties.

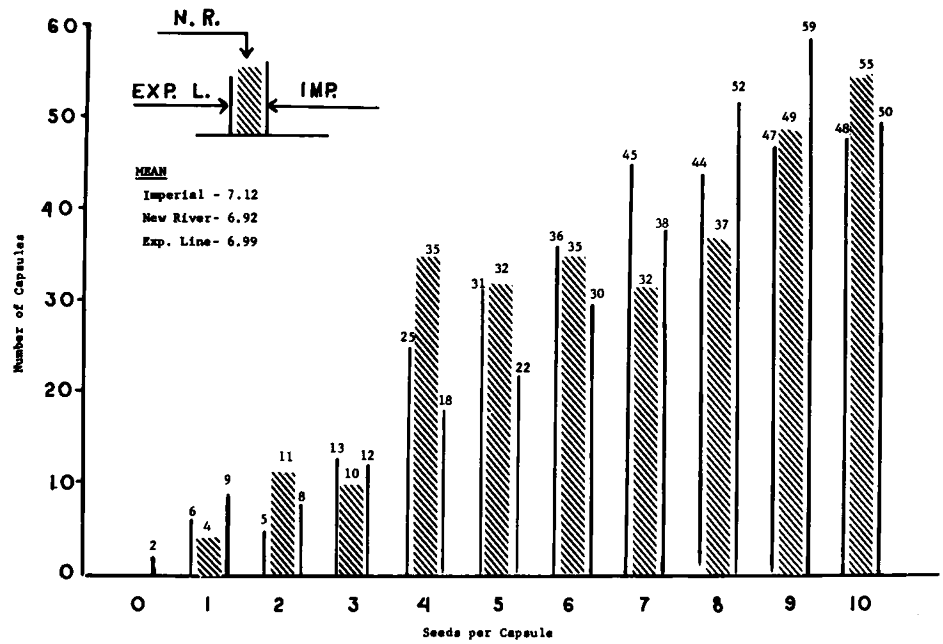
In these tests, two commercial varieties of flax (Imperial and New River) and an experimental line were grown at the Imperial Valley Field Station, University of California, Meloland. The test was planted December 14, 1962 using a 47 lb-per-acre seeding rate on a 1/8-acre plot with two replications. The plot area was fertilized with 230 lbs of nitrogen per acre applied in three portions and was given a total of 12 irrigations.

Capsules per plant

The first problem considered was the rate of increase in number of capsules per plant from the initiation of bloom to maturity. Twenty single plants from each variety (10 per replication) were harvested approximately every two weeks and the number of capsules 1/4 inch in diameter or larger were counted. As shown in graph 1, their numbers increased sharply at first but leveled off about six weeks after March 15, the date on which blooming had started. Eight to nine weeks after bloom the number of

Graph 1. Rate of increase in number of capsules from bloom to maturity in the varieties Imperial, New River and an experimental variety.





Graph 2. Frequency distribution of 300 capsules of flax from each of three varieties (Imperial, New River and an experimental variety) on the basis of the number of seeds per capsule.

capsules showed another small but distinct increase.

Observation of the daily appearance of blooms in the field showed that for about three weeks, from April 7 to April 27, blooming had almost stopped in all varieties and that it started again towards the end of that month. This indicated that the total capsule load appeared in a large initial cycle followed by a smaller second cycle. The period during which the number of capsules had leveled off corresponded to, and obviously resulted from, the period of no bloom.

Variability

In spite of the genetic purity and uniformity of the seed a great deal of variability existed among the single plants of each variety in regard to the number of capsules per plant throughout the sampling period. At maturity, the range was from 34 to 118 capsules per plant in Imperial and from 24 to 188 in New River. This excessive variability due to plant competition was a surprise. Had it been anticipated, more than 20 plants would have been harvested per sample on each harvest date to reduce the experimental error. As shown in graph 1, differences among varieties were quite noticeable. Imperial had the lowest capsule load throughout the growing period but entered the second bloom period earlier. New River had a longer "rest" period between first and second bloom than Imperial; however, it entered the rest period with a greater capsule load. The experimental variety had the sharpest increase in capsule load in the first bloom but the longest rest period and the smallest increase in load during the second bloom.

Seeds per capsule

The next problem considered was the number of seeds per capsule. A normally developed capsule of flax has 10 seeds. More have been observed in rare cases, but finding fewer than 10 seeds per capsule is a common occurrence. To obtain information on the most frequent number of seeds per capsule, 10 capsules were taken at random from each of 30 mature plants from each variety. As shown in graph 2, a rather small proportion of capsules had the full complement of 10 seeds. The mean number of seeds per capsule was 7.12 for Imperial, 6.92 for New River and 6.99 for the experimental variety. It should be noted that yield estimates made on this test indicated that all three varieties yielded in excess of 60 bushels per acre.

The above data confirm the presence of more than one cycle of blooms and capsules in flax. The data also point to the need for more experimentation to find what determines the appearance of distinct cycles of bloom, their magnitude and whether varietal differences exist in this respect. Similar information on the mean number of seeds per capsule would also be valuable. Experiments are now underway to provide information on these problems which may contribute to higher yields of flax.

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BREEDING ALFALFA WITH RESISTANCE TO PHYTOPHTHORA ROOT ROT

Phytophthora root rot has become one of the most important diseases of alfalfa in California. It is particularly a problem on heavy, poorly-drained soils, or on any soil where a layer of free moisture persists for some time after irrigation. Leaves of the diseased plants turn yellow and eventually the plants die. Reddish brown lesions are found on the roots of the infected plants with the woody tissue of the root showing a yellowing above and below the lesion. Improving the drainage is the best control for the disease, but in some soils this may not completely solve the problem.

A survey of alfalfa varieties and introductions for resistance to the disease was made by the Departments of Agronomy and Plant Pathology. No variety was found to be completely resistant to the disease, but an introduction from Arabia contained some plants with a good degree of resistance. Of the commercially-grown varieties, Lahontan proved to be most resistant. Field experiences have shown that the resistance of Lahontan can be of considerable value in some fields. The Arabian selections have no desirable characteristics except for their *Phytopthora* resistance, however, and some time will be required to transfer this character to acceptable varieties.

Recently, a number of plants were selected by William Salle, Farm Advisor in Tulare County, from a plot of Caliverde where *Phytophthora* had severely reduced the stand. These plants were transferred to Davis and their offspring were tested for *Phytophthora* resistance. Some of them proved to be as resistant as Lahontan. It is hoped that reselection from this material will produce a still higher level of resistance that will be useful until the superior resistance from the Arabian selection becomes available.—*E. H. Stanford, Department of Agronomy, University of California, Davis.*