FIELD PRACTICES THAT INFLUENCE SEED PRODUCTION OF LADINO CLOVER (TRIFOLIUM REPENS L.)

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FIELD PRACTICES THAT INFLUENCE SEED PRODUCTION OF LADINO CLOVER (*Trifolium repens* L.)

By

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A THESIS

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INTRODUCTION

Each year Michigan farmers plant a considerable acreage of Ladino clover. In 1952, an estimated 140,000 pounds of seed were used in the state.

Ladino may be used for pasture, hay, silage, or seed. When used for hay or silage, it is commonly used in a mixture with other forages. When used for pasture, it is found in mixtures or growing alone. It is generally growing alone when used for seed purposes.

Michigan farmers experience several problems in producing Ladino for seed. A satisfactory harvesting method is needed. Generally the clover is so short that it lacks the bulk needed to be easily gathered. The presence of volunteer Alsike clover also presents a problem to the seed producer.

It would be beneficial to the farmers and desirable from the economic standpoint if he could produce good quality seed in Michigan.

The purpose of this experiment was to determine what field practices commonly used by farmers would increase seed yields to a point where it would be profitable to produce seed in Michigan.

REVIEW OF LITERATURE

Ahlgren and Burcalow[1] reported that the biggest seed yield of Ladino clover was obtained the year after the seeding was made in Wisconsin. This was almost always followed by a heavy drop in production during the second and succeeding years.

Hollowell[5] reported that for seed production of Ladino clover, the seed heads should develop in late June or early July for best yields. He further reported that clipping aids to control weeds which may be present and tends to delay heading to a more favorable time.

McGee, et al.,[7] found that in Michigan, clipping in the early bloom stage increased the seed yields of red clover, while clipping decreased the seed yields of alsike clover. Late clipping was detrimental to mammoth clover seed production. Clipping tended to decrease the amount of material to harvest.

Thompson, et al.,[13] of Wisconsin found no significant differences in seed yields of Ladino clover treated in the following manner:

1. Check
2. Clipped when 4-6 inches high
3. Clipped when 6-8 inches high
4. Clipped when 8-10 inches high
5. Clipped when 10-12 inches high

They further observed that good yields were recorded in seasons of moderate rainfall. Poor seed yields were recorded in wet seasons.

Willard, et al.,[14] found that the best time to clip red clover for seed production in Ohio, was in the early to late bloom stage.

Brown and Hunsell[2] observed in Connecticut, that a Ladino-red clover mixture reduced the proportions of Ladino and total yields of dry matter. They also noted that in a mixture, timothy competed less with Ladino than did orchard grass.

Schoth[11] reported that hulled timothy is almost inseparable from Ladino seed and that timothy should be avoided in any mixture to be used for seed in Oregon.

Robinson and Sprague[10] in Pennsylvania, observed that Ladino did very poorly with orchard grass on non-irrigated plots.

Sprague and Garber[12] reported that clipping at a two inch height favored the clover more than a higher cutting when Ladino was grown with a grass in Pennsylvania. Clipping when the grass reached an 8-10 inch height maintained the clover in a stand better than later clippings. The application of 60 pounds nitrogen was beneficial to the grass and harmful to the legume.

Hollowell[5] reported that under most conditions phosphorous should be applied in early spring when growing Ladino for seed production.

Thompson, et al.,[13] of Wisconsin, observed that there was no significant difference in the yield of seed between plots with the clippings left on and those with the clippings removed.

Dunavan[4] in South Carolina, concluded that the pollinating of Ladino clover was done by bees, and mostly by honeybees.

MacVicar, et al.,[6] observed that applying DDT at 1 1/2 pounds per acre gave significant increases in the seed yields of red clover in the Dominion of Canada.

Medler and Chamberlain[8] of Wisconsin, reported that spraying or dusting DDT gave higher seed yields of red and Ladino clover than the untreated checks. A one pound application of DDT sprayed on the plots increased seed yields 22 per cent over the check.

Pederson[9] reported that DDT applied at 1 1/2 pounds per acre promoted yield increases in alfalfa and red clover seed in Michigan. He concludes that the application should be made in the prebloom stage.

Thompson, et al.,[13] in Wisconsin observed that plots sprayed with DDT produced more seed than unsprayed plots although the differences were not always significant. In some comparisons, the yields were double those of unsprayed plots.

Dexter and McKibben[3] showed that a vacuum harvester does a more efficient job of harvesting Ladino than does a combine under Michigan conditions. The vacuum harvester was 5 to 10 times more efficient.

EXPERIMENTAL PROCEDURE

This was a field experiment conducted on the college farm, East Lansing, Michigan. Three fields were used: (1) A Conover loam on which a stand of pure Ladino was grown, (2) A Conover loam on which a Ladino-red clover mixture was grown, and (3) A Hillsdale sandy loam on which the following mixtures were grown:

(1) Pure Ladino
(2) Ladino - red clover
(3) Ladino - timothy
(4) Ladino - smooth bromegrass
(5) Ladino - orchard grass.

The size of all of the plots was 17.5 by 25 feet which is equivalent to 1/100 of an acre.

PURE LADINO

The pure Ladino was planted in 1950. In 1951 four treatments were employed. These were:

(1) Check
(2) Clipped - prebloom -- May 29
(3) Clipped - early bloom -- June 11 (approx. 1/10 bloom)
(4) Clipped - late bloom -- June 21 (approx. 1/2 bloom)

The plots were randomized and replicated four times. The plots were clipped to a 2 inch height with a three-foot Jari mower. The clippings were raked off immediately after mowing.

All plots were harvested on August 9 with the Jari mower. A three-foot strip 14.5' long was harvested which is equivalent to 1/1000 of

an acre. The harvested material was placed in a dryer for two weeks and then stored until threshed. The material was threshed on January 10, 1952 and the yields of the cleaned seed were recorded. The seed was cleaned on a clipper fanning mill using a 1/18 upper screen and 6 x 38 lower screen.

In 1952 the number of plots were increased to 54. Six replicates were used and nine treatments were employed. The treatments were:

(1) Check
(2) Clipped - prebloom -- clipped June 6
(3) Clipped - early bloom -- clipped June 13 (approx. 1/10 bloom)
(4) Clipped - late bloom -- clipped June 25 (approx. 1/2 bloom)
(5) Clipped - early bloom -- clippings left on
(6) Clipped - early bloom 200# ammonium sulphate per acre, applied June 18
(7) Clipped - early bloom 400# 0-20-0 per acre, applied April 19
(8) Clipped - early bloom nitrogen and phosphorous
(9) Clipped - early bloom 1 1/2# DDT sprayed on June 23

The clippings were all raked off immediately after mowing with the exception of the plots where the clippings were left on.

The plots were harvested on July 30 with the exception of the plots clipped in the late bloom stage which were harvested on August 10. The material was dried for two weeks and stored. This material was threshed October 10-18.

LADINO - RED CLOVER MIXTURE

The Ladino - red clover was planted in 1950. Four treatments were employed:

(1) Check
(2) Clipped - prebloom -- May 29

(3) Clipped - early bloom -- June 11
(4) Clipped - late bloom -- June 21

The treatments were randomized and replicated four times.

These plots were clipped to a 2 inch height with a Jari mower. The clippings were removed immediately after mowing.

The plots were harvested on August 14 and the material dried for two weeks. The material was threshed on January 17. Preliminary screening was done on a clipper fanning mill using a 1/16 upper screen and a 6 x 38 lower screen. The Ladino clover was separated from the red clover by using a 1/22 hand screen. Some Ladino clover failed to go through the screen and some red clover passed through. The lots of seed were divided down to approximately a one gram sample and analyzed. The percentage of the other specie was determined and the necessary corrections made in the seed yields.

The same area was used again in 1952. The plots were again randomized using three replications. The same treatments were employed as in the previous year. The plots were clipped on the following dates:

1. Prebloom -- June 11
2. Early bloom -- June 18
3. Late bloom -- June 25

The plots were harvested on August 11 and threshed on October 21. The same procedure was used for separating the Ladino from the red clover.

LADINO CLOVER MIXTURES

The various mixtures were planted on June 5 and 7, 1951. The previous crop was buckwheat for green manure purposes. The following mixtures and seeding rates were used:

	Seeding Rate #/A	
	Ladino	Others
1. Pure Ladino	2#	-
2. Ladino - red clover	1#	5#
3. Ladino - bromegrass	1#	2#
4. Ladino - orchardgrass	1#	5#
5. Ladino - timothy	1#	1 1/2#

The plots were clipped on August 17, 1951 to control the volunteer buckwheat.

The plots were not harvested for seed yields as a good stand was established on only about one-half of the plots. Notes were taken on the good plots, however.

RESULTS AND DISCUSSION

PURE LADINO

In 1951 all plots contained a good growth of Ladino. The Ladino was quite high and not too difficult to harvest. All plots were free of weeds.

The seed yields obtained from the various treatments are shown in Table 1.

Table 1. The effect of clipping treatments on the yield of Ladino clover seed harvested in 1951.

Treatment	#/A
Check	94.7
Clipped - prebloom	119.5
Clipped - early bloom	110.1
Clipped - late bloom	122.8

Although there is no significant difference in the above seed yields, the yield of the check is considerably less than the yields of the clipped plots. The variation between replicates was as great as the variation between treatments.

In the spring of 1952 it was noticed that the plots varied considerably. In an effort to see if the previous year's treatment had any effect on the growth of the Ladino, the plots were rated on the basis of good, fair, and poor. This rating was done on May 5. All of the plots receiving phosphorous were rated good. None of the other plots were rated good. The plots receiving phosphorous were darker green in color and seemed to be taller. After clipping this difference was not noted. The other plots varied from poor to fair with no relation to previous treatments.

No visual differences were noted on the plots receiving nitrogen. This was due, probably, to the fact that less than .4 inches of rain was recorded for the two weeks immediately following the application.

The month of June was very dry. All of the clippings were made in June and it was necessary for all recovery to be made under drought conditions. Table 2 shows the weekly rainfall from April 12 to July 26.

Table 2. Weekly rainfall as recorded at the Lansing, Michigan weather station for the period, April 12 - July 26, 1952.

Week ending	Inches PPT.	Monthly PPT.	Average Monthly PPT.
April 19	.83		
April 26	.22	3.32	2.58
May 3	0		
May 10	.52		
May 17	.44		
May 24	3.37		
May 31	.60	4.98	3.43
June 7	.45		
June 14	.42		
June 21	.57		
June 28	.01	1.46	3.51
July 5	1.01		
July 12	.10		
July 19	1.65		
July 26	.28	3.24	3.14

Seed yields obtained in 1952 varied considerably. Table 3 shows the yield for the various treatments.

Table 3. The effect of clipping treatments, fertilizer applications, and spraying with DDT on the yield of Ladino clover seed harvested in 1952.

Treatment	Seed Yield lbs./A	% of Check
Check	55.8	100
Clipped - prebloom	51.8*	92.8
Clipped - early bloom	36.5**	65.4
Clipped - late bloom	12.5	22.4
Clipped - early bloom, clippings left on	26.0	46.6
Clipped - early bloom + 200# ammonium sulphate	27.1	48.6
Clipped - early bloom + 400# 0-20-0	62.8	112.5
Clipped - early bloom + nitrogen and phosphorous	59.1	105.9
Clipped - early bloom + 1 1/2# DDT sprayed	55.0*	98.6

* Average of 4 replicates
** Average of 5 replicates

The check had a satisfactory seed yield. This was due to the weather conditions which were ideal for seed production in June and early July. The yield of the check was significantly higher at the 5% level than the yields of the early bloom clipping, early bloom clipping with the clippings left on, early bloom clipping and nitrogen, and the late bloom clippings.

Only four replicates were averaged in the prebloom clipping treatment as the other two were in an excessively weedy area. The average of the four plots free of weeds was 51.6 pounds per acre which does not vary significantly from the check. The weather during pollination for this treatment was likewise ideal.

One replicate was discarded from the early bloom clipping as it was also very weedy. The average of the five plots free of weeds was 36.5 pounds. This is a drop of 15 pounds from the previous clipping. The lack of moisture is apparently the reason for the clover's failure to recover after clipping.

The late bloom clipping was consistently low in all replicates. The clover made very poor recovery after clipping. There was very little material to harvest. The seed yield for this treatment is significantly lower at the 5% level than all other treatments except the early bloom clipping with the clippings left on and early bloom clipping and nitrogen. It is very close to being significantly lower than these two, also.

No benefit or harm was found in leaving the clippings on the ground. After clipping, this material was evenly spread on the ground. Under field conditions, if this were not done, considerable difficulty might be experienced in harvesting due to the previous bunching of the clover. This would tend to clog the mower. These plots seemed to make as fast a recovery as the others after clipping and the stand appeared as good as the other plots clipped at the same time.

The nitrogen was applied in an attempt to get a ranker growth to facilitate harvesting. However, only .4 inch of precipitation was recorded in the two weeks following the application. No visual effects of the nitrogen were noticed. Again no beneficial or harmful effects were found.

The seed yields for the plots receiving phosphorous were highest of all plots. The yield was nearly doubled over the plots receiving no phosphorous but clipped at the same time. No visual differences were noted after the plots were clipped but the plots receiving phosphorous were greener and contained more forage prior to clipping.

The plots receiving both nitrogen and phosphorous showed no additional benefits from the nitrogen. The yields were no higher than the plots receiving only phosphorous. Neither were any harmful effects found from adding the nitrogen.

The plots receiving DDT also contained two weedy replicates. The average of the four plots which were free of weeds was 55.0 pounds per acre. This was as good as any of the other treatments. The DDT was sprayed just prior to blooming. These results agree with MacVicar, et al.,[6] and Medler et al.,[8] who report that DDT gave significant increases in seed production.

The addition of phosphorous and DDT showed significant increases in seed yields.

Clipping during the prebloom or early bloom stages is desirable to control alsike clover but did not increase the seed yields significantly.

Figure 1 shows the comparative seed yields obtained from the various treatments in 1952.

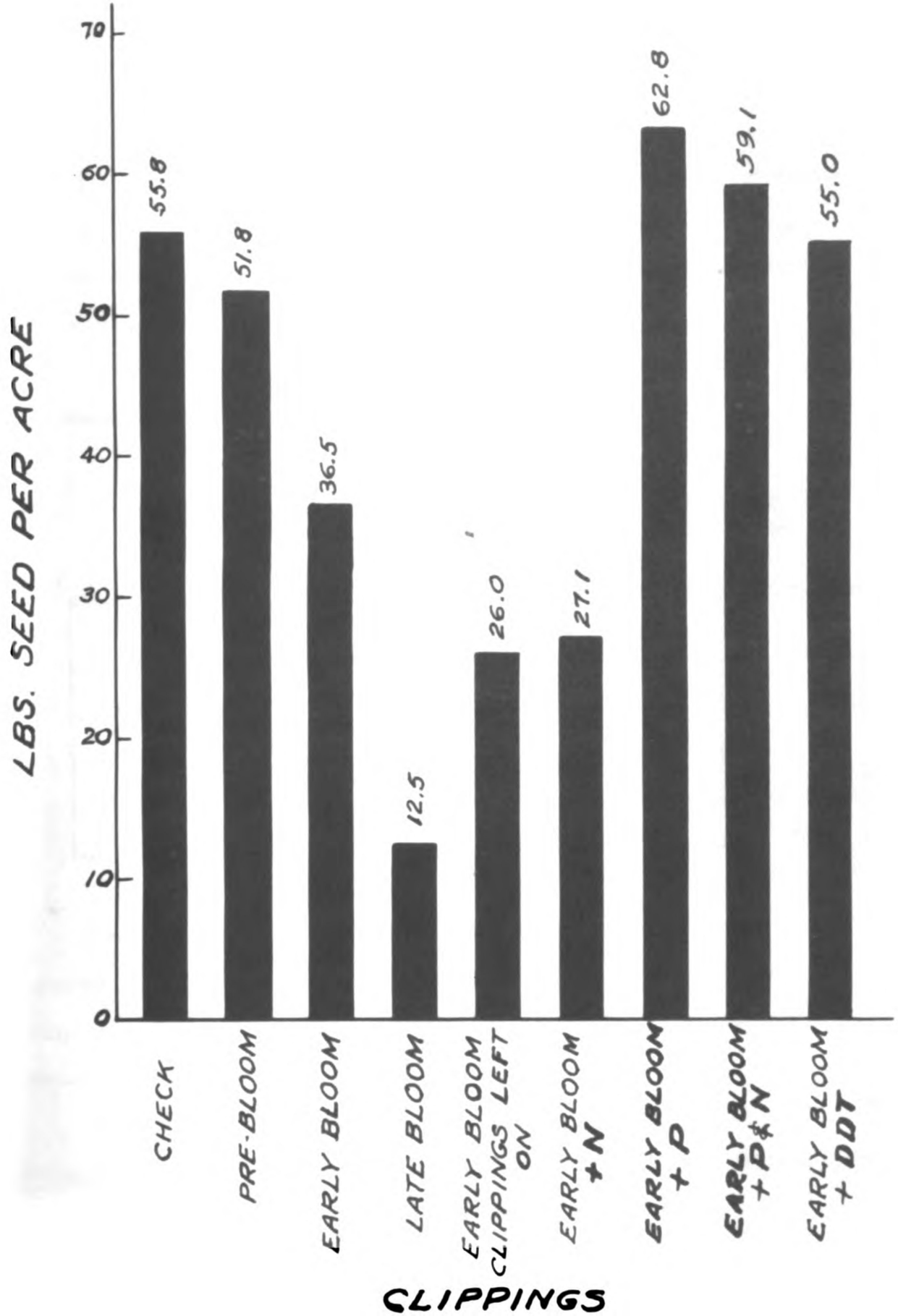

FIGURE 1. THE EFFECT OF CLIPPING TREATMENTS, FERTILIZER APPLICATIONS, & SPRAYING WITH DDT ON THE SEED YIELD OF LADINO CLOVER HARVESTED IN 1952.

LADINO - RED CLOVER MIXTURE

The primary purpose of growing Ladino in a mixture for seed is to provide some bulk to facilitate harvesting. A high seed yield from the companion crop is not the aim. No seed, but sufficient vegetative material to provide bulk would be most desirable.

In 1951 the yield of Ladino increased and the red clover seed yield decreased as the date of clipping was delayed. Table 4

Table 4. The effect of clipping treatments on the seed yields of a one-year-old stand of Ladino - red clover mixture harvested in 1951.

Treatment	Seed yields #/A		% Ladino
	Ladino	Red Clover	
Check	19.8	135.4	12.7
Clipped - prebloom	15.9	126.6	11.1
Clipped - early bloom	22.5	122.7	15.5
Clipped - late bloom	37.4	86.9	30.1

The late bloom clipping was the best date for Ladino clover seed production. The seed yield was significantly higher than any other clipping date. At this clipping date the percentage of Ladino was nearly twice as great as any other treatment.

The greatest seed yields from the red clover were from the earlier clippings. The smallest red clover seed yield was from the plots clipped in the late bloom stage where the Ladino yield was highest.

This was the first crop year for the mixture. The red clover was very vigorous and the Ladino was unable to compete with it. As the clipping date was delayed however, the Ladino was better able to compete.

In all treatments, there was sufficient red clover to provide the bulk necessary for easier harvesting. In the plots which were not clipped, the growth was so great that it was difficult to mow. All plots which were clipped were easy to harvest.

At no time was the seed yield of the Ladino comparable to the seed yields when the Ladino was grown alone. Table 1

In 1952 the seed yields were very different from the previous year. The red clover yields were neglible and the Ladino yields were higher. Table 5.

Table 5. The effect of clipping treatments on the seed yields of a two-year-old stand of Ladino red clover mixture harvested in 1952.

Treatment	Seed yields #/A		% Ladino
	Ladino	Red Clover	
Check	27.1	1.6	94.4
Clipped - prebloom	49.2	2.9	94.4
Clipped - early bloom	29.1	tr.	98.0
Clipped - late bloom	22.7	1.0	95.8

The prebloom clipping was significantly higher than the other treatments.

The percentage of Ladino in the mixture was relatively the same for all treatments.

In 1951 the red clover provided plenty of bulk but the stand was so heavy that the Ladino could not compete with it. In 1952 the red clover was so sparse that it did not provide any noticeable bulk and was of no value in the mixture.

Figure 2 shows the seed yields of the Ladino - red clover mixtures obtained from the various treatments in 1951 and 1952.

Since the red clover and the Ladino cannot be completely separated by ordinary means the production of pure Ladino seed by this method would be very difficult, if not impossible. Since the yields are not comparable to those of the Ladino when grown alone such a mixture is not advisable.

OBSERVATIONS ON THE LADINO CLOVER MIXTURES

The various mixtures showed marked differences in the amount of Ladino present.

The pure Ladino plots were very good in appearance. They appeared to be very vigorous and uniform in growth. These plots were free of weeds.

The Ladino-timothy plots also contained a good stand of Ladino clover. The stand of timothy was, likewise, very good. Both the Ladino and the timothy seemed to ripen at the same time. These plots were free of weeds.

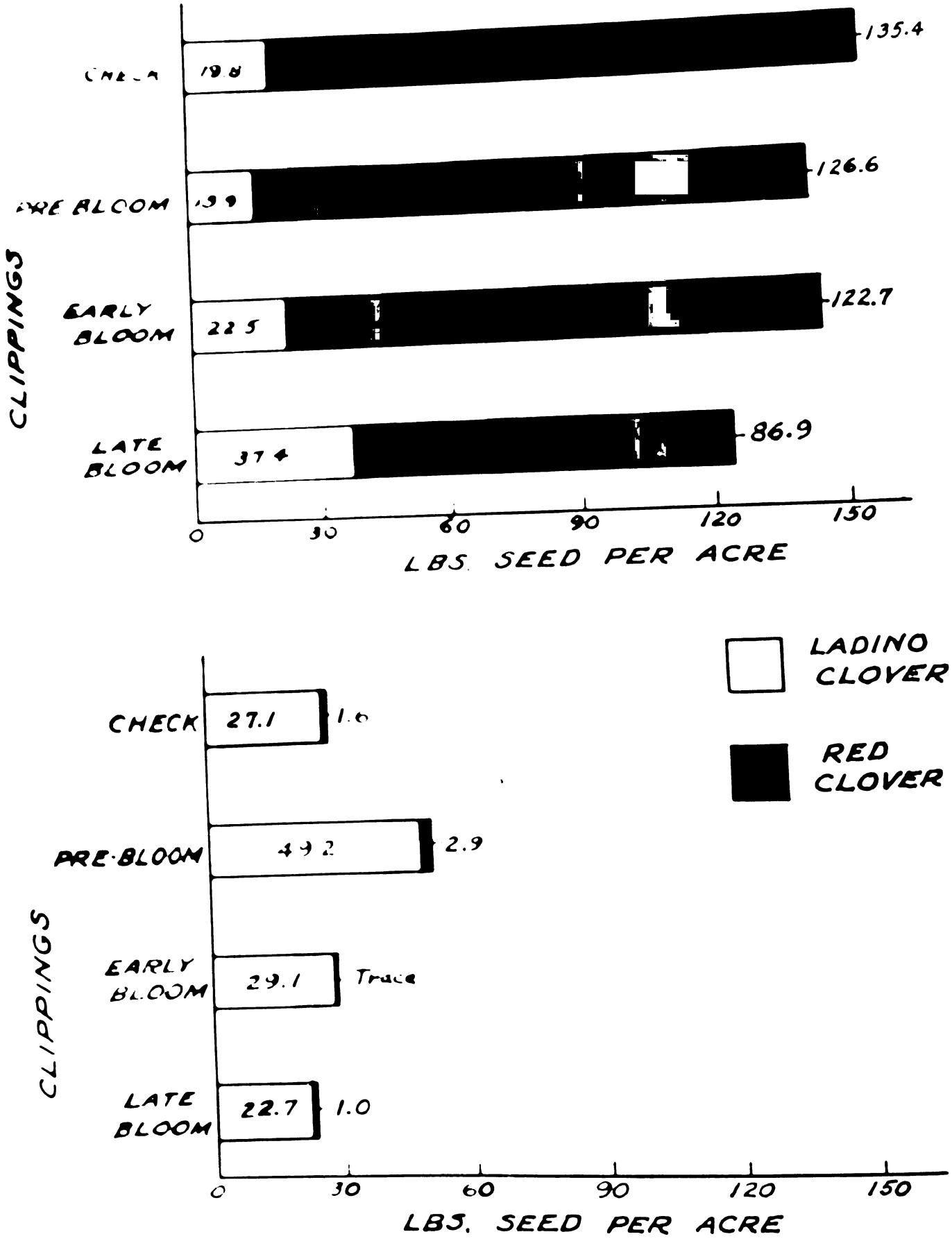

FIGURE 2 THE EFFECT OF CLIPPING TREATMENTS ON THE SEED YIELDS OF A LADINO-RED CLOVER MIXTURE.
UPPER-YIELDS FROM A YEAR OLD STAND HARVESTED IN 1951.
LOWER-YIELDS FROM A TWO YEAR OLD STAND HARVESTED IN 1952

The Ladino-bromegrass plots contained little Ladino. The bromegrass appeared too competitive for the clover. These plots contained some weeds, mostly tickle grass (Panicum capillare L.)

The Ladino-orchard grass plots contained very little Ladino. The orchard grass tended to crowd out the Ladino. These plots had very few weeds.

The Ladino-red clover contained no noticeable Ladino the first year. The Ladino plants which were present were very small and weak. These plots contained no weeds.

The ranking of the mixtures in order of the most desirable from the standpoint of Ladino seed production are:

1. Pure Ladino
2. Ladino-timothy
3. Ladino-bromegrass
4. Ladino-orchard grass
5. Ladino-red clover

Of the four mixtures for seed production only the Ladino-timothy showed any promise. Since both the Ladino and timothy ripened at the same time and it is very difficult to separate the seed by ordinary cleaning methods a clipping date which would delay the heading of the timothy until the Ladino is harvested would be desirable. This mixture seemed to contain enough timothy to supply the necessary bulk for harvesting. The Ladino did not seem to be hindered by the presence of timothy.

The Ladino-orchard grass mixture was undesirable from the Ladino seed standpoint. The Ladino was held back by the more vigorous grass. It is possible that the seeding rate for orchard grass was too high

and should be decreased as there was a good stand of grass in the plots. That the Ladino is unable to compete with the orchard grass under these conditions agree with Robinson.[9]

The Ladino-red clover mixture was mostly red clover. Upon close observation some Ladino plants could be found, but they were very small in relation to the plants in other plots. The Ladino would have been stronger if these plots had been clipped. This was evidenced the previous year in the Ladino-red clover plots already discussed.

SUMMARY AND CONCLUSIONS

1. Clipping did not increase seed yields significantly.
2. The addition of 400# 0-20-0 per acre significantly increased the seed yield of Ladino clover. Phosphorous nearly doubled the seed yield over plots receiving the same treatment minus phosphorous.
3. The addition of 200# ammonium sulphate per acre had no beneficial or harmful effects in the year it was tested. Different results may be obtained under different climatic conditions.
4. Spraying with DDT significantly increased the seed yield of Ladino clover.
5. Leaving the clippings on the ground had no harmful or beneficial effects. If the clippings are not evenly scattered after clipping difficulty in harvesting the seed crop may be experienced due to the plugging of the mower.
6. Growing Ladino clover in a mixture with red clover is not advisable if a seed crop is desired. The first year the red clover dominates the stand and the second crop year the red clover is not present in any sizeable amount. The seed of the two cannot be completely separated by ordinary means.
7. Timothy may be used as a companion crop for Ladino but a desirable clipping date is needed to prevent the timothy from heading at the same time as the Ladino, as the seed cannot be separated.
8. Bromegrass and orchard grass are too competitive for use with Ladino when Ladino is grown for seed purposes.

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