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Connecticut Fiber Flax Trials
1992-93

The Connecticut Agricultural Experiment Station, New Haven

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SUMMARY

Ariane and Viking fiber flax were grown in small plots and large fields at two locations in Connecticut in 1992 and seven locations in 1993. In 1992 yield of retted flax straw ranged 5778-7332 lb/A on small plots. A 3-week planting delay reduced yield of Ariane about 15 percent. Yield in large fields ranged 3532-5251 lb/A. Reduced stand density lowered yield. In 1993 yield of retted flax straw was 2680-5300 lb/A in small plots. A 3-week delay in planting in dry 1993 reduced yield by nearly half. On farms yield ranged 1499-5251 lb/A. Areas with early planting and more favorable rainfall had higher yield. Seed yield in 1992 was greater than in 1993, but both years were below expectation. Viking produced more seed than Ariane. Percent total fiber generally fell within the expected range, 24-28 percent of retted flax straw, except in the drier locations in 1993. Fiber quality of flax from large fields in 1992 ranged from poor to good. Quality of Ariane was slightly higher than Viking and quality at Windsor was higher than at Mt. Carmel.

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Fiber flax, *Linum usitatissimum* L., one of our oldest textile fibers, has been cultivated for an estimated 10,000 years. In contrast, the wheel, one of our most useful inventions, has been in use only about half that time. Remnants of linen, made from flax fiber, have been found among the artifacts of prehistoric lake dwellers in Switzerland. Fine linen fabrics, indicating a high level of skill, were found in Egyptian tombs. Egyptian mummies were wrapped in linen. The Bible makes many references to linen. It is believed that Phoenician traders brought linen from the Mediterranean region to Gaul and Britain. The Romans introduced linen manufacture throughout their empire. By the 17th century the German states and Russia were the major sources of raw material. The linen industry became established in the Netherlands, Ireland, England, and Scotland.

European colonists introduced fiber flax into North America. Flax was grown in colonial Connecticut as early as 1640 (Jenkins 1925). Early Connecticut colonial law required every family to grow 1/8th or 1/4th acre of either flax or hemp, depending on whether they owned livestock or a team. Flax was listed among exports in 1680. This early cultivation was mostly in shoreline towns on Long Island Sound and in the major river valleys. Jenkins (1925) further reported that by the early 1800s more flax was produced in New Haven and Fairfield Counties than in all the rest of New England. The average yield was 200 pounds of flax fiber and 6-8 bushels of seed per acre. In 1802, 100,000 pounds of flax and 4,000 bushels of flax seed were grown in Milford, a seacoast town. This represents production from about 500 acres. Jenkins (1925) concluded that little flax was grown commercially in Connecticut after 1830, but that some flax cultivation for home use continued until about 1880.

Flax was a migratory crop on newly broken soil by pioneer farmers during westward expansion. Culture persisted until a fatal wilt disease caught up with the crop (Wolfe and Kipp 1959). The last region with appreciable fiber flax production was the Willamette Valley in Oregon. Three-year average production was 12,833 acres during 1942-44 and 3067 acres in 1947-49 (Wolfe and Kipp 1959). About 2100 acres were grown in 1951 (Wilson 1955). Withdrawal of government subsidies and introduction of new synthetic fibers caused commercial fiber flax production in the United States to cease during the 1950s.

Presently, short-stem flax is grown for oil seed primarily in North and South Dakota and Minnesota. Some of the straw is used in paper making.

MATERIALS AND METHODS

Sites

In 1992 fiber flax was grown in small plots and large fields in Mt. Carmel and Windsor. At Mt. Carmel the upland glacial till soil was Cheshire and Yalesville fine sandy loam with moderate moisture holding capacity. At Windsor the glacial outwash soil was Merrimac sandy loam with low moisture holding capacity. In 1993 flax was again grown in Mt. Carmel and also in East Windsor, Ellington, Middlebury, Pomfret, Sharon, and Suffield (Table 1).

Rainfall and temperature

During June-August 1992, Mt. Carmel received 16.45 in of rain and Windsor received 16.38 in (Table 2). In 1993, with earlier planting, the period May-August had 5.49 in of rain at Mt. Carmel and 9.15 in at Windsor. At both Mt. Carmel and Windsor mean monthly temperatures ranged 2-4 F lower in 1992 than in 1993. Therefore, the summer of 1992 can be characterized as moist and cool at both Mt. Carmel and Windsor whereas, 1993 was hot and dry.

Cultivars

In 1992, at Mt. Carmel and Windsor two French cultivars, Ariane and Viking, were grown. Ariane is characterized as slow growing, semi-late flowering, late maturing, sensitive to zinc deficiency, resistant to lodging, slightly susceptible to Fusarium, very good fiber quality, and low seed productivity. Viking is characterized as fast growing, early flowering, average maturity, sensitive to zinc deficiency, average resistance to lodging, slightly susceptible to Fusarium, very good fiber production, and average seed production. Their performance at both locations was true to the description. Before flowering the development of Ariane is uneven; by maturity the crop is uniform. At Mt. Carmel in 1992 two unnamed Italian selections were grown in small plots.

Table 1. Soils on which flax was grown in 1992-93.

Town	Soil Type	Texture	Origin	Water Holding Capacity
E. Windsor	Agawam	fsl	outwash	moderate
	Elmwood	sl	outwash	low
	Ninigret	fsl	outwash	moderate
	Scarboro	loam	outwash	moderate
Ellington	Cheshire	fsl	g. till	moderate
	Narragansett	sil	g. till	high
	Sudbury	fsl	outwash	moderate
Middlebury	Charlton	fsl	g. till	high
	Hollis	fsl	g. till	moderate
Mt. Carmel	Cheshire	fsl	g. till	moderate
	Yalesville	fsl	g. till	moderate
Pomfret	Paxton	fsl	g. till	moderate
Sharon	Stockbridge	loam	g. till	high
Suffield	Buxton	sil	lacustrine	high
Windsor	Merrimac	sl	outwash	low

fsl=fine sandy loam, sl=sandy loam, sil=silt loam, g. till=glacial till

Table 2. Rainfall (in) and mean monthly temperature (F) during May-July at Mt. Carmel (MC) and Windsor (Wi).

		Rainfall		Temperature	
Loc.	Month	1992	1993	1992	1993
MC	Apr	1.93	4.64	46.9	49.3
	May	2.91	0.71	58.4	61.5
	Jun	8.52	1.27	66.2	68.6
	Jul	3.79	1.47	71.7	74.8
	Aug	4.14	2.04	69.5	73.3
Wi	Apr	3.35	4.44	46.2	48.9
	May	1.72	1.73	58.6	60.7
	Jun	7.63	1.97	66.5	68.2
	Jul	4.93	3.84	69.8	74.0
	Aug	3.82	1.61	69.2	72.9

Soil preparation

Soil was plowed, disked and smoothed prior to sowing. Added fertilizer was disked into the soil prior to the final smoothing. On soils where American grain drills with disk openers were used it was desirable to allow the soil to settle and firm for several days. Where the European grain drill with floating shoes was used the final disking and smoothing generally occurred just before sowing. In both cases a smooth, pulverized seedbed was desirable.

Fertilizer and amendments

Soil samples were analyzed by the Morgan soil test (Lunt et al. 1950). Available nitrogen was estimated and sufficient additional nitrogen was added to bring the total available nitrogen to 70 lb/A. Every attempt was made to avoid overfertilization in order to minimize the risk of lodging. Additions for small plots and large fields in 1992 are shown in Table 3.

In 1993 the small plots at Mt. Carmel received 120 or 156 lb/A of ammonium nitrate (34-0-0). The lower rate brought available nitrogen to 70 lb/A. The higher rate supplied an additional 12 lb N/A. Half the plots received 1.6 ton/A of ground limestone which was worked into the soil before sowing. Large fields at Mt. Carmel received 0, 30 or 100 lb/A of ammonium nitrate (34-0-0) prior to sowing in order to bring available nitrogen to 70 lb/A. No lime was applied on large fields. Large fields at other locations received adequate fertilizer to bring total available nitrogen to 70 lb/A.

Sowing

In 1992 and 1993 small plots, 3.3x19.8 ft (1x6 m), contained 10 drills at 4-in spacing. Each drill was sown with a Precision Seeder with a special pickup disk modified to drop approximately 20-25 seed/4 in of drill. Variation in seed size affected stand density. Seeding depth was 0.5-0.75 in.

In 1992 flax was sown in large fields, each approximately 0.5 A, with a tractor-drawn Allis-Chalmers

Table 3. Planting date and fertilization of flax in 1992.

Location	Plot	Planted	Cultivar	Fertilizer	lb/A
Mt. Carmel	Small	4/29/92	Ariane	5-10-10	535
			Italian 1	5-10-10	535
			Italian 2	5-10-10	535
		5/19/92	Ariane	5-10-10	535
			Viking	5-10-10	535
	Large	5/20/92	Ariane	10-10-10	250
		5/21/92	Viking	None	
Windsor	Small	5/21/92	Ariane	10-10-10	500
			Viking	10-10-10	500
	Large	5/22/92	Ariane	10-10-10	500
			Viking	10-10-10	500

grain drill with drills at 7-in spacing and a seed sowing rate of approximately 85 lb/A. Disks opened the drills which were closed by press wheels. Seeding depth was approximately 0.75 in. The wheel tracks of the grain drill created an 8 to 10-in gap in the canopy. In an attempt to increase density one field was sown twice with offset drill spacing; this was quickly abandoned because some seed from the first sowing was subsequently buried too deep by the second sowing. In 1993 flax was sown in large fields with rear mounted grain drills preset for 3.5 or 4-in drill spacing at approximately 100 lb seed/A. An American drill utilized double disk openers and press wheels at 4-in spacing. A European drill utilized floating tubes with a special shoe that split the seed stream and formed two drills at 3.5-in spacing. A set of springtooth tines smoothed the soil and covered the seed. Seeding depth was approximately 0.5 in.

Weed control

A tank mix of MCPA amine, sethoxydim (Poast) and crop oil concentrate was applied when the flax seedlings were 3-4 in tall. In 1992 small plots and large fields were sprayed with a calibrated backpack sprayer. In 1993 small plots were sprayed with the backpack sprayer, but large fields were sprayed with tractor-drawn boom sprayers. MCPA was applied at 0.375-0.5 pt/A; sethoxydim at 0.5 pt/A, and crop oil concentrate at 2 pt/A in a spray volume of 12-15 gal/A.

Density and height

In 1992 and 1993 stand density was estimated by counting the number of seedlings in a 4-inch segment of each drill at three locations in each small plot. In 1992 in large fields seedlings in 13 drills were similarly counted at six locations in each field. Height of the stem closest to the center of the 4-inch segment was measured. In 1993 stand density in large fields was not estimated; height in large fields was estimated from a subsample of the yield samples.

Harvesting

Fiber flax is ready to harvest about 85-95 days after sowing when the seed capsules turn yellow-brown and at least the lower third of the stems are defoliated. In 1992 and 1993 harvest of small plots was by handpulling. On each end of the plot a 20-in headrow was pulled. Two outside drills on each side of the plot were pulled. The remaining six interior drills were pulled and all material was spread on the plot surface for retting.

In 1992 the large fields were also pulled by hand. The flax from six or seven drills (42-49 in swath) was laid in a windrow with roots at one side and seed capsules on the other side. Each large field was divided in half and the orientation of stems was reversed on each half to facilitate baling. In 1993 flax in large fields was pulled with a self-propelled single puller. Average swath width was about 53 in. The puller laid the flax stems in uniform windrows with all stems oriented in the same direction relative to the direction of travel. Pulling commenced at the sides of the field and proceeded toward the center.

Retting

Retting is a mild microbiological decomposition that loosens the fiber bundles from the bark, the central woody core of the stem and from one another. Moisture is supplied by rain and dew. Ideally, windrows are turned one or more times during the retting process to ensure uniform retting throughout the depth of the windrow.

During retting the color of flax straw changes from yellow green at pulling to golden brown and finally to silver gray. As the flax begins to turn silver gray it is checked regularly for completion of retting. Several flax stems are held together and broken repeatedly with the fingers when dry. With a push-pull motion the woody stem segments (shives) are dislodged. When the shives separate cleanly and easily retting is complete. Overretting weakens the fibers and allows them to break easily. Underretted flax is difficult to process. When retting is complete and the flax straw is dry, the flax is baled in round bales and placed immediately in dry storage.

In 1992 and 1993 windrows on small plots were turned by hand. In 1992 flax in large fields was not turned. However, because the stand density was reduced retting proceeded uniformly throughout the relatively thin windrows. In 1993 some flax in large fields was turned with self-propelled single turners. A narrow pickup drum lifted the flax from the soil. A toothed belt carried the flax over the turner, inverted it, and laid it in a windrow. The first turning proceeded from the center of the field outward to the edges.

Rippling

Rippling (deseeding) removes the ripe seed capsules from the flax stems. In 1992 and 1993 flax in small plots was rippled 7-14 days after pulling. The stems were pulled through a ripple (large coarse comb) to strip the seed capsules. The air dried seed capsules were weighed and subsequently threshed by lightly crushing and rolling over a ribbed rubber pad. The seed was cleaned by sifting and air separation to remove capsule fragments and chaff. Air dried cleaned seed was weighed for yield determinations.

In 1993 seed removal was attempted in some fields with a tractor-drawn deseeder-thresher. A pickup drum and belts carried the windrowed flax between several pairs of steel and rubber rollers. The crushed capsules released the seed to a series of shaker screens. A coarse upper screen scalped stones and large debris. A finer middle screen removed stems and other debris but allowed the flax seed to pass. A fine bottom screen retained the flax seed but allowed soil and other fine particles to pass. The flax seed passed through an air stream for removal of chaff before transfer by auger to a grain tank. The flax straw passed through the machine, was inverted 180 degrees and returned to a windrow. Deseeding subtituted for the first turning.

Sampling

In 1992 and 1993 all flax on the small plots was pulled. To avoid edge effect the inner 33 ft^2 (0.6x5 m) of each 66 ft^2 (1x6 m) plot was used to estimate yield. In 1992 on the large fields six or eight sample plots 74.8 ft^2 (2.3x3 m) were pulled from each field and moved to Lockwood Farm in Mt. Carmel for rippling and retting. In 1993 four samples per large field were collected after pulling and moved to Lockwood Farm for rippling and retting. Each sample plot was 29.5 ft^2 (1.35x2 m). In both years air dried bundles of straw were weighed for yield estimates.

Fiber extraction

In 1992 samples from small plots and large fields were crushed with a manual flax break, beaten (scutched) with a wooden scutching knife on an inclined scutching board, and combed (hackled) on a coarse hackle to remove short or broken fibers. The yield of long (line) fiber and short fiber (tow) was weighed separately. In 1993 the flax stems were crushed by passing between a pair of fluted rollers. The stem core was broken at approximately 0.5-in intervals. Scutching and hackling proceeded as before.

Fiber quality

Samples of long fiber of Ariane and Viking grown in large fields at Lockwood Farm and Valley Laboratory in Windsor in 1992 were submitted to the Cooperative Liniere de Fontaine-Cany in Normandy, France for evaluation. The samples were judged organoleptically for fiber length, color, degree of retting, homogeneity of retting, scutching, purity, fineness, strength, luster, density, and suppleness. The quality was reported according to three methods: an adjectival rating of six or more grades, a CIPALIN (Comite Interprofessionnel de la Production Agricole du Lin) metric score from 100-700 (Fausten 1992), and a third metric number, Mn, the estimated number of kilometers of fiber per kilogram of scutched fiber (ITL 1990). Coarse fiber yields a low number; fine fiber yields a high number.

RESULTS AND DISCUSSION

Some of the results from 1992-93 have already been reported (Stephens 1994, 1995). A more complete report follows.

Germination

Germination was prompt, usually 5-6 days. In both years Ariane appeared to have some delayed germination. In 1993 deep sowing in some large fields apparently caused delayed germination.

Weed control

In 1992 and 1993 the tank mix of MCPA amine and sethoxydim provided generally good weed control. In both years the extra light entering the canopy from the walks between small plots encouraged survival and growth of weeds. Some hand weeding was necessary. In 1992 the wheel tracks of the grain drill left sufficient opening in the canopy of large fields to encourage weeds. Weeds difficult to control were henbit in the small plots and redroot pigweed in the wheel tracks of large fields in 1992. At Windsor volunteer buckwheat from a previous cover crop resisted control until the flax finally outgrew it.

Table 4. Stand density (stems/ft^2) in small plots at Mt. Carmel (MC) and Windsor (Wi) in 1992.

Cultivar	Planted	MC	Wi
Ital. 1	4/29/92	94	
Ital. 2	4/29/92	82	
Ariane	4/29/92	113	
Ariane	5/19/92	196	
Viking	5/19/92	182	
Ariane	5/21/92		160
Viking	5/21/92		150

Table 5. Stand density (stems/ft^2) in small plots at Mt. Carmel in 1993.

Planted	Ariane	Viking
4/29/93	133	133
5/21/93	105	98

Table 6. Stand density (stems/ft^2) in large fields at Mt. Carmel and Windsor in 1992.

Location	Ariane	Viking
Mt. Carmel	164	78
Windsor	101	90

Table 7. Height (in) of flax stems in small plots at Mt. Carmel (MC) and Windsor (Wi) in 1992.

Cultivar	Planted	MC	Wi
Ital. 1	4/29/92	36.7	
Ital. 2	4/29/92	35.8	
Ariane	4/29/92	37.1	
Ariane	5/19/92	35.3	
Viking	5/19/92	33.4	
Ariane	5/21/92		21.2
Viking	5/21/92		19.9

Lodging

There was no lodging of flax in small plots in 1992 or 1993. In 1992 at Windsor and 1993 in East Windsor a small amount of lodging occurred in large fields. In both cases the lodging occurred during a thunderstorm near the edge of the field adjacent to a wooded area. It is believed the abrupt change in height from field to tree canopy caused the wind to swirl and cause the lodging.

Effect of fertilizer and soil amendments

Apparently nitrogen levels were not excessive in 1992 or 1993 because little lodging occurred. In 1993 increased nitrogen and lime were added to the small plots. European practice is not to apply lime in the year flax is planted but to add it several years in advance (ITL 1990). Extra nitrogen was provided to determine the effect on yield and on lodging. Unfortunately, in dry 1993 soil moisture was limiting and neither the added nitrogen nor the lime had any visible effect on yield or lodging.

Stand density

Stand density in small plots is shown in Table 4 (1992) and Table 5 (1993). The desired stand density is about 185 stems/ft^2. High density helps to suppress weeds and reduce flax stem diameter. Small diameter stems yield fine fiber; thick stems yield coarse fibers. However, excessive stand density makes fiber flax susceptible to lodging by strong wind or heavy rain. In 1993 the marked difference in stand density between the early and late sowing of small plots was apparently due to the dry weather and late sowing date. Approximately the same amount of seed was used in each sowing.

Density in large fields was measured only in 1992 (Table 6). The higher density of Ariane in the large field at Mt. Carmel was due to the double sowing.

The relatively low density in the other fields was due to the wide drill spacing. In order to achieve the desired density of 185 stems/ft^2 it is necessary to have 5 stems/in of drill when drills are 4 in apart. With 7-in drill spacing it would be necessary to have 9 stems/in of drill in order to achieve the same density. The flax would be overcrowded within the drill.

Height

Height of flax stems varied with year and planting date. In 1992 height of flax planted April 29 at Mt. Carmel was slightly greater than flax planted 3 weeks later (Table 7). Flax planted May 21 at Windsor was extremely short. This was likely due to the planting site because there was a pronounced gradient of decreasing height across the three replications.

In 1993 flax in small plots at Mt. Carmel was extremely short (Table 8). A 3-week delay in planting reduced height of Ariane 45 percent and Viking, 40 percent. Note that the rainfall for May through July was only 3.45 in (Table 2), about a third of normal. In contrast, not only was height greater in 1992, a 3-week delay in planting caused only a 4 percent reduction of height of Ariane. However, abundant

Table 8. Height of flax stems (in) in small plots at Mt. Carmel in 1993.

Planted	Ariane	Viking
4/29/93	23.4	24.4
5/21/93	13.0	14.5

Table 9. Height of flax stems (in) in large fields at Mt. Carmel and Windsor in 1992.

Location	Ariane	Viking
Mt. Carmel	28.0	33.9
Windsor	35.5	35.7

rainfall during May-July 1992 was 15.22 in (Table 2). Clearly, dry weather decreases flax height growth and delayed planting in dry years can produce a drastic reduction in height.

In 1992 in large fields flax made satisfactory height growth despite relatively late planting on May 20-22 (Table 9). However, Ariane at Mt. Carmel was stunted compared to the others. Most of this field had been in sod of several fescue cultivars for several years prior to flax. It is not known whether the stunting was due to allelopathy or nitrogen deficiency caused by the decomposing sod.

In 1993 height of flax stems varied with location and planting date (Table 10). Southern Connecticut, typified by Mt. Carmel, was dry with only 3.45 in rainfall during May-July (Table 2). Northern Connecticut, although relatively dry, received 7.54 in during May-July.

In general, planting early or in the more northerly towns resulted in taller flax. The greater height of Ariane at Sharon and of both Ariane and Viking at Pomfret was due to a secondary flush of growth caused by abundant rain in late August and early September. This second flush of growth added at least 4 in to the height. By western European standards flax shorter than 24-26 in would not yield commercially acceptable long fiber.

Yield

Good yield of retted flax straw is 6250 lb/A. The yield of flax straw and its components varied with year, planting date and location. Where height was reduced yield was also reduced. In 1992 in small plots in Mt. Carmel only Ariane met or exceeded the yield goal (Table 11). But a 3-week delay in planting reduced retted straw yield of Ariane 15 percent.

In dry 1993 in small plots at Mt. Carmel yield of retted straw was greatly reduced (Table 12). A 3-week delay in planting reduced yield of retted straw 48 percent for Ariane and 44 percent for Viking.

In 1992 in large fields at Mt. Carmel and Windsor yield of retted flax straw was only two-thirds the yield goal (Table 13). However, we have already seen that stand density was reduced by the widely spaced drills.

In 1993 yield of retted flax straw varied with location and planting date (Table 14). Yield ranged from 23 to 84 percent of the goal. The lowest yield occurred at Mt. Carmel with late planting and low rainfall. The best commercial yield was obtained at East Windsor-Ellington with 80 percent of yield goal for Ariane and 70 percent for Viking.

On average long fiber comprises 16-18 percent of retted flax straw; another 8-10 percent is tow or short fiber. Therefore, with a yield of 6250 lb/A of retted flax straw one could expect 1000-1125 lb/A of long fiber and 500-625 lb/A of tow or 1500-1750 lb/A total fiber. The ratio of long fiber to tow would be about 1:.55.

Yield of long fiber was low and yield of tow was great (Tables 11-14). However, total fiber yield in 1992 ranged 18.0-27.5 percent of weight of retted straw and in 1993, 15.7-43.8 percent. The low ratio of long fiber to tow can be explained in part by overretting which weakens long fiber and increases breakage. Additionally, processing by hand is likely harsher to the fiber than machine processing, especially hackling which generated much of the tow.

In 1992 on small plots at Mt. Carmel the percent total fiber fell within the expected range. Percent total fiber of Ariane was higher for the early planting, 26.9, than for the late, 23.0. In 1993 percent total fiber yield on the small plots was clearly greater for the early planting, 22.5-24.1, compared to the late, 15.7-18.3. Not only was total straw yield reduced by nearly half in the late planting, but the percent total fiber was also greatly reduced.

In 1992 in the large fields there was little difference in percent total fiber between Ariane and Viking, but the percentage was greater for both species at Windsor, 23.9-24.2, compared to Mt. Carmel, 18.0-19.8. In 1993 in large fields percent total fiber varied only slightly among the locations regardless of planting date. On the other hand, late planting and low rainfall reduced yield (Table 14).

Seed removed in the field comprises 8-12 percent of the weight of retted straw. With a yield of 6250 lb/A of retted flax straw expected seed yield would be 500-750 lb/A. If the flax straw was not deseeded prior to baling, seed recovery at the scutching mill would be 5-8 percent of the weight of retted flax straw or 300-500 lb/A. Seed is lost during turning and baling and even during heavy rain while the flax is retting. Seed recovered at the scutching mill is suitable only for oil.

Seed yield was generally low (Tables 11-14) and Ariane generally yielded less than Viking. Although yield in 1992 was greater than in 1993, it was still low by European standards.

Table 10. Height of flax stems (in) in large fields in 1993.

Location	Planting date	Ariane	Viking
East Windsor-Ellington	5/6-11	33.7-41.3	32.7-38.5
Middlebury	5/14-21	36.4-38.2	35.4-38.1
Suffield	5/29-6/4	28.1	25.3-26.2
Mt. Carmel	5/27	26.6-29.0	24.7-34.1
Sharon	5/28	32.5	29.2
Pomfret	6/4	32.3	35.3

Table 11. Fiber flax yield (lb/A) in small plots at Mt. Carmel in 1992.

Cultivar	Planted	Straw[1]	Long fiber	Tow	Total fiber	Seed
Italian 1	4/29/92	5778	354	1066	1420	221
Italian 2	4/29/92	6114	309	998	1307	217
Ariane	4/29/92	7332	605	1374	1979	247
Ariane	5/19/92	6263	467	970	1437	255
Viking	5/19/92	6051	388	1272	1660	369

1 - Retted flax straw before deseeding

Table 12. Fiber flax yield (lb/A) in small plots at Mt. Carmel in 1993.

Planted	Cultivar	Straw[1]	Long fiber	Tow	Total fiber	Seed
4/29/93	Ariane	5300	41	1151	1192	8
	Viking	4760	273	876	1149	106
5/20/93	Ariane	2760	0	434	434	42
	Viking	2680	29	462	491	40

1 - Retted flax straw before deseeding

Table 13. Fiber flax yield (lb/A) in large fields in 1992.

Location	Cultivar	Straw[1]	Long fiber	Tow	Total fiber	Seed
Mt. Carmel	Ariane	4401	104	689	793	216
	Viking	3862	168	594	762	660
Windsor	Ariane	3532	170	674	844	140
	Viking	4011	220	750	970	205

1 - Retted flax straw before deseeding

Table 14. Yield of fiber flax (lb/A) in large fields in 1993.

Location	Planted	Cultivar	Straw[1]	Long fiber	Tow	Total fiber	Seed
E. Windsor-							
Ellington	5/6-11	Ariane	4973	164	1137	1301	101
		Viking	4350	270	833	1103	184
Middlebury	5/14-21	Ariane	3535	130	905	1035	36
		Viking	3125	89	835	924	73
Suffield	5/29-6/4	Ariane	2644	3	738	741	207
		Viking	3275	4	883	887	84
Mt. Carmel	5/27	Ariane	1499	0	420	420	4
		Viking	1984	1	521	522	39
Sharon	5/28	Ariane	5251	0	2302	2302	34
		Viking	3393	42	859	901	90
Pomfret	6/4	Ariane	3986	21	1154	1175	12
		Viking	4169	254	1036	1290	30

[1] - Retted flax straw before deseeding

Table 15. Fiber quality rating of flax from large fields in 1992.

			Mt. Carmel		Windsor		
			Ariane	Viking	Ariane	Viking	
CIPALIN	Adjectival	Mn	No. of samples				Total
350-400	Good	26	2	1	2		5
300-350	Average	20			2	2	4
250-300	Ordinary	15	1	1	2		4
200-250	Weak	10-12	3	2		1	6
<200	Poor	6-9	1	2		3	6
Total			7	6	6	6	25

Fiber quality

Fiber quality of flax from large fields in 1992 ranged from poor to good (Table 15). Although the CIPALIN scale extends to 700, the best sample was rated 400. In comparison, flax fiber produced by the farmer members of the Cooperative Liniere de Fontaine-Cany in Normandy averages 400 and ranges 280-600 (Personal communication, J.-M. Hemeryck, 1993). The fineness of the flax fiber, Mn, increased with increasing score. When flax fiber is very fine its quality is usually very good.

Thirteen of the samples had a CIPALIN score of 250 or higher. Ariane placed 9 of 13 samples in this range whereas Viking had only 4 of 12. At Mt. Carmel 5 of 13 samples were in this quality range; at Windsor 8 of 12 scored 250 or higher. In 1992 fiber quality of Ariane was higher than Viking. Windsor produced higher quality than Mt. Carmel.

CONCLUSIONS

Fiber flax of good quality and acceptable yield can be grown in Connecticut on a variety of soils. Like other crops fiber flax is dependent on the weather. Drought reduces height and yield of retted straw. Early planting is necessary to enhance fiber yield and quality. Late planting in May 1992 was apparently compensated by relatively cool, wet weather in June. High stand density is required to promote good weed control and high yield. Careful nitrogen management should minimize losses from lodging. The low nitrogen requirement of fiber flax makes it a good candidate for sensitive soils above aquifers when there are concerns about nitrogen leaching. If dairy farms continue to go out of production, fiber flax becomes a good candidate for former corn land and reasonably level hay land. Because of the potential for buildup of the serious soil-borne flax wilt (Fusarium) crop rotation is suggested. Hopefully, this would lead to greater diversity among field crops in Connecticut.

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