

Effects of Planting Dates and Storage On Survival of Eastern Red Cedar in Central and Western Oklahoma

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CONTENTS

Introduction	5
Methods	6
Planting Sites	7
Stillwater	7
Norman	8
Mangum	8
Woodward	8
Results	9
1955-1956 Season	9
1956-1957 Season	10
1957-1958 Season	11
Average Survival	12
Miscellaneous Plantings	14
Norman—Immediate Planting of Fleshy-Dug Cedar	14
Woodward—Potted Red Cedar	15
Conclusion and Recommendations	16

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Michel Afanasiev, Albert Engstrom, and Ernest W. Johnson*

Introduction

Two of the most commonly asked questions regarding the establishment of bare-rooted red cedar are: (1) The optimum dates of planting and, (2) the effects of storage on planting stock.

The usual recommendation has been that planting should be done when the plants are "dormant". This period in Oklahoma comprises approximately five months, and consequently field planting of red cedar has been done at any time during the winter and early spring.

Since the results of planting have not been uniformly successful it was suggested that perhaps within the so-called dormant period there is a shorter one in which both the environment and the state of the plants are more favorable for survival of outplanted trees. An attempt to determine the existence and to define the extent of such optimum time of planting was one of the principal objectives of the investigation.

The other objective of the investigation was to determine the effects of practical short-term storage of stock after its arrival from the nursery. Such a problem is often encountered by the prospective planter when unforeseen circumstances prevent him from planting the trees immediately upon arrival at the farm.

In addition to the two problems just stated, it became possible to incorporate into this investigation the study of the effects of some elements of weather and soil on plant mortality, to make comparative evaluation of the use of potted stock in field planting, and of stock planted the same day as dug.

This report is based on the results of field planting red cedar during three consecutive years beginning in 1955.

The three planting and growing seasons happened to include very poor, fair and very favorable conditions, providing a wider and more solid basis for the conclusions and recommendations on planting than would have been the case if the conditions were uniformly poor or good throughout the period of study.

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The reliability of observations and the conclusions are strengthened also by the fact that the work was replicated in four different locations within the State (Figure 1) with considerable variations in weather and soils.

Methods

The two-year seedlings of red cedar used in this study were grown in the Oklahoma State Forest Nursery near Norman. Beginning in the middle of November and continuing through the planting season, sixty plants were dug every week, packaged in the standard manner in water-proof paper with roots packed in moist sphagnum moss, and shipped the same day to each of the four planting sites. The sites were located at Mangum, Norman, Stillwater and Woodward. Thirty plants from each package were planted on the second day after digging. The other thirty were left in the package in a barn or shed and planted one week later.

To reduce the variable effects of soil, each 30-tree group of seedlings was planted in three 10-tree lots, each lot located at random along previously marked and numbered lines. The trees were planted one foot apart in each row, and watered as soon as planting was completed (Figure 2).

The slit method of planting was used in all cases. After inserting the seedling the slit was closed and firmed. A small depression was made around the base of each seedling and a quart or more of water was used to settle the earth around the roots and provide readily available moisture for each plant. This was done regardless of whether the soil

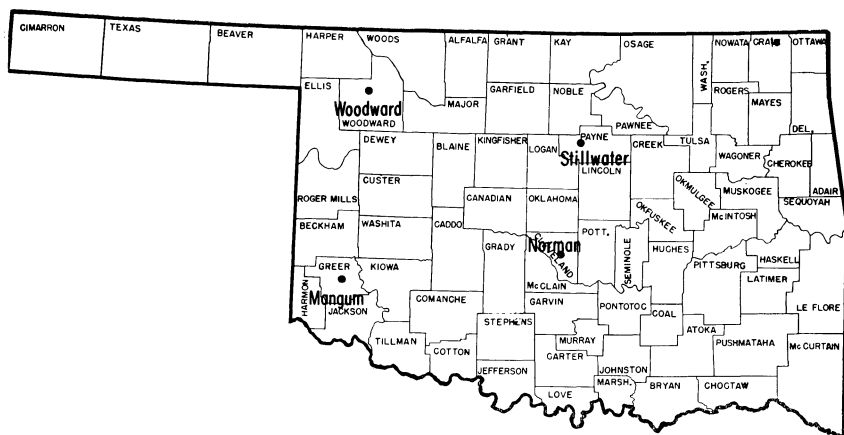


Figure 1. Map Showing Location of the Four Planting Sites



Figure 2. The 1957-58 Planting at Woodward, Oklahoma

was dry or wet. After the water had soaked away, the depression was filled in by raking top soil around the base of the seedling. This single application of water was all the supplemental irrigation the seedlings were given.

In addition to the above outlined standard procedure adapted at all four sites, some other observations were made at three of the four locations. These will be reported in the presentation of the results for individual sites.

Planting Sites

Stillwater

The planting site at Stillwater was located on Cow Creek, one and one-half miles west of town. The site is on a second bottom, classified as Port Soils. During the period of study, the flow of Cow Creek has been very irregular. During the drought year of 1956 the creek bed was mostly dry or had only an occasional flow of water. In 1957, the flow was more frequent and the creek bed was continuously wet. In May of 1957, the creek overflowed its banks and for a period of some 24 to 36 hours covered the entire planting to a depth of 3 to 4 feet. The flooding did not have a noticeable effect on survival.

The area is very small, but there is a considerable variation in the physical characteristics of the soil. Soil samples taken at twenty-one

locations at ten and twenty-inch depths varied in the combined silt and clay content from 62% to 94%, with the greater part of the soil made up of between 80% and 88% of silt and clay.

The soil is acid with pH ranging from 5.6 to 6.4. The planting site is protected on all sides by natural stand of local hardwoods, (mostly pecan, cottonwood, elm) and by a post plantation located some 200 yards to the north. Immediately north of the site (within 12 feet) is a red cedar windbreak which adds to the protection of planted seedlings against cold winter winds.

Norman

The Norman site was a part of the State Nursery area and considered ideal for any tree species adapted to our climate. The soil is very fine sandy loam on a loessal terrace with uniform texture to a depth of about forty feet. Drainage is excellent, due to a gentle slope of about two percent in a southerly direction. The site is exposed to wind from all directions. Soil pH is from 6.7 to 7.0. During two of the previous ten years, nursery crops had been grown on this site. All other years, cover crops of rye and vetch alternating with sudan grass had been grown on this area. These crops had been plowed into the soil for green manure.

During each planting season a green crop of rye and vetch covered the site. This was scalped away for each tree during the planting. All of it was hoed out before the rye headed out so that the site was clean by May 30.

Mangum

The Mangum site was located on the Sandy Land Experiment Station operated by the Oklahoma Experiment Station. The soil is deep sand of medium texture. It erodes easily when exposed to wind. Weed growth was extremely heavy. About half of the site was located on a bed of heavy Bermuda grass. Due to extreme erosion, dry weeds and litter were left on the site to protect the trees from being blown out during the planting season.

Woodward

All three plantings were made in the nursery at the United States Southern Great Plains Field Station, just southwest of the town of Woodward. The soil is classified as Pratt fine sandy loam. The soil is deep and can be considered as being very favorable for tree growth. The pH is 7.0 to 7.2. The planting blocks were laid out so that no additional moisture came from adjoining land, nor was there any soil erosion problem within the blocks.

Discussion and Results

1955-1956 Season

Severe drought was experienced at all four planting sites during this season. (Table 1). There was considerable moisture during October at Stillwater, Norman and Mangum, but the months of November through April were very dry at all planting sites. This resulted in the low percentages of survival of red cedar planted the same date as received and stock stored 7 days after receiving. (Tables 2, 3, 4 and 5).

The average percent survival for cedar planted the same date as received ranged from 28.33 at Stillwater to 68.05 at Norman. For stock stored 7 days after receiving, the percent survival ranged from 27.59 at

Table 1—Monthly and Seasonal Precipitation (Inches) for Stillwater, Norman, Mangum, and Woodward, Oklahoma.

Monthly Precipitation												
Location	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
1955												
Stillwater							1.36	2.44	1.16	5.03	0.00	0.18
Norman							0.10	3.80	5.68	4.42	0.00	0.15
Mangum							0.75	0.73	4.56	6.30	0.00	0.02
Woodward							1.34	0.73	1.85	1.74	T	T
1956												
Stillwater	0.39	1.08	0.59	0.42	4.53	1.79	1.09	0.91	0.20	2.17	1.90	1.67
Norman	0.76	1.58	0.63	2.79	3.28	0.93	3.07	0.66	0.02	1.34	1.44	1.62
Mangum	0.19	0.34	0.01	T	7.81	0.51	4.30	0.52	0.04	2.36	0.60	0.97
Woodward	0.21	0.50	0.43	1.16	1.74	3.72	3.31	3.07	0.00	0.76	0.16	0.32
1957												
Stillwater	0.81	1.64	2.30	5.30	16.56	9.42	0.93	1.88	4.06	1.81	2.40	9.98
Norman	1.62	0.85	3.05	8.48	13.43	13.19	1.05	1.48	6.78	2.98	2.79	0.75
Mangum	0.47	1.01	2.98	7.35	8.98	3.89	0.26	0.21	1.40	3.14	1.19	0.07
Woodward	0.80	1.17	5.54	5.38	11.41	7.88	T	0.70	3.95	4.35	1.56	0.11
1958												
Stillwater	1.83	0.81	4.52	1.40	0.97	6.64						
Norman	1.50	0.76	3.89	1.92	3.52	5.22						
Mangum	1.12	0.43	3.04	2.71	2.06	3.39						
Woodward	0.91	0.17	2.76	1.71	1.06	6.82						
Seasonal Precipitation				July-1-55 to June-30-56			July 1-56 to June-30-57			July-1-57 to June-30-58		
Location												
Stillwater						18.97"						37.23"
Norman						24.12"						32.64"
Mangum						21.22"						19.02"
Woodward						13.42"						24.10"

Stillwater to 64.18 at Norman. The variation between cedar planted the same date as received and trees properly stored 7 days prior to planting was not significant. In general, seedlings planted during January and February showed a greater percent survival than the other four months.

The results at Stillwater were very erratic. The highest percent survival for cedar planted the same date as received was the second week in January and for stock stored 7 days prior to planting, the highest survivals were the last week in December, the second week of January, and the third week in February.

At Norman, the best survival was the first two weeks in January for both types of stock. Results at Mangum showed the optimum planting dates to be the 1st and 3rd weeks in January for stock planted as soon as received, while the last week of April and the first week of May were the best for stock stored 7 days after receiving. The only explanation for the results with late planting at Mangum may be that there was considerable moisture during May, in contrast to the extremely dry winter conditions.

At Woodward, a 90% or better survival was found for the plantings made the second and fourth week in December, the second week in January, and the first week in February for stock planted as soon as received. The stock stored 7 days after receiving showed the highest survival the 3rd week of January, and the 1st and 2nd weeks in February. As in the case at Mangum, the survival of planting made the first week in May was also 80%, which was considerably better than the average for the season. The rains of April and May may explain this exception. The extremely low survival from the planting made the last of January resulted from the weather experienced at the time of planting, when the temperature was 25°F, and there was a light snow on the ground.

1956-1957 Season

The 1956-1957 season was more favorable for survival of seedlings planting than the preceding season. Total precipitation was considerably above the first season of the test, but most of this moisture was recorded during the months of April, May and June, (Table 1). The heavy losses occurred during the dry winter weather. The plantings at Stillwater showed an average survival of only 59.62% for trees planted as soon as received, and 56.03% for stock stored 7 days after receiving. Plantings at the other three sites averaged from 71.12% to 82.16%.

At Stillwater, the better planting dates ranged from the 3rd week in November to the 1st week in March for stock planted as soon as received. The highest percent survival for stock stored 7 days after

receiving was recorded the 3rd week in March (Table 2). The average for both type plantings was only 57.80%, which can be considered as being very poor.

Several of the Norman plantings averaged 76.7% for this season, compared with 66.1% for the preceding season. There were 8 weeks between the 1st week in January and the 2nd week in March, when the survival was 90% or more for stock planted as soon as received. For stock stored 7 days after receiving, there were also 8 weeks when the survival was 90% or greater, with the range of dates from the 3rd week in January to the 3rd week in March.

The Mangum planting shows a higher average percent survival due to the fact that the first three plantings at the beginning of the season were omitted. The average survival, therefore is not a true figure for comparison with the other three sites. There was the same tendency regarding dates of planting, however. Seven planting dates showed a 90%, or greater survival for the 1st week in

**Table 2—Average Survival—Red Cedar Date Planting
Stillwater, Oklahoma**

	Planted Same Date as Received				Stored 7 days After Receiving			
	1955-56	56-57	57-58	Average	1955-56	56-57	57-58	Average
2nd Wed. Nov.	.0	23.3	100.0	41.10				
3rd Wed. Nov.	.0	33.3	93.3	42.20	.0	30.0	100.0	43.33
4th Wed. Nov.	10.0	36.7	100.0	48.90	.0	66.7	96.7	54.47
1st Wed. Dec.	10.0	43.3	100.0	51.10	12.0	36.7	96.7	48.47
2nd Wed. Dec.	33.3	70.0	100.0	67.77	13.3	16.7	96.7	42.23
3rd Wed. Dec.	40.0	80.0	100.0	73.33	.0	66.7	96.7	54.47
4th Wed. Dec.	53.3	56.7	100.0	70.00	80.0	56.7	96.7	77.80
1st Wed. Jan.	23.3	66.7	96.7	62.23	50.0	50.0	100.0	66.66
2nd Wed. Jan.	80.0	93.3	96.7	90.00	80.0	56.7	100.0	78.90
3rd Wed. Jan.	13.3	68.7	96.7	59.56	---	60.0	100.0	80.00*
4th Wed. Jan.	26.7	66.7	100.0	64.47	3.3	43.3	96.7	47.77
5th Wed. Jan.	---	66.7	100.0	83.35*	---	53.3	90.0	71.65*
1st Wed. Feb.	---	83.3	96.7	90.00*	3.3	53.3	100.0	52.20
2nd Wed. Feb.	43.3	70.0	100.0	71.10	70.0	83.3	93.3	82.20
3rd Wed. Feb.	46.7	73.3	100.0	73.33	90.0	73.3	100.0	87.77
4th Wed. Feb.	3.3	80.0	96.7	60.00	73.3	80.0	100.0	84.43
1st Wed. Mar.	6.7	86.7	100.0	64.47	3.3	86.7	100.0	63.33
2nd Wed. Mar.	20.0	36.7	100.0	52.33	6.7	73.3	93.3	57.77
3rd Wed. Mar.	6.7	43.3	100.0	50.00	10.0	100.0	100.0	70.00
4th Wed. Mar.	20.0	46.7	96.7	54.47	3.3	53.3	100.0	52.20
1st Wed. Apr.	50.0	26.7	93.3	56.67	6.7	23.3	96.7	42.23
2nd Wed. Apr.	40.0	---	96.7	68.35*	---	13.3	96.7	55.00*
3rd Wed. Apr.	46.7	---	86.7	66.70*	23.3	---	100.0	61.65*
4th Wed. Apr.	50.0	---	90.0	70.00*	23.3	---	80.0	51.65*
Average	28.33	59.62	97.51		27.59	56.03	96.97	

Note: *Average for two (2) year period only.

Jan. through the 4th week in February for stock planted as soon as received. For stock stored 7 days after receiving, there were only 6 weeks, between the last week in January and the 3rd week in March when the percent survival was 90% or greater.

At Woodward, there was an average of only 73.1% survival for the entire season. There were only 4 dates when there was a 90% survival, or greater, of stock planted as soon as received. These were rather widely-separated dates from the second week in December through the 3rd week in March. For stock stored 7 days after receiving, a 90% survival was recorded on the 2nd and 3rd weeks in January, and the 1st and 2nd weeks in March. Between these dates survivals were more than 83%. (Table 5).

1957-1958 Season

This season could be considered as excellent for planting bare-rooted red cedars at Stillwater, Norman, and Woodward. At Mangum, there was only a total of 19.02" of precipitation for the entire season, which was less than the very dry season of 1955-56, and resulted in a much lower average survival than at the other three planting sites. (Table 1).

At Stillwater, there were 13 weeks when there was a 100% survival of trees planted the same date as received. These planting dates ranged from the 2nd week in November through the 3rd week in March. All but one of the other planting dates showed a survival of 90% or greater. For stock stored 7 days after receiving, there were 11 weeks when a 100% survival was recorded. Again, all but one week's planting of the remaining dates showed a survival of 90% or greater. The average survival for all plantings was 97.1%, which can be considered as being excellent. (Table 2).

Results at Norman were even better than at Stillwater. The average survival of all plantings was 98.6%. There were 17 weeks when a perfect stand was recorded, extending from the 3rd week in November through the 4th week in April, for stock planted as soon as received. All other plantings survived with a percentage of 93.3 or greater. For stock stored 7 days after receiving, there were 14 weeks when the survival was 100%. Again, the remaining weeks show a survival of 93.3% or greater. (Table 3).

At Mangum, the results were not as favorable as at the other three sites, but in spite of relatively dry weather, there were five weeks when a 90% or greater survival was recorded. This was for stock planted as soon as received (Table 4). For stock stored 7 days after receiving, there were 9 weeks when the percent survival was 90% or greater. The

**Table 3—Average Survival—Red Cedar Date Planting
Norman, Oklahoma**

	Planted Same Date as Received				Stored 7 days After Receiving			
	1955-56	56-57	57-58	Average	1955-56	56-57	57-58	Average
2nd Wed. Nov.	56.8	6.7	96.7	53.40				
3rd Wed. Nov.	83.3	50.0	100.0	77.77	13.3	10.0	96.7	40.00
4th Wed. Nov.	16.7	66.7	100.0	61.13	30.0	70.0	96.7	65.57
1st Wed. Dec.	80.0	36.7	100.0	72.23	70.0	80.0	96.7	82.23
2nd Wed. Dec.	86.7	80.0	96.7	87.80	66.7	73.3	96.7	78.90
3rd Wed. Dec.	60.0	66.7	100.0	75.57	70.0	76.7	93.3	80.00
4th Wed. Dec.	73.3	70.0	100.0	81.10	86.7	60.0	100.0	82.23
1st Wed. Jan.	100.0	96.7	96.7	97.80	96.7	60.0	100.0	85.57
2nd Wed. Jan.	100.0	96.7	100.0	98.90	100.0	83.3	100.0	94.43
3rd Wed. Jan.	33.3	83.3	93.3	69.97	83.3	100.0	100.0	94.43
4th Wed. Jan.	93.3	96.7	100.0	96.67	63.3	60.0	100.0	74.43
5th Wed. Jan.	83.3	90.0	100.0	91.10	76.7	96.7	96.7	90.03
1st Wed. Feb.	80.0	90.0	96.7	88.90	86.7	90.0	100.0	92.23
2nd Wed. Feb.	90.0	96.7	100.0	95.57	76.7	90.0	96.7	87.80
3rd Wed. Feb.	50.0	96.7	100.0	82.23	93.3	90.0	100.0	94.43
4th Wed. Feb.	33.3	86.7	96.7	72.23	86.7	96.7	100.0	94.47
1st Wed. Mar.	73.3	83.3	100.0	85.53	76.7	93.3	96.7	88.90
2nd Wed. Mar.	63.3	100.0	100.0	87.77	56.7	83.3	100.0	80.00
3rd Wed. Mar.	43.3	96.7	100.0	80.00	90.0	90.0	100.0	93.33
4th Wed. Mar.	46.7	66.7	100.0	71.13	20.0	66.7	96.7	61.13
1st Wed. Apr.	76.7	80.0	100.0	85.57	43.3	73.3	100.0	72.20
2nd Wed. Apr.	53.3	63.3	96.7	71.10	33.3	53.3	100.0	62.20
3rd Wed. Apr.	63.3	---	100.0	81.65*	66.7	---	93.3	80.00*
4th Wed. Apr.	93.3	---	100.0	96.65*	26.7	---	100.0	63.35*
1st Wed. May					26.7	---	100.0	63.35*
Average	68.05	77.29	98.90		64.18	76.03	98.34	

Note: *Average for two (2) year period only.

range of the higher percent survival was from the 2nd week in November, thru the 3rd week in April. The average of all plantings was 81%.

The plantings at Woodward averaged 98% survival for all plantings. For stock planted as soon as received, there were 13 weeks when a 100% survival was recorded, ranging from the 2nd week in December through the 2nd week in April. (Table 5). All but two of the other planting dates showed a survival of 96.7%. For stock stored 7 days after receiving, there were 15 planting dates when a perfect stand was recorded. All other plantings except one resulted in a 93.3% survival or greater.

Average Survival

The results of the average percent survival of bare-rooted red cedar planted as soon as received at all four sites are shown graphically in Figure 3. While there is some variation in results between sites, the graph shows that, in general, planting during the months of January and February gave the most consistent high survivals. Except in the

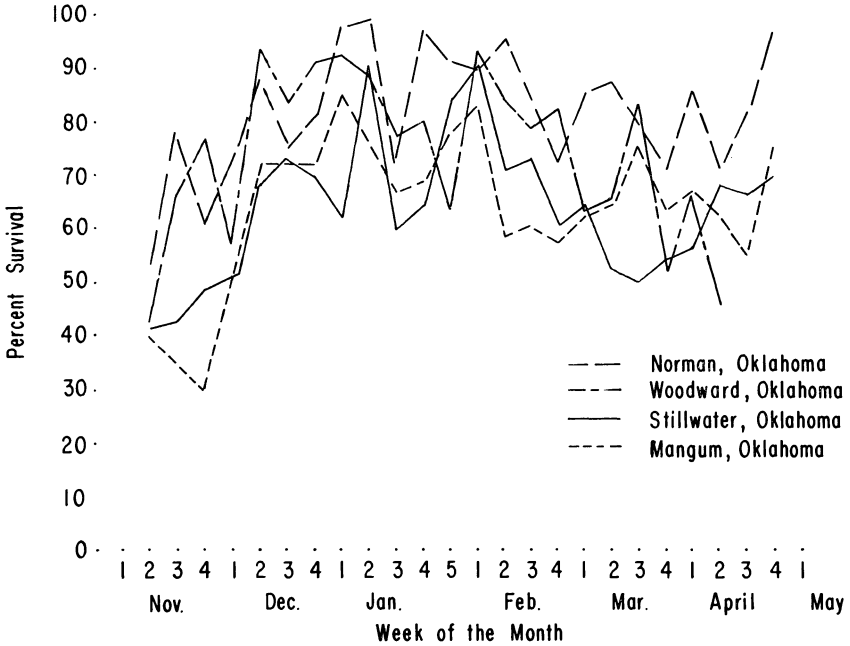


Figure 3. Red Cedar Date Planting—Average Percent Survival 1955-58. The plants Were Planted the Same Day they Were Received.

case of Norman, all other sites showed a low percent survival at both the early and late parts of the planting seasons.

In Figure 4, the average percent survival of stock stored 7 days after receiving is shown in graph form. This figure illustrates graphically how similar the results were with stock stored 7 days after receiving and stock planted as soon as received (Figure 3). Again, the optimum planting dates were in January and February, with a smaller percent survival at both the beginning and toward the end of the test period.

Miscellaneous Plantings

Norman, Immediate Planting of Freshly-Dug Cedar.

At Norman, since planting stock was near at hand, it was convenient to plant an extra 30-tree lot each week, freshly dug and planted immediately after digging. This was done on the same day and at the same time as the regular project test trees. These plots were laid out at the same time and randomized with the other plots.

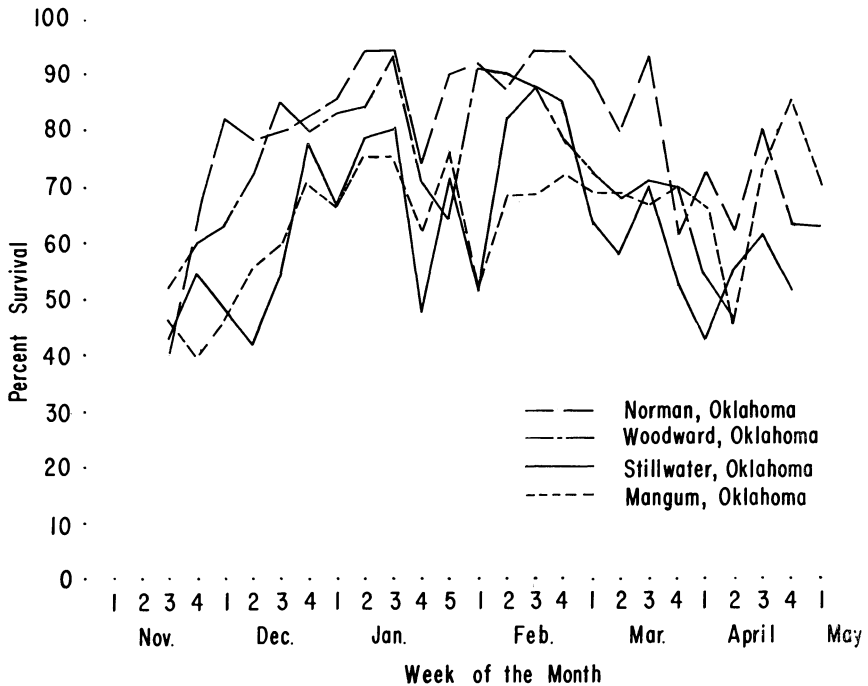


Figure 4. Red Cedar Date Planting—Average Percent Survival 1955-58. Plants Were Stored 7 Days.

Results show that this freshly dug stock survived ten percent better than the packaged stock (Table 6). It was also noted that survival was best with January plantings, and that losses were greatest from plantings made in November. January plantings of fresh dug stock was ten percent higher than November plantings. The practical application of this would be that farmers could come to the nursery, pick up their trees and plant them the same day and expect better survival.

Woodward—Potted Red Cedar

Potted plants of red cedar were planted once a month during the planting tests at the Woodward Station. Bare-rooted cedar were transplanted the preceding season in $2\frac{3}{4}$ " x $2\frac{3}{4}$ " x $10\frac{3}{4}$ " pots made of 15 pound roofing felt and were kept in a lathe house until planting in the test.

**Table 4—Average Survival—Red Cedar Date Planting
Mangum, Oklahoma**

	Planted Same Date as Received				Stored 7 days After Receiving			
	1955-56	56-57	57-58	Average	1955-56	56-57	57-58	Average
2nd Wed. Nov.	6.7	---	73.3	40.00*				
3rd Wed. Nov.	13.3	---	56.7	35.00*	.0	---	93.3	46.65*
4th Wed. Nov.	20.0	---	40.0	30.00*	3.3	---	76.7	40.00*
1st Wed. Dec.	46.7	20.0	86.7	51.13	13.3	---	80.0	46.65*
2nd Wed. Dec.	60.0	70.0	86.7	72.23	63.3	33.3	70.0	55.53
3rd Wed. Dec.	60.0	80.0	76.7	72.23	40.0	76.7	63.3	60.00
4th Wed. Dec.	60.0	66.7	90.0	72.23	40.0	83.3	90.0	71.10
1st Wed. Jan.	80.0	90.0	83.3	84.43	43.3	76.7	80.0	66.67
2nd Wed. Jan.	56.7	93.3	73.3	74.43	50.0	86.7	90.0	75.57
3rd Wed. Jan.	73.3	46.7	80.0	66.66	66.7	76.7	83.3	75.57
4th Wed. Jan.	20.0	90.0	96.7	68.90	30.0	73.3	83.3	62.20
5th Wed. Jan.	53.3	90.0	90.0	77.77	40.0	93.3	96.7	76.67
1st Wed. Feb.	73.3	90.0	86.7	83.33	3.3	86.7	63.3	51.10
2nd Wed. Feb.	13.3	90.0	73.3	58.87	33.3	90.0	83.3	68.87
3rd Wed. Feb.	26.7	76.7	80.0	61.13	16.7	96.7	93.3	68.90
4th Wed. Feb.	23.3	90.0	60.0	57.77	50.0	90.0	76.7	72.23
1st Wed. Mar.	30.0	80.0	76.7	62.23	23.3	100.0	83.3	68.87
2nd Wed. Mar.	13.3	86.7	93.3	64.43	30.0	86.7	90.0	68.90
3rd Wed. Mar.	60.0	86.7	80.0	75.57	23.3	90.0	86.7	66.67
4th Wed. Mar.	30.0	66.7	93.3	63.33	26.7	86.7	96.7	70.03
1st Wed. Apr.	56.7	83.3	63.3	67.77	33.3	70.0	93.3	65.53
2nd Wed. Apr.	46.7	70.0	70.0	62.23	53.3	---	83.3	68.30*
3rd Wed. Apr.	26.7	---	83.3	55.00*	56.7	---	90.0	73.30*
4th Wed. Apr.	66.7	---	83.3	75.00*	90.0	---	80.0	85.00*
1st Wed. May					80.0	---	60.0	70.00*
Average	42.36	77.20	78.19		37.91	82.16	82.77	

Note: *Average for two (2) year period only.

Table 7 shows the results. Note that during the 1955-56 and 1956-57 seasons the percent survival 98.89 and 90.00, respectively, as compared with 52.64 and 73.14 for the average of the bare-rooted stock planted as soon as received and plants stored one week. There was very little difference between the results of bare-rooted and potted stock during the favorable 1957-58 season.

One interesting preliminary test of summer planting of potted red cedar during the months of June, July, August, September and October during 1957 resulted in 96.67; 86.67; 96.67; 100.00, and 100.00 percent survival respectively. Further investigation of summer planting of potted red cedar is justified.

Conclusions and Recommendations

The date of planting appears to have a definite effect on the success of field planting, even if sometime this effect might be obscured by the effects of soil and weather conditions at the time of planting. During the years of 1955-58, the optimum periods of planting were between the middle of December and the middle of March. (Figures 3 & 4). The

Table 5—Average Survival—Red Cedar Date Planting
Woodward, Oklahoma

	Planted Same Date as Received				Stored 7 days After Receiving			
	1955-56	56-57	57-58	Average	1955-56	56-57	57-58	Average
2nd Wed. Nov.	3.3	26.7	96.7	42.22	0.0	60.0	96.7	52.22
3rd Wed. Nov.	60.0	53.3	86.7	66.66	56.7	36.7	86.7	60.00
4th Wed. Nov.	80.0	53.3	96.7	76.66	33.3	60.0	96.7	63.33
1st Wed. Dec.	46.7	26.7	96.7	56.67	73.3	50.0	93.3	72.22
2nd Wed. Dec.	90.0	90.0	100.0	93.33	73.3	83.3	100.0	85.55
3rd Wed. Dec.	70.0	83.3	96.7	83.33	73.3	66.7	100.0	80.00
4th Wed. Dec.	100.0	73.3	100.0	91.11	86.7	63.3	100.0	83.33
1st Wed. Jan.	86.7	90.0	100.0	92.22	90.0	96.7	100.0	96.7
2nd Wed. Jan.	90.0	80.0	96.7	88.89	90.0	90.0	100.0	93.33
3rd Wed. Jan.	56.7	76.7	100.0	77.78	26.7	86.7	100.0	71.11
4th Wed. Jan.	63.3	80.0	96.7	80.00	6.7	86.7	100.0	64.44
5th Wed. Jan.	3.3	86.7	100.0	63.33	90.0	83.3	100.0	91.11
1st Wed. Feb.	96.7	83.3	100.0	93.33	90.0	86.7	93.3	90.00
2nd Wed. Feb.	76.7	90.0	86.7	84.44	80.0	83.3	100.0	87.77
3rd Wed. Feb.	66.7	66.7	100.0	77.78	53.3	83.3	100.0	78.88
4th Wed. Feb.	60.0	86.7	100.0	82.22	26.7	90.0	100.0	72.22
1st Wed. Mar.	10.0	80.0	100.0	63.33	13.3	90.0	100.0	67.77
2nd Wed. Mar.	20.0	76.7	100.0	65.55	33.3	80.0	100.0	71.11
3rd Wed. Mar.	53.3	96.7	100.0	83.33	36.7	73.3	100.0	70.00
4th Wed. Mar.	16.7	36.7	100.0	51.11	3.3	60.0	100.0	54.44
1st Wed. Apr.	46.7	56.7	96.7	66.67	40.0	---	100.0	70.00*
2nd Wed. Apr.	36.7	---	100.0	68.35*	33.3	---	---	33.33**
3rd Wed. Apr.	36.7	---	---	36.67**	26.7	---	---	26.67**
4th Wed. Apr.	63.3	---	---	63.33**	80.0	---	---	80.00**
1st Wed. May								
Average	55.56	71.12	97.74		49.72	75.17	98.26	

Note: *Average for two (2) year period only.
**Average for one (1) year period only.

existence of an optimum period does not preclude successful planting made either before December 15 or after March 15. High survival has been observed in individual lots planted during the early and the late periods of the dormant season.

Weather and soil conditions at the time of planting and immediately after, have a strong effect on the success of field planting. These conditions in Oklahoma vary widely from year to year and therefore do not permit recommendation of fixed specific dates on which field planting should be done. It might be suggested, however, that, in general, planting during the months of January and February has a better chance of success than that before or after this period. Planting in November or delaying planting till late March or April is especially risky.

Leaving seedlings for an extra week in packages in which they arrived from the nursery had very little, if any, effect on survival.

**Table 6—Average Survival—Freshly Dug Red Cedar
Date Planting—Norman, Oklahoma**

	1955-56	1956-57	1957-58	Average
2nd Wed. Nov.	96.7	63.3	100.0	86.67
3rd Wed. Nov.	96.7	80.0	96.7	91.13
4th Wed. Nov.	63.3	76.7	100.0	80.00
1st Wed. Dec.	90.0	83.3	90.0	87.77
2nd Wed. Dec.	100.0	86.7	100.0	95.57
3rd Wed. Dec.	96.7	83.3	100.0	93.33
4th Wed. Dec.	96.7	96.7	100.0	97.80
1st Wed. Jan.	93.3	93.3	100.0	95.53
2nd Wed. Jan.	96.7	96.7	100.0	97.80
3rd Wed. Jan.	90.0	80.0	96.7	88.90
4th Wed. Jan.	100.0	96.7	96.7	97.80
5th Wed. Jan.	100.0	86.7	100.0	95.57
1st Wed. Feb.	93.3	86.7	100.0	93.33
2nd Wed. Feb.	100.0	76.7	100.0	92.23
3rd Wed. Feb.	86.7	90.0	100.0	92.23
4th Wed. Feb.	43.3	100.0	100.0	81.10
1st Wed. Mar.	93.3	93.3	96.7	94.43
2nd Wed. Mar.	73.3	96.7	100.0	90.00
3rd Wed. Mar.	93.3	96.7	96.7	95.57
4th Wed. Mar.	80.0	70.0	100.0	83.33
1st Wed. Apr.	90.0	73.3	100.0	87.77
2nd Wed. Apr.	93.3	70.0	93.3	85.53
3rd Wed. Apr.	86.7	---	96.7	91.70*
4th Wed. Apr.	96.7	---	100.0	98.35*
Average	89.59	85.31	98.48	

Note: *Average for two (2) year period only.

During the three year period, the average survival of trees planted immediately after arrival was 70.99%, that of the trees stored in packages for the extra week was 70.43%.

The planter should be reminded, however, that exposing stored stock to drying or to extremes of temperature would usually cause serious injury to the plants. If planting is to be delayed, the packaged stock must be stored in a barn, shed or cellar, free from danger of freezing and with packing material continuously moist, though not wet. Excessively wet packing material combined with reasonably warm temperature may cause molding and injury to the trees.

Observations at all four locations suggest that the precipitation and the resulting quantities of soil moisture does have a pronounced effect on survival of plants. High mortality of 1956-57 and particularly of 1955-56 trials was caused by deficiency of soil moisture during the time of planting and immediately following planting.

The comparative results of planting during severe drought and during seasons of good moisture shows the negative results that can be

Table 7—Average Survival—Potted Plants Red Cedar Planting Woodward, Oklahoma

Month	1955-56	1956-57	1957-58	Average
November	100.00	96.67	100.00	98.89
December	93.33	86.67	96.67	92.22
January	100.00	93.33	96.67	96.67
February	100.00	90.00	100.00	96.67
March	100.00	76.67	96.67	91.11
April	100.00	96.67	96.67	97.78
Average	98.89	90.00	97.78	95.55

anticipated during very dry years. During drought years it would be better to do no planting at all, or use potted plants, or provide for supplemental irrigation.

Use of potted stock during the years of low precipitation resulted in an exceptionally high survival as compared with the survival of the bare-rooted stock. The combined average survival of potted plants in 1956 and 1957 was 95.69%, while that of bare-rooted stock on the same site was only 69.86%.

The superior performance of potted plants was not as evident, however, during the year of abundant rainfall and generally favorable growing conditions because all stock, bare-rooted as well as potted, survived to the extent of over 93.70%. From the practical standpoint, the use of potted plants appears as a promising way to overcome the damaging effect of dry weather. Where the soil is dry and the prospects of immediate precipitation are dim, the use of potted stock could be depended on to prevent high mortality of plants during the first season in the field.

Planting of freshly dug stock shows a 10% advantage in survival over stock packaged and in shipment two days or stock stored 7 additional days in the package.