

CHARACTERISTICS OF SOIL TEMPERATURE AND MOISTURE,
GERMINATION OF JACK PINE SEED, AND SEEDLING ESTABLISHMENT
ON SEEDBEDS CREATED BY A MIDDLEBUSTER PLOW IN
SOUTHEASTERN MANITOBA

Project MS-222

by

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INTRODUCTION

The successful regeneration of jack pine in southeastern Manitoba is greatly dependent upon seedbed preparation. One method used creates a furrow two to three inches deep and three to four feet wide with an overturned-sod ridge on each side. In 1962 a study was begun to assess the capacities of the seedbeds created for germination, survival and growth. Preliminary studies on three sites--oligotrophic dry, mesotrophic fresh minus, and oligotrophic fresh (Mueller-Dombois 1964) indicated that the dry site was the most critical, and in 1964 the study was intensified on such a site. Studies on the original three sites were terminated in 1966. Studies on the dry site were terminated in the fall of 1968. This report presents data collected in the final year of the study.

WORK COMPLETED IN 1968

Methods

Seedspot and planting tally and measurement--Seedlings established in 1966 were checked during early May and late September of 1968 for mortality. Total height and 1968 growth measurements were taken on all surviving seedlings during August. Root-collar diameters were measured and the seedlings harvested in early October. Oven dry weights were obtained in the laboratory.

Precipitation measurements--Rainfall was collected at weekly intervals beginning April 30 and ending October 10 by means of three Beal-type rain gauges.

Results

Mortality on 1966 seedspots--Per cent winter, summer and yearly mortality of seedlings established in 1966 is shown in Table 1. The highest mortality for the year occurred on Ridge¹ seedbeds, the least on T seedbeds. Summer mortality was greater than winter mortality on all except the U seedbeds. Most mortality occurred on the N exposure followed by the S and M exposures.

Survival of planted stock--First, second and third year survival of planted stock established in 1966 is shown in Table 2. Excluding third year survival on the R and U seedbeds, survival was excellent in all cases.

Growth on seedspots--Average height of seedlings established in 1966 is shown in Table 3. After three growing seasons the tallest seedlings were found on the M and S exposures. Growth on the seedbeds of these exposures was approximately equal, however growth on the N exposure was greatly reduced.

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The Ridge, Trough, Base of south-facing slope, Base of north-facing slope and the undisturbed seedbeds will be defined as R, T, BSF, BNF and U respectively. The North, Middle and South exposures are defined as N, M and S respectively.

TABLE 2
MORTALITY ON 1966 SEEDSPOTS

Exposure	No. seedlings Fall 1967	No. seedlings died Fall 1967 - Spring 1968	Per cent mortality ¹ Fall 1967 - Spring 1968	No. seedling Spring 1968	No. seedling died Spring 1968 - Fall 1968	Per cent mortality Spring 1968 - Fall 1968	No. seedling Fall 1968	No. seedling died Fall 1967 - Fall 1968	Per cent mortality Fall 1967 - Fall 1968
R									
N	79	15	19.0	64	16	25.0	48	31	39.2
M	-	-	-	-	-	-	-	-	-
S	7	2	28.6	5	2	40.0	3	4	57.1
Total	86	17	19.8	69	18	26.1	51	35	40.7
T									
N	111	8	7.2	103	13	12.6	90	21	18.9
M	14	1	7.1	13	1	7.7	12	2	14.3
S	18	2	11.1	16	0	0.0	16	2	11.1
Total	143	11	7.7	132	14	10.6	118	25	17.5
U									
N	26	5	19.2	21	1	4.8	20	6	23.1
M	1	0	0.0	1	1	100.0	0	1	100.0
S	-	-	-	-	-	-	-	-	-
Total	27	5	18.5	22	2	9.1	20	6	25.9
BNF									
N	12	11	15.2	61	12	19.7	49	23	31.9
M	34	1	2.9	33	1	3.0	32	2	5.9
S	38	0	0.0	38	2	5.3	36	2	5.3
Total	144	12	8.3	132	15	11.4	117	27	18.8
BSF									
N	117	12	10.2	105	15	14.3	90	27	23.1
M	11	1	9.1	10	0	0.0	10	1	9.1
S	4	1	25.0	3	0	0.0	3	1	25.0
Total	132	14	10.6	118	15	12.7	103	29	22.0
All seedbeds.									
N	405	51	12.6	354	57	16.1	297	108	26.7
M	60	3	5.0	57	3	3.5	54	6	10.0
S	67	5	7.5	62	4	6.4	58	9	13.4
Total	532	59	11.1	473	64	13.5	409	123	23.1

¹ Per cent based upon number of seedling at the beginning of each period.

TABLE 2

FIRST SECOND AND THIRD YEAR SURVIVAL OF PLANTED STOCK

Exposure	Number planted	Seedlings remaining end of first year	First year survival per cent	Seedlings remaining end of second year	Second year survival per cent	Seedlings remaining end of third year	Third year survival per cent	Per cent survival time of planting to Sept. 1950
R								
N	15	15	100.0	15	100.0	7	46.7	46.7
M	15	14	93.3	13	92.8	12	92.3	80.0
S	15	13	86.7	13	100.0	11	84.6	73.3
Total	45	42	93.3	41	97.6	30	73.2	66.7
T								
N	15	15	100.0	15	100.0	15	100.0	100.0
M	15	14	93.3	14	100.0	14	100.0	93.3
S	15	15	100.0	15	100.0	15	100.0	100.0
Total	45	44	97.8	44	100.0	44	100.0	97.8
U								
N	15	15	100.0	15	100.0	7	46.7	46.7
M	15	14	93.3	13	92.8	10	76.9	66.7
S	15	14	93.3	14	100.0	13	92.8	86.7
Total	45	43	95.6	42	97.6	30	71.4	66.7
BNF								
N	15	15	100.0	15	100.0	11	73.0	73.3
M	15	15	100.0	15	100.0	15	100.0	100.0
S	15	15	100.0	15	100.0	15	100.0	100.0
Total	45	45	100.0	45	100.0	41	91.1	91.1
BSF								
N	15	15	100.0	15	100.0	14	93.3	93.3
M	15	15	100.0	15	100.0	15	100.0	100.0
S	15	15	100.0	15	100.0	14	93.3	93.3
Total	45	45	100.0	45	100.0	43	95.6	95.6
All seedbeds.								
N	75	75	100.0	75	100.0	54	72.0	72.0
M	75	72	96.0	70	97.2	66	94.3	88.0
S	75	72	96.0	72	100.0	68	94.4	90.7
Total	225	219	97.3	217	99.1	188	86.6	83.6

TABLE 3
SEEDLING HEIGHTS AFTER THREE YEARS OF GROWTH
1966 PLANTING AND SEEDSPOTS

Seedbed	R		T		U		BNF		BSF		All seedbeds	
Exposure	No. seedlings	Avg. ht. (inches)	No. seedlings	Avg. ht. (inches)	No. seedlings	Avg. ht. (inches)	No. seedlings	Avg. ht. (inches)	No. seedlings	Avg. ht. (inches)	No. seedlings	Avg. ht. (inches)
<i>Planting</i>												
N	6	28.9	14	24.6	5	24.6	9	27.7	14	29.5	48	27.1
M	9	31.3	14	34.7	10	35.6	14	33.3	15	33.1	62	33.6
S	10	27.8	15	32.8	8	33.2	13	29.6	12	29.9	58	30.7
Avg. NMS	25	29.4	43	30.7	23	32.4	36	30.5	41	30.9	168	30.8
<i>Seedspots</i>												
N	41	6.3	91	2.4	16	4.9	46	1.8	89	3.2	283	3.3
M	0	-	8	8.1	0	-	25	9.7	8	8.4	41	9.1
S	3	7.9	16	6.6	0	-	35	9.0	2	7.0	56	8.2
Avg. NMS	44	6.4	115	3.4	16	4.9	106	6.1	99	3.7	380	4.6

Height growth of planted stock--The height of planted stock after three growing seasons is shown in Table 3. Tallest seedlings were found in the M exposure followed by the S and N exposures respectively but differences were not great. A comparison of total height growth on the various seedbeds averaged for all exposures, showed that height ranged from a high of 32.4 inches on the U seedbeds to a low of 29.4 inches on the R seedbeds.

Root-collar diameters and oven-dry weights of 1966 stock--Average root-collar diameters and oven-dry weights of the planted and seeded stock are shown in Tables 4 to 7 inclusive. The planted and seeded stock exhibited the largest root-collar diameters and greatest oven-dry weights on the M and S exposures respectively. Considering seedbeds, all exposures averaged, the planted stock exhibited the largest root-collar diameters on the U seedbeds followed by the R, BNF, BSF and T respectively, and greatest oven-dry weights on the U seedbeds followed by the BSF, R, BNF and T seedbeds respectively. The seeded stock exhibited the largest root-collar diameters on the R and BNF seedbeds followed by the U, T and BSF seedbeds respectively, and greatest oven-dry weight on the BNF seedbeds followed by the R, U, T and BSF seedbeds.

Precipitation--Precipitation for the period April 30 to October 10, 1968 is shown in Table 4. Compared to the thirty-year average at Sprague, Manitoba the precipitation was 154.4 per cent of the normal.

REFERENCES

- Mueller-Dombois, D. 1964. The forest habitat types in southeastern Manitoba and their application to forest management. Can. Jour. Bot. 42:1417-1444.

TABLE 4
AVERAGE ROOT-COLLAR DIAMETER 1966 PLANTING

Exposure	Root-collar diameters (cm.) seedbed					
	R	T	U	BNF	BSF	All seedbeds
N	1.80	0.96	1.27	0.98	1.10	1.08
M	1.56	1.67	1.82	1.67	1.68	1.67
S	1.70	1.39	1.80	1.51	1.42	1.55
All exposures	1.55	1.33	1.68	1.42	1.41	1.46

TABLE 5
AVERAGE ROOT-COLLAR DIAMETER 1966 SEEDSPOTS

Exposure	Root-collar diameters (cm.) seedbed					
	R	T	U	BNF	BSF	All seedbeds
N	0.32	0.15	0.25	0.13	0.17	0.18
M	0	0.42	0	0.46	0.44	0.44
S	0.37	0.37	0	0.47	0.48	0.44
All exposures	0.32	0.21	0.25	0.32	0.20	0.25

TABLE 6
AVERAGE OVEN-DRY SEEDLING WEIGHTS 1966 PLANTING

Exposure	Oven-dry seedling weights (grams)					
	R	T	U	BNF	BSF	All seedbeds
N	46.6	24.9	40.0	30.7	40.4	34.8
M	76.7	94.4	112.5	96.7	110.9	98.2
S	85.6	80.8	93.2	72.1	67.8	79.3
All exposures	72.9	66.1	87.2	70.0	73.9	73.2

TABLE 7
AVERAGE OVEN-DRY SEEDLING WEIGHTS 1966 SEEDSPOTS

Exposure	Oven-dry seedling weights (grams) seedbed					
	R	T	U	BNF	BSF	All seedbeds
N	1.78	0.39	1.32	0.19	0.45	0.66
M	—	3.62	—	4.89	4.05	4.46
S	3.70	3.18	—	5.19	4.40	4.53
All exposures	1.89	1.07	1.32	3.05	0.87	1.70

TABLE 8
PRECIPITATION DURING THE PERIOD
APRIL 30 TO OCTOBER 10, 1968

<i>Rainfall (inches)</i>			
<i>Collection period</i>	<i>Total</i>	<i>Beal gauge</i>	<i>30 year avg Sprague</i>
<i>April 30</i>	<i>April 30</i>	<i>0.12</i>	<i>0.03</i>
<i>May 1-6</i> <i>7-13</i> <i>14-20</i> <i>21-27</i> <i>28-31</i>	<i>May 1-31</i>	<i>0.70</i>	
		<i>0.31</i>	
		<i>0.17</i>	
		<i>0.47</i>	
		<i>0.60</i>	
		<i>2.25</i>	<i>1.95</i>
<i>June 1-3</i> <i>4-10</i> <i>11-17</i> <i>18-24</i> <i>25-30</i>	<i>June 1-30</i>	<i>0.45</i>	
		<i>3.55</i>	
		<i>0.22</i>	
		<i>0.39</i>	
		<i>2.62</i>	
		<i>7.23</i>	<i>3.06</i>
<i>July 1</i> <i>2-8</i> <i>9-15</i> <i>16-22</i> <i>23-29</i> <i>30-31</i>	<i>July 1-31</i>	<i>0.44</i>	
		<i>0.10</i>	
		<i>1.56</i>	
		<i>1.04</i>	
		<i>0.33</i>	
		<i>0.34</i>	
		<i>3.81</i>	<i>2.92</i>
<i>Aug. 1-5</i> <i>6-12</i> <i>13-19</i> <i>20-26</i> <i>27-31</i>	<i>Aug. 1-31</i>	<i>1.98</i>	
		<i>0.29</i>	
		<i>0.90</i>	
		<i>2.37</i>	
		<i>0.36</i>	
		<i>5.90</i>	<i>3.51</i>
<i>Sept. 1-2</i> <i>3-9</i> <i>10-16</i> <i>17-23</i> <i>24-30</i>	<i>Sept 1-30</i>	<i>0.16</i>	
		<i>0.30</i>	
		<i>1.19</i>	
		<i>0.05</i>	
		<i>NIL</i>	
		<i>1.70</i>	<i>2.28</i>
<i>Oct. 1-6</i> <i>7-10</i>	<i>Oct 1-10</i>	<i>NIL</i>	
		<i>0.88</i>	
		<i>0.88</i>	<i>0.43</i>
<i>Total</i>	<i>April 30-Oct 10</i>	<i>21.89</i>	<i>14.18</i>