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A Study on the Phenotypic Stability of Selected Eastern Forage Synthetics Grown Under Utah Conditions

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A STUDY ON THE PHENOTYPIC STABILITY OF SELECTED EASTERN FORAGE SYNTHETICS GROWN UNDER UTAH CONDITIONS

by

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Approved:

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Don J. Heinz

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INTRODUCTION

The production of forage seed for use in the eastern United States is a large industry in Utah and other Western States. The development of forage synthetics in the east with production of seed in the west raises the question: "Is there a change in the synthetic when seed is produced under different environmental conditions?" To obtain information relating to genetic stability of grass and legume seed crops produced under various environmental conditions, the USDA-ARS Crops Research Division, Forage and Range Research Branch, Foundation Seed Production Section, set up several experimental plots in the western United States. These are located in Washington, Utah, Texas, and California.

This study reports the photoperiodic response and seed set of the various clones, which make up the synthetics, when grown under northern Utah conditions.

REVIEW OF LITERATURE

The idea that environment can affect the growth habit of plants is not new. Garner and Allard (1920) reported that length of day and night and other factors of environment affected plant growth and reproduction. Clausen, Keck, and Hiesey (1940) studied the reaction of clonaly reproduced plants of the same parental material at three different altitudes (Stanford, Mather, and Timberline) in California. They found variation between the growth of the clones at the three altitudes, such as differences in time of flowering, growth height (some plants at a different altitude produced only rosettes), and other morphological differences.

Much work has been done in the greenhouse to demonstrate the effect of environment upon plant growth and reproduction. Borthwich (1946) stated that with long day plants reduction in length of photoperiod below the critical length promoted vegetative development, whereas extension of the photoperiod above the critical length hastened reproductive development.

With greenhouse studies of smooth bromegrass during the winter, it was found that no flowering occurred with normal day length (9 - 10 hours), some with 15-hour days, and good flowering was produced using 18-hour days. Also, general panicle production was greater in late maturing clones. (Evans and Wilsie, 1946).

Knight (1955) found that dallisgrass grown under a 16- and 14-hour photoperiod flowered earlier and produced a significantly higher number of panicles, a higher total seed weight and a higher percentage

of seed with caryopses.

The locality of seed production has been studied to determine the effect of environment. Laude and others stated, "That when seed of a forage is produced for several generations in a region differing climatically from the area of forage production, the variety may exhibit characteristics reflecting the seed growing environment." Such changes could seriously affect the value of a synthetic variety.

Newell and Keim (1943) noted distinct differences in vegetative growth and panicle production between bromegrass plants originating from northern sources and those from Nebraska and Kansas. Chamblee (1954) observed that different lots of Ladino seed from the west coast (California, Oregon, and Washington) differed greatly in amount of flowering when grown in North Carolina.

Bird (1948) states that seed produced from a second cutting of Dollard Red Clover, consisting of early and late maturing types, would eliminate all slowly developing late flowering plants from seed production. This would alter the makeup of the synthetic.

Smith (1955) found that Certified Ranger Alfalfa seed originating from one generation of increase in southern latitudes produced a greater number of tall plants and fewer short plants in the populations following early fall cutting. These plants were winter injured more than populations derived from seed originating from one generation of increase in northern latitudes (foundation or registered seed). These contrasts were even more apparent when the plant populations were derived from seed lots originating from a second generation of increase in a southern latitude.

Jackobs and Hittle (1953) reported that there were marked differences in the genetic makeup of different seedlots of certified Ladino

Clover produced in 1951 in four Ladino seed-producing states (Washington, Oregon, California, and Idaho) when grown under Illinois conditions. The differences among certified seedlots in fall vigor, winter survival, and size suggest that there are differences in the agronomic value of different seedlots.

Results of a study in which Tennessee Anthracnose-resistant Red Clover was grown in the Pacific Northwest for six generations and tested in the East, showed that there was a loss of adaptation beginning in the first generation, with the sixth generation performing like common western red clover (Beard and Hollowell, 1958).

Laude and others (1958) studied the response of parental clones of Pilgrim Ladino Clover grown at Davis, California. They found that the clones differed markedly in response to over-wintering conditions and photoperiod with respect to earliness and persistence of flowering.

PLANT MATERIALS

This study included six grass and nine legume synthetics. The plant materials were assembled from various eastern states and Canada by the USDA-ARS Crops Research Division, Forage and Range Research Branch, Foundation Seed Production Section. Plantings were made at five locations in the west. The plantings in Utah were under the direction of the Department of Agronomy, Utah Agricultural Experiment Station, Utah State University.

C. S. Garrison (1958) gathered the information describing the characteristics, at the place of origin, of the various clones which make up the synthetics used in this study. All descriptions given below are from the place of origin and are as described by USDA personnel, except for the Macdonald Red Clover Synthetic.

Legumes

Alfalfa Synthetic (*Medicago* spp.)

The Alfalfa Synthetic was made up of 4 clones obtained from Minnesota. Clone Minn. 247 had a yellow flower, was wilt resistant, had excellent winter hardiness, was resistant to rust, and had a prostrate growth habit. Clone Minn. 265, a selection from Ladak, had blue flowers, good winter hardiness, was susceptible to rust, was a good seed producer, and was resistant to leaf spot and wilt. Clone Ka. 30-1182 had blue flowers, an erect growth habit, was resistant to wilt, susceptible to leaf spot, and was less winter hardy than Minn. 247 or 265. Clone C-40, a Nebraska selection from polycross progeny of C-55 (Ohio), was

resistant to bacterial wilt, but susceptible to blackstem and common leaf spot. It had less winter hardiness than either of the Minnesota clones.

Birdsfoot Trefoil Synthetics (Lotus spp.)

Beltsville Birdsfoot Trefoil was a synthetic made up of 4 clones. Clone 32-60 was originally out of a commercial seed stock from Italy. It was large seeded, vigorous, intermediate in type, and somewhat open-crowned with rather coarse stems, and bloomed sparingly at Beltsville. Clone 32-73 was selected out of PI-164001 from Czechoslovakia, and was a vigorous, intermediate type, average with respect to number of stems and seed size, and was a good seed producer. Clone 33-115 was selected out of PI-121196 from Turkey. It was fair in vigor, medium to large in seed size, and more decumbent in type of growth. Clone 35-449, a selection out of Viking, was included because of its tolerance to root rots. It carried good vigor, produced many stems, and was a generally desirable plant. Clones 32-60, 32-73, and 33-115 were lacking in resistance to crown and root rots. For each of these clones the highest proportion of plants at the early flower stage was observed on May 18 at Beltsville.

Pennsylvania Six Clone and Pennsylvania Seven Clone Synthetics were assembled at Pennsylvania State University. Information pertaining to the origin and general characteristics of the various clones was not available.

Red Clover Synthetics (Trifolium pratense)

Kentucky Red Clover. This synthetic consisted of 10 clones selected from Kenland Red Clover. In 1956, 20 plants of each clone

were established near Patterson, California, and in Jessemine County, Kentucky. Very mild symptoms of virus infection (presumedly Bean Yellow Mosaic Virus) were observed in all clones, but with little reduction in vigor. Mildew was observed in Kentucky on clones -525, -603, and -703. All clones were screened for resistance to southern anthracnose and possessed satisfactory resistance. Only clone -54 did not possess a leaf mark, and all clones were red flowered.

Macdonald Red Clover. This was a 3-clone synthetic supplied by Macdonald College of McGill University, Quebec, Canada. These 3 clones were selected from Dollard Red Clover. Dollard Red Clover was selected from improved strains of early and late red clover from similar foundation material. A description of the three types (Sleppler and Raymond, 1954) is given below.

Clone no. 9, type 1, produced a strong rosette with one or very few flower stems and was prostrate in growth habit. Clone no. 12, type 2, produced a fairly prominent rosette with a ring of flower stems and was generally prostrate. Clone no. 23, type 4, produced no rosette and had many upright flower stems which were sparsely leaved.

White Clover Synthetics (Trifolium repens)

New Hampshire White Clover. A 5-clone synthetic made at Durham, New Hampshire. Clone NH302 (PC 24043) was from certified seed produced in Oregon. It was intermediate in type, flowered in New Hampshire on June 18, and produced flowers rated at 5 on the basis of 1 = most, and 5 = least. Clone NH1178 (LC 61) was progeny from the parents of Pilgrim. It was small in type, flowered on June 16 in New Hampshire, and produced flowers rated at 4 on the basis of 1 = most, and 5 = least. Clone NH1737 (LC 73) was progeny from the parents of Pilgrim.

It was Ladino in type, flowered on June 16 in New Hampshire, and produced flowers rated at 3 on the basis of 1 = most, and 5 = least. Clone NH2075 (PC 24051) was from an Iowa synthetic. It was Ladino in type, flowered on June 16 in New Hampshire, and produced flowers rated at 4 on the above system. Clone NH2104 originated from a seed lot from F. S. Prince. It was Ladino in type, flowered on June 15 in New Hampshire, and produced flowers at the rate of 4 on the above system. All clones showed some infection of pepper spot and virus. The above information is from observations made at Durham, New Hampshire, in 1954.

Pasture Laboratory White Clover. This was a 6-clone synthetic selected at the U. S. Regional Pasture Research Laboratory, State College, Pennsylvania. All clones were selected the year of establishment from a source nursery consisting of single crosses made among more persistent clones from a previous cycle selection. Clone 56-60 was homozygous recessive for no V-leaf marking. The parents of clone 56-60 were Sclerotinia resistant. On the basis of parental type, clone 56-60 should be Ladino in type, producing fewer flowers. Clone 56-61 had a faint V-leaf marking and its parents were Sclerotinia resistant. It should be Ladino in type and produce few flowers. Clone 56-64 was a homozygous recessive for no V-leaf marking. It was intermediate in leaf size with earlier and more abundant flowering. Clone 56-65 was a homozygous recessive for no V-leaf marking. It was intermediate in leaf size with earlier and more abundant flowering. Clone 56-66 was a homozygous recessive for no V-leaf marking; was intermediate in leaf size, with earlier and more abundant flowering. Clone 56-67 was a homozygous recessive for no V-leaf marking. It was

intermediate in leaf size, with earlier and more abundant flowering. Clones 56-66 and 56-67 were sister selections from the same single cross.

South Carolina White Clover. A 6-clone synthetic made at Clemson Agricultural College, Clemson, South Carolina. Clone 269 (PC 24051) was from an Iowa seed source and had no leaf mark. Clone 462 (PC 24060) was from an Oregon seed source, and had a leaf with a white V mark and red flecking. Clone 2682 was from Arrington's farm in Alabama and had a broken V above a full V for a leaf marking. Clone 3756 was from a Ladino plot in variety tests at Tallassee, Alabama, and had a white V mark, and flecking was rare if any. Clone 3757 was from Experiment, Georgia, and had no leaf mark. Clone 4292 was from Ladino at the Alabama Sand Mountain Agricultural Experiment Station, and had a white V for a leaf marking.

Grasses

Smooth Bromegrass Synthetics (Bromus inermis)

Saratoga Bromegrass. Saratoga smooth bromegrass was a synthetic variety developed from 5 selected relatively self-incompatible clones from the breeding program in the Department of Plant Breeding, Cornell University, Ithaca, New York. Clone 41-11 was intermediate to bunch in plant type. It grew to a height of 60 inches, and produced 49 grams of seed per plant at Cornell. It was the latest maturing of the 5 clones. Under open pollination 47 percent fertile florets were produced. Clone 46-19 was creeping in plant type. It grew to a height of 60 inches and produced 49 grams of seed per plant. It was intermediate in maturity. Under open pollination 60 percent fertile florets were produced. Clone 46-92 was intermediate in plant type. It grew to

a height of 68 inches and produced 38 grams of seed per plant. It was intermediate in maturity. Under open pollination 72 percent florets were produced. Clone 46-157 was creeping in plant type. It grew to a height of 64 inches and produced 41 grams of seed per plant. It was the earliest maturing of the clones. Under open pollination 46 percent fertile florets were produced. Clone 46-166 was creeping in plant type. It grew to a height of 64 inches, and produced 42 grams of seed per plant. Under open pollination 56 percent fertile florets were produced.

Wisconsin Bromegrass. A synthetic of 5 clones assembled in Wisconsin. Information was not available on these clones.

Orchardgrass Synthetics (Dactylis glomerata)

Beltsville Orchardgrass. A 4-clone synthetic developed by the Forage and Range Research Branch, Foundation Seed Production Section of the ARS, Crops Research Division, Beltsville, Maryland. Clone 36-15 headed earliest with 30 percent heading in mid May, clone 34-27 with 8 percent, clone A-III-6 with 1 percent, and clone 38-25 with 0 percent. All clones were rated as equal in disease susceptibility.

Pennsylvania Orchardgrass. A 4-clone synthetic produced in Pennsylvania. Information was not available on these clones.

Timothy Synthetics (Phleum pratense)

Indiana Timothy. A 4-clone synthetic produced at Purdue University. Clone 13 had a diameter of 25.0 cm. with a height of 40.3 inches. Clone 14 had a diameter of 19.8 cm. with a height of 27.7 inches. Clone 17 had a diameter of 24.8 cm. with a height of 27.7 inches. Clone 19 had a diameter of 24.0 cm. with a height of 27.5

inches. Diameter was rated on an average of 12 plants. All heights were taken on June 30 at Purdue University.

New York Timothy (Essex). Essex Timothy was a synthetic variety developed from 4 selected clones from the breeding program in the Department of Plant Breeding, Cornell University, Ithaca, New York. At Cornell, date of bloom for Essex Timothy was July 9. It was tolerant in reaction to leaf diseases and was a good yielder.

METHODS AND PROCEDURE

Field Information

The experiment consisted of plantings at three locations: the Evans Experimental Farm south of Logan, Utah; the Jesse Barker farm, and the D. Ronald Clark farm, Newton, Cache County, Utah. Plantings at the Evans Farm consisted of .5 acre (figure 1), while those at the Barker (figure 2) and Clark (figure 3) locations consisted of 1 acre each.

The soil at the Evans Farm has been surveyed and classified as a Perley silty clay. The soil consists of a dark grayish brown (10YR 3/2, moist) top soil, with a noncalcareous A horizon, with a calcium horizon occurring in the B horizon extending into the C horizon. It is well drained and is of alluvium parental materials. The soil at the Barker and Clark farms has been surveyed and classified as a Greenson loam. The Greenson series has a deep, well developed profile of alluvium parental materials high in lime with a developed lime zone approximately 20 inches down. It is well drained and has a soil surface color of light brown.

Cache County, Utah, has a relatively short growing season and is an area of low rainfall. The low, high, and average temperatures for the 1958 growing season are listed in table 1. The actual precipitation and departure from normal for the 1957 and 1958 growing seasons are listed in table 2.

Information relating to field, block, tier, and plot layout are listed in tables 3 (Evans Farm), 4 (Barker farm), and 5 (Clark farm).

Table 1. High, low, and average temperatures (March through August) at Logan, Utah, for 1958 (Fahrenheit readings)*

Month	High	Low	Average
March	60	13	35.7
April	74	25	44.3
May	88	37	62.3
June	92	41	67.1
July	93	47	71.3
August	96	50	74.4

* From Climatological Data for Utah (1958)

Table 2. Monthly precipitation in inches at Logan, Utah, (March through August) for 1957 and 1958*

Month	Precipitation 1957	Departure from Normal 1957	Precipitation 1958	Departure from Normal 1958
March	2.00	+ .08	2.61	+ .75
April	3.41	+1.47	.77	-1.39
May	1.00	+ .70	.85	-1.04
June	1.29	+ .25	.41	- .94
July	.08	- .49	.53	+ .10
August	.50	- .18	.69	- .02

* From Climatological Data for Utah (1957 and 1958)

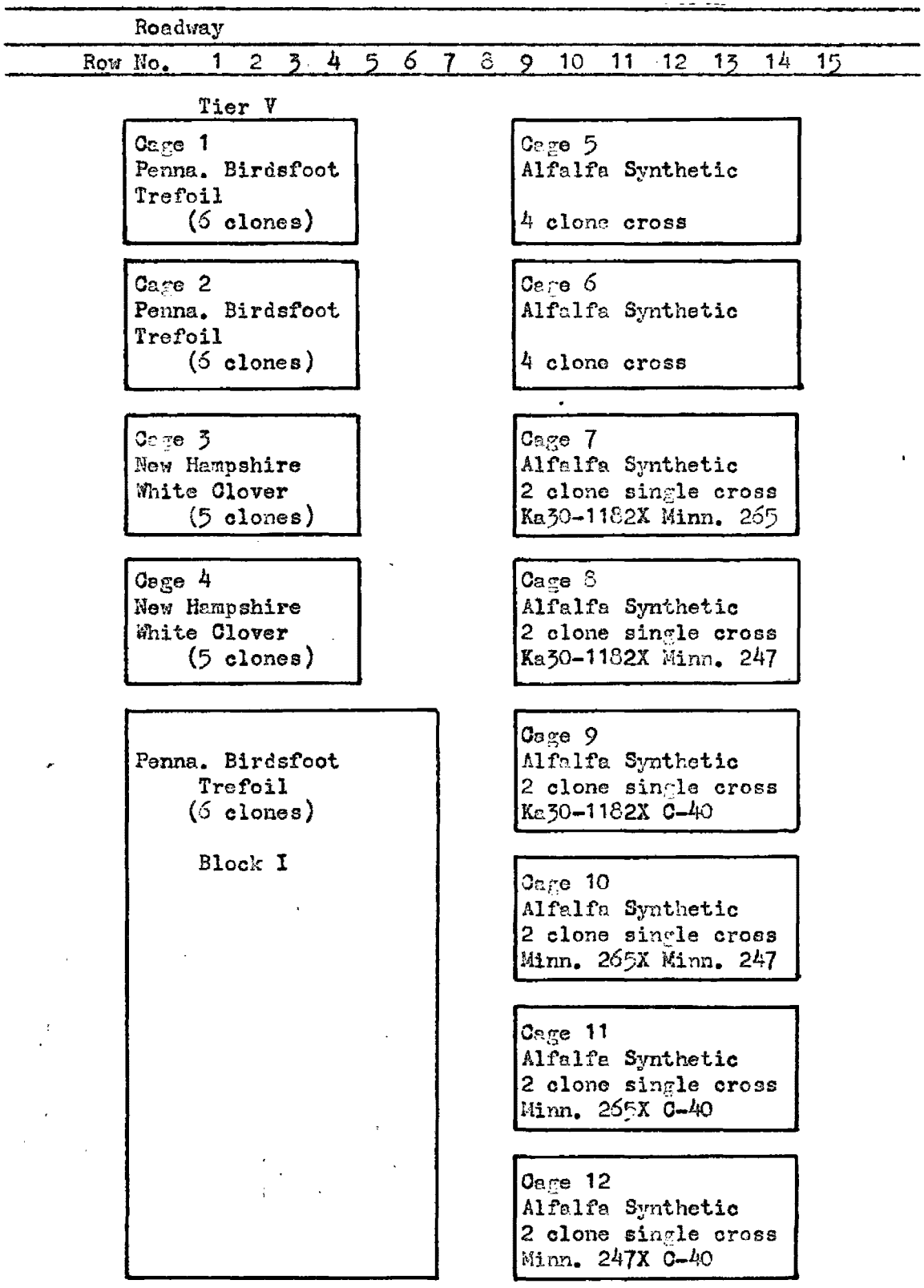

Figure 1. Tier and block design on the Evans Farm, Logan, Cache County, Utah

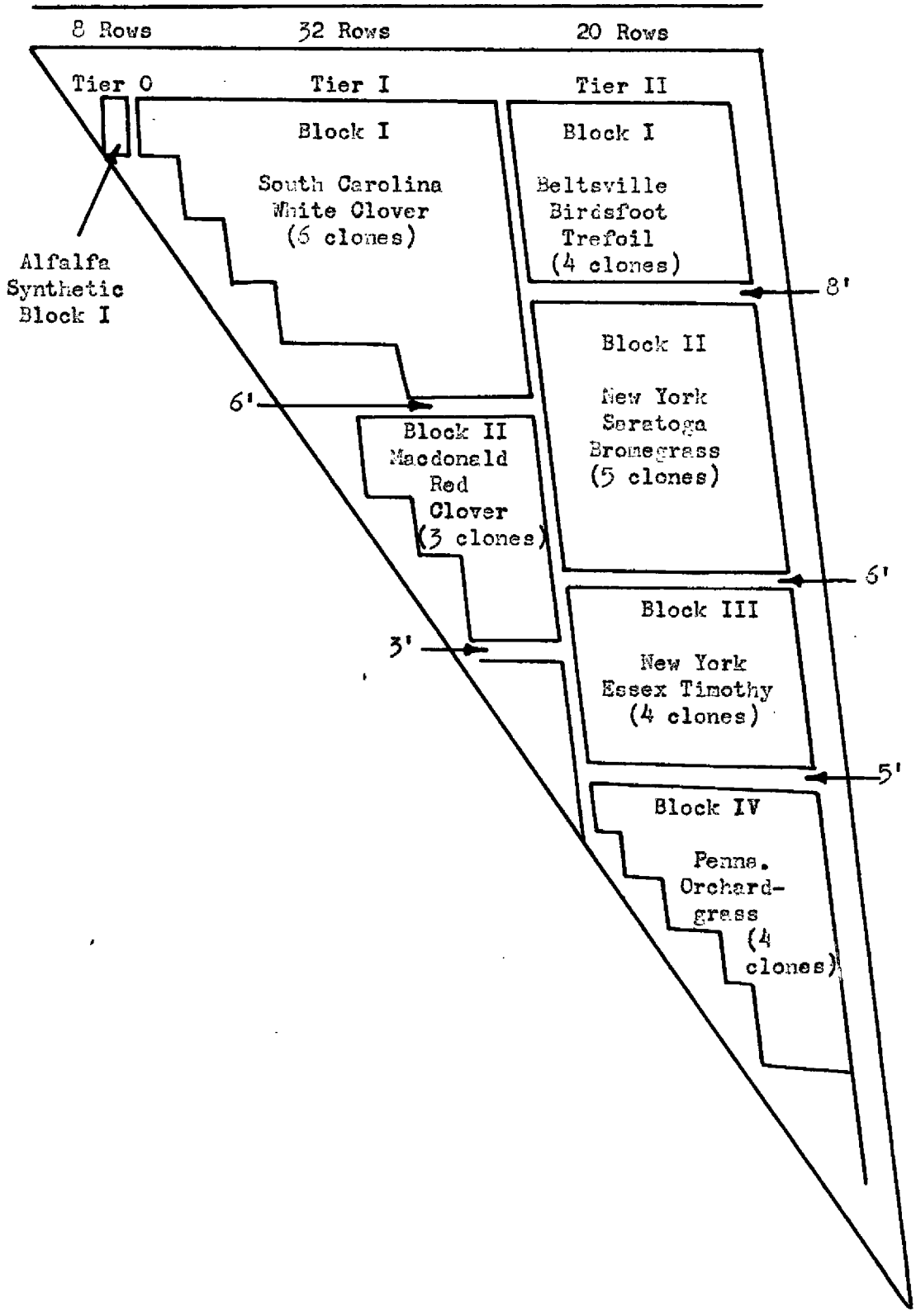

Figure 2. Tier and block design on the Barker farm, Newton, Cache County, Utah

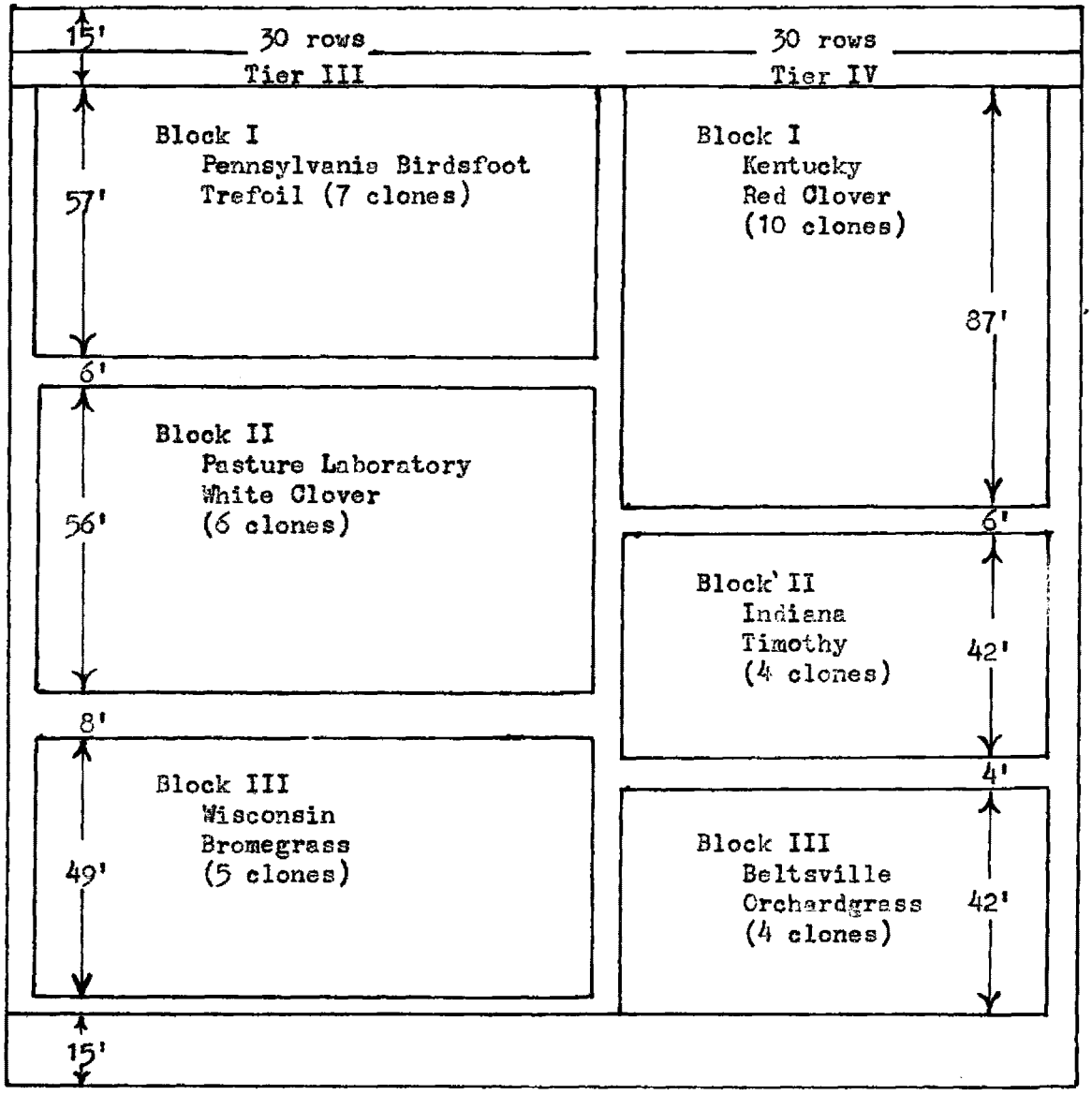

Figure 3. Tier and block design on the Clark farm, Newton, Cache County, Utah

Table 3. Plot information pertaining to the synthetics located on the Evans Farm, Logan, Utah

Tier V (Cages 1 & 2)

Penna. Birdsfoot Trefoil

6 clones
2 cages
40" between rows
18" between plants in rows
3 plants per plot
4 replications per cage

Tier V (Cages 3 & 4)

New Hampshire White Clover

5 clones
2 cages
40" between rows
48" between plants in rows
1 plant per plot
6 replications per cage

Tier V Block I

Penna. Birdsfoot Trefoil

6 clones
40" between rows
36" between plants in rows
5 plants per plot
10 replications

Tier VI (Cages 5 & 6)

Alfalfa Synthetic

4 clone polycross
2 plants per plot
7 replications per cage
2' between plants

Tier VI (Cages 7 - 12)

Alfalfa Synthetic

4 clone single cross
5 plants per plot
3 replications per cage
2' between plants

Table 4. Plot information pertaining to the layout of the synthetics on the Barker farm, Newton, Utah

Tier 0 Block I

Alfalfa Synthetic

4 clones
42" between rows
36" between plants in rows
3 plants per plot
10 replications

Tier I Block I

South Carolina White Clover

6 clones
42" between rows
48" between plants in rows
5 plants per plot
20 replications

Tier I Block II

Macdonald Red Clover (Canada)

3 clones
42" between rows
36" between plants in rows
5 plants per plot
20 replications

Tier II Block I

Beltsville Birdsfoot Trefoil

4 clones
42" between rows
36" between plants in rows
5 plants per plot
20 replications

Tier II Block II

Saratoga Bromegrass (New York)

5 clones
42" between rows
42" between plants in rows
5 plants per plot
20 replications

Tier II Block III

Essex Timothy (New York)

4 clones
42" between rows
36" between plants in rows
5 plants per plot
20 replications

Tier II Block IV

Pennsylvania Orchardgrass

4 clones
42" between rows
36" between plants in rows
5 plants per plot
20 replications

Table 5. Plot information pertaining to the layout of the synthetics on the Clark farm, Newton, Utah

Tier III Block I	Tier IV Block I
Pennsylvania Birdsfoot Trefoil	Kentucky Red Clover
7 clones	10 clones
42" between rows	42" between rows
36" between plants in rows	36" between plants in rows
5 plants per plot	5 plants per plot
17 replications	18 replications
Tier III Block II	**Tier IV Block II**
Pasture Laboratory White Clover (Penna.)	Indiana Timothy
6 clones	4 clones
42" between rows	42" between rows
48" between plants in rows	36" between plants in rows
5 plants per plot	5 plants per plot
15 replications	20 replications
Tier III Block III	**Tier IV Block III**
Wisconsin Bromegrass	Beltsville Orchardgrass
5 clones	4 clones
42" between rows	42" between rows
42" between plants in rows	36" between plants in rows
5 plants per plot	5 plants per plot
18 replications	20 replications

Crop Culture

Rooted cuttings of the clonal material were planted by hand on May 7, 9, and 10, 1957. Each cutting received water at the time of planting. During May there were frequent heavy rains, which resulted in the loss of a number of red clover and trefoil cuttings.

During 1957, a fence was built around the Barker and Clark fields; cultivation and weeding was practiced throughout the season. Seed was harvested in the fall of 1957. A straw mulch was placed on the South Carolina White Clover plantings to prevent winter killing the fall of 1957, and removed the spring of 1958. The plantings at Newton were sprinkle irrigated every two weeks during the summer of 1957, while those at Logan were furrow irrigated.

The first irrigation for 1958 was May 24 at the Barker and Clark farms, and May 29 at the Evans Farm. All plots were furrow irrigated the first time. Thereafter the plots at the Clark farm were sprinkle irrigated. All irrigations were at 2-week intervals until August 13.

The plots were fertilized with treble super phosphate on August 14, 1957, at the rate of 184 pounds of available P_2O_5 to the acre. Nitrogen was applied to the grasses at the rate of 50 pounds of available N per acre in June, 1957, and 100 pounds of available N per acre in April, 1958. All fertilizer was applied by hand.

Insecticides were applied to the plots during 1958 as indicated below. Heptachlor was sprayed on all plots on April 15 as a general control measure with a tractor-powered spray attachment. All plots were hand dusted with 15 percent malathion May 24, and with 10 percent DDT on June 10 as a general control measure. The alfalfa plot on Barker's was dusted again on June 28 with 10 percent DDT to control

Epicauta spp. All timothy plots were hand sprayed with parathion on July 14, and again on September 2 to control the timothy mite Oligonychus pratensis after the plants had been clipped to mower length. The alfalfa on the Evans Farm was sprayed with systox on August 7 after the bees were removed from the cages for aphids and as a general control measure.

It was probable that a virus disease affected the South Carolina and New Hampshire White Clovers. A sporadic yellowing and stunting of growth in the Beltsville and Pennsylvania (7 clone) trefoil can probably also be attributed to a virus disease. Positive identification of the diseases was not possible at that time (late summer 1958).

Cages (figure 4) enclosing the alfalfa, birdsfoot trefoil, and New Hampshire White Clover were 20 feet x 20 feet x 6 feet in area. The cage frames were constructed from ½ inch conduit. Cage covers were made of 18 x 14 mesh fiber glass screen, with zippers in each corner. In the field the cages were braced with steel posts in the corners and anchored with wire to stakes driven in the soil. Straw was placed around the bottom on the outside of the cages to prevent possible contamination by the bees leaving the cages and returning with a foreign source of pollen.

Bees were used as pollinators in all cages on the Evans Farm. They were placed in the cages enclosing trefoil the last week in May. Bees were placed in cages enclosing the alfalfa and New Hampshire White Clover on June 11. Bee colonies were maintained for open pollination at both Newton locations.

All plots were hand harvested for top growth when mature. The plant meterial was placed in kraft paper bags for drying. The three

Figure 4. Cages enclosing the alfalfa, Pennsylvania Birdsfoot Trefoil (6 clone) and the New Hampshire White Clover synthetics on the Evans Farm (1957).

center plants of each legume and grass plot were harvested and kept separate with the exception of the alfalfa, caged trefoil, and white clover, where all plants in a plot were harvested. The first and fifth plants of the trefoil and red clover plots were harvested and bulked by clones while the first and fifth plants of the grass plots were discarded. Special precautions were taken in separating the foliage of the alfalfa to prevent mixing of the seed. It is doubtful if all foreign material was separated from the various alfalfa clones. The author personally inspected and picked as much contaminating material from the various alfalfa clones as possible.

All plant material was threshed in a plot harvester. The seed was then hand cleaned with screens and blowers in the laboratory.

The seed was kept separate by plots and weighed on a Torsion balance.

Data Collected

Legumes

Alfalfa Synthetic. Date of flowering was recorded when 5 stems per clone showed flowers. Flower color and plant type (erectness of growth) were taken at time of flowering. The pods from 5 racemes of similar maturity were harvested at two 2-week intervals from two plants per plot and placed in separate envelopes. The seeds were counted and the average number of seeds per pod was determined.

Birdsfoot Trefoil. Date of flowering was recorded when 5 stems showed one or more flowers. Plant density and type (erectness) were recorded at time of flowering. A minimum of 10 pods were harvested at two 2-week intervals from each plot with the number of seeds per pod being determined.

Red Clover. Date of flowering was recorded when 1, 5, and 10 heads per plant were in full bloom. The number of mature heads on two plants per plot was counted prior to harvesting.

White Clover. Date of flowering was recorded when 1, 5, and 10 heads per plant were in full bloom. Plant spread, leaf size, and density of growth were taken at time of flowering. Leaf markings were checked against the original description. The number of mature heads per square foot at two locations in five replications of each clone in Pennsylvania White Clover was determined prior to harvest. Due to the smallness of most plants of New Hampshire White Clover, a count of the mature heads per plant prior to harvest was made. A count of the mature heads per square foot in all extra plants of South Carolina White Clover clones was made.

Four heads were harvested from each plot at two 2-week intervals for red and white clover clones. To facilitate harvesting of heads, pods, and/or racemes, different colored tags were attached at 2-week intervals. All heads, pods, and/or racemes were harvested from plants 1 and 5, with half coming from each plant, each being put in separate envelopes. Profuseness of flowering was recorded at weekly intervals for all legumes. The number of florets and seeds per head was determined, with seeds per floret being determined for the white clover and percent fertile florets being determined for red clover.

Grasses

The date anthesis began and the date anthesis ended was recorded by plant on at least five replications. Type of basal leaf growth, node color, and number of culms per plant were recorded at time of anthesis. Height of the plant was determined by measuring the height

reached by about 50 percent of the heads. In timothy the length of 10 heads per plot was measured.

Panicles were tagged to represent the flowering period of plants 1 and 5 on all grasses. Three panicles of bromegrasses were harvested from each of plants 1 and 5 with the number of spikelets on each panicle being recorded. The three center branches from each panicle were clipped, with the number of spikelets being recorded. In the laboratory the average number of florets per spikelet, total number of seeds in the three center branches, and fertility were determined.

The same procedure as outlined for bromegrass was followed for the orchardgrass synthetics except that two panicles were harvested from plants 1 and 5.

Two timothy panicles were harvested from each of plants 1 and 5. The number of florets and seeds was determined as accurately as possible.

All panicles were placed in separate envelopes with the information pertaining being recorded on the envelopes.

All information was taken from at least five replications in both legumes and grasses.

Date of harvest was recorded for each grass and legume synthetic. Where selective harvesting of individual plots or clones was necessary, date of harvest was recorded individually.

RESULTS

The results presented here are arranged in the same order as in the plant materials. General plant characteristics (date and profuseness of flowering, flower color, type of growth, plant erectness, plant density, leaf size or type, first and last date of anthesis, plant height, node color, number of culms, and date of harvest) pertaining to each synthetic are listed in table form. The Duncan's (1955) Multiple Range Test was used to test the significant differences in the means of seeds per floret or percentage of fertility, seeds per gram and the weight of seeds in grams for the clones. The basis of this test is that the difference for significance between means varies with the number of means in the comparison. The difference required for significance increases as means further apart in rank are compared. There is no significant difference between means which are found in the same range, however a significant difference exists between means found in different ranges.

All tables are self explanatory, therefore the written explanation has been held to a minimum.

Alfalfa Synthetics

Plant characteristics and seed yield data are listed in tables 6a - 8d. Tables 6a - 6d are the results of the caged 4-clone cross on the Evans Farm and tables 6a and 7a - 7c are the results of the caged single crosses on the Evans Farm. Differences in yield were noticed between the single crosses and the 4-clone cross. The data was compiled

Table 6a. Average date of first flowering, period of most profuse flowering, flower color, and date of harvest; Alfalfa Synthetic (4-clone and single cross); Evans Farm

Clone	Date and profuseness of flowering: May 30	2	7	June 12	19	27	July 5	10	19	28	Flower color	Type of Growth
Ka 30-1182				x	———						Blue	Erect
Minn. 265				x	———						Blue	Erect
Minn. 247			x	———							Yellow	Prostrate
C-40	x		———								Blue	Erect

x = Date of flowering
___ = Period of most profuse flowering, based on the scale 1 = most; 5 = none. Ratings of 1 - 3 shown here.
Date of harvest: August 27, 1953

Table 6b. Ranked means of seeds per pod; Alfalfa Synthetic (4-clone cross) Evans Farm

Clone	Means of 10 racemes per plot; 12 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
Minn. 265	3.39	|
Ka 30-1182	2.29	|
Minn. 247	2.00	|
C-40	1.11	|
$\bar{X}$	2.19	
F value	20.15**	
$S_{\bar{X}}$	.2081	
C.V. percent	32.93	

** Significant at the 1 percent level.

Table 6c. Ranked means of seeds per gram; Alfalfa Synthetic (4-clone cross); Evans Farm

Clone	Means seed from 10 racemes per plot, 12 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
C-40	610	
Minn. 247	602	
Minn. 265	530	
Ka 30-1182	491	
$\bar{X}$	558	
F value	7.37**	
$S_{\bar{x}}$	21.335	
C.V. percent	13.24	

** Significant at the 1 percent level.

Table 6d. Ranked means of grams of seed per plant; Alfalfa Synthetic (4-clone cross); Evans Farm

Clone	Means 15 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
Ka 30-1182	40.06	
Minn. 265	32.33	
Minn. 247	3.33	
C-40	7.46	
$\bar{X}$	22.05	
F value	68.82**	
$S_{\bar{x}}$	2.006	
C.V. percent	35.25	

** Significant at the 1 percent level.

Table 7a. Ranked means of seeds per pod combined for all 6 single crosses; Alfalfa Synthetic (single cross); Evans Farm

Clone	Means of 10 racemes per plot; 36 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
Minn. 265	2.76	
Ka 30-1182	2.24	
Minn. 247	1.96	
C-40	.95	
$\bar{X}$	1.98	
F value	91.3**	
$S\bar{x}$	.02528	
C.V. percent	24.22	

** Significant at the 1 percent level.

Table 7b. Ranked means of seeds per gram combined for all 6 single crosses; Alfalfa Synthetic (single cross); Evans Farm

Clone	Means of the seeds from 10 racemes per plot; 36 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
Minn.	715	
C-40	611	
Minn. 265	571	
Ka 30-1182	517	
$\bar{X}$	603	
F value	23.63**	
$S\bar{x}$	17.261	
C.V. percent	17.17	

** Significant at the 1 percent level.

Table 7c. Ranked means of grams of seed per plant combined for all 6 single crosses (single cross); Evans Farm

Clone	Means per plant 18 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
Ks 30-1182	33.97	a
Minn. -265	22.19	b
Minn. -247	4.57	c
C-40	3.52	c
$\bar{X}$	16.06	
F value	124.71**	
$S_{\bar{X}}$	1.315	
C.V. percent	34.75	

** Significant at the 1 percent level.

Table 8a. Average date of first flowering; period of most profuse flowering; flower color and type of growth; Alfalfa Synthetic; Barker farm

Clone	Date and profuseness of flowering: June 5	7	10	17	25	July 1	9	16	25	Flower color	Type of growth
Ka 30-1182			x	———						Blue	Erect
Minn. 265		x		———						Blue	Erect
Minn. 247		x	———							Yellow	Prostrate
C-40	x	———								Blue	Erect

x = Date of flowering
___ = Period of most profuse flowering, based on the scale 1 = most, 5 = none. Ratings of 1 - 3 shown here.
Date of harvest: August 27, 1958

Table 8b. Ranked means of seeds per pod; Alfalfa Synthetic; Barker farm

Clone	Means per plot of 10 racemes, 10 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
Minn. 265	4.30	|
Ka 30-1182	2.64	|
Minn. 247	2.27	|
C-40	1.60	|
$\bar{X}$	2.70	
F value	38.97**	
$S_{\bar{x}}$	.1844	
C.V. percent	21.60	

** Significant at the 1 percent level.

Table 8c. Ranked means of seeds per gram; Alfalfa Synthetic; Barker farm

Clone	Means of the seeds from 10 racemes per plot; 10 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
Minn. 247	488	
C-40	481	
Minn. 265	447	
Ka 30-1182	430	
$\bar{X}$	461	
F value	7.65**	
$S_{\bar{x}}$	9.949	
C.V. percent	6.82	

** Significant at the 1 percent level.

Table 8d. Ranked means of grams of seed per plant; Alfalfa Synthetic; Barker farm

Clone	Means 10 reps.	Least significant (Duncan's Multiple Range Test) 1 percent level
Ka 30-1182	33.9	
Minn. 265	27.5	
Minn. 247	16.0	
C-40	4.9	
$\bar{X}$	20.6	
F value	75.4**	
$S_{\bar{x}}$	1.476	
C.V. percent	22.60	

** Significant at the 1 percent level.

separately so that a comparison could be made. The results for the 4-clone cross on the Barker farm are listed on tables 8a - 8d.

Epicauta spp. attacked the alfalfa on the Barker farm in June resulting in flower destruction for a week before control measures were effective.

There was no winter damage to any of the alfalfa clones.

Birdsfoot Trefoil Synthetics

Beltsville Birdsfoot Trefoil plant characteristics and seed yield data are presented in tables 9a - 9d. A warm period in March, 1958, resulted in early growth of this synthetic. After growth was initiated, a severe frost killed a number of plants and severely weakened others. Most of the weakened plants had not recovered sufficiently by the time of harvest to contribute much to the production of seed. All clones were injured by the frost, but there seemed to be little if any winter injury.

Pennsylvania Birdsfoot Trefoil (6 clone) plant characteristics and seed yield data are found in tables 10a - 11d. Tables 10a - 10d give the data for clones grown under cages, where noticable differences were observed when these clones were compared to those grown in the open (tables 11a - 11d). There was no winter injury or frost injury to any of the clones. Diseased plants were not observed.

Pennsylvania Birdsfoot Trefoil (7 clone) plant characteristics and seed yield data are found in tables 12a - 12d. There was some winter damage but no frost damage after growth was initiated. Diseased plants were observed, presumably infected with a virus. Clone C-50 was harvested on two different dates with no loss in seed yield.

Table 9a. Average date of first flowering; period of most profuse flowering; average plant erectness, and plant density; Beltsville Birdsfoot Trefoil; Barker farm

Clone	Date and profuseness of flowering: May 19	May 22	May 24	June 1	June 3	June 7	June 12	June 19	June 28	Plant erectness	Plant density	Date of harvest
32-60			x	___	___	___	___			2.6	2.4	July 8
32-79		x		___	___	___	___			4.2	2.5	July 8
33-115	x			___	___	___	___			3.8	2.8	July 8
35-449			x	___	___	___	___	___		2.8	2.1	July 16

x = Date of flowering
___ = Period of most profuse flowering based on the scale 1 = most, 5 = none. Ratings of 1 - 3 shown here.
Plant erectness: 1 = erect, 5 = prostrate
Plant density: 1 = dense, 5 = open

Table 9b. Ranked means of seeds per pod; Beltsville Birdsfoot Trefoil; Barker farm

Clone	Means per pod of 6 pods per plant, 2 plants per plot, 16 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
35-449	15.50	
33-115	13.25	
32-79	10.31	
32-60	8.44	
$\bar{X}$	11.87	
F value	24.05**	
$S\bar{x}$	.6221	
C.V. percent	20.98	

** Significant at the 1 percent level.

Table 9c. Ranked means of seeds per gram; Beltsville Birdsfoot Trefoil; Barker farm

Clone	Means of seeds from 12 pods per plot, 16 reps.
33-115	699
35-449	683
32-60	679
32-79	631
$\bar{X}$	673
F value	1.26
C.V. percent	15.64

Table 9d. Ranked means of grams of seed per plant; Beltsville Birdsfoot Trefoil; Barker farm

Clone	Means 20 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
33-115	11.64	
32-79	6.59	
32-60	5.57	
35-449	5.36	
$\bar{X}$	7.29	
F value	10.53**	
$S\bar{x}$	.909	
C.V. percent	55.76	

** Significant at the 1 percent level.

Table 10a. Average date of first flowering, period of most profuse flowering, plant erectness, plant density, and date of harvest; Pennsylvania Birdsfoot Trefoil (6 clone, caged); Evans Farm

Clone	Date and profuseness of flowering: May 19	May 22	May 24	May 27	June 2	June 5	June 13	June 19	Plant erectness Average of 3 plants per plot; 8 reps.	Plant density	Date of harvest
C-37	x			———					2.9	3.2	July 10
C-40	x								2.5	2.7	July 10
C-50				x	———				2.5	2.0	July 15
C-78				x					2.5	3.1	July 10
C-96			x	———					2.7	2.4	July 15
C-112			x	———					2.7	3.2	July 10

x = Date of flowering
___ = Period of most profuse flowering based on the scale 1 = most, 5 = none. Ratings of 1 - 3 shown here.
Plant erectness: 1 = erect, 5 = prostrate
Plant density: 1 = dense, 5 = open

Table 10b. Ranked means of seeds per pod; Pennsylvania Birdsfoot Trefoil (6 clone, caged); Evens Farm

Clone	Means of 12 pods per plot; 5 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
C-40	16.30	
C-37	11.74	
C-112	10.10	
C-96	8.28	
C-50	4.54	
C-78	4.54	
$\bar{X}$	9.25	
F value	9.80**	
$S\bar{x}$	1.445	
C.V. percent	34.36	

** Significant at the 1 percent level.

Table 10c. Ranked means of seeds per gram; Pennsylvania Birdsfoot Trefoil (6 clone, caged); Evans Farm

Clone	Means of seeds from 12 pods per plot, 5 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
C-78	1308	a
C-112	838	b
C-96	816	b
C-40	745	b
C-37	651	b
C-50	633	b
$\bar{X}$	832	
F value	7.06**	
$S\bar{x}$	93.1612	
C.V. percent	25.04	

** Significant at the 1 percent level.

Table 10d. Ranked means of grams of seed per plant; Pennsylvania Birdsfoot Trefoil (6 clone, caged); Evans Farm

Clone	Means 8 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
C-37	6.77	
C-40	6.00	
C-112	3.36	
C-96	2.46	
C-50	.71	
C-78	.46	
$\bar{X}$	3.29	
F value	16.89**	
$S_{\bar{x}}$	.6423	
C.V. percent	55.22	

** Significant at the 1 percent level.

Table 11a. Average date of first flowering; period of most profuse flowering, plant erectness, plant density, and date of harvest; Pennsylvania Birdsfoot Trefoil (6 clone, open); Evans Farm

Clone	Date and profuseness of flowering: May 22	May 24	May 27	May 30	June 5	June 13	June 19	Plant erectness Average of 5 plants per plot; 5 reps.	Plant density Average of 5 plants per plot; 5 reps.	Date of harvest
C-37	x			_____				2.6	2.6	July 10
C-40		x		_____				2.8	2.8	July 10
C-50			x	_____				2.2	2.4	July 15
C-78				x				1.8	2.2	July 10
C-96	x			_____				3.0	2.2	July 15
C-112	x			_____				2.8	3.0	July 10

x = Date of flowering
___ = Period of most profuse flowering based on the scale 1 = most, 5 = none. Ratings from 1 - 3 shown here.
Plant erectness: 1 = erect, 5 = prostrate
Plant density: 1 = dense, 5 = open

Table 11b. Ranked means of seeds per pod; Pennsylvania Birdsfoot Trefoil (6 clone, open); Evans Farm

Clone	Means of 12 pods per plot; 7 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
C-37	16.60	
C-40	13.70	
C-112	8.04	
C-96	7.23	
C-78	3.95	
C-50	3.77	
$\bar{X}$	8.69	
F value	19.06**	
$S\bar{x}$	1.143	
C.V. percent	34.79	

** Significant at the 1 percent level.

Table 11c. Ranked means of seeds per gram; Pennsylvania Birdsfoot Trefoil (6 clone, open); Evans Farm

Clone	Means of seeds from 12 pods per plot; 7 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
C-78	889	
C-96	821	
C-40	786	
C-50	749	
C-37	694	
C-112	682	
$\bar{X}$	770	
F value	4.86**	
$S_{\bar{x}}$	35.79	
C.V. percent	12.28	

** Significant at the 1 percent level.

Table 11d. Ranked means of grams of seed per plant; Pennsylvania Birdsfoot Trefoil (6 clone, open); Evans Farm

Clone	Means 10 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
C-40	19.89	
C-37	14.01	
C-96	7.50	
C-112	7.27	
C-50	.87	
C-78	.52	
$\bar{X}$	8.34	
F value	14.15**	
$S_{\bar{X}}$	2.004	
C.V. percent	7.60	

** Significant at the 1 percent level.

Table 12a. Average date of first flowering, period of most profuse flowering, date of harvest, plant erectness, and plant density; Pennsylvania Birdsfoot Trefoil (7 clone); Clark farm

Clone	Date and profuseness of flowering: May 19	May 21	May 24	May 26	June 2	June 6	June 12	June 15	Plant erectness: Average of 5 plants per plot; 7 reps.	Plant density: Average of 5 plants per plot; 7 reps.	Date of harvest
C-38	x		_____						2.3	2.4	July 7
C-39			x		_____				2.9	2.1	July 30
C-50				x	_____				1.7	1.9	½ July 16 ½ July 30
C-51		x	_____						2.6	2.9	July 7
C-69		x	_____						3.0	3.0	July 7
C-95			x_____						2.7	2.7	July 16
C-105		x	_____						2.7	2.1	July 7

x = Date of flowering
___ = Period of most profuse flowering rated on the scale 1 = most, 5 = none. Rating of 1 - 3 shown here.
Plant erectness: 1 = erect, 5 = prostrate
Plant density: 1 = dense, 5 = open

Table 12b. Ranked means of seeds per pod; Pennsylvania Birdsfoot Trefoil (7 clone); Clark farm

Clone	Means of 12 pods per plot; 7 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
C-69	14.38	
C-105	13.61	
C-38	13.16	
C-51	11.74	
C-95	6.57	
C-50	5.10	
C-39	4.80	
$\bar{X}$	9.98	
F value	35.35**	
S$\bar{x}$	.7287	
C.V. percent	19.33	

** Significant at the 1 percent level.

Table 12c. Ranked means of seeds per gram; Pennsylvania Birdsfoot Trefoil (7 clone); Clark farm

Clone	Means of seed from 6 pods per plant, 2 plants per plot; 7 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
C-39	952	
C-51	801	
C-69	694	
C-95	650	
C-50	608	
C-38	590	
C-105	581	
$\bar{X}$	697	
F value	20.74**	
$S\bar{x}$	29.813	
C.V. percent	11.31	

** Significant at the 1 percent level.

Table 12d. Ranked means of grams of seed per plant; Pennsylvania Birdsfoot Trefoil (7 clone); Clark farm

Clone	Means 17 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
C-69	6.08	
C-105	5.65	
C-51	4.15	
C-38	2.53	
C-95	.65	
C-39	.25	
C-50	.20	
$\bar{X}$	2.79	
F value	60.18**	
$S\bar{x}$	.3272	
C.V. percent	48.35	

**Significant at the 1 percent level.

Red Clover Synthetics

Kentucky Red Clover plant characteristics and seed yield data are found in tables 13a - 13d. There was considerable difficulty getting the cuttings established in 1957 with clone 59-L38-525 losing the most cuttings. There was very little winter damage. Mildew was found on clones 59-L38-700 and -273 with sporadic infections on clones -700, -846, -551, and -603.

Macdonald Red Clover plant characteristics and seed yield data are found in tables 14a - 14d. There was considerable trouble getting clone no. 9, type 1, established in 1957. There was no winter damage. There were no diseased plants.

Table 13a. Average date 1, 5, and 15 heads were in flower, period of most profuse flowering, and mature blossoms per plant at harvest; Kentucky Red Clover; Clark farm

Clone	Date and profuseness of flowering												Mature blossoms at harvest, 2 plants per plot, 5 reps.
	May						June					July	
	24	28	31	2	5	7	9	11	15	19	28	5	
59-438-700			1		5			15					111.8
-117						1		5	15				95.8
-273						1		5	15				119.6
-525			1				5		15				139.8
-551			1		5			15					101.8
-603			1				5		15				112.0
-732		1			5			15					126.4
-781			1				5		15				126.2
-833	1		5		15								81.2
-846		1			5		15						87.4

1, 5, or 15 = Date 1, 5, or 15 heads were in flower
_____ = Period of most profuse flowering based on the scale 1 = most, 5 = none. Ratings of 1 - 3 shown here.
Date of harvest: July 21, 1958

Table 13b. Ranked means of percent fertility; Kentucky Red Clover; Clark farm

Clone	Means of 4 heads per plot, 10 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
59-L38-551	65.52	
-846	60.05	
-833	59.40	
-781	58.50	
-273	56.59	
-732	44.39	
-525	35.20	
-117	33.34	
-603	29.94	
-700	16.45	
$\bar{X}$	45.94	
F value	25.64**	
$S\bar{x}$	3.249	
C.V. percent	22.36	

** Significant at the 1 percent level.

Table 13c. Ranked means of number of seeds per gram; Kentucky Red Clover; Clark farm

Clone	Means of the seed from 4 heads per plot, 10 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
59-L38-551	569.7	
-732	533.9	
-333	512.6	
-117	505.6	
-781	452.3	
-700	451.4	
-846	449.7	
-273	442.8	
-603	442.2	
-525	431.3	
$\bar{X}$	479.2	
F value	22.18**	
$S_{\bar{x}}$	10.09	
C.V. percent	6.66	

** Significant at the 1 percent level.

Table 13d. Ranked means of grams of seed per plant; Kentucky Red Clover; Clark farm

Clone	Means 18 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
59-L38-273	13.97	
-551	13.12	
-751	12.68	
-846	11.97	
-732	10.93	
-525	8.04	
-333	7.99	
-603	7.30	
-700	6.62	
-117	4.50	
$\bar{X}$	10.27	
F value	516.7**	
$S_{\bar{x}}$	.220	
C.V. percent	9.09	

** Significant at the 1 percent level.

Table 14a. Average date 1, 5, and 15 heads were in flower; period of most profuse flowering, mature blossoms at harvest, and date of harvest; Macdonald Red Clover; Barker farm

Clone	Date and profuseness of flowering												Mature blossoms at time of harvest	Date of harvest
	June								July					
	7	9	11	13	19	26	28	30	3	5	8	18		
9, type 1								1	5	15			244	Aug. 26
12, type 2			1		5	15							149	July 24
23, type 4-1				5	15								150	July 24

1, 5, or 15 = Date 1, 5, or 15 heads were in flower
_____ = Period of most profuse flowering based on the scale 1 = most, 5 = none. Ratings of 1 - 3 shown here.

Table 14b. Ranked means of percent fertility; Macdonald Red Clover; Barker farm

Clone	Means per plant 10 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
No. 12, type 2	43.32	|
No. 23, type 4	17.80	|
No. 9, type 1	5.51	|
$\bar{X}$	22.21	
F value	82.53**	
$S\bar{x}$	2.124	
C.V. percent	30.22	

** Significant at the 1 percent level.

Table 14c. Ranked means of seeds per gram; Macdonald Red Clover; Barker farm

Clone	Means of the seed of 4 heads per plot, 10 reps.
No. 23, type 4	567
No. 12, type 2	546
No. 9, type 1	544
$\bar{X}$	552
F value	1.26
C.V. percent	6.61

Table 14d. Ranked means of grams of seed per plant; Macdonald Red Clover; Barker farm

Clone	Means 20 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
No. 12, type 2	8.15	|
No. 23, type 4	4.50	|
No. 9, type 1	2.87	|
$\bar{X}$	5.13	
F value	30.50**	
$S_{\bar{x}}$	.155	
C.V. percent	42.30	

** Significant at the 1 percent level.

White Clover Synthetics

New Hampshire White Clover plant characteristics and seed yield data are found in tables 15a - 15d. A virus (presumably) disease infected all clones during mid summer 1958, with a fair recovery from the disease noticable towards late summer and early fall. There was no winter injury.

Pasture Laboratory (Pennsylvania) White Clover plant characteristics and seed yield data are found in tables 16a - 16d. There were no diseased plants observed in this synthetic and winter injury was negligible.

South Carolina White Clover plant characteristics and seed yield data are found in tables 17a - 17d. A virus (presumably) disease infected all clones. The disease was first observed next to the alfalfa synthetic (Barker's) and progressed throughout the block; there was no noticable return of plant vigor. There was no winter injury; however, there was a reduction in plant vigor due to lateness in getting the straw mulch off in the spring.

Table 15a. Average date 1, 5, and 15 heads were in flower, period of most profuse flowering, spread, plant density, leaf size, mature blossoms per plant at harvest, and date of harvest; New Hampshire White Clover; Evans Farm

Clone	Date and profuseness of flowering										Plant spread	Plant density	Leaf size	Mature blossoms per plant at harvest
	May					June				July				
	24	27	30	2	5	10	15	19	28	5				
NH-1737	1	5	15								2.1	2.4	3.6	133
NH-1178			1		5		15				3.5	3.3	5.0	73
NH-2075						1		5		15	3.1	2.7	2.9	70
NH-2104		1		5		15					2.2	2.0	2.7	98
NH-802							1	5		15	2.4	2.7	2.6	41

1, 5, or 15 = Date 1, 5, or 15 heads were in flower
_____ = Period of most profuse flowering based on the scale 1 = most, 5 = none. Ratings of 1 - 3 shown here.
Plant spread: 1 = most, 5 = least
Plant density: 1 = dense, 5 = open
Leaf size: 1 = large ladino type, 5 = small

Table 15b. Ranked means of seed per floret; New Hampshire White Clover; Evans Farm

Clone	Means of 2 heads per plot; 10 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
NH-2104	1.76	
NH-802	1.08	
NH-1178	.85	
NH-2075	.84	
NH-1737	.29	
$\bar{X}$	.97	
F value	17.4**	
$S\bar{x}$	.1273	
C.V. percent	41.49	

** Significant at the 1 percent level.

Table 15c. Ranked means of seeds per gram; New Hampshire White Clover; Evans Farm

Clone	Means of the seed of 2 heads per plot; 10 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
NH-2075	2296	
NH-2104	2208	
NH-802	2065	
NH-1178	1938	
NH-1737	1576	
$\bar{X}$	2016	
F value	9.38**	
$S_{\bar{x}}$	92.08	
C.V. percent	14.44	

** Significant at the 1 percent level.

Table 15d. Ranked means of grams of seed per plant; New Hampshire White Clover; Evans Farm

Clone	Means 12 reps.
NH-2104	3.76
NH-2075	3.47
NH-802	3.02
NH-1737	2.25
NH-1178	2.08
$\bar{X}$	2.92
F value	1.20
C.V. percent	80.24

Table 16a. Average date 1, 5, and 15 heads were in flower; period of most profuse flowering; plant spread, plant density, leaf size, mature blossoms per sq. ft., and date of harvest; Pasture Laboratory (Pennsylvania) White Clover; Clerk farm

Clone	Date and profuseness of flowering: May 19	May 24	May 27	May 31	June 2	June 5	June 7	June 10	June 12	June 19	June 28	Plant spread (Average of 5 plants per plot, 6 reps.)	Plant density (Average of 5 plants per plot, 6 reps.)	Leaf size (Average of 5 plants per plot, 6 reps.)	Mature blossoms per sq. ft., average 2 plants per plot 6 reps.
56-60			1			5	15	———				2.3	2.7	1.3	16.5
56-61	1		5		15			———				3.7	3.8	2.1	30.0
56-64	1		5		15	———						2.5	2.0	3.3	73.5
56-65		1		5	15	———						3.0	2.0	2.1	38.5
56-66	1		5		15	———						3.0	2.7	3.0	36.3
56-67		1		5								2.5	2.1	3.7	16.2

1, 5, or 15 = Date 1, 5, or 15 heads were in flower
——— = Period of most profuse flowering based on the scale 1 = most, 5 = none. Ratings of 1 - 3 shown here.
Plant spread: 1 = most, 5 = least
Plant density: 1 = dense, 5 = open
Leaf size: 1 = large ladino type, 5 = small
Date of harvest: July 15, 1958

Table 16b. Ranked means of seeds per floret; Pasture Laboratory (Pennsylvania) White Clover; Clark farm

Clone	Means of 4 heads per plot, 11 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
56-65	2.36	|
56-61	1.80	|
56-64	1.49	|
56-60	1.48	|
56-67	1.16	|
56-66	1.14	|
$\bar{X}$	1.57	
F value	33.30**	
$S\bar{x}$	.07348	
C.V. percent	15.60	

** Significant at the 1 percent level.

Table 16c. Ranked means of seeds per gram; Pasture Laboratory (Pennsylvania) White Clover; Clark farm

Clone	Means of the seeds from 4 heads per plot, 11 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
56-67	2018	
56-65	1970	
56-60	1882	
56-61	1831	
56-64	1661	
56-66	1598	
$\bar{X}$	1827	
F value	7.82**	
$S_{\bar{X}}$	59.50	
C.V. percent	16.07	

** Significant at the 1 percent level.

Table 16d. Ranked means of grams of seed per plant; Pasture Laboratory (Pennsylvania) White Clover; Clark farm

Clone	Means 15 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
56-65	12.36	a
56-64	7.96	b
56-61	7.12	b
56-66	4.62	c
56-60	2.08	d
56-67	.97	e
$\bar{X}$	7.81	
F value	117.95**	
$S_{\bar{X}}$	.5151	
C.V. percent	25.53	

** Significant at the 1 percent level.

Table 17a. Average date 1, 5, and 15 heads were in flower; period of most profuse flowering; plant spread, plant density and leaf size; South Carolina White Clover; Barker farm

Clone	Date and profuseness of flowering: May 26	29	3	7	10	13	19	22	28	July 5	Plant spread	Plant density	Leaf size
269			1	5		15	_____				1.7	1.6	2.0
462		1	5	15			_____				2.0	2.0	3.2
2682		1	5		15		_____				2.6	2.5	2.1
3756	1	5	15				_____				3.2	3.0	1.5
3757					1		5				2.5	2.1	2.4
4292		1	5		15		_____				3.0	3.4	2.2

1, 5, or 15 = Date 1, 5, or 15 heads were in flower
_____ = Period of most profuse flowering, based on the scale 1 = most, 5 = none. Ratings of 1 - 3 shown here.
Plant spread: 1 = most, 5 = least
Plant density: 1 = dense, 5 = open
Leaf size: 1 = large ladino type, 5 = small

Table 17b. Ranked means of seeds per floret; South Carolina White Clover; Barker farm

Clone	Means per plot of 4 heads; 13 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
462	2.69	
2682	2.54	
4292	2.44	
3757	2.07	
269	1.90	
3756	1.90	
$\bar{X}$	2.26	
F value	10.27**	
$S_{\bar{X}}$	.1072	
C.V. percent	17.14	

** Significant at the 1 percent level.

Table 17c. Ranked means of seeds per gram; South Carolina White Clover; Barker farm

Clone	Means per plot of 4 heads; 13 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
462	2421	
269	2194	
3757	2171	
2682	2074	
3756	1802	
4292	1733	
$\bar{X}$	2066	
F value	26.11**	
$S_{\bar{X}}$	50.565	
C.V. percent	8.82	

** Significant at the 1 percent level.

Table 17d. Ranked means of grams of seed per plant; South Carolina White Clover; Barker farm

Clone	Means 20 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
4292	13.32	a
462	7.58	b
2682	6.42	b
269	4.78	c
3756	4.08	c
3757	2.03	d
$\bar{X}$	6.37	
F value	113.3**	
$S\bar{x}$	.3674	
C.V. percent	25.8	

** Significant at the 1 percent level.

Bromegrass Synthetics

Saratoga (New York) Bromegrass plant characteristics and seed yield data are found in tables 18a - 18d. There were no diseased plants observed in the synthetic and there was no winter injury.

Wisconsin Bromegrass plant characteristics and seed yield data are found in tables 19a - 19d. Neither diseased nor winter injured plants were observed.

Table 18a. First and last date of anthesis, plant height, number of culms, node color, leaf type, date of harvest, and seeds per spikelet; Saratoga (New York) Bromegrass; Barker farm

Clone	Plant height in inches	Number of culms	Node color	Leaf type	Seeds per spikelet
	Average of 5 plants per plot, 8 reps.				
46-11	38.1	141.1	olive to light green	1.0	4.06
46-19	39.0	115.7	brown to light brown	2.6	7.41
46-92	42.2	97.8	olive green	3.0	4.67
46-157	42.0	151.0	light brown	2.2	4.97
46-166	42.0	182.6	brown to light brown	2.0	5.47

Leaf type: 1 = erect, 5 = lazy (droop)
First date of anthesis, all clones, June 15, 1958
Last date of anthesis, all clones, June 26, 1958
Date harvested, all clones, July 15, 1958

Table 18b. Ranked means of percent fertility; Saratoga (New York) Bromegrass; Barker farm

Clone	Means of the 3 center branches of 6 panicles per plot, 5 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
46-19	88.30	
46-166	81.32	
46-157	78.14	
46-92	68.94	
46-11	65.92	
$\bar{X}$	76.52	
F value	10.82**	
$S\bar{x}$	2.779	
C.V. percent	8.12	

** Significant at the 1 percent level.

Table 18c. Ranked means of seeds per gram; Saratoga (New York) Bromegrass; Barker farm

Clone	Means of the seed from 3 center branches of 6 panicles per plot, 5 reps.	Least significant (Duncan's Multiple Range Test) 1 percent level
46-11	327	a
46-157	278	b
46-19	273	b
46-92	271	b
46-166	200	c
$\bar{X}$	278	
F value	23.28**	
$S\bar{x}$	6.434	
C.V. percent	5.17	

** Significant at the 1 percent level.

Table 18d. Ranked means of grams of seed per plant; Saratoga (New York) Bromegrass; Barker farm

Clone	Means 20 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
46-166	101.45	
46-19	81.95	
46-157	72.55	
46-92	56.20	
46-11	51.10	
$\bar{X}$	72.65	
F value	65.44**	
$S_{\bar{x}}$	2.514	
C.V. percent	15.47	

** Significant at the 1 percent level.

Table 19a. First and last date of anthesis, number of culms, node color, leaf type, plant height, seeds per spikelet, and date of harvest; Wisconsin Bromegrass; Clark farm

Clone	Number of culms	Node color	Leaf type	Plant height in inches	Seeds per spikelet
	Average of 5 plants per plot, 8 reps.				
55-4	60	light brown	1	34.0	.60
55-7	67	purple	2	29.5	3.84
55-10	69	1/3 light brown 1/3 olive green 1/3 light green	1	26.1	3.82
55-15	47	olive to light green	1.5	28.2	1.58
55-16	117	olive to light green	2.4	31.6	3.56

Leaf type: 1 = erect, 5 = lazy (droop)
First date of anthesis, all clones, June 17, 1958
Last date of anthesis, all clones, June 24, 1958
Date of harvest, all clones, July 16, 1958

Table 19b. Ranked means of percent fertility; Wisconsin Bromegrass; Clark farm

Clone	Means of the 3 center branches of 6 panicles per plot, 5 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
55-16	56.80	
55-10	48.82	
55-7	48.18	
55-15	13.98	
55-4	10.82	
$\bar{X}$	32.92	
F value	20.88**	
$S\bar{x}$	4.416	
C.V. percent	26.75	

** Significant at the 1 percent level.

Table 19c. Ranked means of seeds per gram; Wisconsin Bromegrass; Clark farm

Clone	Means of the seed from 3 center branches of 6 panicles per plot, 5 reps.	Least significant range (Duncan's Multiple Range Test) 5 percent level
55-4	510	
55-10	463	
55-16	444	
55-7	423	
55-15	342	
$\bar{X}$	436	
F value	4.14*	
$S_{\bar{x}}$	30.38	
C.V. percent	15.53	

* Significant at the 5 percent level.

Table 19d. Ranked means of grams of seed per plant; Wisconsin Bromegrass; Clark farm

Clone	Means 18 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
55-16	18.9	
55-7	16.7	
55-10	15.1	
55-15	6.2	
55-4	4.2	
$\bar{X}$ -	12.2	
F value	37.97**	
$S\bar{x}$	1.068	
C.V. percent	37.15	

** Significant at the 1 percent level

Orchardgrass Synthetics

Beltsville Orchardgrass plant characteristics and seed yield data are found in tables 20a - 20d. Initial spring growth was slow. No winter injury or diseased plants were observed.

Pennsylvania Orchardgrass plant characteristics and seed yield data are found in tables 21a - 21d. No winter injury or diseased plants were observed.

Table 20a. First and last date of anthesis, plant height, number of culms, seeds per spikelet, and date of harvest; Beltsville Orchardgrass; Clark farm

Clone	First date of anthesis	Last date of anthesis	Plant height in inches	Number of culms	Seeds per spikelet	Date harvested
	Average of 5 plants per plot, 10 reps.					
A-II-6	June 12	June 25	23.8	73.0	1.67	July 16
34-27	June 9	June 25	29.0	88.3	2.74	July 16
36-15	June 8	June 25	27.4	77.1	2.34	July 16
38-25	June 20	July 7	27.0	49.3	3.30	July 24

Table 20b. Ranked means of percent fertility; Beltsville Orchardgrass; Clark farm

Clone	Means of the 2 center branches of 4 panicles per plot, 5 reps.	Least significant range (Duncan's Multiple Range Test) 5 percent level
38-25	54.4	
34-27	41.6	
36-15	36.2	
A-II-6	32.0	
$\bar{X}$	41	
F value	4.84*	
$S\bar{x}$	4.425	
C.V. percent	24.12	

* Significant at the 5 percent level.

Table 20c. Ranked means of seeds per gram; Beltsville Orchardgrass; Clark farm

Clone	Means of the seed from 2 center branches of 4 panicles per plot, 5 reps.
34-27	1232
A-II-6	1228
38-25	1226
36-15	1180
$\bar{X}$	1216
F value	2.06
C.V. percent	3.13

Table 20d. Ranked means of grams of seed per plant; Beltsville Orchardgrass; Clark farm

Clone	Means 20 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
36-15	12.51	
34-27	12.07	
38-25	9.31	
A-II-6	8.29	
$\bar{X}$	10.51	
F value	5.39**	
$S\bar{x}$	.9017	
C.V. percent	38.36	

** Significant at the 1 percent level.

Table 21a. First and last date of anthesis, plant height, number of culms, node color, and date of harvest; Pennsylvania Orchardgrass; Barker farm

Clone	First date of anthesis	Plant height in inches	Number of culms	Node color	Leaf type	Seeds per spikelet
	Average of 5 plants per plot, 8 reps.					
MIV-5	June 8	28.0	30.5	light green	4	4.36
MIV-17	June 9	38.9	59.7	light brown to purple	2	4.46
XLI-8	June 14	35.6	81.4	olive green	1	2.48
XLI-17	June 12	38.7	76.6	olive green	2.6	3.92

Leaf type: 1 = erect, 5 = lazy (droop)
Last date of anthesis, all clones, approximately June 27, 1958

Table 21b. Ranked means of percent fertility; Pennsylvania Orchardgrass; Barker farm

Clone	Means of the 2 center branches of 4 panicles per plot, 5 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
MIV-5	67.6	
MIV-17	58.4	
XLI-17	48.0	
XLI-8	36.6	
$\bar{X}$	52.65	
F value	6.41**	
$S\bar{x}$	5.079	
C.V. percent	22.39	

** Significant at the 1 percent level.

Table 21c. Ranked means of seeds per gram; Pennsylvania Orchardgrass; Barker farm

Clone	Means of the seed from 2 center branches of 4 panicles per plot, 5 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
XLI-8	1468.8	
XLI-17	1439.6	
MIV-17	1231.4	
MIV-5	1042.6	
$\bar{X}$	1295.6	
F value	11.75**	
$S\bar{x}$	58.1	
C.V. percent	10.03	

** Significant at the 1 percent level.

Table 21d. Ranked means of grams of seed per plant; Pennsylvania Orchardgrass; Barker farm

Clone	Means 20 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
MIV-17	22.45	
XLI-17	19.39	
XLI-8	12.57	
MIV-5	10.27	
$\bar{X}$	16.17	
F value	26.89**	
$S\bar{x}$	1.10	
C.V. percent	30.43	

** Significant at the 1 percent level.

Timothy Synthetics

Indiana Timothy clone characteristics and seed yield data are found in tables 22a - 22d. All plants lacked vigor with new growth at a minimum throughout the summer. All clones were infested with timothy mites. There was no winter injury, but numerous plants were lost in clone 19 during the summer of 1958.

New York Timothy (Essex) clone characteristics and seed yield data are found in tables 23a - 23d. All clones were infested with timothy mites, but there was no winter injury. Percentage of fertile florets was extremely low in this synthetic.

Table 22a. First and last date of anthesis, plant height, number of culms, node color, head length, and date of harvest; Indiana Timothy; Clark farm

Clone	First date of anthesis	Last date of anthesis	Plant height in inches	Number of culms	Node color	Head length in inches
			Average of 5 plants per plot, 6 reps.			
13	July 2	July 25	18.5	38.2	olive green and purple	3.13
14	July 2	July 22	26.7	57.8	olive to light green	3.25
17	July 10	July 25	19.7	30.5	olive to light green	3.20
19	July 2 thru July 24	Some in anthesis at harvest	15.2	21.8	light green and brown	3.07

Date harvested: August 16, 1958

Table 22b. Ranked means of percent fertility; Indiana Timothy; Clark farm

Clone	Means of 4 panicles per plot, 6 reps.	Least significant range (Duncan's Multiple Range Test) 5 percent level
17	58.0	
13	49.6	
14	38.6	
19	21.0	
$\bar{X}$	41.8	
F value	3.54*	
$S\bar{x}$	8.497	
C.V. percent	45.45	

* Significant at the 5 percent level.

Table 22c. Ranked means of seeds per grams; Indiana Timothy; Clark farm

Clone	Means of seed from 4 panicles per plot, 6 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
17	2634.6	|
19	2055.8	|
14	2042.6	|
13	1994.8	|
$\bar{X}$	2182.0	
F value	14.87**	
$S\bar{x}$	78.536	
C.V. percent	8.05	

** Significant at the 1 percent level.

Table 22d. Ranked means of grams of seed per plant; Indiana Timothy; Clark farm

Clone	Means 20 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
13	6.43	|
14	5.13	| |
17	3.99	|
19	.67	|
$\bar{X}$	4.06	
F value	22.54**	
$S\bar{x}$	.5197	
C.V. percent	57.24	

** Significant at the 1 percent level.

Table 23a. First and last date of anthesis, plant height, number of culms, node color, head length, and date of harvest; New York Timothy (Essex); Barker farm

Clone	First date of anthesis	Last date of anthesis	Plant height in inches	Number of culms	Node color	Head length in inches
	Average of 5 plants per plot; 7 reps.		Average of 5 plants per plot; 5 reps.			
48-30	July 13	July 19	32.6	117.4	brown	4.80
48-140	July 14	July 21	33.0	161.0	brown	5.38
48-154	July 24	July 29	23.4	138.6	olive green	3.98
48-215	July 10	July 28	23.4	175.6	olive green to light brown	4.46

Date of harvest, all clones, August 29, 1958

Table 23b. Ranked means of percent fertility; New York Timothy (Essex); Barker farm

Clone	Means 5 reps.
48-215	12.86
48-30	8.72
48-140	8.20
48-154	7.48
$\bar{X}$	9.31
F value	1.12
C.V. percent	54.86

Table 23c. Ranked means of seeds per gram; New York Timothy (Essex); Barker farm

Clone	Means of seeds from 4 panicles per plot, 5 reps.
48-140	2288
48-154	2208
48-215	1982
48-30	1781
$\bar{X}$	2065
F value	.683
C.V. percent	30.03

Table 23d. Ranked means of grams of seed per plant; New York Timothy (Essex); Barker farm

Clone	Means 20 reps.	Least significant range (Duncan's Multiple Range Test) 1 percent level
48-215	4.12	|
48-30	3.77	|
48-140	2.99	|
48-154	1.04	|
$\bar{X}$	2.98	
F value	8.34**	
$S_{\bar{x}}$	.4769	
C.V. percent	70.94	

** Significant at the 1 percent level.

DISCUSSION

This study has shown significant differences in the clonal performance within eastern forage synthetics grown under Utah conditions.

A comparison can be made between the clones of the alfalfa and Pennsylvania Birdsfoot Trefoil (6 clone) synthetics that were grown under both caged and open conditions. The initiation of flowering in the 4 alfalfa clones under cages occurred over a 2-week period (clone C-40 May 30, with clones Ka. 30-1182 and Minn. 265 June 12) while those grown under open conditions at Newton were over a 1-week period (clone C-40 June 5, and clone Ka. 30-1182 June 10). Seed yields were about the same under both open and caged conditions with the exception of clone Minn. 247, which produced about four times as much seed under open conditions. The Pennsylvania Birdsfoot Trefoil (6 clone) showed marked differences in plant characteristics between the caged and open clones. Seed yield per plant was reduced 1/2 - 3/4 under the cages as compared to the open. Undoubtedly reduced light and higher humidities under the cages played a big part in character differences.

There was a distinct drop in seed yield for the alfalfa when the 4-clone crosses were compared to the single crosses. One may assume that a higher percentage of selfing and a lower percentage of cross fertility probably attributed to this loss. This would agree with work reported by Pedersen (1953) and Wilsie (1951) in which they found a reduction in seed yields when selfing was forced and when restricted crossing was practiced.

The alfalfa and birdsfoot trefoil (Pennsylvania Birdsfoot Trefoil, 6 clone and 7 clone) synthetics showed a relationship between the least seeds per pod produced, with the most seed per gram, and least seed produced per plant. This relationship was also observed in the Saratoga Bromegrass Synthetic with percentage of fertile florets. This would indicate a smaller seed for those clones producing the least percentage fertile florets or seeds per pod and seed weight per plant. This relationship was almost reversed in the Kentucky Red Clover and the South Carolina White Clover synthetics. These synthetics showed that those clones producing the highest percentage of fertile florets or seeds per floret also produced the most seed per plant and smallest individual seeds.

Disease in the New Hampshire White Clover synthetic reduced the seed yield and affected other measurable plant characteristics. Those clones that were not diseased failed to make a vigorous growth indicating other unfavorable conditions. The production of seed on this synthetic under Utah conditions would undoubtedly alter the original phenotype.

A reduction in percentage of fertile florets in clone no. 9, type 1, of the Macdonald Red Clover was probably due to its being selfed or failure to cross. Flower initiation in clone no. 9, type 1, was three weeks behind that of the other 2 clones and at a time when the other 2 clones had completed flowering.

The grass synthetics performed considerably different in Cache Valley from their performance at the sources of origin for those for which information was obtained. The Saratoga Bromegrass clones produced a higher percentage of fertile florets and more grams of seed

per plant than was reported in New York. It is interesting to note that the difference in seed produced per plant between the highest and lowest clone in New York was 11 grams, while at Cache Valley the difference was about 50 grams. This could result in the change of the synthetic if seed were produced under Utah conditions if the proportion of seed produced was changed.

There was a wide range in percentage of fertile florets and seed produced in the Wisconsin Bromegrass synthetic.

The orchardgrass synthetics performed in much the same manner as the other synthetics, there being a wide range in fertility and seed production.

There was a low percentage of fertile florets in the New York Timothy (Essex) synthetic. This is hard to explain with the information obtained in Utah. Vigor in the timothy synthetics was reduced by the mite infestation, but this cannot explain the lack of plant vigor and growth by the Indiana Timothy synthetic, which failed to measure up to its performance at Purdue University.

Many of the clones within the various synthetics produced little or no seed. The contribution of these clones by seed weight would have to be considered of no value to the makeup of a synthetic. However, the contribution of these clones in the crossing complex may be of considerable value which cannot be measured at this stage.

SUMMARY AND CONCLUSIONS

The effect of climatic and environmental conditions was observed on 15 eastern forage synthetics, nine legumes and six grasses at Logan and Newton, Cache County, Utah. Plant characteristics and seed yield data were recorded during 1958. The seed yield data were statistically analyzed by the Duncan's Multiple Range Test.

Significant differences in clonal performance were found within each synthetic. Time of flowering, persistence of flowering and period of most profuse flowering varied for the clones within the legume synthetics, as did the number of culms, and the period of anthesis for the clones within the grass synthetics.

The number of seeds per pod or spikelet, and/or fertility varied for the clones within each synthetic. Seeds per gram showed great variation.

The greatest and most significant difference was found in the grams of seed produced per plant. Many clones failed to produce enough seed (some clones within a synthetic produced less than 1 gram of seed per plant, whereas some produced as high as 10 - 20 grams per plant) to be of significant value in making up a synthetic variety. While the contribution of these clones to the synthetic by seed produced would be low, the contribution through cross fertilization with other plants could not be determined, but probably would be limited in value due to sparceness of flowering.

In a study of this type, data collected in a one-year period cannot be considered as conclusive evidence to anything other than what

happened during that season. Another year's study would help to indicate any trends that many of the factors observed during the 1958 period would follow.

It may be stated that a disproportionate contribution to flower production, time and period of flowering and seed production could materially change the synthetic. This could happen if seed for the synthetic was produced under conditions differing from those where the synthetic was originally produced.

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APPENDIX FIGURES

Figure 1. Variation in the Pennsylvania Birdsfoot Trefoil (6 clone). June 2, 1958, Evans Farm. Profuseness of flowering was at its peak for all clones.

Figure 2. Pennsylvania Birdsfoot Trefoil (6 clone) showing one type plant with the most and one type plant with the least amount of flowering. June 2, 1958, Evans Farm.

Figure 3. Pennsylvania Birdsfoot Trefoil (7 clone) showing two types of plants in the synthetic. June 2, 1958, Clark farm.

Figure 4. Pennsylvania White Clover showing leaf marking versus no leaf marking. June 2, 1958, Clark farm.

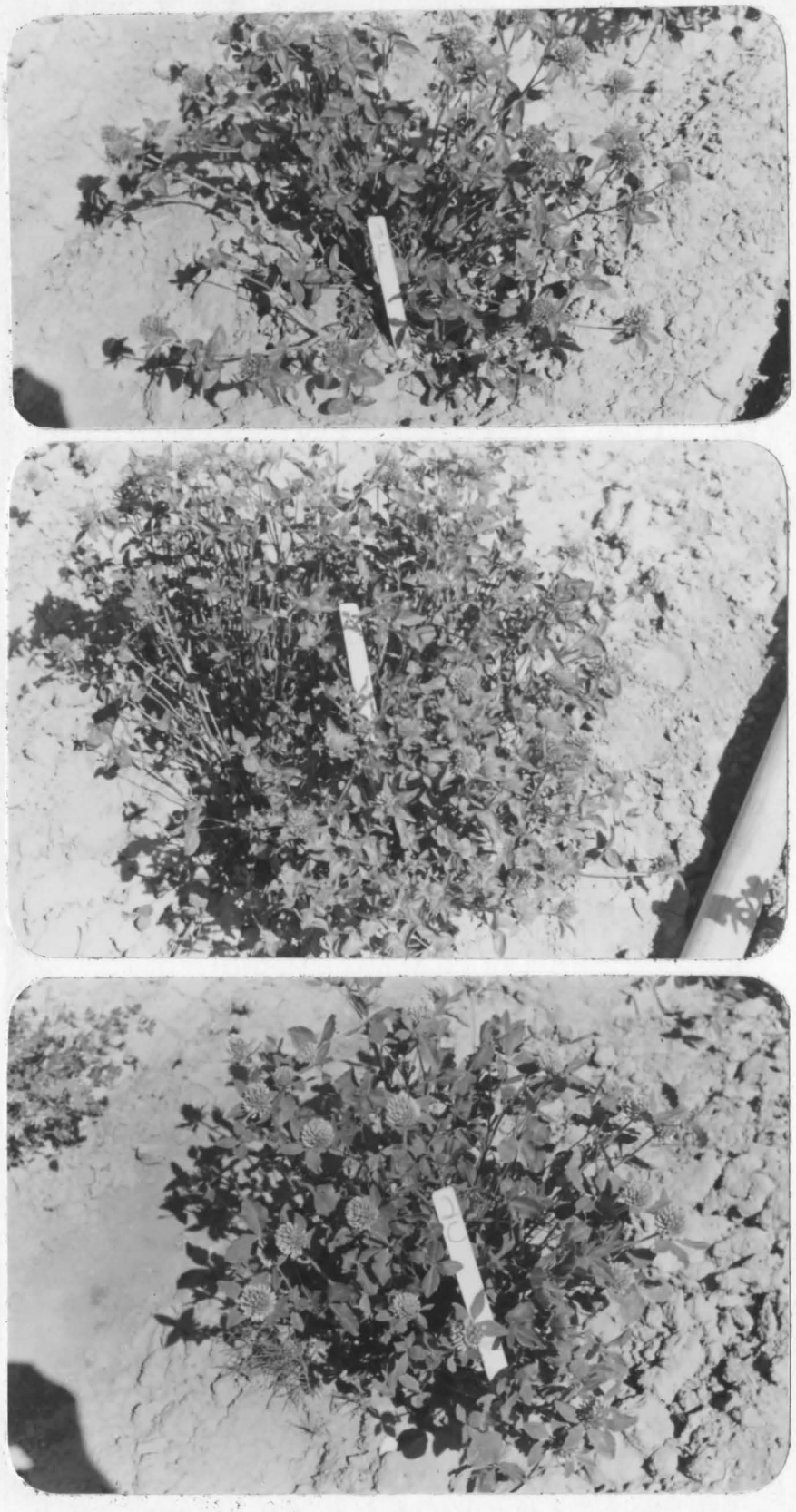

Figure 5. Kentucky Red Clover showing the three predominant types of plant growth in the synthetic. June 14, 1958, Clark farm.

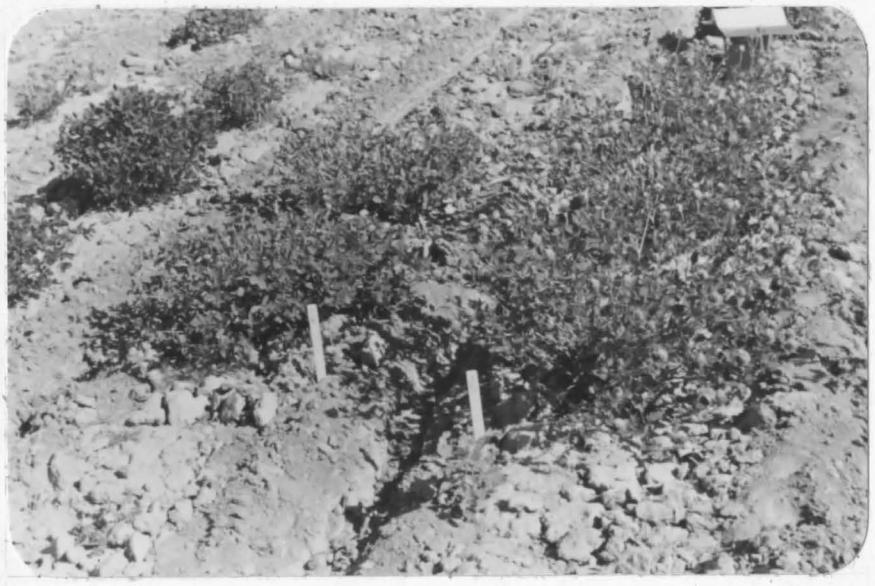

Figure 6. Macdonald Red Clover showing the three types of plant growth in the synthetic. June 14, 1958, Barker farm.

Figure 7. Saratoga Bromegrass. June 14, 1958, Barker farm. Beltsville Birdsfoot Trefoil in the foreground.

Figure 8. New York Essex Timothy showing the variation among the 4 clones. August 8, 1958, Barker farm.