CULTURAL STUDIES AND STRAIN EVALUATIONS FOR *PISUM* AND *CICER*

by

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CULTURAL STUDIES AND STRAIN EVALUATIONS

FOR PISUM AND CICER

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PART I

INTRODUCTION

The importance of chickpeas and field peas in the economy of the world is well recognized by their wide distribution, high production, and varied utilization.

The field pea crop is believed to be one of the oldest cultivated crops. It is native to western Asis from the Mediterranean sea to the Himalaya mountains. It was brought to the United States by colonists from England at an early date. It is presently grown for forage and seed in the north and for cover crop, green manure and pasture in Southeastern United States and in the Pacific Northwest. The acreage planted in peas in the United States was 318,000 acres in 1959 and approximately 300,000 acres were harvested. This was 28% above the 228,000 acres planted in 1958 and slightly higher than the 10 year average.

In India, chickpea and field pea seed are used as feed for poultry, cattle and human consumption. Chickpea is an important pulse crop in India. This crop ranks fourth in acreage and production among the food grains of India. It supplies high quality protein to the diets of both people and cattle.

The primary objectives of these investigations were to determine the effect of planting date, row width and rate of planting on the seed and forage yield of two varieties of field peas and the effect of date and rate of planting on the growth of one chickpea strain. Several plant introductions of field peas and chickpeas were planted at two dates for observation.

PART II

REVIEW OF LITERATURE

Pisum

Gross (11) studied the effect of planting date and seeding rate on the total seed yield of the field peas. The planting dates were mid-May, mid-June and mid-July at 60, 90, 120 and 150 pounds per acre. Mid-May gave the highest seed yields and mid-July the lowest. He found that the 90 pound seeding rate was optimum for early planting, 120 pounds per acre for mid-season and up to 150 pounds for the late planting.

Fuchs (10) reported that thirty-eight strains of peas were planted at 11 different intervals between April 9 and July 17 to study the influence of planting date on plant development. He found that the shortest time from planting to first bloom was obtained on that date which was under the influences of the longest day length. In this study plant growth was influenced by weather conditions but the data indicated that plant height was less as the plant date was delayed.

Bailey et al. (1) drilled and broadcasted Austrian Winter field peas on four dates and at three rates. The plantings were made in drill rows 12 inches apart and broadcast on September 30, October 26, November 23 and December 19. The seeds were planted at 30, 45, and 60 pounds per acre. An increase

of about 10 percent in dry matter was obtained from the drilled planting for September and October than for the November and December plantings. The 60 pounds per acre rate produced more than the 30 and 45 pound rates.

Boswell (2) studied the effect of the planting date on the yield of garden peas. The plantings were made at approximately seven day intervals starting on March 29 and were continued for seven successive plantings. The results indicated that there was a decrease in the number of days between planting and harvesting in progressive order. As the season shortened the yields decreased. The planting made on April 3 gave the highest yield.

Dodd (5) obtained the highest yields of threshed peas from early plantings and narrow rows.

Delwiche et al. (7) studied the planting date and rate of Alaska and Late Sweet canning peas. Early seeding and heavy rates, 180-240 pounds per acre, gave the highest seed yield. Other seeding rate trials were made on Alaska peas seeded at the rates of 179, 219 and 274 pounds per acre. The 219 pounds per acre rate gave the highest seed yield.

Delwiche (6) and Vinall (38) studied the date and rate of planting peas. They found that peas were successfully grown when planted from March 31 to May 21. They reported that small-seeded varieties produced highest yields at 90 to 120 pounds per acre, medium-sized peas at 105-150 pounds and large-seeded varieties at 150-210 pounds per acre.

DeVcic and Popovich (8) studied row spacing and rate using the Alaska variety to determine effect on yield. The plantings were made approximately 6, 8 and 12 inches between rows and approximately 1.6, 2.4 and 3.2 inches between plants. They reported a positive correlation between density of planting and yield. The 6 x 24 inch spacing gave significantly higher seed yields than other combinations. Fewer weeds were found at the close spacing than at wider spacings.

Evans (9) reported that 90 to 100 pounds per acre of large-seeded varieties yielded as high as heavier rates and 75 to 90 pounds per acre of the small-seeded varieties produced the highest yield of forage and seed. At low seeding rates the stands were thin and wild oats and other weeds were a serious problem. On the other hand, when the seeding rate was too high, low yields resulted. The April planting gave higher yields than later plantings because hot weather reduced the yields of the late plantings. Hulbert and Burkhart (15) studied the rate of planting on market peas and found that four to five plants per square foot gave maximum yields.

The effect of planting date and rate on yield was studied by Hulbert (14). Blue Prussian field pea was planted at three different dates and five rates. The planting dates were made early followed by plantings at two week intervals. Rates included 60, 75, 90, 105 and 120 pounds per acre. He reported that early seeding at the rate of 90 pounds per acre

produced the highest yield. In another series of experiments with three dates of planting, Hulbert (14) found no difference in the total yield for the early and medium-early plantings. However, the late planting reduced the yield. He studied row width of early seeded peas in 18 and 24-inch single rows, 18 and 30-inch double rows and drilled. There was little difference between the row and drilled treatments. The 18-inch single row and 30-inch double rows produced higher yields than the other treatments.

Hyslop (16) reported a very rapid decline in vigor and yield as planting was delayed from medium to late spring. Koonce (18) studied large-seeded field peas at 80 and 120 pounds per acre and small-seeded varieties at 50 and 90 pounds per acre in rows spaced 8, 18 and 36 inches apart. The 8 and 18-inch spacings gave about the same yield regardless of the variety used. The 36-inch spacing gave the lowest yield. The difference in yields from the two rates was not significant.

Kreutz and Schelhorn (19) determined the optimum sowing time of certain strains for field peas. The plantings were made at different times in the autumn and spring. The autumn plantings from the middle of September to early October were the best. The yields of green forage and seeds depended on the success of overwintering. The different autumn plantings began to flower in the spring about the same time and had a more abundant production of flowers than spring plantings.

Larson (20) studied the effect of spacings on the total yield of market peas. Four dwarf and two medium tall varieties were planted with 1/2, 1, 2, 4, and 8-inches between plants in three row plots spaced three feet apart. The one inch spacing gave the highest yield. For dwarf varieties, two inches between plants could be used without reducing seed yields. Decreasing the spacing to one-half inch between plants gave no additional increase in yields.

Row spacings of 8, 16, and 24 inches were studied in all combinations with spacings of 1, 2 and 3 inches within the rows by Reynolds (31). Wider rows and wider spacing within rows gave more pods per plant and the weight of peas per plant was increased considerably with wider spacing between rows; however, the 8-inch spacing produced higher yields than the other two spacings.

Riepma (26) studied the effect of spacing and seeding rate on the yield of peas. There was little difference in seed yields in row spaced approximately 6, 10 and 13 inches apart. However, yields decreased at row spacings of 16 and 20 inches. The optimum rate was 196 and 250 pounds per acre on river clay soils and 143 to 196 pounds per acre on sandy soils.

Riepma (29) reported that 40 to 70 plants per square yard were sufficient for producing dry peas. The rate of 100 plants per square yard was more suitable for the dwarf, non-branching early varieties. The number of pods set and the weight of 100 seeds were greatest at low plant densities

and slightly higher on clay than on sandy soils. Riepma (27) reported on a row width study with canning peas on a clay soil. He found a decrease in yield for a 20-inch row width but planting rate influenced yields more than drill width. Maximum yields were obtained with 55 to 105 plants per square yard depending on the size of seed. The number of pods per plant and seed per pod decreased as the planting rate increased.

Riepma (28) indicated that the spring plantings started blooming slightly later than early plantings. The late sowing tillered less and the number of pods per plant, number of seed per pod and the weight of 1000 seeds were also less.

Date, rate and row width studies for field peas were conducted by Robb (30). From three spring plantings at 10-day intervals the early seeding produced higher forage and seed yields than the medium and late plantings. Small-seeded varieties planted at 60 to 80 pounds per acre and medium-sized varieties at 85 to 90 pounds per acre were sufficient for profitable production. Drilling was found to be superior to broadcasting. A row spacing of 14 to 21 inches gave the highest seed and forage yields. October plantings of Austrian Winter field peas were reported the most successful in western Oregon by Scoth. This date produced good stands that became established before unfavorable growing weather occurred. However, fall seeding in eastern Oregon was not recommended. Spring seedings were more susceptible to aphid damage than fall seedings. In the

Willamette Valley seeding in February or early March gave satisfactory stands and yields with ample moisture. The 90 pounds per acre seeding rate gave maximum yields.

Vittum et al. (38) found that mid-April plantings produced higher yields than May plantings. They planted in rows 7 and 14 inches apart at 216.6, 150.6, 144.6 and 108.6 pounds per acre. They found that a 7-inch row width sown at the rate of 216.6 pounds per acre resulted in the highest seed yield. Three hundred pounds per acre of canning pea seed produced the highest yield except for an early planting of the Horseford variety according to Sayre (32). However, for the latter, 240 pounds per acre gave highest yields.

Hoare (13) reported that March and April planting produced the higher seed yields than those drilled in May and June because late plantings were usually damaged by insects and diseases. Market peas at the rate of 150 pounds per acre in rows 15 inches apart produced desirable plants. Lower seeding rates were required with spacing over 15 inches between rows.

Jones (17) studied the effect of date of planting for varieties of three maturity groups on yield. The plantings were made at 10-day intervals from April 20 to June 8. Mean seed yields for the early, medium and late maturing varieties of canning peas were highest for plantings made May 18, April 28 and May 8, respectively.

Oats and Austrian Winter field peas grown in combination produced 25 percent less dry matter per acre than when peas

were grown alone according to Sturkie (35). The Austrian Winter field peas produced approximately 3.5 times more dry matter per acre than oats. Thatcher (36) found that oats in combination with peas produced hay with a higher protein content than oats alone while the hay yields remained constant.

Chickpea (*Cicer arietinum*)

Guzovskii (12) reported the results of the experimental trial in which the plantings were made in drill rows about 6 and 18 inches apart. The 6-inch spacing gave a higher seed yield than 18 inch spacing.

Padwick (21) observed that the incidence of fusarium wilt was correlated with high temperature during germination and early growth of chickpea. Late plantings accompanied by a fall in temperature reduced the incidence of wilt.

Parr (23) observed that optimum time for planting chickpea appeared to be the second or third week of October. Chickpeas planted at seven day intervals from September 23 through October 28 was studied by Padwick and Bhagawager (22). When planting was delayed until mid-October or later, the incidence of gram wilt was reduced but yield increased until the middle of October, after which there was a decline in yield except in 1938-39 when plantings after October 14 resulted in increased yields.

Broadcast rates at 40 and 80 pounds per acre and in rows 12 and 18 inches apart on lateritic sandy loam soil were studied by Sen and Java (34). The rows were thinned to 18 x

12, 18 x 9, 12 x 12, and 12 x 9 inches between plants. They reported that plantings in rows gave more seed per acre than broadcasting at 40 pounds per acre. The spacings of 12 x 12 and 18 x 9 inches also gave significantly higher yields than broadcasting with 80 pounds per acre. Among the row spacing treatments the 12 x 12 inches between plants gave the highest yield and 18 x 12 inches gave the lowest per acre yield.

In east Africa the chickpea is usually planted on black cotton soils in May according to Clegg (4). He reported that chickpea grows well when planted late under Lake Province conditions because yield is not reduced by drought.

According to Piper (24) chickpeas are grown in the winter in India, Spain, Mexico and California. The crop was not injured by a temperature of 13° F. in California. Spring plantings are best in Idaho, Washington, Colorado, Iowa and Ontario. At the Ontario Agricultural College, chickpeas produced about 2136 pounds per acre of seed and one ton per acre of straw.

Chaugule et al. (3) planted chickpea on September 23, in 18-inch rows at a rate of 50 pounds per acre after the harvest of a maize crop. The average maximum and minimum temperatures were 86° F. and 56° F., respectively. The crop was free from insects and diseases. The yield of green seed was 2744 pounds per acre.

Raheja and Das (25) studied the dates, depths and row widths for chickpea. The planting dates were October 27, November 10 and November 24 at depths of 2.5 and 5.0 inches

and the spacings between rows of 10, 15 and 20 inches. Emergence of the plants was delayed but the stands were improved on the late plantings. In early planting, both the cumulative growth, length and initial rapidity of growth were greater. Differences in plant heights were small amongst the three spacings. With increase in row width, the flower production per plant was greater. Deep planted seeds had a significantly higher emergence than shallow planted seed. Flower production was greater from shallow than deep planted seed. A high yield was obtained for the November 24 planting but mean yields for the three dates were not significant. The temperature was lower after the November 24 planting and germination improved the 10-inch spacing between rows gave highest number of plants per plot.

PART III

MATERIALS AND METHODS

This study was conducted on a Kirkland silt loam soil at the Agronomy Research Station near Stillwater, Oklahoma, during 1959 and 1960.

Two varieties of field peas (Austrian Winter and Romac) were seeded in November and March at the rates of 3 and 6 seed per foot and row widths of 10 and 20 inches. Four row plots 10 feet long were used. One strain of chickpeas (Cp 42) was also planted in single row plots 10 feet long in both November and March in rows 20 inches apart at 3 and 6 seed per foot. The treatments for the Pisum and Cicer cultural study are shown in Table I. The Pisum and Cicer observation study was planted in single rows four feet long. Eight strains of field peas and 19 chickpea accessions were planted in November. Eight strains of field peas and 15 chickpea accessions were planted in March. Two seeds per foot was used for chickpea accessions and four seed per foot for field pea strains for both dates of planting.

A randomized block design with four replications was used for the Austrian Winter field pea at both planting dates and for the chickpea in the November planting. Only three replications were used for the Romac field pea and for the chickpea in March planting because of limited seed supply.

TABLE I

THE TREATMENTS USED FOR THE FIELD PEA AND CHICKPEA CULTURAL STUDY CONDUCTED ON THE AGRONOMY RESEARCH STATION NEAR STILLWATER, 1959-1960

Treatment No.	Strain	Row Spacing (ins.)	Rate (Seed per foot)	Month Planted
1	Romac	10	3	November
2	Romac	10	6	November
3	Romac	20	3	November
4	Romac	20	6	November
5	Romac	10	6	March
6	Romac	20	6	March
7	A.W.F.P.	10	3	November
8	A.W.F.P.	10	6	November
9	A.W.F.P.	20	3	November
10	A.W.F.P.	20	6	November
11	A.W.F.P.	10	3	March
12	A.W.F.P.	10	6	March
13	A.W.F.P.	20	3	March
14	A.W.F.P.	20	6	March
1	Chickpea Cp-42	20	3	November
2	Chickpea Cp-42	20	6	November
3	Chickpea Cp-42	20	3	March
4	Chickpea Cp-42	20	6	March

The observation tests were replicated twice at both dates of planting. A four foot alley was left between each range. The experiment was planted November 24 and 25, 1959, and March 25 and 26, 1960, with a V-belt nursery planter.

The November planted experiment was fertilized on February 12, with 10-20-0 fertilizer in bands along side the row at the rate of 200 pounds per acre. The March planting area was fertilized by broadcasting and disking in 10-20-0 fertilizer at the rate of 250 pounds per acre on February 25, 1960.

The experiment was sprayed on May 14, 1960, for pea aphid control with Malathon at a rate of one teaspoonful per gallon of water. Only slight injury had occurred before the application was made.

When the plants in the field pea plots reached the full bloom stage, eight feet from the center portion of two rows in each treatment were harvested for forage. The forage was harvested on June 10, 1960. Samples were weighed and a small sample of the green forage was obtained, weighed and oven-dried at a temperature of 140° F. in a forced draft oven. The dry weights were determined after 48 hours. The percentage of dry matter for each field pea plot was calculated. The samples were ground with a Wiley Mill and a portion of the mixed forage from each plot was used for determining the nitrogen content.

The field pea plots were harvested for seed yield on June 27, 1960. The plots were cut and placed in mesh bags

until dry and then were threshed with a nursery thresher. The chickpea and observation plots that survived were harvested for seed yields on June 14 and June 27, 1960, and threshed with a nursery thresher.

Observation notes were recorded throughout the growing season for each treatment. Data obtained include:

1. Emergence counts--Number of plants emerged, counted at intervals during early growth.
2. Plant height--Distance in inches from the ground level to the top of the plant when in full bloom.
3. Branching--Number of branches produced at the time of forage harvest.
4. Days to first bloom--Number of days from planting to the first bloom date.
5. Days to pod--Number of days from date of blooming to the date of the first pod.
6. Maturity date--Number of days from planting to the date harvested for seed.
7. Protein content--Percentage of protein contained in each treatment. Samples analyzed by Kjeldahl procedure for nitrogen and results multiplied by a constant factor of 6.25.

PART IV

RESULTS AND DISCUSSION

Rainfall and Temperature

The daily precipitation and daily maximum and minimum temperatures taken three miles north of Stillwater are shown in Tables II and III. Precipitation was a limiting factor during germination and early growth of the November tests. The soil was moist at the time of both the November and March plantings. However, 28 days were required for complete emergence for the November plantings compared with seven days for the March planting. Plant emergence for comparable treatments was 7 to 24 percent more for the field peas for the March planting than for the November planting. However, 13 to 17 percent more plants emerged from the November chickpea planting than from the March planting. The monthly precipitation was 0.40, 2.56, 0.91, 2.02, 0.72, 1.86 and 5.43 inches, respectively, for November, December, January, February, March, April and May.

The November planting was exposed to 75 days where the minimum temperature was below 32° F. between November 25 and March 31. During this period there were only seven days when the maximum temperature was above 70° F. The lowest minimum temperatures during the study occurred March 3, 4,

TABLE II

DAILY PRECIPITATION AT STILLWATER, OKLAHOMA
FROM NOVEMBER 1, 1959 TO MAY 31, 1960

Days	November	December	January	February	March	April	May
1			0.02	T		0.47	
2			T		0.28		
3				0.09	T		
4	0.30			0.97			0.40
5	T	T	T	0.16			0.08
6			0.11				1.22
7					T		
8					T	0.06	
9					0.02	0.01	
10				T	T		
11		0.10			0.02		
12			0.12				
13							
14			0.47		T	0.38	
15		T		0.20	0.15		
16		0.40			0.08	0.27	
17	T	0.20	0.14			0.21	
18		1.51	0.05		T		0.80
19					T		0.28
20				T			0.75
21				0.21			
22							
23		0.08		0.15			
24							
25				T	0.02		0.83
26							
27	0.10	0.27		T			
28				0.24		0.28	0.16
29						0.18	0.91
30					0.15		
31							
Totals	0.40	2.56	0.91	2.02	0.72	1.86	5.43

TABLE III

DAILY MAXIMUM AND MINIMUM TEMPERATURES AT STILLWATER LOCATION FROM NOVEMBER 1, 1959 TO MAY 31, 1960

Day	Nov.		Dec.		Jan.		Feb.		Mar.		Apr.		May	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	74	45	59	37	44	36	61	38	29	18	80	45	69	39
2	75	44	55	25	44	31	66	31	27	20	59	36	73	39
3	75	63	70	28	36	18	60	42	27	2	66	35	78	48
4	72	50	61	42	38	25	47	37	21	9	66	40	74	59
5	69	28	47	28	39	26	45	33	21	6	70	35	81	53
6	38	17	60	20	38	17	57	23	35	19	89	50	61	50
7	58	23	70	24	38	18	54	30	36	30	84	45	65	41
8	61	26	64	32	51	23	64	38	35	32	70	48	73	39
9	69	33	60	26	65	37	77	40	55	32	69	36	75	50
10	68	42	58	31	60	39	67	26	51	34	79	41	73	51
11	61	42	59	37	67	37	39	20	45	26	80	62	71	51
12	67	47	62	25	69	60	37	18	48	19	75	61	72	38
13	60	30	64	27	64	39	37	15	54	35	71	62	77	41
14	31	10	58	43	57	44	40	19	47	36	75	56	75	59
15	45	14	52	43	44	29	37	29	39	32	85	59	77	60
16	42	23	54	45	35	23	57	19	38	26	82	65	88	64
17	35	8	54	47	33	29	49	29	42	23	80	42	85	59
18	52	18	48	32	30	18	42	24	57	19	70	33	83	60
19	62	29	52	24	28	13	53	23	54	32	79	44	87	59
20	58	41	55	28	40	14	50	34	61	23	76	64	69	53
21	67	25	55	24	41	15	43	19	62	25	85	42	82	53
22	60	41	56	40	35	14	56	22	61	37	82	64	87	52
23	64	27	48	35	30	16	53	21	68	25	79	65	85	60
24	59	35	49	33	49	17	21	13	66	32	83	66	85	65
25	68	31	56	48	55	22	27	10	57	29	84	60	85	61
26	68	27	64	53	62	39	28	13	66	33	77	44	82	57
27	41	16	61	36	62	32	27	21	75	45	75	51	89	56
28	37	22	45	33	39	23	28	10	82	51	77	49	85	61
29	47	15	45	31	47	30	22	12	75	49	77	61	81	60
30	60	20	49	22	57	17			67	44	71	40	77	52
31			45	27	57	30			84	41			83	57
Average	58.1	29.7	56.0	33.1	46.9	26.8	46.3	24.4	51.1	28.5	76.5	50.0	78.3	53.1

and 5 for which 2, 9 and 6° F., respectively, were recorded. The minimum temperature recorded during the study indicate that there was ample opportunity to study the survival of certain field peas and chickpea strains. No winter killing was noted in the field pea cultural study.

Row Width, Variety, Date and Rate for Field Peas

The yields for dry forage and protein in pounds per acre by row spacings are shown graphically in Figure 1 and for seed yields in Figure 2. A summary of the data obtained for the field pea cultural study are presented in Table IV.

The plots with 10-inch row spacings produced 36, 49 and 44 percent, respectively, more pounds per acre of dry forage, protein and seed than the 20-inch spacing. The mean number of branches and the number of days to first bloom, from bloom to pod formation and planting to maturity did not appear to be influenced by row spacing.

Photographs showing Austrian Winter field pea plots in 10 and 20-inch rows for the November and March plantings are shown in Figures 3 and 4. Photographs showing Romac in 10 and 20-inch rows for both the November and March plantings are shown in Figure 5 and 6.

The yields for the forage and protein grouped by planting dates are presented graphically in Figure 7 and for seed yields in Figure 8. The pounds per acre of dry forage, protein and seed were, respectively, 40, 40 and 48 percent higher for the November than the March planting. Plant

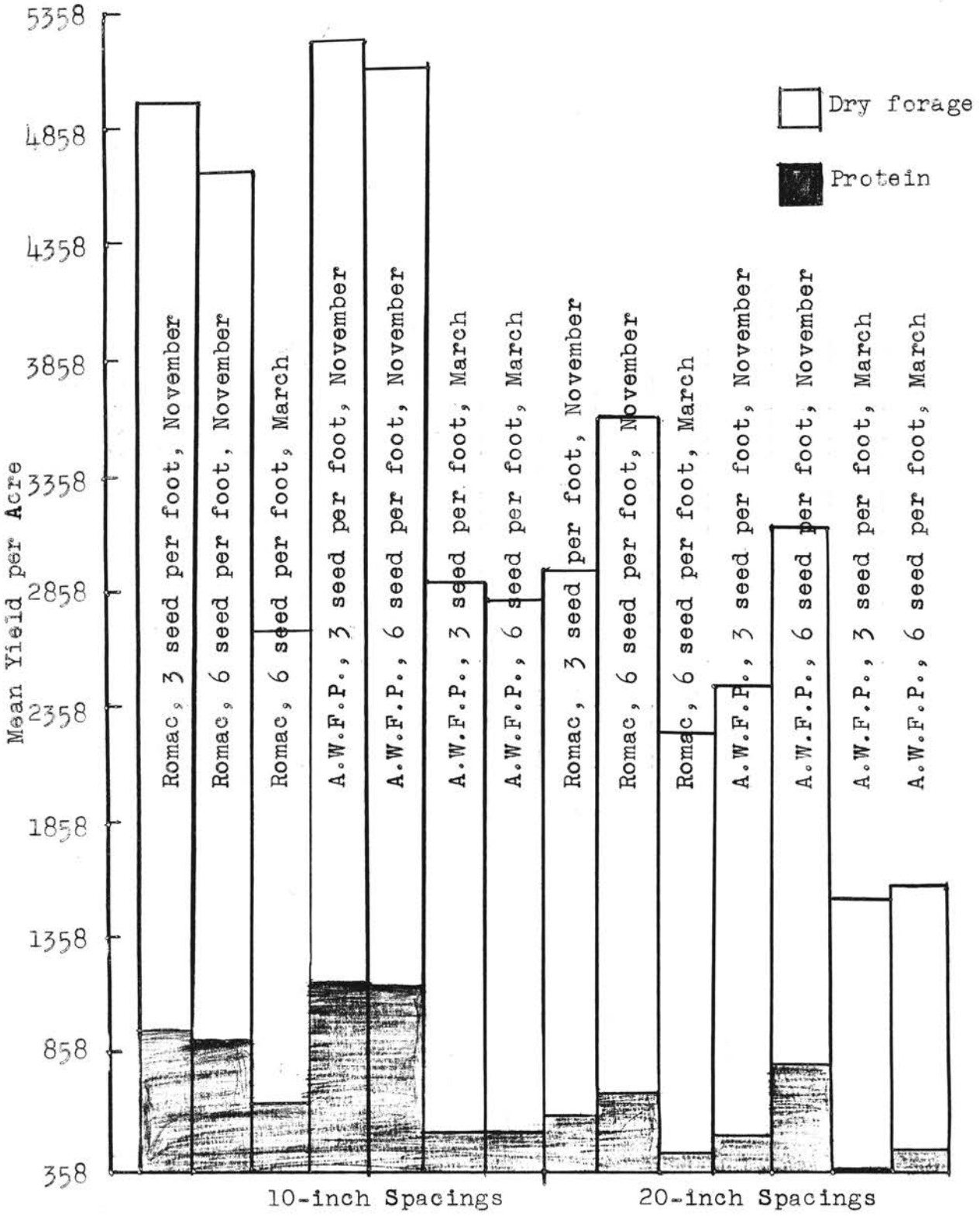

Figure 1. Graphic presentation of the forage and protein in pounds per acre grouped for comparing the 10 and 20-inch row spacings.

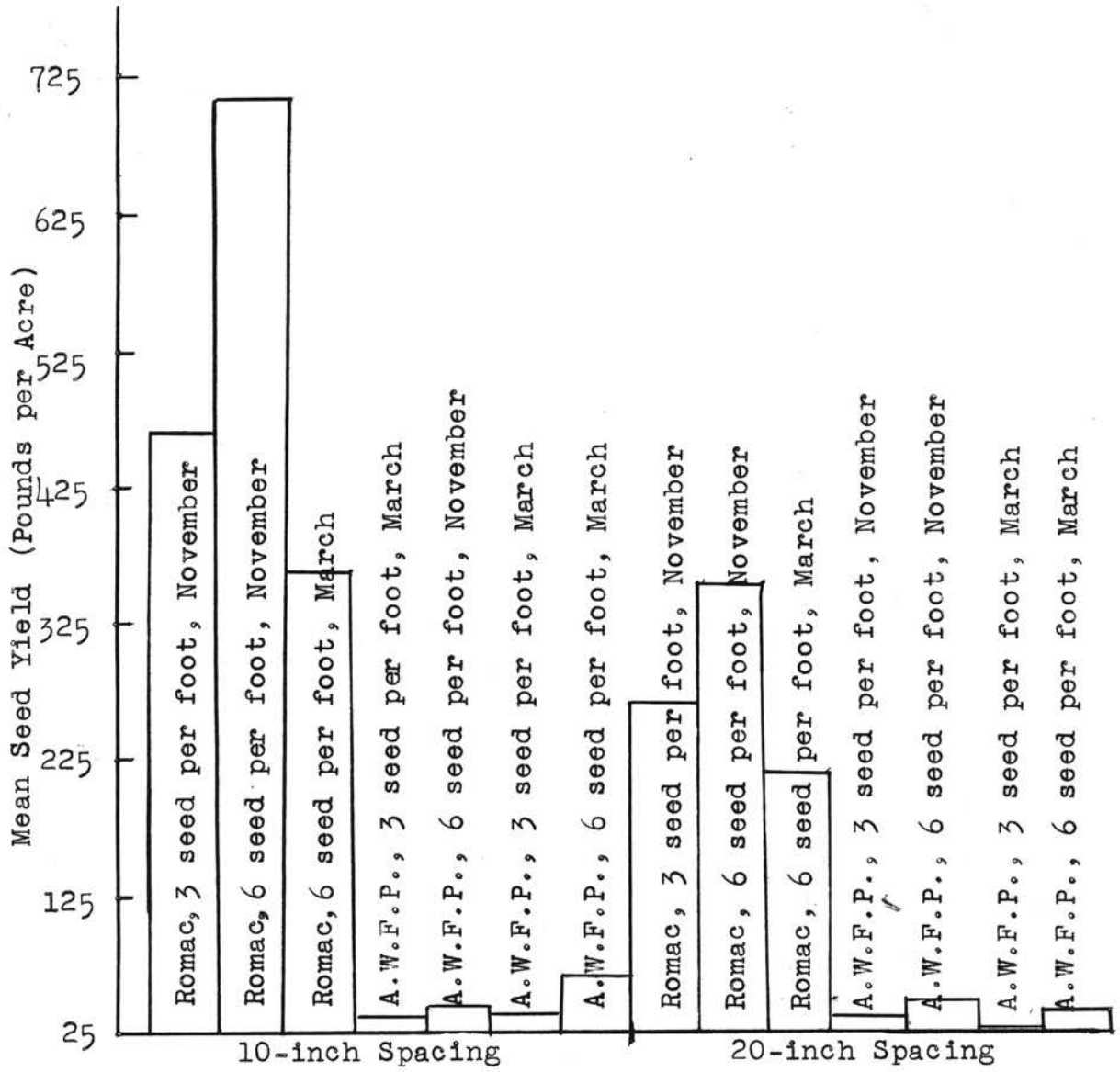

Figure 2. Graphic presentation for pounds of seed per acre grouped for comparing 10 and 20-inch row spacings.

TABLE IV

SUMMARY OF DATA OBTAINED IN THE FIELD PEA CULTURAL STUDY CONDUCTED ON THE STILLWATER AGRONOMY RESEARCH STATION, 1959-1960

Date, Variety Rate and Row Width	Mean No. of Plants emerged per 10' row			Ht. (ins.)	Mean No. of Branches per Plant	Number Days to:			Percentage		Mean Yield (lbs. per Acre)		
						Date of Bloom	Pod-ding	Matu-rity	Dry Mat-ter	Pro-tein	Forage Dry Mat-ter	Forage Pro-tein	Seed
	12/23	12/31	1/20										
NOVEMBER PLANTING													
Romac													
3 seed/foot													
10" row width	9	15	27	34	3.8	167	10	215	35.0	21.1	5051	1049	440
20" row width	8	14	26	36	3.3	167	7	215	33.9	21.8	3032	652	265
6 seed/foot													
10" row width	14	24	50	38	3.3	167	7	215	34.9	20.8	4723	984	714
20" row width	16	24	45	41	3.3	171	6	215	33.0	21.3	3684	782	358
A.W.F.P.													
3 seed/foot													
10" row width	7	13	26	39	3.3	177	13	215	33.0	22.7	5314	1246	42
20" row width	8	15	27	40	3.3	177	13	215	35.2	22.3	2511	554	40
6 seed/foot													
10" row width	10	25	47	41	3.3	182	13	215	34.2	22.2	2182	1180	44
20" row width	11	22	47	44	3.3	177	13	215	33.0	22.8	3195	717	53
MARCH PLANTING													
Romac	4/2	4/5	4/8										
6 seed/foot													
10" row width	4	12	54	25	3.0	64	8	94	33.2	20.8	2755	721	359
20" row width	8	33	59	27	3.0	64	8	94	34.0	20.7	2315	489	220
A.W.F.P.													
3 seed/foot													
10" row width	1	12	29	32	3.5	70	5	94	34.5	21.4	2952	590	35
20" row width	11	17	29	39	3.3	70	7	94	35.2	22.1	1663	358	25
6 seed/foot													
10" row width	16	43	59	35	3.3	70	7	94	33.5	22.0	2887	590	69
20" row width	19	44	59	36	3.3	70	7	94	33.3	22.1	2184	489	46

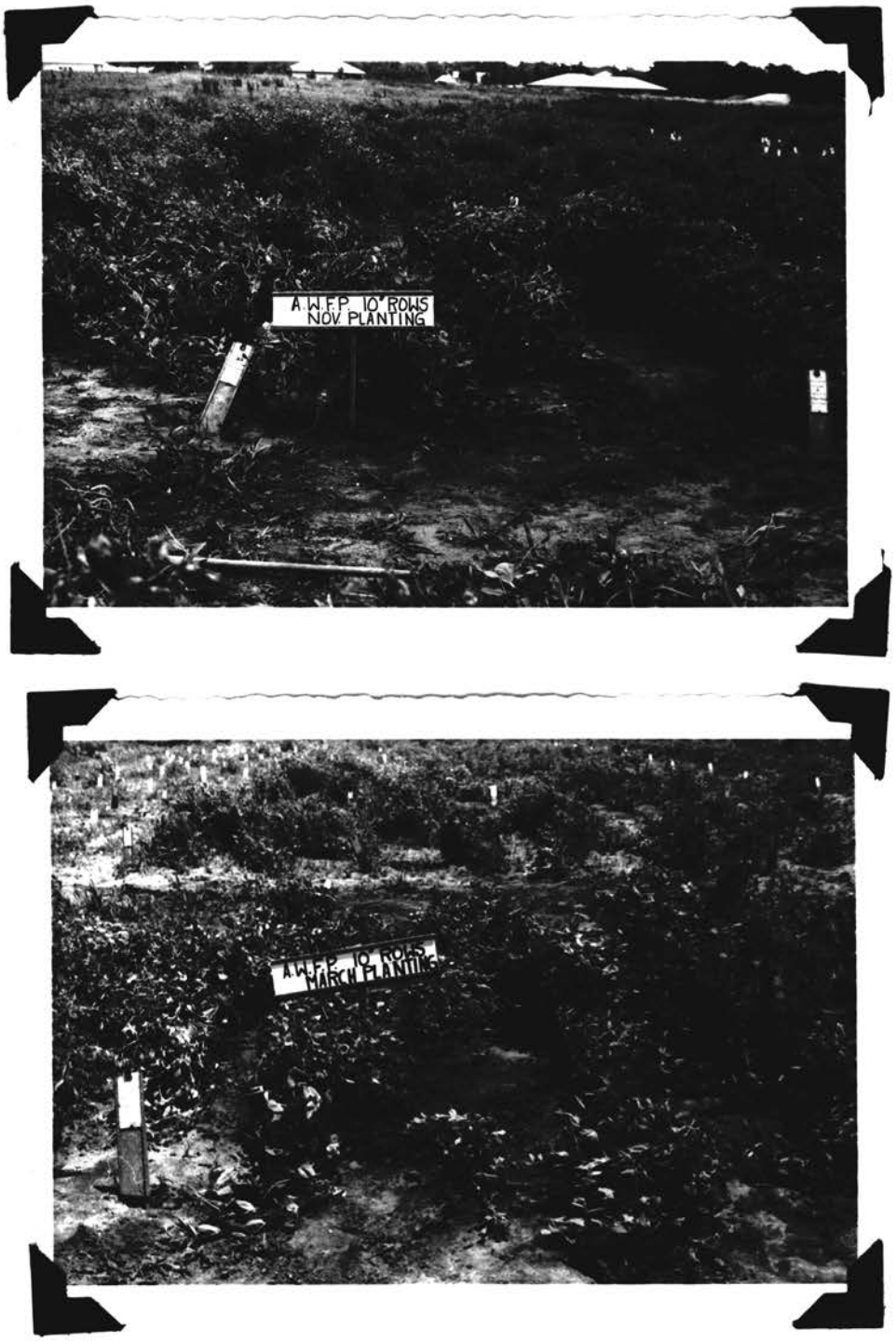

Figure 3: Photographs taken on June 5, 1960, showing Austrian Winter field peas planted in rows 10 inches apart on November 24, 1959 (upper) and March 25, 1960 (lower).

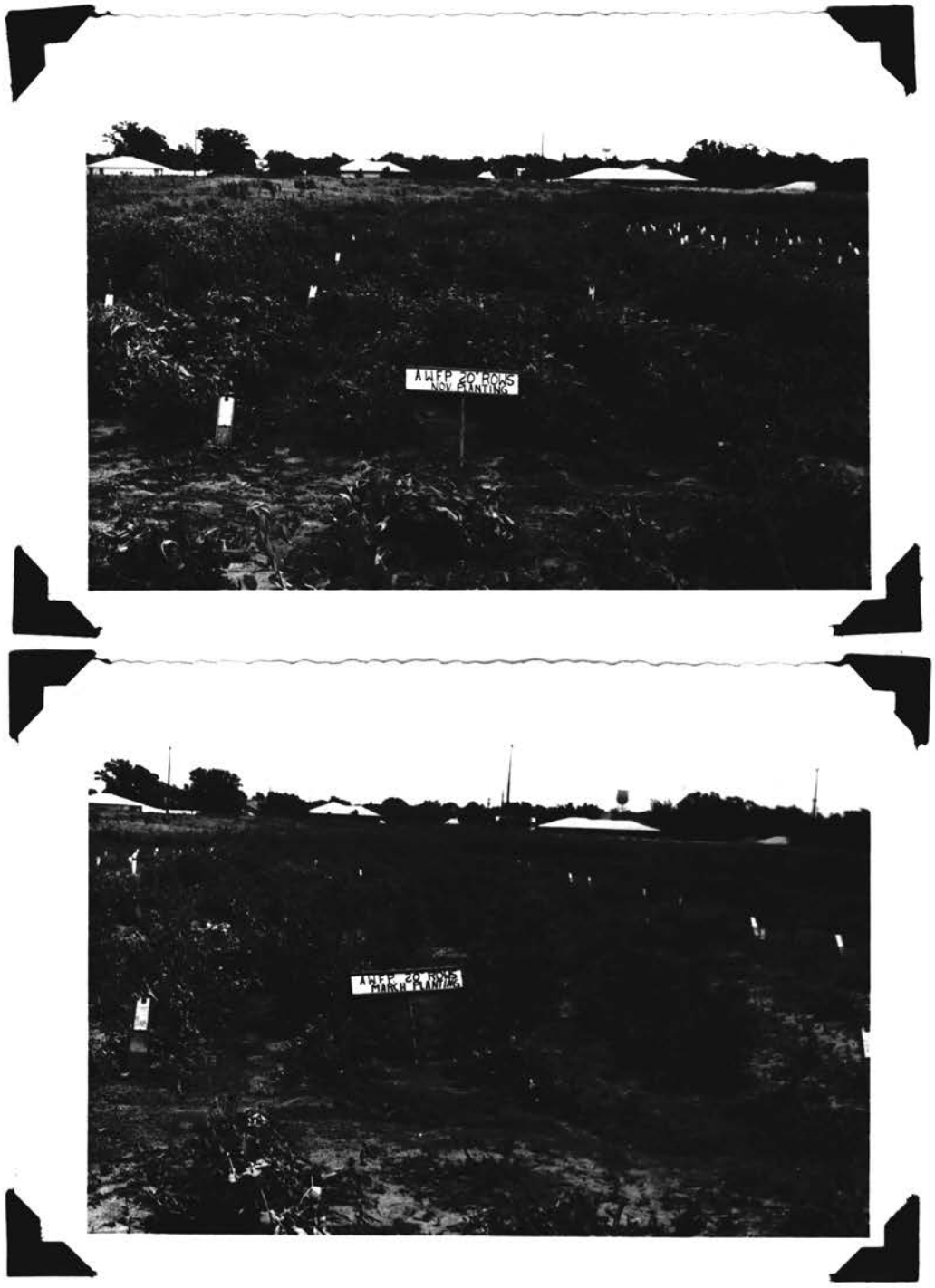

Figure 4: Photographs taken on June 5, 1960 showing the growth of Austrian Winter field peas planted in rows 20 inches apart on November 24, 1959 (upper) and on March 25, 1960 (lower).

Figure 5: Photographs taken on June 5, 1960 showing Romac field peas in rows spaced 10 inches apart and planted on November 24, 1959 (upper) and March 25, 1960 (lower).

Figure 6: Photographs taken on June 5, 1960 showing the growth of Romac field peas planted in rows 20 inches apart on November 24, 1959 (upper) and March 25, 1960 (lower).

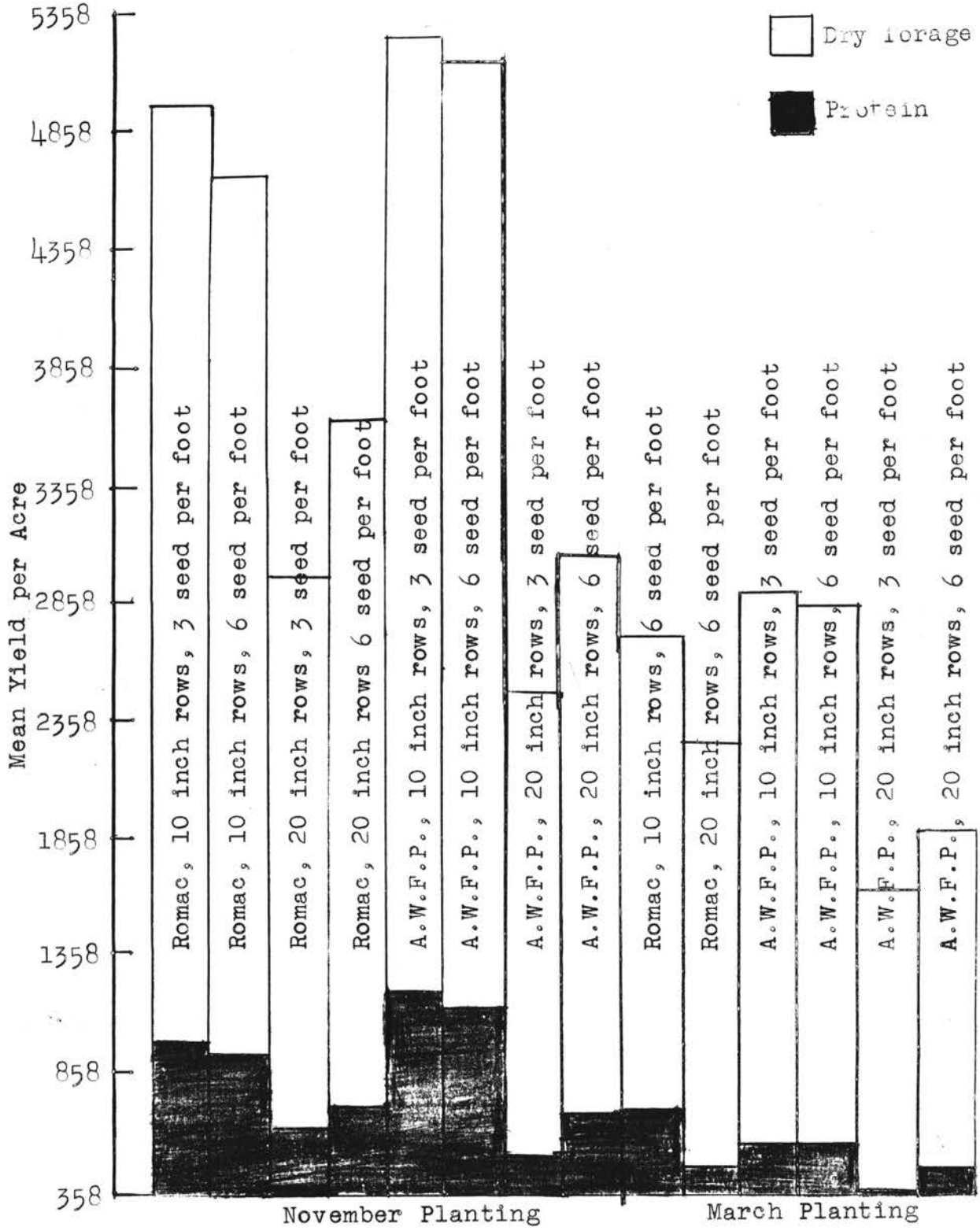

Figure 7. Graphic presentation of pounds per acre of forage and protein grouped for comparing the November and March planting.

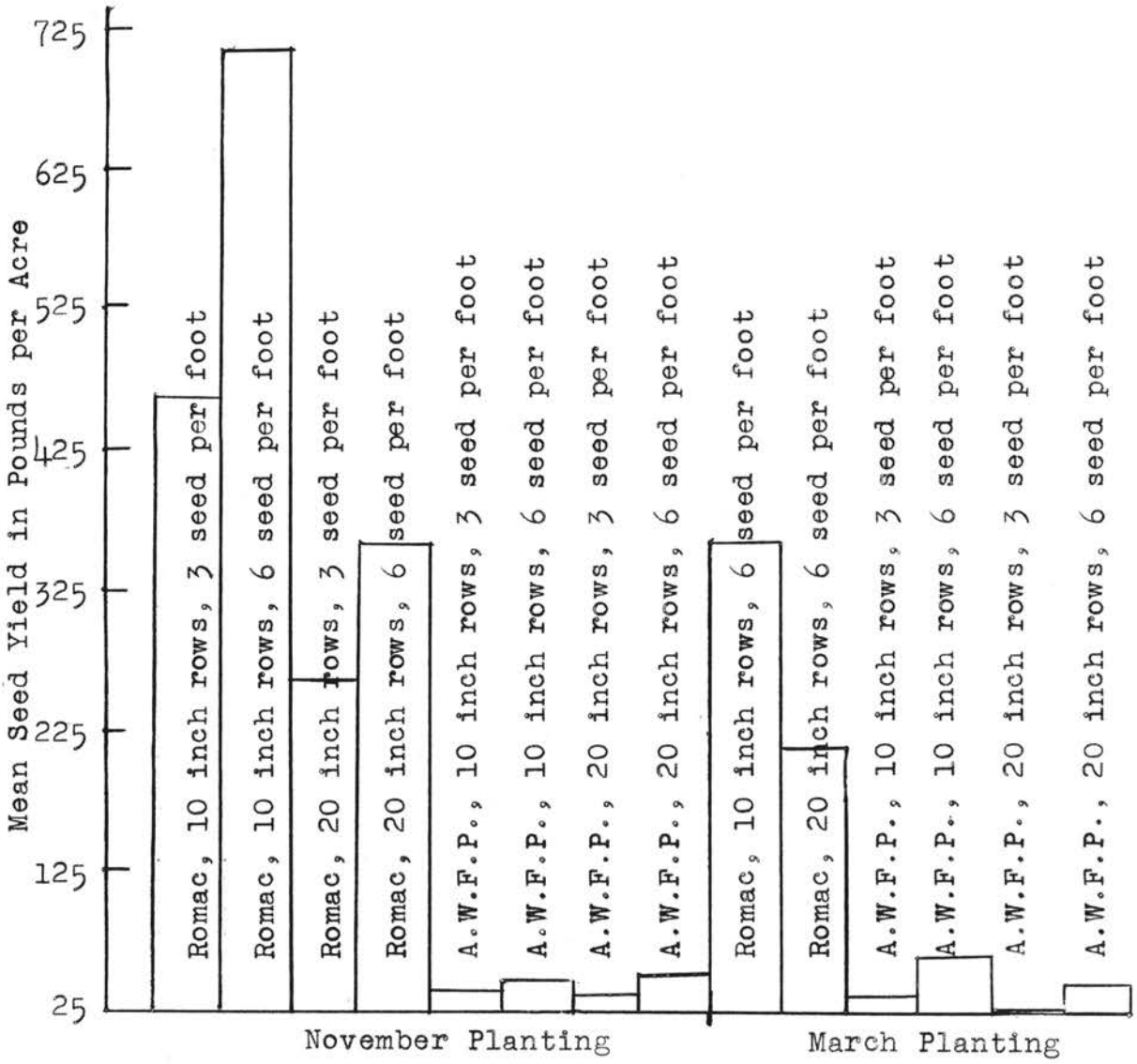

Figure 8. Graphic presentation for pounds per acre of seed grouped for comparing November and March plantings.

emergence was quicker and more abundant for the March planting which averaged 4.8 plants per foot compared with 3.7 plants per foot for the November planting. The plants averaged approximately seven inches taller in the November than for the March planting. The number of branches at the time the forage was harvested averaged 3.36 for the November treatments compared with 3.23 for the March treatments. The number of days from planting to first bloom averaged 173 for November and 70 for the March plantings. It required an average of 215 days from planting to maturity for the November planted plots, and 94 days for the March planted plots.

The dry forage and protein yields for Romac and Austrian Winter field pea are presented graphically in Figure 9 and seed yield in Figure 10. The Romac variety produced 10 percent more forage, 8 percent more protein and 88 percent more seed per acre than the Austrian Winter field peas. No variety differences were apparent for the mean number of plants that emerged, maturity and percentage of dry matter. The Austrian Winter field peas averaged approximately five inches taller and one percent more protein than Romac.

Plant counts indicated that the mean number of plants in a 10 foot row was 30 plants for the 3 seed per foot rate and 52 plants for the 6 seed per foot rate (Table IV). Plant spacing within the row had very little influence on plant height, number of branches per plant, date of blooming, and yield of dry forage and protein in this study. The seed yields for the 6 seed per foot rate was 39 percent higher

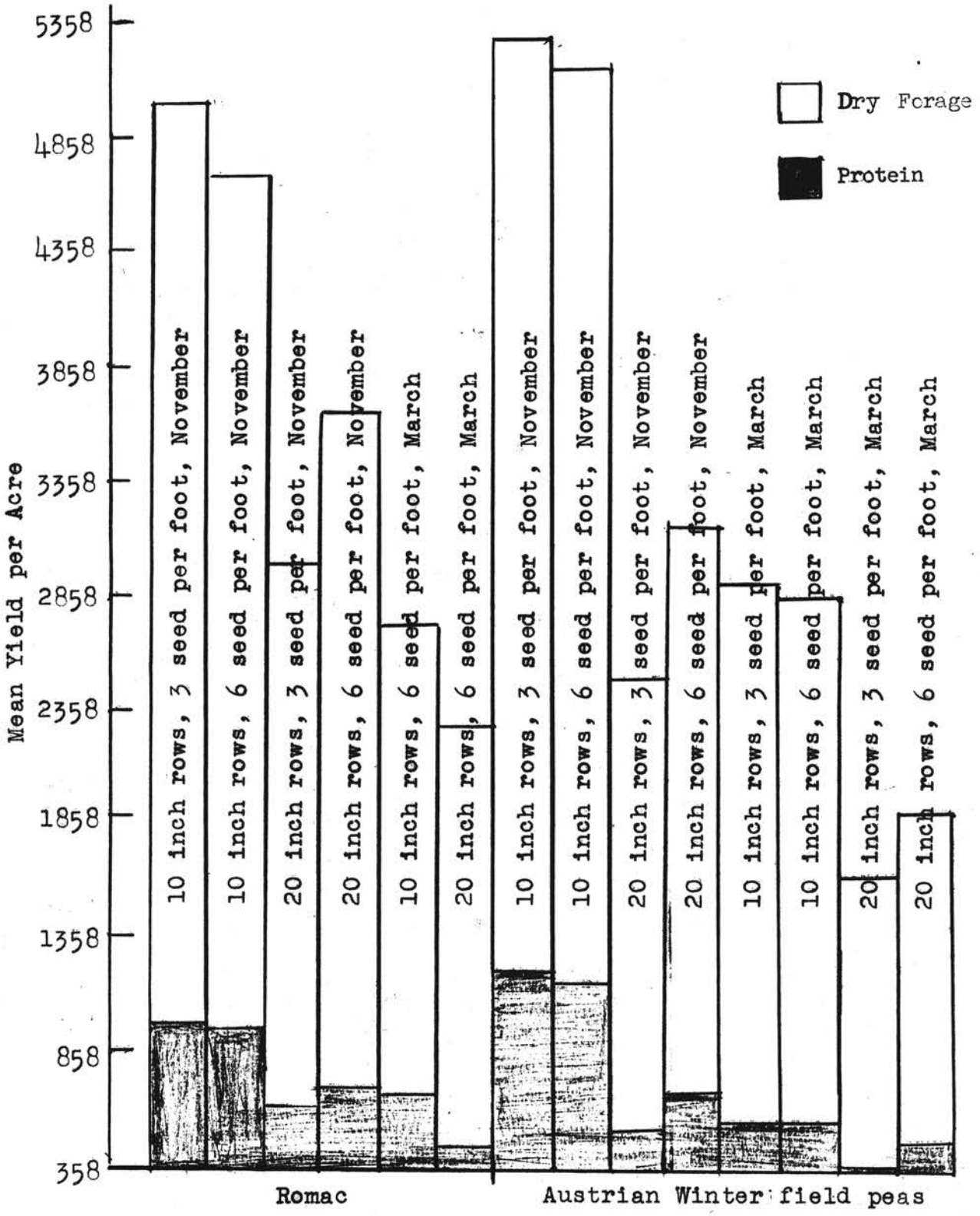

Figure 9. Graphic presentation for pounds per acre of forage and protein grouped for comparing Romac with Austrian Winter field peas.

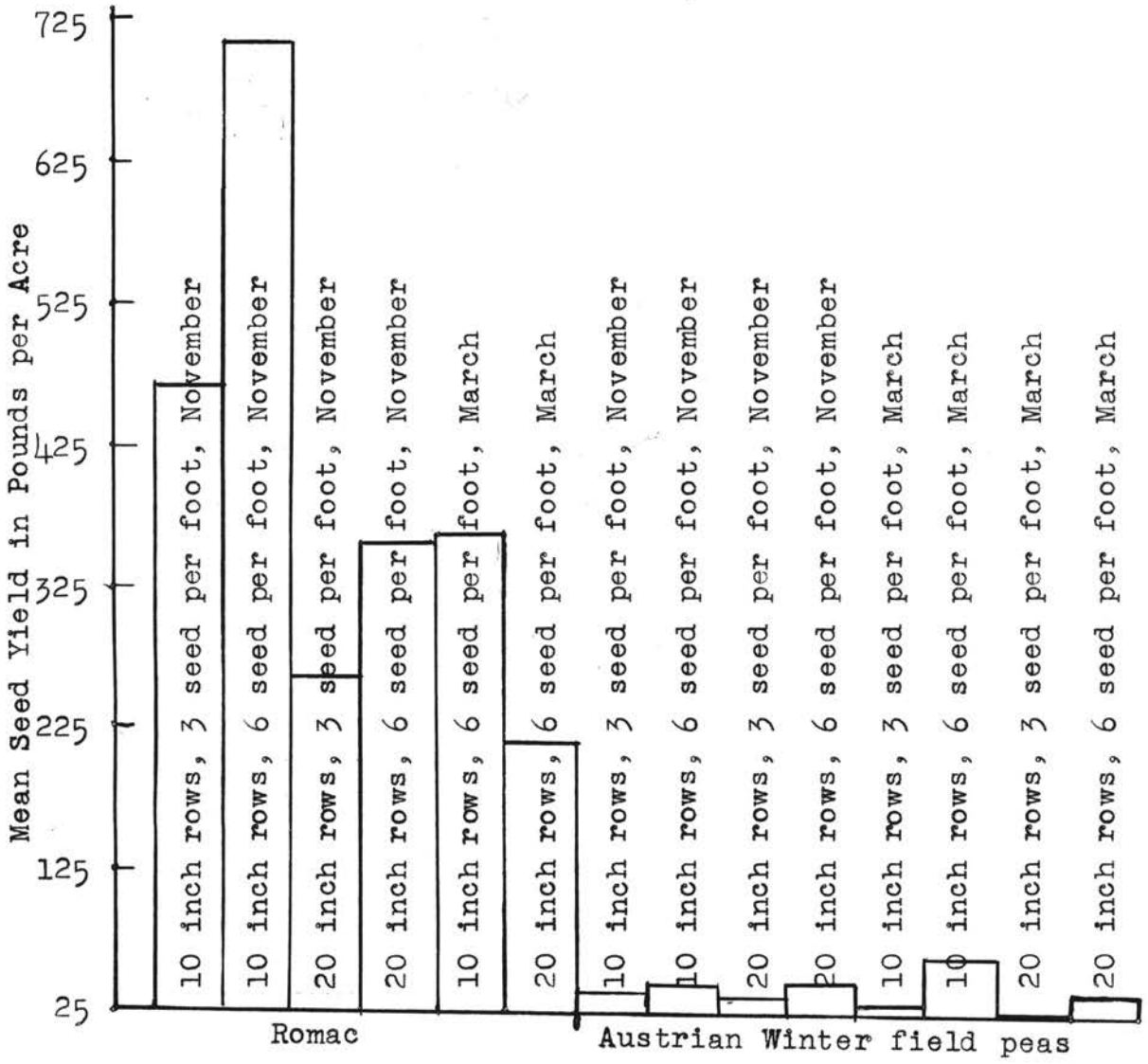

Figure 10. Graphic presentation for pounds per acre of seed grouped for comparing Romac and Austrian Winter field peas.

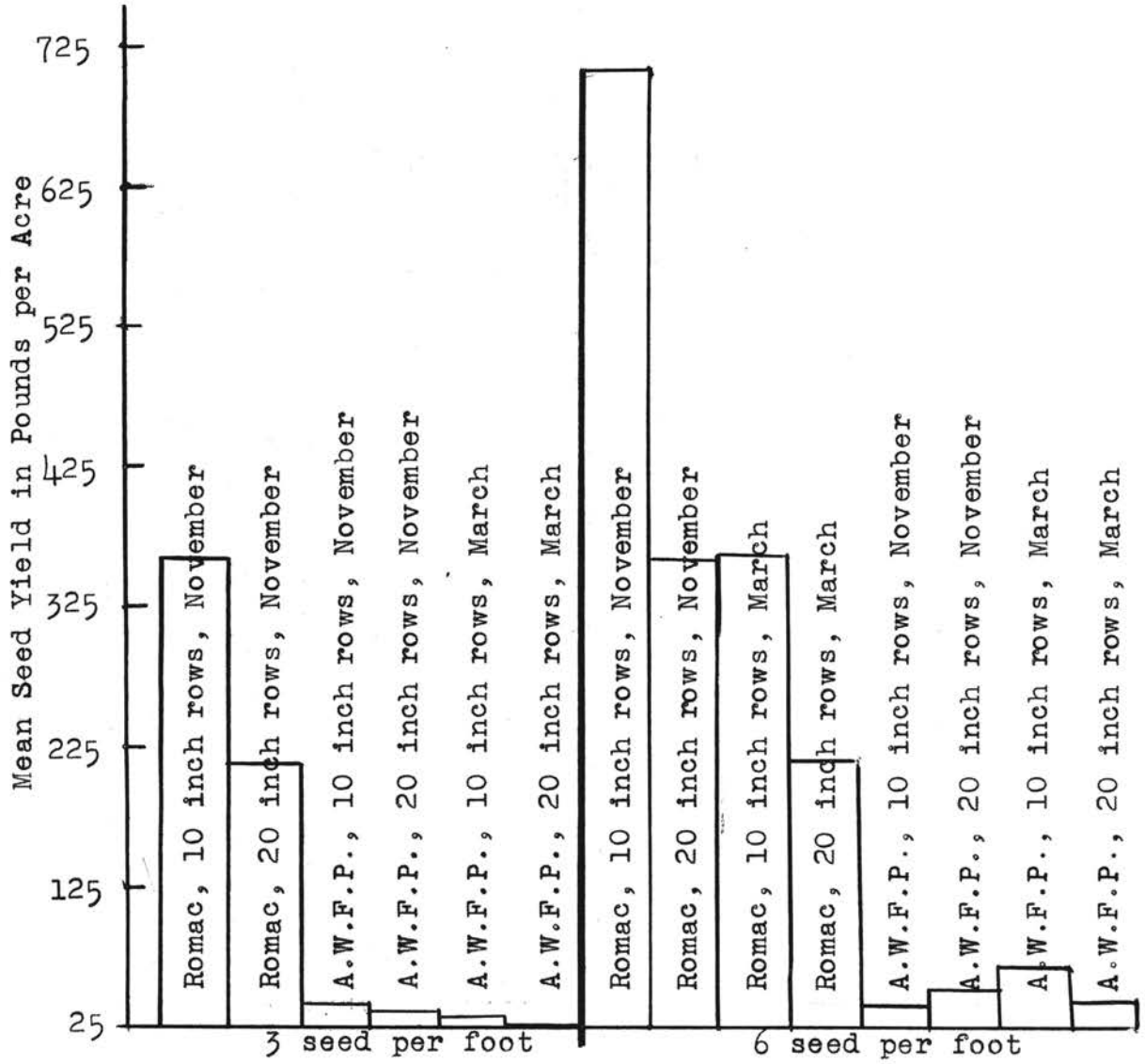

Figure 11. Graphic presentation for pounds of seed per acre grouped for comparing the 3 and 6 seeds per foot

than the 3 seed per foot rate. Seed yields are grouped by rates and presented graphically in Figure 11.

Date and Rate for Chickpea

The data obtained for the chickpea cultural study are shown in Table V. Fifty days are required for complete emergence of the chickpea plants in the November planting compared with 13 days for the March planting. The lack of rainfall until December 18 contributed to the slow emergence for the November planting. The chickpea plants in all plots began dying in early May and within 10 days were dead. The abundant rainfall in May, prevalence of disease and the fine-textured slowly permeable soil apparently were important factors causing the chickpea plants to die. Plant heights just before the plants died averaged 26 centimeters for the November planting and 12 centimeters for the March planting. At both planting dates the plants in plots with 3 seed per foot were slightly taller and contained a few more branches per plant than the 6 seed per foot rate.

Field Pea Observation Study

The data obtained for five strain and three plant introductions of Pisum planted in November and March are shown in Table VI. Though emergence required approximately 30 days for the November planting an average of 6 to 10 plants emerged out of the 16 seed planted in each four foot plot. Emergence required about seven days in the March

TABLE V

SUMMARY OF DATA OBTAINED FOR A CHICKPEA STRAIN IN THE DATE AND RATE OF PLANTING STUDY ON THE STILLWATER AGRONOMY RESEARCH STATION 1959-1960

Date and Rate of Chickpea	Mean Number of Plants Emerged per 10' row on 12/31	1/12	1/20	No. of Plants Survived	Mean Ht. of Plant (cm.) 3/31	Mean No. of Branch per Plant	Mean No. of Days to Bloom from Planting	Mean No. of Days to Pod from Bloom
November planting								
3 seed/ft.	1	4	23	0	28	3.3	163	11
6 seed/ft.	0	3	58	0	24	3.0	161	14
March planting								
		4/5	4/8		6/8			
3 seed/ft.		12	21	0	13	3.3		
6 seed/ft.		20	48	0	11	3.0		

TABLE VI

SUMMARY OF DATA OBTAINED FOR FIELD PEAS STRAINS AND INTRODUCTIONS PLANTED IN NOVEMBER AND MARCH ON THE STILLWATER AGRONOMY RESEARCH STATION, 1959-1960

Okla. Code No.	Strain	Mean No. of Plants Survived on June 27, 1960	Mean Height (ins.)	Mean No. of Branches	Mean No. Days to: Bloom	Bloom to Pod	Mean No. of Days: Planting to Harvest	Mean Seed Yield per Plot (grams)
				NOVEMBER PLANTING				
Sp 127	First and Best	0	0	0	0	0	0	0
Sp 128	Valley	1.5	29	3.5	167	7	202	3.5
Sp 129	Dashaway	2.0	38	3.0	188	8	215	3.5
Sp 131	OAC 181	2.5	37	3.5	171	9	202	1.5
Sp 133	Stral	4.0	34	4.0	163	8	215	12.5
Fp 5	Multipler	3.0	37	4.0	169	7	202	3.0
Sp 126	PI 257592	5.0	29	4.0	160	7	202	11.5
Sp 134	PI 257593	7.0	34	3.5	160	7	202	15.0
Sp 125	PI 257594	1.5	34	3.5	160	7	202	3.5
				MARCH PLANTING				
Sp 127	First and Best	11.5	30	2.5	55	8	93	10.0
Sp 128	Valley	2.5	29	2.5	68	10	93	0.5
Sp 129	Dashaway	2.0	36	2.5	61	11	93	7.0
Sp 131	OAC 181	4.0	35	3.0	49	9	93	4.0
Sp 133	Stral	3.0	29	4.0	68	8	93	3.5
Fp 5	Multipler	0	0	0	0	0	0	0
Sp 126	PI 257592	14.0	34	3.5	55	8	80	21.5
Sp 134	PI 257593	6.5	37	2.5	49	8	93	22.0
Sp 125	PI 257594	12.5	38	3.5	55	8	93	19.5

planting and an average of 5 to 16 plants emerged from the 16 seed planted in each four foot plot.

Over 50 percent of the plants of Stral, P. I. 257592 and P. I. 257593 survived from the November planting. More than fifty percent of the plants of First and Best and plant introductions 257592, 257593 and 257594 in the March planting survived. Plant height and number of branches recorded on June 27 indicated that the plants of Dashaway and Stral were slightly taller for the November planting than those for the March planting but plant introductions 257592, 257593 and 257594 were 3-10 inches taller for the March than the November planting. Dashaway, Valley, OAC 181 and P. I. 257593 contained 0.5 to 1.0 more branches for the November than for the March planting. Fast emergence and quick growth of the strains in the March planting was indicated since there was a range of 49 to 68 days between planting and bloom compared with 160 to 188 for the November planting.

Plant introductions 257592 and 257593 produced good seed yield at both dates and P. I. 257594 was productive in March planting, Stral was productive in the November planting and First and Best planted only in March was productive.

Chickpea Observation Study

The data obtained for 19 Cicer introductions planted in November and 15 introductions planted in March are shown in Table VII. Emergence notes taken January 20, 1960, indicated from 2 to 8 plants out of 8 seed planted had emerged in the

TABLE VII

SUMMARY OF DATA OBTAINED FOR CHICKPEA STRAINS AND INTRODUCTIONS PLANTED IN NOVEMBER AND MARCH ON THE STILLWATER AGRONOMY RESEARCH STATION, 1959-1960

Okla. No.	P. I. No.	Mean No. Plants per four foot row on: 12/23	12/31	1/20	Mean No. of Plants Survived 6/27	Mean Ht. of Plant (cm.) 3/31	Mean Number of: Branches 3/21	Days to Bloom	Days Pod to Bloom
					NOVEMBER PLANTING				
Cp 3	207470	0	0	3.0	0	13	3	167	-
Cp 5	211010	1.5	1.5	2.0	0	11	2	171	-
Cp 6	211722	1.5	1.5	5.0	0	14	2	171	-
Cp 7	212091	1.0	1.5	2.0	0	12	2	167	-
Cp 8	212092	1.5	3.0	4.5	0	17	3	169	-
Cp 9	212595	0.5	3.0	4.0	0	13	3	167	-
Cp 10	214311	0	0	2.5	0	10	2	-	-
Cp 16	218068	1.0	2.5	6.5	0	14	2	165	10
Cp 17	219727	0.5	1.5	5.0	0	16	3	171	-
Cp 20	219730	0	0	1.5	0	14	2	163	-
Cp 21	220649	0	0	1.0	0	-	-	-	-
Cp 22	220776	0	0	2.0	0	13	3	171	11
Cp 27	222771	1.5	2.0	8.0	1	12	3	167	10
Cp 28	222772	0	4.0	6.0	0	15	3	160	7
Cp 31	228433	2.0	3.0	5.0	0	12	2	167	-
Cp 32	257583	1.5	3.5	6.5	0	11	2	165	8
Cp 33	257584	1.0	3.5	5.5	0	-	-	-	-
Cp 34	257585	1.5	3.0	5.0	0	13	2	163	8
Cp 35	257586	0	1.0	4.0	0	20	3	160	11
					MARCH PLANTING				
		4/2	4/5	4/8		6/8	6/8		
Cp 8	212092	1.0	5.0	8.0	0	15	2	56	8
Cp 9	212595	0	3.0	7.0	0	18	2	52	-
Cp 10	214311	0	5.0	7.0	0	22	3	52	-
Cp 16	218068	2.0	5.0	8.0	0	21	2	53	8
Cp 17	219727	2.0	5.0	8.0	0	25	3	53	8
Cp 21	220649	0	4.0	6.0	0	15	3	52	-
Cp 22	220776	0	4.0	5.0	0	15	3	-	-
Cp 27	222771	0	2.0	5.0	3.5	15	3	61	10
Cp 32	257583	0	4.0	5.0	0	13	3	-	-
Cp 33	257584	1.0	4.0	6.0	0	13	2	-	-
Cp 34	257585	0	1.0	4.0	0	10	2	-	-
Cp 35	257586	0	3.0	5.0	0	13	3	52	-
Cp 36	OAECp-59-1	0	1.0	3.0	0	11	2	-	-
Cp 40	OAECp-59-5	2.0	5.0	6.0	0	15	2	-	-
Cp 45	OAECp-59-8	2.0	4.0	6.0	0	11	3	-	-

November test. Notes for April 8, 1960, indicated from 4 to 8 plants had emerged from the 8 seed planted in the March test. By late June an average of 1.0 and 3.5 plants of P. I. 222771 were living for the respective November and March tests. The chickpea accessions survived the winter but apparently excess spring moisture on a finer textured soil than chickpeas are adapted and the prevalence of disease contributed to the higher death rate. A photograph illustrating dead and living plants is shown in Figure 12. Plant introduction 222771 survived and required 202 days to mature and averaged 2 grams of seed per plant for November and required 93 days and averaged about 2 grams of seed per plant for the March test.

The number of days from planting to first bloom ranged from 160 to 171 for November and from 52 to 61 for March.

Figure 12: Photograph of chickpea strains taken on June 5, 1960 showing dead plants of P. I. 220649 on the left and living plants on the right.

PART V

SUMMARY AND CONCLUSION

The experiment was conducted in 1959-1960 at the Agronomy Research Station near Stillwater, Oklahoma, on a Kirkland silt loam soil. The purposes were to study the effect of planting date, row width and rate of planting on the performance of Austrian Winter and Romac field peas, the effect of date and rate of planting on the yield of a chickpea strain and to observe several strains and accessions of Pisum and Cicer.

The temperature and rainfall played the important role on the emergence of plants in each test. Approximately 28 days were required for complete emergence for the November plantings while only seven days for the March plantings. The lack of moisture and minimal daily temperatures following the November plantings apparently influenced emergence.

The field peas emerged 7 to 24 percent more in March than November but the chickpeas emerged 13 to 17 percent more in November than in March. The field pea cultural study and all chickpeas planted in November survived the minimal temperature 2° F. The field pea strains and accessions in the November planted observation test suffered heavy winter injury except for P. I. 257593.

The field pea cultural study with the 10-inch row spacings gave 36 percent more forage per acre, 49 percent more protein

per acre and 44 percent more seed per acre than the 20-inch row spacing. Plant emergence, branching, date of blooming, date of pod formation and date of harvest were not influenced by row spacing in this study. The pounds of dry forage, protein and seed were, respectively, 40, 40 and 48 percent higher in November than March planting. The field peas in the November test averaged seven inches taller than those in March. Plots planted in November required an average of 215 days to mature compared with 94 days for the March test. The Romac variety produced 10 percent more forage, 8 percent more protein and 88 percent more seed per acre than Austrian Winter field peas.

The chickpea cultural study, the plants began dying in early May and within ten days were dead. No yield data were obtained. The mean plant height was 26 centimeters for the November planting and 12 centimeters for the March plantings.

Field pea plant introductions, 257592 and 257593 gave high seed yield at both dates of planting. Stral gave desirable seed yields for the November planting and P. I. 257594 and the First and Best variety for the March planting.

In the chickpea observation test, P. I. 222771 survived to maturity and produced about two grams of seed per plant for both dates. Heavy May rainfall, prevalence of disease and a fine textured soil apparently were important factors causing the failure of the chickpeas.

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