FLAT PEA FOR HIGHWAY SLOPES IN MASSACHUSETTS

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The tremendous cost of repairing highway slopes eroded because of poor vegetative cover is a serious problem. Flat pea (Lathyrus sylvestris L.), a perennial herbaceous legume, is an excellent plant for erosion control and a good soil stabilizer. Because it was not being used in the state, it was essential to determine its adaptability to the climate and to the acidic, infertile cut and fill slopes that lack topsoil. A greenhouse experiment was conducted using 2 soils, one very acidic and low in fertility and the other only slightly acidic and of medium fertility, to determine the plant's response to lime and fertilizer. The plants in the very acidic soil that received fertilizer and both lime and fertilizer responded well. It was found that the pH requirement of flat pea is not so critical as that of crownvetch. Based on the results obtained in the greenhouse studies, successful plot plantings and seedings were made throughout the state over a 4-year period. Seedings made in the spring or as dormant seedings in late fall before the ground freezes produce best results. Late summer and fall seedings are risky because the seedlings generally have too much competition from grasses and weeds.

•FLAT PEA (Lathyrus sylvestris L.) is a climbing herbaceous perennial legume with long, vein-type stems. The leaflets are narrow and about 5 cm (2 in.) in length. The plant is similar in appearance and growth habits to the ornamental or everlasting pea (Lathyrus latifolius L.) (2). When in blossom in June and July, the flowers are an attractive rose color but are less conspicuous than those of the garden variety. The plant has a procumbent growth habit, producing a dense mat of leaves and stems from 61 to 95 cm (2 to 3 ft) high (5, 8). Once established in an area, it is permanent and resists invasion from other species. Flat pea is deep-rooted and spreads by underground root stocks. An excellent plant for erosion control, it is hardy, drought-tolerant, and adapted to a wide variety of soil conditions (3, 6, 7). It is best suited to well-drained soils and does well on low-fertility sites such as sands and gravels (5).

There is increased interest in the replacement of grass by crownvetch and other legumes for erosion control and full cover on critical highway sites in Massachusetts. Grass is seeded on all disturbed areas along highways for fast cover and for control of erosion. However, establishing good grass cover is sometimes a problem, especially on fill and cut slopes where soil materials are acidic, infertile, devoid of organic matter, and poor in physical condition. Many areas seeded to grass soon deteriorate, and erosion occurs. Reseeding is very expensive and may not be a permanent solution to the problem. The use of other adaptable herbaceous plants is necessary in critical areas where grass will not solve the problem.

At this time, crownvetch is being used throughout Massachusetts as a supplement to grass seedings. Flat pea also seems promising and should be considered for slope seedings because it is an excellent conservation cover plant. Because erosion damage calls for additional expenditures of time and money, economics becomes a primary motivation for developing methods and techniques of establishing vegetation on newly

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graded areas and slopes (1). This is also true for established slopes that are eroding and whose cover is deteriorating.

A review of literature shows that very little has been done with flat pea in the United States. The Soil Conservation Service has done more testing than any other agency of various strains of flat pea for erosion control, soil stabilization, and establishment on logging roads, dam sites, gravel pits, and mine spoils (4). It was found that flat pea has excellent stabilization qualities, is drought resistant, and thrives in moderately acidic soils or in those soils that may be slightly more acidic than crownvetch will tolerate (4, 6, 8). After years of selection, the SCS Plant Materials Center in Big Flats, New York, released under the name of "Lathco" a fast-spreading flat pea with seedling vigor and the quality of producing dense vegetative cover (5).

Lathco flat pea has been tested and has proved to be an excellent conservation plant for the Northeast. It has been successfully established on logging roads, utility rights-of-way, and openings created by construction in wooded areas (4, 5). It was found that a solid stand of flat pea inhibits the reinvasion of forest species (4). A seeding of various grasses and legumes on a dam site in Berkshire County, Massachusetts, resulted in flat pea's having provided the thickest cover of many species tested by the end of the second summer (9).

Flat pea had not been used on roadsides in Massachusetts, but because it appeared to have good possibilities, a greenhouse experiment was conducted from December 1969 to April 1970 to study its response to lime and soil fertility. Also, late in 1970 and in 1971, a series of plots was set up along a roadside to determine the best seeding time for successful establishment of this legume under Massachusetts climatic conditions.

GREENHOUSE EXPERIMENT

Materials and Methods

Two soil types, a Hinckley sandy loam with a pH of 4.2 and a Scarboro sandy loam with a pH of 6.3, were used. The soil analysis data are given in Table 1. Commercial fertilizer, 28-97.8-186.6 kg of N, P, K per hectare (25-87.4-166.6 lb of N, P, K per acre), was used. The lime treatments for the Hinckley soil (4.2 pH) and Scarboro soil (6.3 pH) were at the rates of 5600 kg per hectare (5,000 lb per acre) and 1120 kg per hectare (1,000 lb per acre) respectively.

Various soil treatments were used and are given in Table 2. The experimental design was a random block arrangement with 3 replicates. Prior to seeding, the seeds were inoculated. Twelve seeds were then planted per plastic pot, which measured 15 cm (6 in.) deep and 13 cm (5 in.) wide. After the seeds had germinated, excess seedlings were removed to leave 6 plants per pot. The soil in the pots was watered to field capacity and subsequently watered when the moisture content in the pots reached approximately one-half field capacity. Seed germination and emergence were slow but good in both soils. The plants were harvested 14 weeks after seeding.

Results

By using height and dry weight of plants to show their response to lime and fertilizer it was found that, in regard to the very acidic Hinckley soil, there were no significant differences between the control plants and those in the lime-surface and lime-mixed treatments (Tables 2 and 3). It is possible that flat pea will tolerate acidic soil conditions. There were no significant differences among the plants in treatments 4 through 7. Treatments of fertilizer alone or fertilizer and lime combined, either applied on the surface or mixed in, produced similar results (Figure 1).

Among the plants grown in the slightly acidic Scarboro soil, there were no significant differences in response, even in the control plants (Tables 2 and 3). It appeared that the soil pH and fertility levels were adequate for the establishment of flat pea. There was a large difference in height and dry weight response in the control plants of the two soils because of differences in fertility levels and pH. The low fertility levels under the acidic soil conditions of the Hinckley soil were overcome, it seems, by applied fertilizer. Lime alone did not significantly increase plant growth.

Table 1. Soil analysis data.

Soil	pH	Lime Requirement (kg/ha)	Element Content (kg/ha)			
			Ca	K	P	Mg
Hinckley sandy loam	4.2	6720	1120	268	27	27
Scarboro sandy loam	6.3	0	3584	560	224	112

Table 2. Comparative response of top growth of flat pea to various lime and fertilizer treatments in centimeters (average of 3 replicates).

Treatment	Hinckley Soil, Very Acidic	Scarboro Soil, Slightly Acidic
1. Control, no treatment	7.3 a	16.0 a
2. Lime, surface	8.1 a	15.6 a
3. Lime, mixed	8.3 a	13.7 a
4. Fertilizer, surface	14.7 b	16.8 a
5. Fertilizer, mixed	12.7 b	14.1 a
6. Lime and fertilizer, surface	14.4 b	15.5 a
7. Lime and fertilizer, mixed	11.6 b	15.0 a

Note: Treatment means in the same column having no letters in common are significantly different at the 5 percent level, using Duncan's New Multiple Range Test.

Table 3. Comparative growth response of flat pea to lime and fertilizer treatments using the average dry weight in grams of 6 plants (average of 3 replicates).

Treatment	Hinckley Soil, Very Acidic	Scarboro Soil, Slightly Acidic
1. Control, no treatment	0.49 a	2.68 a
2. Lime, surface	0.41 a	2.30 a
3. Lime, mixed	0.43 a	1.79 a
4. Fertilizer, surface	1.74 b	2.47 a
5. Fertilizer, mixed	1.52 b	1.97 a
6. Lime and fertilizer, surface	1.89 b	1.97 a
7. Lime and fertilizer, mixed	1.44 b	2.10 a

Note: Treatment means in the same column having no letters in common are significantly different at the 5 percent level, using Duncan's New Multiple Range Test.

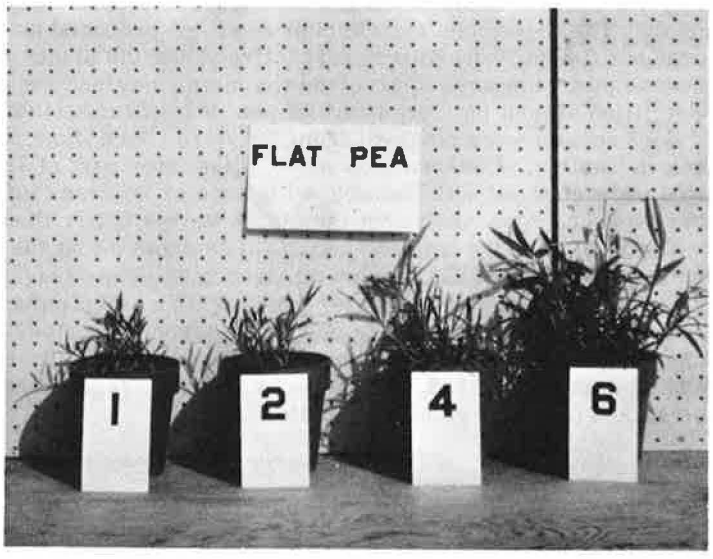

Figure 1. Growth response of flat pea grown in the very acidic Hinckley soil: 1 = control; 2 = lime, surface; 4 = fertilizer, surface; 6 = lime and fertilizer, surface.

ROADSIDE EXPERIMENT

Materials and Methods

An east-facing, 3:1 cut slope on I-86 in Sturbridge, Massachusetts, was the site of the roadside experiment. The brown-colored till was mostly parent material and very stony. A mechanical analysis of the soil showed that it consisted of 71 percent sand, 22 percent silt, and 7 percent clay. It was classified as a stony sandy loam. Because of the many stones on the site, it was almost impossible to develop a good seed bed. The mixing of the limestone and fertilizer and the incorporation of the flat pea seed were done in 3 operations by back-grading with a bulldozer blade. Limestone was applied at the rate of 3360 kg per hectare (3,000 lb per acre) and 0-8.7-16.6 (N, P, K) fertilizer at the rate of 896 kg per hectare (800 lb per acre). Inoculated Lathco flat pea seed was broadcast at the rate of 23 kg per hectare (21 lb per acre) and mulched with hay at the rate of 2240 kg per hectare (1 ton per acre). Plots 7.6 by 15.2 m (25 by 50 ft) were seeded starting December 1, 1970, a dormant seeding, and continuing each month from April through October 1971. An application of 0-8.7-16.6 (N, P, K) fertilizer at the rate of 392 kg per hectare (350 lb per acre) was given to all plots in June 1972.

Seedling or plant counts were taken every month from 4 squares, each 0.3-m (1-ft) on a side, selected at random to determine establishment and survival for the various seeding dates. Data on plant height were also taken (Figure 2).

Results

Table 4 gives the average number of seedlings and heights of plants for each monthly seeding date. On the date of each successive seeding, data were taken on the seedings made the previous months. The number of seedlings per square foot may appear low, but since there are only about 15,000 flat pea seeds per 453 g (1 lb) and the rate of seeding was 23 kg per hectare (21 lb per acre), one could expect only about 7.5 seeds per 0.3-m (1-ft) square.

The dormant seeding produced the least seedlings per 0.3-m square. However, at the end of the second growing season, this plot had produced a good stand of flat pea. In it, also, was a dense stand of grass and clover that had been introduced with the grass mulch. The September and October seedings produced an excellent and a fair seedling count per 0.3-m (1-ft) square respectively, but the plants were small. In 1972, cover in these plots appeared sparse and the plots contained weeds and grass; in 1973, they were filled almost entirely with flat pea, but still contained weeds.

Best results were obtained from the April, May, June, and July seedings, as can be seen in Table 4. Observations made in the later part of July 1972 indicated that these plots were covered with flat pea, with little or no grass or weeds. The August seeding also produced good cover, but the plants were smaller than those in plots seeded earlier.

The results of the time-of-seeding data showed that the earlier seedings of flat pea had a good chance to establish well-developed plants (Figure 3); later seedings produced smaller plants due to the shorter growing time. September and October seedings did not produce full cover even by the end of the second summer. Blossoms were observed only on plants from the December and April through July seedings during the second year of growth. In 1973, the plants in all plots, regardless of seeding date, had blossomed and produced good-to-excellent cover.

SUMMARY AND CONCLUSIONS

It appears that flat pea is somewhat tolerant of acidic soil conditions. It has been found growing on sites with a pH of 5.0 (3). However, it establishes itself more rapidly when the pH is nearer the neutral point and fertility levels are high. In order to introduce flat pea on roadside slopes in Massachusetts where the soil is mostly subsoil and parent material, it is recommended that the soil be limed according to the lime requirement test and that fertilizer be applied prior to seeding.

Seeding can be accomplished from the time one is able to work the soil in the spring until the latter part of June. July and August seedings are, naturally, dependent on the

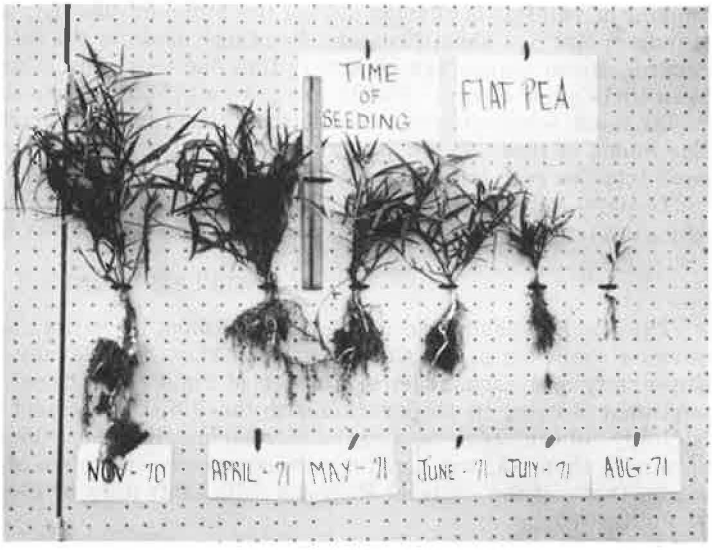

Figure 2. Size of flat pea plants seeded December 1, 1970, and in April, May, June, July, and August 1971. Picture taken in September 1971.

Table 4. Number and heights (average of 4 readings) of flat pea plants per 0.3-m (1-ft) square.

	1971										1972	
	June		July		Aug.		Sept.		Oct.		June	
Date of Seeding	No.	Height (cm)	No.	Height (cm)	No.	Height (cm)	No.	Height (cm)	No.	Height (cm)	No.	Height (cm)
Nov. 23, 1970	2	3.8	2	5.5	2	8.6	2	9.1	2	13.9	2	38.8
April 4, 1971	3	4.5	4	6.3	4	11.4	4	14.7	4	17.7	6	40.3
May 12, 1971			5	11.6	5	20.5	6	25.4	5	26.4	5	55.8
June 7, 1971			3	5.3	4	13.7	4	17.7	4	18.5	5	44.9
July 6, 1971					5	6.6	6	9.3	6	10.4	6	25.6
Aug. 6, 1971							4	6.8	6	7.1	6	18.0
Sept. 8, 1971											6	6.0
Oct. 5, 1971											3	3.5

Figure 3. June seeding of flat pea. Picture taken in June the second year shows complete cover.

amount of rainfall occurring during the summer months; if rainfall is adequate, good stands of flat pea should result. Seedings made in the fall of the year are not so successful; these stands are generally thin due to winter injury, especially when there has been little snow cover. Weeds are also a problem when the stand is sparse.

Dormant seedings made before the ground freezes produce good stands of flat pea. The seeds of this legume are large, and best results are obtained by incorporating the seed into the soil and mulching the area.

To date, successful plantings have been made on deteriorating slopes in the 8 highway districts of Massachusetts, and the cover of flat pea is excellent.

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