TESTING STRAINS OF KOREAN LESPEDEZA UNDER THREE METHODS OF ESTABLISHMENT

TESTING STRAINS OF KOREAN LESPEDEZA UNDER THREE METHODS OF ESTABLISHMENT

By

MARVIN GIBSON BROTHERTON

Bachelor of Sciences

Oklahoma Agricultural and Mechanical College

Stillwater, Oklahoma

1942

Submitted to the Department of Agronomy

Oklahoma Agricultural and Mechanical College

In Partial Fulfillment of the Requirements

for the Degree of

MASTER OF SCIENCES

1949

APPROVED BY:

Melvin D. Jones
Chairman, Thesis Committee

H. Livingston
Member, Thesis Committee

[signature]
Head of the Department

[signature]
Dean of the Graduate School

ACKNOWLEDGMENT

The writer wishes to express his sincere appreciation to Professor V. B. Hawk, who helped plan and lay out the experiment in the field, and to his major advisors, Professors M. D. Jones, H. W. Staten, and W. C. Elder, who gave constant advice and constructive criticism.

TABLE OF CONTENTS

Introduction

Korean lespedeza is a native of the Manchurian peninsula of Eastern Asia. It was introduced into the United States in 1919 by Dr. Ralph Mills, a medical missionary who sent some seed from Chosen (formerly Korea) to the United States Department of Agriculture for testing. Since its introduction into the United States, methods of establishing it in single rows, in alternate rows of small grain and lespedeza, in broadcast seedings with small grain, and in broadcast seedings alone have been used intermittently.

A large area extending into the corn and cotton belts during recent years has been planted to Korean lespedeza. It is particularly popular in these areas because of its ability to produce good hay and seed yields on slightly acid soils and to add nitrogen and organic matter to the soil; its resistance to insects and diseases; its capability to fit into a rotation series; and its importance as a milk and beef producer for livestock, Peters (8). [1] Strain tests have shown that some selections are better adapted to the above mentioned areas than others.

Staten (11) reported in a recent unnumbered mimeographed circular that Korean lespedeza, Lespedeza stipulacea Maxim, is an excellent summer annual legume which is particularly adapted to the eastern half of Oklahoma and, to a limited extent, to the central part of the state. Methods of establishing and testing Korean lespedeza in nursery plots would be valuable to farmers in Oklahoma who plant this legume on a large scale.

The primary objective of this investigation was to test the relative vigorous of 12 Korean lespedeza strains when grown in 3-foot cultivated rows, in alternate 6-inch rows with oats, and in broadcast 12-inch oat rows.

---

[1] Figures in parenthesis refer to literature cited, p. 17.

Review of Literature

Several procedures of establishing strains of Korean lespedeza for testing have been used by investigators, but little published information was found in which a comparison of the methods was made.

The history of Lespedeza stipulacea Maxium in the United States has been related by Pieters and Van Eseltine (9), who first studied methods of seeding in the United States. They also illustrated cultural and threshing practices as used at the Arlington Experiment Farm, Arlington, Virginia, in 1922 and 1923. Their methods of establishing Korean lespedeza in experimental plots was in 3-, 6-, and 18-inch rows. Their establishment of broadcast seedings in oats, however resulted in failure.

McFee (7) and Pieters (8) have summarized the culture of Korean lespedeza on a national basis. Information on the culture and utilization of lespedeza in Kansas is reported by Anderson (1) and in Missouri by Helm (4). The adaptation of Korean lespedeza to the conditions of Oklahoma and the species and strains available for farm use have been described by Staten (11).

Some of the methods that have been used for testing are shown by Harper (3) who found that with Oklahoma soil and climatic conditions, a better stand of lespedeza and a more vigorous growth were obtained when the lespedeza was seeded with a companion (nurse crop) of small grain in widely spaced rows.

While under farm practices lespedeza is seeded with a small grain companion crop, most nursery tests are conducted in cultivated rows of pure stands such as those described by Wilsie and Hughes (14).

No positive results are reported in the literature concerning the comparative response in yield of hay or seed of lespedeza strains when grown in cultivated rows and in solid broadcast seedings with a cereal companion

crop. Sisters (8), Helm (4), and Kinney, Kenney, and Forgus (5) reported seeding Korean lespedeza both alone and with a small grain with favorable results.

Tysdal and Kiesselbach (13), and Klages (6) found a close correlation between the response in nursery-row-plots and field plots for alfalfa and small grain, respectively.

Morrie and Allison (12) found that red clover strains responded relatively the same when seeded in nursery plots with or without timothy as a companion crop. Churchill (2) concluded that in testing strains of brome-grass in Michigan it would seem advisable to plant them in a mixture with alfalfa instead of by the usual method of planting alone in cultivated rows or in solid stands.

Materials and Methods

This study was conducted in 1948 on Kirkland very fine sandy loam soil at the Oklahoma Experiment Station, Stillwater, Oklahoma. Methods of establishing and testing in 3-feet lespedeza rows, (Fig. 1), alternate 6-inch rows of lespedeza and oats (Fig. 2), and broadcast lespedeza in 12-inch oat rows (Fig. 3) were used.

On the basis of previous yield data, twelve strains of Korean lespedeza were selected from the high, medium, and low hay producers as follows:

High	Medium	Low
P.I.31249	P.I.31853	P.I.31492
P.I.90553	P.I.31493	P.I.31481
P.I.31856	P.I.31820	P.I.31851
P.I.31478[1/2]	P.I.19601	P.I.19604[1/2]

[1/2] Previous yields for these two Korean lespedeza strains were reported for only one year at the Oklahoma Experiment Station, Stillwater, Oklahoma.

Fig. 1.--Korean lespedeza growing in 36-inch rows. This was one method used for testing Korean lespedeza at Oklahoma Experiment Station in 1948.

Fig. 2.--Establishment of Korean Lespedeza by planting in alternate 6-inch rows of Kanota oats.

Fig. 3.—Establishment of Korean Lespedeza by broadcasting in 12-inch Kanota oat rows.

Seedings of lespedeza and oats were made on March 29, as soon as the expectancy of the last killing frost had passed. The design used was a multiple experiment with 5 replications for each of the three methods of establishment. The strains of Korean lespedeza were randomized in each replication.

The plot size was 3 by 17 feet and terminated by a 3-foot alley. The size and shape of the replications were 20 by 36 feet for the three-foot lespedeza rows (Method A), and 20 by 48 feet for the alternate 6-inch rows of lespedeza and oats (Method B), and for broadcast seedings in 12-inch oat rows. Three-foot border plots were seeded between each method. In Methods B and C, one-foot alleys were seeded between plots.

A germination test was conducted on the seed of all strains prior to planting, and the seeding rate was corrected in each method to approximately the same amount of viable seed. The rate of seeding for Method A was 18.82 pounds to the acre or 10 grams to the plot, and for Methods B and C, 28.24 pounds to the acre or 15 grams to the plot. The lespedeza was seeded with the "V"-Belt Seeder in the single and alternate rows of lespedeza and oats (Fig. 4). In Method C, the lespedeza seed was mixed with a small amount of sand and scattered over the plot by hand. The oats were seeded with a Planet Jr. Planter before the lespedeza was planted. The 3-foot rows of lespedeza were cultivated following each rain.

Half plots were trimmed to 8 feet in length before being cut for forage by the Jari mower. A few of the decumbent stems not cut by the mower were trimmed with hand clippers. Two hundred and fifty grams of green forage were weighed from each plot, put into a kraft bag, and placed in a drying oven at 100°c.

The 250 gram samples (corrected to a 20% moisture basis) were used to

Fig. 4.--Seeding Korean Lespedeza with a "V" Belt Seeder.

determine the % of leaves for each strain. The leaves were plucked by hand. Later the remaining 8-feet of rows for each of the strains were cut for seed with a hand sickle. They were tied into bundles and placed in a cloth sack. Each bundle was labeled and after being air dried was threshed on a Vogel Nursery Thresher according to the method reported by Pieters and Van Eseltine (9).

As soon as the companion crop of Manota oats in Methods B and C had reached the "tough dough" stage, the two center rows were harvested for seed yield and the two outside oat rows of each plot were discarded to eliminate border effect. After the oats had air dried, they were threshed on a Vogel Nursery Thresher and the yields were recorded.

At the appropriate period during the growth of the Korean lespedeza, information was recorded concerning height, date of first bloom, and date of harvest.

Results and Discussion

Hay Yields

The hay yields in pounds per acre, corrected to a 20% moisture basis, for 12 strains of Korean lespedeza are presented in Table 2 (appendix). The average total production for each of the 3 methods of establishment shows that lespedeza seeded in 3-foot rows (Method A) was highest with 3,810 pounds to the acre. The lespedeza in alternate 6-inch oat rows (Method B) was intermediate in yield with 2,122 pounds. Broadcast lespedeza in 12-inch oat rows (Method C) was lowest in hay yield with 988. A difference between methods of 316 pounds was required for significance at the 1% level (Table 2); thus Method A was better than Method B, and Method B was better than Method C at the 1% level of significance.

A difference between the hay yields of individual strains was also obtained. In Method A, the high strain was P.C.31856 with 4,181 pounds per acre. The low strain was P.C.31481 with 3,400 pounds. A difference of 445 pounds was required for significance at the 5% level and 588 pounds at the 1% level. No strain was high enough above the mean yield to be significant at the 5% level in Method A.

The high strain in hay yields in pounds per acre for the alternate 6-inch rows of lespedeza and oats (Method B) was P.C.31820 with 2,672, while the low strain was P.C.31493 with 1,037. Strains P.C.90553, P.C.31820, P.C.31851 and P.C.19604 were significantly higher in yield than the mean.

For the broadcast lespedeza in 12-inch oat rows (Method C), P.C.90553 was highest in pounds per acre with 1,292, and P.C.31493 was lowest with 582. No strain was higher than the mean at the 5% level of significance.

A highly significant interaction of strains under the 3 methods of establishment was found (Table 1). Thus the strains did not respond in the same way under all methods. This might be expected since there were such great differences between the average production of the methods. The highest producers, as shown by the average of the 3 methods, were P.C.31851 with 2,636 pounds; P.C.31856 with 2,579 pounds, and P.C.19604 with 2,525 pounds per acre.

Table 1.--Analysis of variance of hay yields, % of leaves, and seed yields for 12 strains of Korean lespedeza grown under 3 methods of establishment at Stillwater, Oklahoma, in 1948.

Hay (Corrected to 20% moisture)				
Source of Variation	DF	SS	MS	F
Methods	2	241892760	120946380.0	376.0385**
Error a	12	3859595	321632.9	
Replication	(4)			
Reps x Methods	(8)			
Strains	11	12356779	1123343.545	8.779223**
Strains x Methods	22	9680482	440021.909	3.438886**
Error b	131[3]	16762076	127954.788	
Strains x Replicates	(44)			
Strains x Methods x Reps	(88)			
TOTAL	178*	284551692		

% Leaves				
Source of Variation	DF	SS	MS	F
Methods	2	639.4755	319.7377	45.35**
Error	12	84.5984	7.0498	
Replications	(44)			
Reps x Methods	(88)			
Strains	11	982.50	89.3181	7.10**
Strains x Methods	22	641.7550	29.1706	2.32**
Error	132	1660.5364	12.5798	
Strains x Replicates	(44)			
Strains x Methods x Reps	(88)			
TOTAL	179	4008.8653	22.3958	

Seed				
Source of Variation	DF	SS	MS	F
Methods	2	34301.6	17150.8	7.667**
Error a	12	26843.6	2236.96	
Replications	(44)			
Reps x Methods	(88)			
Strains	11	769164.8	69924.07	15.38585**
Strains x Methods	22	274688.4	12485.83	2.7473 **
Error b	132	599900.2	4544.698	
Strains x Replicates	(44)			
Strains x Methods x Reps	(88)			
TOTAL	179	1678055.0		

[3] One degree of freedom lost due to calculation of missing plot data according to Snedecor (10).

** Significant at 1% level.

Percentage of Leaves

Contrary to the relative rank of the methods in hay yields, the average total % for each of the 3 methods of establishment shows that lespedeza in broadcast 12-inch rows (Method C) was highest with 58.3% leaves (Table 3-appendix). However, the method of alternate 6-inch rows of lespedeza and oats was intermediate, as it was in hay production, with 56.0%. Method A (3-foot row of lespedeza) was lowest with 53.7%. A difference of 1.05 and 1.46% was required for significance at the 5% and 1% levels respectively (Table 3). Method C was better than Method B and Method B was better than Method A at the 1% level of significance.

A difference in % of lespedeza leaves between strains was also obtained. In Method A, P.C.31478 was highest with 58.70% and P.C.31493 was lowest with 43.66%. A difference between strains of 4.41% was required for significance, and 5.81% was necessary for it to be highly significant. P.C.31478 was significantly higher than the mean at the 5% level.

In the alternate 6-inch rows of lespedeza and oats, P.C.31478 with 61.01% was highest while the lowest strain was P.C.31851 with 51.93%. P.C.31478 was significantly higher than the mean at the 5% level.

For the broadcast lespedeza in 12-inch oat rows, P.C.19601 with 60.29% and P.C.31820 with 60.28% were highest. The lowest strain was P.C.31851 with 55.29%. No strain was higher than the mean at the 5% level of significance. A highly significant interaction of strains under the 3 methods of establishment was shown (Table 1). Strains with the highest % of leaves as shown by the average of the 3 methods were: P.C.31478 with 59.43%, P.C.19604 with 58.45%, and P.C.19601 with 57.36%.

Seed Yields

Seed yields in pounds per acre for the 12 strains of Korean lespedeza are presented in Table 4 (appendix). The average total production for each of the 3 methods of establishment shows that the lespedeza seeded in 3-foot rows (Method A) was highest with 103.7 pounds of seed per acre. Yields in alternate 6-inch rows of lespedeza and oats (Method B) was intermediate with 94.5 pounds. Broadcast lespedeza in 12-inch oat rows (Method C) was lowest with 70.9 pounds. A difference of 26 pounds was required for significance at the 1% level between methods. Thus the relative significant rank of the methods was the same as for hay yields.

A difference was shown between individual strains in seed yield. The high strain in pounds per acre was P.C.19604 with 324, while the low strain was P.C.31481 with 4 pounds. Previous yields of P.C.31481 in Oklahoma have been low. The consistently low seed yields in this investigation verify this rank and indicate it as a strain not adapted to this area for seed yield. A difference of 83 pounds was required for significance at the 5% level and 110 pounds at the 1% level between strains (Table 4). In Method A, P.C.31478 and P.C.19604 were highly significant above the mean.

In the alternate 6-inch rows of lespedeza and oats (Method B), P.C.19604 with 268 pounds per acre was highest, whereas P.C.31481 with 19 pounds was lowest. Strains significantly higher than the mean were P.C.31478 and P.C. 19604, while P.C.19604 was highly significant.

P.C.19604 was highest in seed yield with 114 pounds per acre in the broadcast lespedeza in 12-inch oat rows (Method C) and P.C.31851 was lowest with 17 pounds. No strain was higher than the mean at the 5% level of significance. The rank of strains in each of the methods was not the same.

Thus a highly significant interaction of strains was shown (Table 1). The strains having highest seed yields in pounds per acre, shown by the average of the 3 methods, were P.C.19604 with 235, P.C.31478 with 202, and P.C.90553 with 188 pounds.

Oat Yields

Yields of Kanota oats in alternate 6-inch rows of lespedeza and oats (Method B) averaged slightly higher with 22.7 bushels per acre. Broadcast lespedeza in 12-inch oat rows (Method C) with an average yield of 22.1 bushels was lowest in seed production. No significant differences were shown between the average yields. The yield of oats was not affected by methods of seeding lespedeza.

Meteorological Data

Meteorological data, at Stillwater, Oklahoma, for the period of March, 1948 to November, 1948 are presented in Table 5 (appendix). The rainfall was slightly above normal during March, June, and July and was below normal during May and June. During the latter part of August and the month of September the rainfall was far below normal which was unfavorable for the seed production of lespedeza. This was especially true for the late strains. The temperature was 5 degrees below normal during the summer months. The first killing frost occurred on October 18.

Plant Characteristics

The greatest height of lespedeza plants was attained in lespedeza in 3-foot rows (Table 6). The date of first bloom was July 26 and the date of seed harvest was October 4. There were 40 days between the dates of first

bloom and seed harvest. A correlation was observed between the height of the plant and forage yields, since the tallest plants were found in Method A and the most forage was produced in Method A. It was expected that the above conditions would be found since it was the only method in which there was no competition for moisture and plant food from a companion crop. The early growth of forage was encouraged by favorable climatic conditions (Table 5).

Method B was intermediate in growth with an average height of 5 inches. On August 6, the first blooms appeared and on October 3 the seed was harvested. There was an average of 58 days between the above two dates (Table 6).

Method C ranked lowest in plant height with an average of 3 inches. On August 17, the first blooms appeared and on October 13 the seed was harvested. The average number of days between the above two dates was 57 days. The plant heights and forage yields were correspondingly low in this method. Climatic conditions did not favor the production of seed (Table 6).

Summary

An investigation was conducted to determine the relative response of 12 Korean lespedeza strains under 3 methods of establishment on the Oklahoma Experiment Station at Stillwater, Oklahoma in 1948.

The one year's data show the following results:

1. Method A was highest in average hay production with 3,810 pounds per acre, Method B was intermediate with 2,122 pounds, and Method C was lowest with 988 pounds.
2. In hay yields, Method A was better than Method B and Method B was better than Method C at the 1% level of significance.

3. The best strain for hay in pounds per acre for each method was F.C.31856 with 4,181 pounds in Method A, F.C.31820 with 2,672 pounds in Method B, and F.C.90553 with 1,292 in Method C.

4. Strains significantly higher in hay production than the mean of Method B were F.C.90553, F.C.31820, and F.C.19604.

5. A highly significant interaction of strains for hay yields under the 3 methods of establishment was found.

6. The highest hay producers as shown by the averages of the strains under all 3 methods, were F.C.31851, F.C.31856, and F.C.19604.

7. Contrary to the relative rank of methods for hay yields, the highest method in % of leaves was Method C, followed by Methods B and A.

8. The highest strain in % of leaves for each method was F.C.31478 with 58.70% in Method A, F.C.31478 with 61.01% in Method B, and F.C.19601 with 60.28% in Method C.

9. F.C.31478 in Methods A and B was significant above the mean for % of leaves.

10. A highly significant interaction of strains for % of leaves under the 3 methods of establishment was found.

11. F.C.31478 with 59.43%, F.C.19604 with 58.45% and F.C.19601 with 57.36% were highest in % of leaves when compared with the averages of strains in all methods.

12. The most lespedeza seed was produced in Method A with an average of 103.7 pounds to the acre. Method A appeared to be better than Method B and B was better than C.

13. The strain highest in pounds of seed per acre was F.C.19604 in Methods A, B, and C with 324, 268, and 114 pounds, respectively.

14. In seed production, strains highly significant above the mean of each method were F.C.31478 and 19604 in Method A and F.C.19604 in Method B; while F.C.31478 was significant in Method B.

15. A highly significant interaction of strains for seed production under the 3 methods of establishment was found.

16. The Kanota oat yields in Method B with an average of 22.7 bushels per acre was slightly higher than the average production in Method C with 22.1 bushels.

17. The rainfall at Oklahoma Experiment Station favored the production of hay and % of leaves by being above normal during June and July and unfavorable for the production of seed by being below normal during the latter part of August, and September. The late strains were more adversely affected than the early strains.

18. Method A had the tallest plants, while Method C had the shortest plants.

19. Method A was earliest in time of first bloom and seed harvest on July 26 and October 4, respectively. There was 40 days between the above dates. The average date of first bloom, in Method B, was August 17 with 58 days until seed harvest. Method C was latest in time of first bloom with an average of 57 days until seed harvest.

Literature Cited

1. Anderson, Kling L.
Korean lespedeza in Kansas. Kansas Agr. Exp. Sta. Circ. 210. 1941.

2. Churchill, E. E.
Productiveness of bromegrass strains from different regions when grown in pure stands and in mixtures with alfalfa in Michigan. Jour. Amer. Soc. Agron., 39:750-761. 1947.

3. Harper, Horace J.
Wide row planting of small grain to establish sweet clover and lespedeza. Okla. Agr. Exp. Sta. Bul. B-298. 1946.

4. Helm, C. A.
Management of Korean lespedeza. Univ. Mo. Agr. Exp. Sta. Circ. 210. 1940.

5. Kinney, E. J., Kenney, Ralph, and Fergus, E. N.
Lespedeza in Kentucky. Ky. Agr. Ext. Circ. 407. 1945.

6. Kloges, K. H. H.
The reliability of nursery tests as shown by correlated yields from nursery rows and field plots. Jour. Amer. Soc. Agron., 25:464-472. 1933.

7. McKee, Roland.
Lespedeza culture and utilization. U. S. Dept. Agr. Farmer's Bul. 1852. 1940.

8. Pieters, A. J.
The annual lespedezas as forage and soil-conserving crops. U. S. Dept. Agr. Circ. 536. 1939.

9. Pieters, A. J. and Van Eseltine, G. P.
Korean lespedeza; a new forage crop. U. S. Dept. Agr. Circ. 317. 1924.

10. Snedecor, G. W.
Statistical methods. The Iowa State College Press, Ames, Iowa. Fourth Edition. 1946.

11. Staten, H. W.
The lespedezas in Oklahoma. Unnumbered mimeographed circ. Oklahoma Agricultural Experiment Station. 1944.

12. Torrie, J. H. and Allison, J. L.
Methods of evaluation of red clover strains grown alone and with timothy in small plots. Jour. Amer. Soc. Agron., 37:852-857. 1945.

13. Tysdal, H. M. and Kiesselbach, T. A.
Alfalfa nursery technique. Jour. Amer. Soc. Agron., 31:83-98. 1939.

14. Wilsie, C. P. and Hughes, H. D.
Development of early maturing wilt-resistant strains of Korean lespedeza. Jour. Amer. Soc. Agron., 39:615-622. 1947.

A P P E N D I X

Table 2.—Yield of 20% moisture hay (lbs./acre) for twelve strains of Korean lespedeza grown in 5 replications under three methods of establishment at Stillwater, Oklahoma in 1948.

Strain	I	II	III	IV	V	Average lb/A.
			Lespedeza in 3-ft. rows (Method A)[14]			
P.C.31249	3822	3753	3773	4106	3494	3789
P.C.90553	3398	3839	4421	3721	3775	3830
P.C.31856	4783	4008	3870	4397	3848	4181
P.C.31493	4207	3775	3572	3841	4040	3887
P.C.31853	4214	4067	4459	3267	3728	3947
P.C.31478	3590	3557	4726	3590	3498	3792
P.C.31492	3630	3902	4332	3485	3646	3799
P.C.19601	3423	3594	4000	3088	3822	3585
P.C.31481	3779	2902	3274	3125	3920	3400
P.C.31820	3917	3356	3594	3441	3716	3604
P.C.31851	4263	3924	4712	3871	3629	4079
P.C.19604	3668	3468	4421	3540	4040	3827
					Average	3810

Table 2.—Continued.

Strain	I	II	III	IV	V	Average lb/A.
Alternate 6-inch rows oats and Lespedeza (Method B)[4]						
P.C.31249	2454	1380	2042	2155	2649	2136
P.C.90553	2831	2230	2855	2405	2755	2615*
P.C.31856	2296	1448	2134	1815	2242	1987
P.C.31493	776	1347	1008	835	1220	1037
P.C.31853	2859	1037	1562	2178	1715	1870
P.C.31478	2069	1357	1661	2108	2205	1880
P.C.31492	3136	1329	2176	2672	2021	2266
P.C.19601	2695	2414	2478	2770	2414	2554
P.C.31481	898	1158	1612	998	1358	1204
P.C.31820	2454	2763	3138	2566	2439	2672*
P.C.31851	3460	2269	2776	2017	2468	2598*
P.C.19604	2450	2631	2400	3594	2173	2649*
					Average	2122

Table 2.--Continued.

Strain	I	II	III	IV	V	Average lb/A.
	Broadcast lespedeza in 12-inch oat rows (Method C)[14]					
P.C.31249	935	1168	849	569	1298	963
P.C.90553	1583	1429	1208	1486	756	1292
P.C.31856	680	1168	1405	718	1071	1008
P.C.31493	434***	743	566	492	679	582
P.C.31853	582	1263	947	1005	885	936
P.C.31478	926	898	1238	1044	842	989
P.C.31492	776	1423	1298	1165	900	1112
P.C.19601	898	1008	1016	988	1089	999
P.C.31481	533	792	544	572	615	611
P.C.31820	1053	889	1098	1035	1107	1036
P.C.31851	1165	2248	915	1062	775	1233
P.C.19604	517	1436	820	1764	964	1100
					Average	988

[14] A significant difference between methods required 225 pounds at the 5% level and 316 pounds at the 1% level. Significant differences between strain yield was 445 pounds at the 5% level and 588 pounds at the 1% level.

* Significant at the 5% level above the method's average yield.

*** Missing plot data calculated according to Snedecor (10).

Table 3.—Yield of leaves in % for 12 strains of Korean lespedeza grown in 5 replications under 3 methods of establishment at Stillwater, Oklahoma, in 1948.

Strain	I	II	III	IV	V	Average %
			Lespedeza in 3-ft. rows (Method A)/5			
P.C.31249	53.84	54.54	57.14	55.17	49.35	54.00
P.C.90553	56.41	54.25	55.17	53.65	51.25	54.14
P.C.31856	51.76	45.65	51.21	55.29	52.50	51.28
P.C.31493	40.78	47.50	40.24	43.37	46.42	43.66
P.C.31853	52.32	53.01	55.12	47.50	51.89	51.96
P.C.31478	55.81	67.50	58.33	55.81	56.09	58.70*
P.C.31492	65.00	53.48	53.24	58.75	59.75	58.04
P.C.19601	56.09	53.40	55.26	54.21	53.08	54.40
P.C.31461	58.82	62.19	57.31	57.14	55.00	58.09
P.C.31820	57.83	46.51	62.50	56.96	56.09	55.97
P.C.31851	52.87	45.65	42.04	50.63	46.23	47.48
P.C.19604	63.95	53.84	51.72	57.83	59.52	57.37
					Average	53.7

Table 3.--Continued.

Strain	I	II	III	IV	V	Average
			Alternate 6-inch rows of oats and lespedeza (Method B)			
P.C.31249	56.86	56.41	57.60	55.20	57.55	56.72
P.C.90553	56.73	54.70	60.33	53.77	49.27	54.96
P.C.31856	62.62	54.88	55.35	52.00	58.46	56.66
P.C.31493	56.84	47.47	57.32	55.43	52.57	53.96
P.C.31853	54.16	56.25	57.72	55.33	58.51	56.39
P.C.31478	60.83	55.90	68.19	56.43	63.70	61.01*
P.C.31492	51.21	56.55	48.62	54.68	56.48	53.50
P.C.19601	60.00	55.78	56.19	55.04	60.00	57.40
P.C.31481	50.00	60.34	57.65	60.00	60.29	57.65
P.C.31820	54.80	50.47	52.63	57.42	55.46	54.15
P.C.31851	51.81	50.40	48.87	56.41	52.20	51.93
P.C.19604	60.74	54.00	58.26	56.36	61.65	58.20
					Average	56.0

Table 3.--Continued.

Strain	I	II	III	IV	V	Average %
	Broadcast Lespedeza in 12-inch oat rows (Method C)[1/]					
P.C.31249	57.28	58.97	53.84	58.82	53.63	56.50
P.C.90553	56.88	56.19	61.15	56.34	57.98	57.70
P.C.31856	62.61	55.55	60.46	58.40	53.38	58.08
P.C.31493	56.84	54.94	58.65	55.67	58.82	56.98
P.C.31853	59.81	56.03	57.75	63.41	59.83	59.36
P.C.31478	56.86	55.45	62.09	61.73	56.89	58.60
P.C.31492	63.15	54.08	62.72	53.27	63.70	59.38
P.C.19601	60.00	54.45	63.39	63.63	60.00	60.29
P.C.31481	61.22	54.63	59.63	60.46	55.37	58.26
P.C.31820	55.17	63.26	60.90	62.28	59.83	60.28
P.C.31851	52.33	55.08	52.67	59.82	56.55	55.29
P.C.19604	59.13	58.40	62.83	59.25	59.32	59.78
					Average	58.3

[1/] Significant difference between methods was 1.05% at the 5% level and 1.46% at the 1% level. Significant differences between strain yields were 4.41% at the 5% level and 5.81% at the 1% level.

* Significant at the 5% level above the average yield of that method.

Table 4.—Yield of seed (lbs/acre) for twelve strains of Korean lespedeza grown in 5 replications under three methods of establishment at Stillwater, Oklahoma in 1948.

Strain	I	II	III	IV	V	Average lbs./A.
			Lespedeza in 3-ft. rows (Method A)16			
P.C.31249	31	135	59	37	76	67
P.C.90553	108	132	167	161	100	133
P.C.31856	42	18	14	82	6	32
P.C.31493	36	93	109	64	325	125
P.C.31853	2	10	8	8	6	6
P.C.31478	173	246	292	605	220	307**
P.C.31492	496	41	90	18	71	143
P.C.19601	33	51	110	24	33	50
P.C.31481	4	10	6	2	2	4
P.C.31820	9	43	58	23	24	31
P.C.31851	9	41	13	13	17	18
P.C.19604	243	250	342	397	388	324**
					Average	103

Table 4.--Continued.

Strain	I	II	III	IV	V	Average
	Alternate 6-inch rows of Lespedeza (Method B)[16]					
P.C.31249	70	107	17	35	198	85
P.C.90553	154	168	93	91	200	141
P.C.31856	75	63	35	45	67	57
P.C.31493	69	75	21	36	92	58
P.C.31853	89	12	8	25	24	31
P.C.31478	104	248	132	183	342	201*
P.C.31492	218	44	46	40	158	101
P.C.19601	115	127	128	82	81	106
P.C.31481	30	8	42	6	13	19
P.C.31820	32	34	34	40	37	35
P.C.31851	86	23	14	2	13	27
P.C.19604	204	191	255	303	389	268**
					Average	94.5

Table 4.--Continued.

Strain	I	II	III	IV	V	Average
Broadcast lespedeza in 12-inch oat rows (Method C)[16]						
P.C.31249	114	51	247	110	33	111
P.C.90553	25	42	46	50	95	51
P.C.31856	52	36	54	47	111	60
P.C.31493	48	75	31	75	65	58
P.C.31853	15	18	19	69	64	37
P.C.31478	100	152	34	108	99	98
P.C.31492	24	161	59	43	104	78
P.C.19601	40	95	85	106	160	97
P.C.31481	32	37	78	23	47	43
P.C.31820	85	109	65	43	120	84
P.C.31851	18	19	18	9	23	17
P.C.19604	148	44	72	220	67	114
					Average	70.9

[16] Significant difference between methods was 18 pounds at the 5% level and 26 pounds at the 1% level. Significant difference between average strain yields were 83 pounds at the 5% level and 110 pounds at the 1% level.

* Significant at the 5% level above the average of all strains in that method.

** Highly significant at the 1% level above the average of all strains in that method.

Table 5.—Meteorological data at the Oklahoma Agricultural and Mechanical College Experiment Station Agronomy Farm from March until November, 1940.

	Temperature					Precipitation inches				
	Mean	Dept. from Normal	Highest	Date	Lowest	Date	Total	Dept. from Normal	Amt. per day	Date
Mar.	45.3	-4.9	81	20	-5	12	4.15	1.96	1.36	1
Apr.	66.4	6.9	90	6	33	1	2.61	-1.20	2.20	25
May	68.1	0.20	92	22	41	7	2.65	-2.12	1.08	10
June	77.3	0.40	100	19	57	2	7.84	3.75	1.85	23
July	79.9	-1.5	96	28	62	31	4.83	2.15	1.15	8
Aug.	78.7	-2.6	100	21	58	5	3.55	0.32	0.85	8
Sept.	74.3	0.80	99	7	47	27	0.61	-2.91	0.60	24
Oct.	61.0	-0.80	90	14	28	18	0.41	-2.75	0.16	21

Table 6.--Average maximum height, date of first bloom, and date of harvest for 12 strains of Korean lespedeza grown under 3 methods of establishment at Stillwater, Oklahoma in 1948.

Strain	Height (inches)	Date of first Bloom	Date of Harvest
	Lespedeza in 3-foot rows (Method A)		
P.I.31249	11	Aug. 30	Oct. 27
P.I.90553	13	July 20	Sept.19
P.I.31856	11	Aug. 12	Oct. 11
P.I.31493	9	July 19	Sept.20
P.I.31853	15	Aug. 23	Oct. 30
P.I.31478	13	July 21	Sept.24
P.I.31492	13	July 24	Sept.24
P.I.19601	11	Aug. 4	Oct. 11
P.I.31481	9	Aug. 10	Oct. 11
P.I.31820	10	Aug. 10	Oct. 11
P.I.31851	14	July 24	Sept.20
P.I.19604	13	July 13	Sept.20
Average	11	July 26	Oct. 4
	Alternate 6-in. rows lespedeza and oats (Method B)		
P.I.31249	6	Aug. 30	Oct. 20
P.I.90553	6	July 26	Sept.25
P.I.31856	5	Aug. 14	Oct. 8
P.I.31493	3	July 23	Sept.25
P.I.31853	6	Aug. 27	Oct. 20
P.I.31478	4	July 21	Sept.15
P.I.31492	7	July 30	Sept.25
P.I.19601	5	Aug. 15	Oct. 13
P.I.31481	4	Aug. 13	Oct. 13
P.I.31820	5	Aug. 13	Oct. 13
P.I.31851	9	July 25	Sept.25
P.I.19604	7	July 21	Sept.22
Average	5	Aug. 6	Oct. 3
	Broadcast Lespedeza in 12-in. cut rows (Method C)		
P.I.31249	4	Sept.13	Oct. 29
P.I.90553	5	July 26	Oct. 4
P.I.31856	4	Sept. 2	Oct. 15
P.I.31493	2	July 27	Oct. 9
P.I.31853	4	Sept.10	Oct. 29
P.I.31478	3	Aug. 2	Oct. 4
P.I.31492	4	Aug. 4	Oct. 9
P.I.19601	4	Aug. 19	Oct. 15
P.I.31481	2	Sept.18	Oct. 19
P.I.31820	3	Aug. 28	Oct. 19
P.I.31851	6	Aug. 12	Oct. 9
P.I.19604	5	Aug. 2	Oct. 2
Average	3	Aug. 17	Oct. 13

Typist: Mary Wallace Spohn