EFFECT OF CLIPPING ON THE SUBSEQUENT SEED YIELD OF SEVERAL CLOVERS

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INTRODUCTION

One of the principle problems confronting the farmers of Michigan in the production of sweet clover (Melilotus alba Desr.), medium red or June clover (Trifolium pratense L.), mammoth red clover (Trifolium pratense perenne Hort.) and alsike clover (Trifolium hybridum L.) seed consists in handling the early spring growth in such a manner that a maximum yield of seed is obtained and seed harvest is facilitated.

It is a general practice among Michigan seed growers to take the first crop of mammoth red clover and alsike clover, the second crop of medium red or June clover and either the first or second crop of sweet clover for seed production. However, in order to eliminate bulky growth, reduce the amount of coarse material to be handled at seed harvest, control weeds and insects, obtain a hay crop, increase seed yields or cause the crop to set seed at a more favorable time farmers have resorted to rolling, clipping or pasturing the first crop. As these clovers differ widely in their reaction, desirable treatments for one clover is not necessarily the best treatment for any one of the other clovers. Neither can results obtained in other states be applied to Michigan conditions owing to variations in soil type and climatic conditions.

This thesis reports specifically on the effect of cutting the early spring growth of the above mentioned clovers on seed

yields. Since each clover reacts differently to cutting treatments they are discussed separately and the literature reviewed separately.

SWEET CLOVER (*Melilotus alba* Desr.)

Sweet clover differs from other clovers in that when it is grown on fertile soil it makes a more rank growth attaining a height of six to seven feet. With such a rank and coarse growth of sweet clover it is very difficult to harvest the seed crop efficiently with a binder, mower or combine. The bulky unharvested crop is difficult to plow under and makes very poor material to add to the soil as organic matter. As a result many farmers burn over the field thus losing a hay or pasture crop, a seed crop and most of the organic material. Some growers cut or pasture the early growth of sweet clover to reduce the bulky growth and report a loss of stand and a corresponding decrease in seed yields.

Coe (1) found that only those portions of the plant exposed directly to the sunlight set seed abundantly and that thin stands usually produced more seed than heavy stands due to seed setting on the lower branches. He found that on a heavy stand, seed set only on the upper 24 to 30 inches of the plant. If the stand was thick and indicated a yield of from one to three tons of dry matter per acre he recommended pasturing or cutting for hay previous to the production of a seed crop. Coe found that the second crop will ordinarily

produce more seed if there is a heavy stand to begin with. Willoughby and Wells (12) working in Kansas, recommended pasturing the first "two or three months" of growth or clipping the early growth of the season when 12 to 16 inches in height leaving a stubble of 10 to 12 inches. Garber, et al, (2) working in West Virginia found that sweet clover cut at the "prebud" stage of growth (26 inches in height) could be depended on to produce "ample seed for reestablishing the crop", whereas if the sweet clover was cut at a later stage it may or may not produce sufficient seed, depending somewhat on the season. Willard (10) working in Ohio, clipped sweet clover with a hand sickle to imitate the action of a "stripped" binder and found that clipping usually decreased the yield of seed. Later cuttings gave correspondingly greater decreases in seed yield. He clipped the clover six to ten inches below the general level of growth at the time of clipping. Willard found that clipping sweet clover as early as May 9, with the mowing machine cutter bar set as high as possible resulted in nearly total loss of stand.

An experiment was set up on the College farm at East Lansing, Michigan, during the season of 1939, to determine whether sweet clover could be cut during the second year of growth and not materially reduce the seed yield. Two series of sixteen plats (15 feet by 180 feet) were laid out with 2½-foot alleyways between each plat. All cutting treatments were made in duplicate. One group of four plats was cut back to four inches from 6, 9, 12 and 18 inches. Another group

was cut back to seven inches from 9, 12, 18 and 22 inches and a third group was cut back to ten inches from 12, 18, 22 and 32 inches. Every fifth plat was left as a control or check and received no treatment. Iron shoes fitted to a mowing machine cutter bar as described by Megee (4) were used to obtain the desired height for cutting the sweet clover. At the time of the first cutting, made May 8, the sweet clover was six to seven inches high. The last cutting was made June 1, when the sweet clover was in the early bud stage of bloom and from 30 to 32 inches in height.

Table I shows the various cutting treatments, the coefficient of yield (8) for each plat of the duplicate series and the condition of the crop when harvested. The average yield of eight check plats was 301.34 pounds of clean seed per acre. Results indicate that although clipping sweet clover did not, in many cases, increase the seed yield materially, neither was the yield decreased. Best results from the standpoint of seed yield were obtained when the clover was clipped to four inches from a height of 10 to 18 inches. It is of interest to note that when stubble of four inches was left the later the clipping was made, up to May 23, or when the clover was 18 inches in height, the higher was the yield of seed. This may be due to the fact that the stand was decreased to 75 or 80 per cent of the check plats. The thinner stand in combination with profuse branching may have induced larger yields of seed. When the stand was decreased below 75 per cent the seed yields dropped.

Table I. The influence of height of clipping and height of sweet clover plants when clipped upon yield of seed.

Average yield of eight check plats was 301.34 pounds of clean seed per acre.

Plat No.	Ht. of stubble	Ht. when clipped	Date clipped	Coefficient of Yield (P/C) Series I	Series II	Average	Condition of crop at harvest % stand	Height	Size of stems**
1	4 in.	6 in.	May 8	1.1175	.7685	.9430	100	6 ft.	----
2	4 in.	9 in.	May 11	1.4016	1.1676	1.2846	100	5½ ft.	---
3	4 in.	12 in.	May 17	1.4850	1.2656	1.3753	90	5 ft.	--
4	4 in.	18 in.	May 23	1.5245	1.3644	1.4445	75	4 ft.	-
6	7 in.	9 in.	May 11	1.1389	1.0540	1.0865	100	6 ft.	----
7	7 in.	12 in.	May 17	1.0628	.9111	.9870	100	5½ ft.	---
8	7 in.	18 in.	May 23	1.1797	.9282	1.0540	85	4 ft.	-
9	7 in.	22 in.	May 26	1.0114	1.0863	1.0489	50	3 ft.	-
11	10 in.	12 in.	May 17	.9444	1.0643	1.0044	100	6½ ft.	----
12	10 in.	18 in.	May 23	.8694	1.2038	1.0366	95	5 ft.	---
13	10 in.	22 in.	May 26	.8407	1.3676	1.1042	70	4 ft.	-
14	10 in.	32 in.	June 1	.7615	1.0294	.9270	30	2½ ft.	-

** Size of stems at time of seed harvest.
---- Same as check plat.
--- Finer than check plat.
-- Fine stems.
- Very fine stems.

Clipping off two inches of growth when the plants were 6, 9 and 12 inches high set the sweet clover back some at the time of cutting but recovery was very rapid and differences in height, stand and size of stems could not be detected when compared with unclipped plants at harvest time. This agrees with the results obtained by Garber, et al, (2) in that plants clipped early made a more rapid recovery than those clipped at a later stage of growth.

When five inches of growth were removed from the plant (plats 2 and 7) the subsequent growth was not decreased appreciably although it was somewhat shorter and the stems were smaller when compared with plants on the check plats at the time of harvest. The stems were not fine enough however to increase to any great extent the ease and efficiency with which the crop could be harvested with a binder, mower or combine. When eight inches or more of the plant was removed the resulting crop was much shorter and finer of stem when compared with uncut plants at harvest time. Any one of plats number 3, 4, 8, 9, 13 and 14 could have been harvested with ease using any of the common methods of harvesting.

MEDIUM RED or JUNE CLOVER (Trifolium pratense L.)

Although farmers in Michigan have, for many years, removed the first crop of medium red clover leaving the second crop for seed, all growers are not in agreement as to the proper time to cut the first crop. Some cut as early as the bud stage of growth while many prefer the full bloom stage and others leave until the heads are turning brown. The

practice of pasturing the field for various periods in the spring is sometimes followed. Recommendations for the time of cutting the first crop varies with the section of the country. Westgate and Hillman (9) recommend cutting when the clover is two-thirds in bloom. Moore and Delwiche (7), working in Wisconsin, cut at 40 to 50 per cent bloom. Hunter (3) of Oregon, gives a wide range. He recommends cutting from May 1 to June 20, depending on the season, clipping later in a wet season than in a dry one. Willard, et al, (11) working in Ohio, recommend cutting the second week in June, or about when the first flowers appear.

An experiment was set up during the seasons of 1938 and 1939, on the College farm at East Lansing, Michigan, to determine at what stage of growth medium red clover should be cut under Michigan conditions to give the greatest yield of seed. The experiment consisted of 16 plats 11 feet x 180 feet (1/22.000 acre). Six cutting dates, replicated twice, were used with four checks.

Table II shows that early clipping of the first crop of medium red clover resulted in increased seed yields with the increase becoming greater as the cutting was delayed up to the time the clover started to bloom. The greatest increase in seed production was obtained when the clover was cut in the late bud stage of growth or just as the clover started to bloom. This is in agreement with Willard's work in Ohio. A slight decrease from this peak production of seed was obtained if the cutting was delayed until the clover was three-fourths

to full bloom. A very marked decrease in seed production, lower than the check yields, was obtained if the first crop of clover was cut after the blossoms start turning brown.

Table II. The effect of clipping medium red clover at various stages of growth on the seed yield.

Treatment	Lbs. seed per acre 1938	1939	Condition of crop when clipped 1939
Not clipped	55	111	
Clipped May 23	114	122	10" high
Clipped June 1	162	140	14" high, very early bud stage
Clipped June 8	199	178	18" high, 1/5 bloom
Clipped June 15	176	130	20" high, ¾ bloom, 1/10 bloom
Clipped June 23	---	59	20" high, full bloom, ¼ brown
Clipped July 1	---	22	20" high, ¾ brown

Plats cut June 8, 1939, when the clover was beginning to bloom gave a seed yield of 178 pounds of plump seed per acre and no shrivelled seed when harvested August 16. Another plat treated in the same manner gave a seed yield of but 21.4 pounds per acre of plump seed and 96.0 pounds of shrivelled seed when harvested on August 7, indicating the necessity of waiting until the crop is well matured before beginning the harvest.

A plat cut at weekly intervals on May 23, June 1, June 8 and June 15 was harvested for seed on August 29, giving a yield of 76 pounds of plump seed per acre, indicating a possibility of pasturing medium red clover advantageously for a short period in the spring and leaving the field for seed production (6). It is possible that better seed yields would

be obtained if the crop was not pastured after June 5, to allow the plants to recover for a longer period of time.

The first crop of seed was harvested from the control plats July 26. A second crop of seed was harvested October 11, giving an average yield of 18 pounds of plump seed per acre. Dry weather during the fall of 1939, made it possible to make this harvest. It is not recommended, however, that seed be harvested so late due to difficulties ordinarily encountered in getting the crop sufficiently dry to thresh at that time.

Data were taken to determine the effect of clipping on the relative number and size of seed per head.

Table III. The effect of time of clipping medium red clover on the average number of heads per square foot, weight per 1,000 and number per head of plump seed at time of harvest, 1939.

Treatment	Heads per square foot	Plump Seeds	
		No. per head	Wt. per 1,000
	heads	seeds	grams
Not clipped	75.6	30.0	1.87
Clipped May 23	61.8	44.9	1.55
Clipped June 1	58.0	58.0	1.62
Clipped June 8	55.0	60.2	1.53
Clipped June 15	53.8	64.8	1.55
Clipped June 23	40.2	72.4	1.47
Clipped July 1	37.0	77.5	1.43

Table III shows that delayed cutting made fewer heads per square foot, more seeds per head and smaller seed. Similar results were obtained in 1938.

MAMMOTH RED CLOVER (Trifolium pratense perenne Hort.)

Mammoth red clover, a single cut clover, makes such a rank growth when the crop is grown on a fertile soil that growers have difficulty in handling the seed crop efficiently. An experiment was set up during the seasons of 1938 and 1939 on the College farm at East Lansing, Michigan, to determine, if possible, a cutting treatment which would cut down the amount of bulky growth and still maintain or increase seed yields. The experiment consisted of 16 plats 11 feet x 177 feet (1/22.373 acre). Six cutting dates, replicated twice, were used with four checks.

Table IV. The effect of cutting mammoth red clover at various stages of growth on the seed yield.

Treatment	Pounds seed per acre 1938	1939	Condition of crop when clipped 1939
Not clipped	212	230	
Clipped May 23	261	182	7" high
Clipped June 1	270	71	12" high
Clipped June 8	243	62	15" high
Clipped June 15	226	39	19" high, early bud stage
Clipped June 23	---	16	23" high, late bud stage
Clipped July 1	---	9	23" high, 1/3 bloom

Table IV indicates that the effect of clipping mammoth red clover on the subsequent seed yield varies with the season. Clipping greatly reduced the seed yield of the succeeding crop, even when cut in very early stages of growth, during a dry season. In 1938, a season of greater than average rainfall, the seed production was not decreased as a result of clipping. The peak of seed production during that

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year was obtained from plats clipped early, June 1 or before, as compared with June 8 for medium red clover. This placed the desirable cutting date for mammoth red clover about two weeks before the bud stage of bloom when the plants were 8 to 10 inches tall while the proper time for medium red clover was early bloom stage with the plants 18 to 20 inches tall. During the dry season of 1939, the growth of the mammoth red clover on the control plats was not as extensive as the growth made in 1938, hence these plats had a tendency to produce more seed. Due to a deficiency of moisture those plats on which the plants were clipped failed to make seed yields comparable to the yields obtained during the more favorable season of the year before. Willard, et al, (11) working in Ohio, found that it was unsafe to clip mammoth red clover for seed after May 20, and that it probably reduced the seed yield whenever it was done.

Plats clipped June 15, and harvested September 14, gave a yield of 39 pounds of clean seed per acre while a plat cut at weekly intervals (May 23, June 1, June 8 and June 15) and harvested September 14, gave a yield of 22 pounds per acre. This indicates that pasturing mammoth red clover to a certain date may be more detrimental to seed production than clipping at that date. If the clover is pastured the cattle should be removed from the field a week or 10 days prior to the time the plat would ordinarily be clipped if the field was not pastured (6).

Data were taken to determine the effect of clipping on the relative number and size of seed per head.

Table V. The effect of time of clipping mammoth red clover on the average number of heads per square foot, weight per 1,000 and number per head of plump seed at the time of harvest, 1939.

Treatment	Heads per square foot	Plump Seeds	
		No. per head	Wt. per 1,000
	heads	seeds	grams
Not clipped	149.0	39.7	1.75
Clipped May 23	98.2	47.0	1.62
Clipped June 1	36.0	64.0	1.51
Clipped June 8	29.8	61.8	1.48
Clipped June 15	22.0	64.2	1.43
Clipped June 23	9.6	68.3	1.50
Clipped July 1	6.2	61.1	1.50

Table V shows that delayed clipping greatly reduced the number of heads per square foot, increased somewhat the number of plump seeds per head and decreased the size of the seed. Unlike the medium red clover, delayed clipping after June 1, had little effect on the number or size of plump seeds per head in relation to the number of heads per square foot.

ALSIKE CLOVER (*Trifolium hybridum* L.)

Alsike clover grown for seed often becomes badly infested with weeds owing to the less extensive growth as compared to medium red, mammoth red or sweet clover. Fields are sometimes clipped to control weed growth when the crop is to be used for seed production. An experiment was set up during the seasons of 1938 and 1939, on the College farm at East Lansing, Michigan, to determine to what extent seed yields were decreased by clipping the first crop at various stages of growth. The experiment consisted of 16 plats 11 feet x 121 feet (1/32.727 acre). Six

cutting dates, replicated twice, were used with four checks.

Table VI shows that clipping at any time after the alsike clover is six to eight inches high greatly decreased the seed yield. When clipped as late as the bud stage of bloom no seed was obtained, while clipping when the plants were six to eight inches in height decreased seed yields as much as 60 per cent. These results agree with those obtained by Willard, et al, (11) working in Ohio.

Table VI. The effect of cutting alsike clover at various stages of growth on the seed yields.

Treatment	Pounds seed per acre 1938	1939	Condition of crop when clipped, 1939
Not clipped	159	259	
Clipped May 23	79	36	7" high
Clipped June 1	no seed	2	11" high, early bud stage
Clipped June 8	no seed	no seed	13" high, ½ bloom
Clipped June 15	no seed	no seed	17" high, full bloom
Clipped June 23	---	no seed	19" high, ¼ brown
Clipped July 1	---	no seed	19" high, ¾ brown

During the season of 1938, there was a heavy growth of weeds on the alsike clover plats. Although clipping May 23 decreased the seed yield considerably it also very greatly decreased the amount of weed seeds in the clover at harvest. Clippings made earlier than May 23 may aid materially in checking weeds on badly infested fields and not materially decrease the seed yield of the alsike clover.

METEROLOGICAL DATA*

Table VII. Monthly mean temperatures in degrees Fahrenheit for 1938 and 1939, as compared with normal mean temperatures over a 50-year period.

	1938	1939	Normal
Jan.	22.4	26.8	22.4
Feb.	29.5	24.8	22.9
Mar.	40.6	32.0	32.2
Apr.	47.2	43.0	45.6
May	57.2	60.3	56.9
June	65.2	68.1	66.4
July	71.2	71.2	70.9
Aug.	72.2	70.0	68.5
Sept.	59.6	63.6	61.4
Oct.	53.6	50.9	50.3
Nov.	41.2	37.4	37.5
Dec.	28.2	31.8	27.2

* Data from United States Weather Bureau
East Lansing, Michigan.

Chart I. Deviations of monthly mean temperature from the normal mean temperature in degrees Fahrenheit for 1938 and 1939.

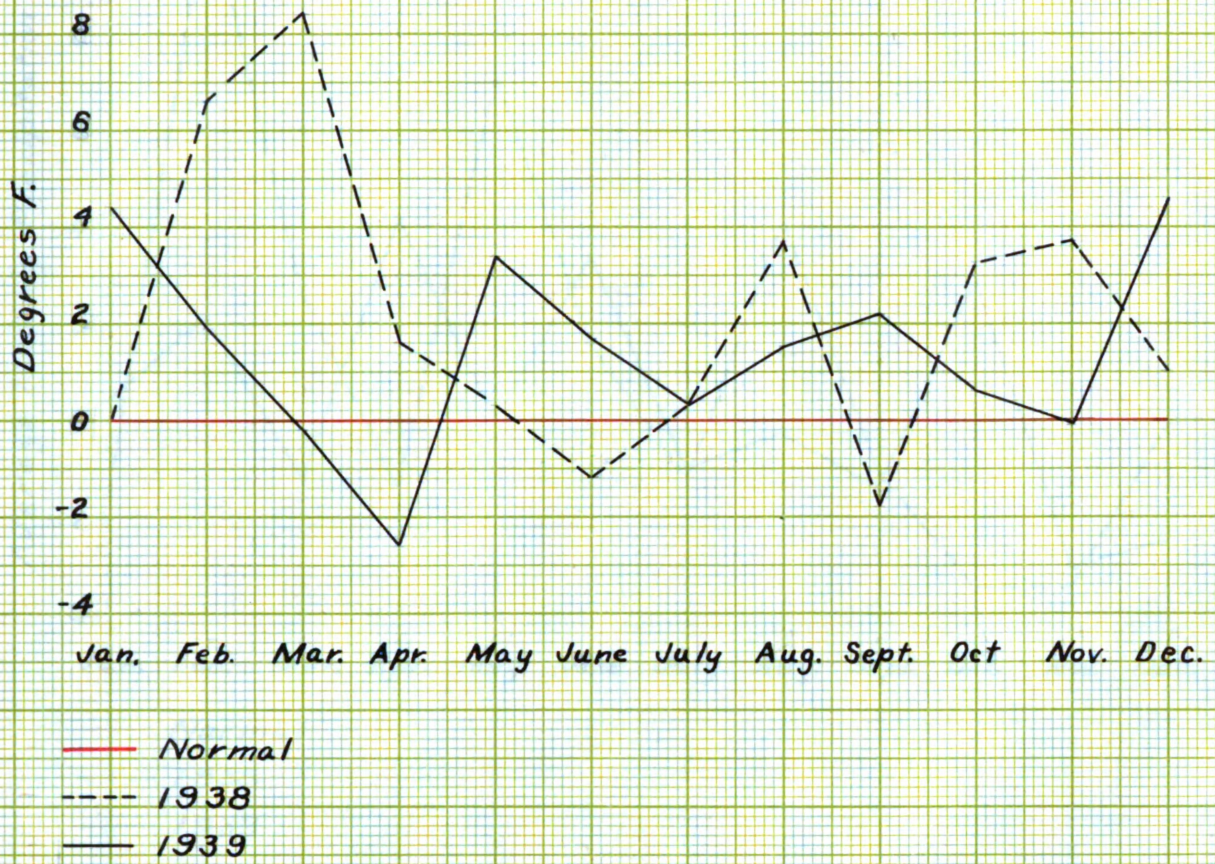
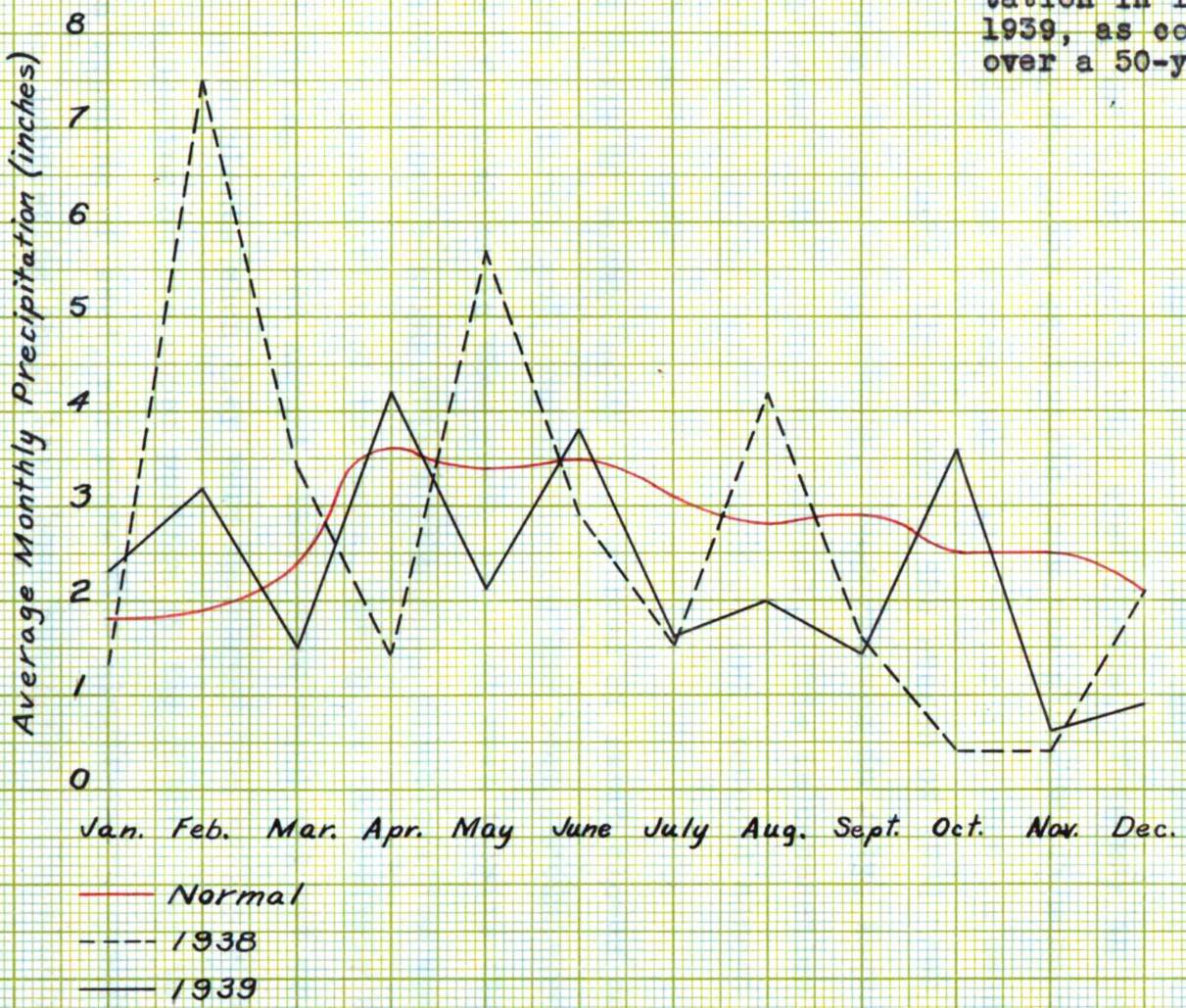


Chart II. Average monthly precipitation in inches for 1938 and 1939, as compared with normal over a 50-year period.



DISCUSSION

There were greater fluctuations in seed yields during 1938 than 1939. Excessive precipitation during February and March (Chart II) in connection with above normal temperatures during March and April, 1938 (Chart I, Table VII) stimulated vegetative growth. It is commonly believed that immoderate vegetative growth is not conducive to high seed yields. This may in part account for the lower seed yield from the plats which were not clipped and for the correspondingly greater increase in seed yield from the plats clipped during the season of 1938 than from those clipped during 1939. Temperatures in July, August and September, 1939, were above normal. This in connection with below regular rainfall for this period produced almost drought conditions.

In years of normal rainfall the seed of sweet clover does not ripen uniformly and some difficulty has been encountered in the use of a combine in that green material goes in with the seed which causes heating with a resulting discoloration and decrease in germination of the seed. Owing to exceedingly dry weather during July and August, 1939, seed which was set on the sweet clover plants when they were harvested was mature with no blooms appearing on the upper portion of the plant. Due to the uniform ripening of seed, all plats with plants small enough to facilitate harvesting could have been harvested successfully with a combine harvester and thresher. A small amount of precipitation from August 15 to 20, caused some new growth to appear, flower buds to form and blooming to take place. These blooms

failed to set seed before frost. It is probable that during a season of normal rainfall more profuse branching would take place from the growth buds after the sweet clover had been clipped.

Sweet clover differs from other clovers discussed in this paper in its growth habit in that growth starts in the spring from crown buds which send up shoots and any later growth made after the crop is cut must come from growth buds in the axils of the branches and leaves. Cuttings made on sweet clover must be made at a height that will allow some active growth buds to remain on the stubble if the plant is to live and make further growth. If the stand is thick or the plants have started to bloom, they must be cut at a height of 10 to 12 inches in order to leave active buds on the stubble for a second crop. If cut before bloom, a height of eight inches is sufficient (5).

In this report, sweet clover clipped when the plants were 12 to 18, 18 to 22, and 22 to 32 inches in height leaving a stubble of 4, 7 and 10 inches respectively, resulted in a crop which was much shorter and finer of stems and which maintained or increased seed yields as compared with plants which were not clipped.

Medium red or June clover is commonly known as a "double-cut" red clover, i.e., two crops may be taken in one season as a crop of hay and a crop of seed or pasture. Highest seed yields were obtained from plats which were cut June 8, when the medium red clover was 18 to 20 inches in height and beginning to bloom.

Mammoth red clover is a single-cut clover, i.e., but one crop of seed or hay can ordinarily be harvested in one season. Mammoth red clover does not have the ability to initiate as extensive a new growth when cut as does medium red clover, unless it is cut in very early stages of growth.

Clipping mammoth red clover greatly reduces the seed yield of the succeeding crop during a dry season, even when cut in very early stages of growth.

Results from clipping indicate that if the first cutting of either medium red or mammoth red clover was pastured the cattle should be removed from the field a week or ten days prior to the time the plat would ordinarily be clipped if the field was not pastured.

Alsike clover is very similar to mammoth red clover in growth habit in that it is strictly a single-cut clover. Clipping alsike clover at any time after it reached a height of six to eight inches reduced the seed yield of the succeeding crop as much as 80 per cent as compared with the plats on which the plants were not clipped.

SUMMARY

Experiments were set up on the College farm at East Lansing, Michigan, during the seasons of 1938 and 1939, to determine the effect of cutting on the subsequent seed yield of biennial white sweet clover (*Melilotus alba* Desr.), medium

red or June clover (Trifolium pratense L.), mammoth red clover (Trifolium pratense perenne Hort.) and alsike clover (Trifolium hybridum L.)

The sweet clover that was not clipped made such a rank and coarse growth that it would have been most difficult to harvest a seed crop by the usual methods of harvesting.

Clipping off two inches of growth when the plants were 6, 9, and 12 inches high delayed growth to some extent, but recovery was very rapid and differences in height, stand and size of stems could not be detected at harvest time when compared with plants not clipped. Seed yields from these plats were maintained or very slightly decreased but the growth was too rank to harvest efficiently for seed.

When five inches of growth were removed from plants 9 and 12 inches high, the subsequent growth was somewhat shorter and the stems smaller when compared with plants not clipped. The growth was not fine enough, however, to increase to any great extent the ease and efficiency with which the crop could be harvested. Seed yields from these plats were maintained.

Sweet clover clipped when the plants were 12 to 18, 18 to 22, and 22 to 32 inches in height leaving a stubble of 4, 7 and 10 inches respectively, resulted in a growth which was much shorter and had finer stems as compared to plants which were not clipped. This greatly facilitated seed harvest. Seed yields from these plats were maintained or increased.

Highest yields of medium red or June clover seed were obtained from plats on which the plants were cut June 8, when

the clover was 18 to 20 inches in height and beginning to bloom. A slight decrease from this peak production of seed was obtained if the cutting was delayed until the clover was three-fourths to full bloom. A very marked decrease in seed production was obtained if the first crop of clover was cut after the blossoms started to turn brown.

Clipping the first crop of medium red clover resulted in fewer heads per square foot, more seeds per head and smaller seeds in the succeeding crop as the date of cutting was delayed.

The seed yield of mammoth red clover during a dry season was greatly reduced when the clover was clipped, even when cut in very early stages of growth.

Clipping mammoth red clover as late as the early bud stage of growth during a season of greater than average rainfall did not reduce the seed yield as shown by this study.

Results from clipping indicate that if the first cutting of either medium or mammoth red clover was pastured the cattle should be removed from the field a week or ten days prior to the time the plat would ordinarily be clipped if the field was not pastured.

Clipping alsike clover at any time after it reached a height of six to eight inches reduced the seed yield of the succeeding crop as much as 80 per cent as compared with the plats on which the plants were not clipped.

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