

SUGAR BEET

SPRING MECHANISATION 1970

SUMMARY: Hand singling gave the highest yield of sugar, outyielding drilling to a stand and mechanical gapping by 3 and 8 cwt per acre respectively. Drilling to a stand at 6 inch spacing resulted in the highest plant population and the greatest incidence of small roots.

OBJECT To examine four methods of mechanisation of spring work in the sugar beet crop, their effects on plant population and yield. Also to compare early and late harvesting both by hand and machine.

TREATMENTS Main:- date of lifting

1. Early lift
2. Late lift

Sub:- methods of spring mechanisation

1. 3 inch spacing hand singled
2. 3 inch spacing mechanically gapped
3. 3 inch spacing mechanically gapped and hand trimmed.
4. 6 inch spacing drilled to a stand.

Sub,sub:- method of harvesting

1. Hand
2. Machine

LAYOUT 4 randomised blocks with split plots

Treatment area 25 yds x 5 rows x 20 inches
Harvest area 23 yds x 1 row x 20 inches

SOIL TYPE Ashley (sandy loam)

**PREVIOUS
CROPPING**

1967 Winter oats and barley
1968 Winter wheat
1969 Spring barley

MANURING 6 cwt per acre of a 20.15.15 compound - Fertiliser
5 cwt Kainit (18% K₂O) in autumn before ploughing

VARIETY Sharpes Klein Polybeet (9-12/64 unpelleted)

SUGAR BEET

SPRING MECHANISATION 1970

METHOD A fine moist seedbed was prepared on 24 April but drilling was delayed until 29 April. The variety was Sharpe's Klein Polybeet. Weed control was by pyrazone overall sprayed at 2.2 lb a.i. per acre. Mechanical and hand singling were carried out on 4 June, with hand trimming of the gapped and trimmed treatment on 15 June. (removal of doubles)
The early lift was taken on 27 October under moist surface conditions but very dry beneath resulting in some below ground losses. The late lift was carried out on 7-8 December under extremely wet conditions.

RESULTS

FINAL PLANT POPULATION ('000 per acre)

Method of spring mechanisation	Method of harvesting		Date of lifting		Mean
	Hand	Machine	Early	Late	
	($\pm 1.75v$ $\pm 1.69hi$)		($\pm 1.81v$ $\pm 1.82h$)		(± 1.28)
Hand singled	29.6	33.4	32.9	30.2	31.5
Gapped	32.2	32.9	32.9	32.2	32.5
Gapped and trimmed	31.7	32.2	31.7	32.2	31.9
Drilled to a stand	39.8	40.0	39.7	40.0	39.9
	($\pm 1.26v$ $\pm 1.20hi$)				(± 0.93)
Date of lifting					
Early	34.2	34.4			34.3
Late	32.5	34.8			33.6
	(± 0.85)		(± 0.93)		
Mean	33.3	34.6	34.3	33.6	34.0

SE per plot (3df) = $\pm 1,860$ plants per acre or 5.48% of GM.

SE per sub plot (18df) = $\pm 3,620$ plants per acre or 10.66% of GM.

SE per sub, sub plot (24df) = $\pm 4,790$ plants per acre or 14.11% of GM.

1. Drilling to a stand at 6 inch spacing resulted in a high final plant population of 39,900 per acre, whereas the three other methods of spring mechanisation gave populations much closer to the target of 30,000 plants per acre.

YIELD OF SUGAR (cwt per acre)

Method of spring mechanisation	Method of Harvesting		Date of Lifting		Mean
	Hand	Machine	Early	Late	
	($\pm 2.42s. \pm 2.98hi$)		($\pm 1.69i. \pm 1.71h$)		(± 1.20)
Hand singled	78.3	68.5	74.4	72.4	73.4
Gapped	69.1	62.7	65.1	66.7	65.9
Gapped and trimmed	73.1	56.4	63.5	66.1	64.8
Drilled to a stand	74.7	66.3	70.6	70.4	70.5
Date of lifting	($\pm 1.75s. \pm 2.11hi$)				(± 0.88)
Early	72.9	63.8			68.4
Late	74.7	63.2			68.9
Mean	(± 1.49)		(± 0.88)		68.6
	73.8	63.5	68.4	68.9	

SE per plot (3df) = ± 1.77 cwt per acre or 2.58% of GM
 SE per sub plot (18df) = ± 3.38 cwt per acre or 4.93% of GM
 SE per sub-sub plot (24df) = ± 8.44 cwt per acre or 12.29% of GM

- Sugar content was not affected by method of spring mechanisation and therefore differences in sugar yield were a reflection of differences in root yield. Hand singling outyielded drilling to a stand by 3 cwt per acre and the mechanical gapping treatments by 8 cwt sugar per acre.
- The late lift gave 1.8 ton per acre more washed beet but the sugar content fell by 1.6% resulting in little differences in sugar yield between the two dates of lifting.
 N.B. This result is contrary to that of the previous year when late harvesting increased the yield of sugar. The 1970 results however must be regarded as suspect due to the mechanical failure of the pressure washer at the early lifting date.
- The incidence of small roots was highest from drilling to a stand and lowest from hand work. Losses of small roots from mechanical harvesting at the early date of lifting were low at 0.5 ton per acre and represent only a small proportion of the total loss due to mechanical harvesting. This suggests that below ground losses under these extremely dry conditions together with losses of large beet were the principle causes of the lower yield recorded from machine harvesting.

At the late date of lifting when conditions were very wet losses of small beet were higher for all methods of spring mechanisation and in particular from drilling to a stand where a loss of 3.2 ton per acre was recorded. The loss of small roots, at this late date of lifting, accounted for a higher proportion of the yield loss due to mechanical harvesting.

APPENDIX 1.

TOTAL YIELD ROOTS (ton per acre)

Method of spring mechanisation	Method of harvesting		Date of lifting		Mean
	Hand	Machine	Early	Late	
	(± 0.61 h, ± 0.76 hi)		(± 0.40 h, ± 0.41 hi)		(± 0.28 h)
Hand singled	21.63	18.90	19.67	20.85	20.26
Gapped	19.00	17.32	17.12	19.20	18.16
Gapped and trimmed	20.03	15.65	16.74	18.94	17.84
Drilled to a stand	20.55	18.19	18.53	20.21	19.37
Date of lifting	(± 0.44 h, ± 0.54 hi)				(± 0.21 h)
Early	19.17	16.86			18.02
Late	21.43	18.17			19.80
Mean	(± 0.38 h)		(± 0.21 h)		
	20.30	17.51	18.02	19.80	18.91

SE per plot (3df) = ± 0.438 ton per acre or 2.31% of GM.
 SE per sub plot (18df) = ± 0.804 ton per acre or 4.25% of GM.
 SE per sub,sub plot (24df) = ± 2.162 ton per acre or 11.43% of GM.

1. The highest yield of roots was obtained from hand singling followed by drilling to a stand, 20.3 and 19.4 tons per acre respectively. There was no difference between gapping only and gapping followed by trimming but yields of 18.2 and 17.8 tons per acre respectively were lower than from hand singling or drilling to a stand.
2. At the late date of lifting a mean yield increase of 1.8 tons per acre was obtained.

APPENDIX II

SUGAR PERCENTAGE

Method of spring mechanisation	Method of harvesting		Date of lifting		Mean
	Hand	Machine	Early	Late	
	($\pm 0.126_{\text{v}}$, $\pm 0.117_{\text{h}}$)		($\pm 0.134_{\text{v}}$, $\pm 0.140_{\text{h}}$)		(± 0.095)
Hand singled	18.13	18.14	18.91	17.36	18.13
Gapped	18.21	18.17	19.00	17.38	18.19
Gapped and trimmed	18.27	18.09	18.92	17.43	18.18
Drilled to a stand	18.24	18.23	19.04	17.43	18.23
	($\pm 0.097_{\text{v}}$, $\pm 0.083_{\text{h}}$)				(± 0.077)
Date of lifting					
Early	19.01	18.93			18.97
Late	17.41	17.39			17.40
	(± 0.058)		(± 0.077)		
Mean	18.21	18.16	18.97	17.40	18.18

SE per plot (3df) = $\pm 0.155_{\text{v}}$ or 0.85_{h} of GM.
 SE per sub plot (18df) = $\pm 0.268_{\text{v}}$ or 1.47_{h} of GM.
 SE per sub,sub plot(24df) = $\pm 0.330_{\text{v}}$ or 1.82_{h} of GM.

1. Spring mechanisation method had no effect on sugar percentage.
2. The sugar content of the roots fell by 1.6_{h} between early and late lifting.

APPENDIX III

YIELD OF SMALL ROOTS (ton per acre)

Method of spring mechanisation	Method of harvesting		Date of Lifting		Mean
	Hand	Machine	Early	Late	
	($\pm 0.191s$, $\pm 0.206hi$)		($\pm 0.175vi$, $\pm 0.280h$)		(± 0.124)
Hand singled	1.06	0.34	0.70	0.70	0.70
Gapped	2.68	1.10	1.65	2.13	1.89
Gapped and trimmed	1.28	0.60	1.00	0.88	0.94
Drilled to a stand	3.78	2.06	3.13	2.71	2.92
Date of lifting	($\pm 0.257v$, $\pm 0.145hi$)				
Early	1.87	1.37			1.62
Late	2.53	0.68			1.61
Mean	2.20	(± 0.103) 1.02	(± 0.235) 1.62	1.61	1.61

SE per plot (3df) = ± 0.470 ton per acre or 29.17% of GM.
 SE per sub plot (18df) = ± 0.351 ton per acre or 21.77% of GM.
 SE per sub,sub plot (24df) = ± 0.581 ton per acre or 36.08% of GM.

1. The incidence of small roots was inversely related to the amount of hand work involved in producing the final plant stand.
2. Losses of small roots were high from machine harvesting at the late date of lifting.

APPENDIX IV

SMALL ROOTS AS PERCENT OF TOTAL YIELD

Method of spring mechanisation	Method of harvesting		Date of Lifting		Mean
	Hand	Machine	Early	Late	
	($\pm 0.99v, \pm 1.00hi$)		($\pm 0.98vi, \pm 1.37h$)		(± 0.69)
Hand singled	4.9	1.8	3.5	3.3	3.4
Gapped	13.8	6.2	9.4	10.7	10.0
Gapped and trimmed	6.4	4.1	6.0	4.5	5.3
Drilled to a stand	18.3	11.3	16.8	12.8	14.8
	($\pm 1.19v, \pm 0.71hi$)				(± 1.08)
Date of lifting					
Early	9.9	7.9			8.9
Late	11.8	3.8			7.8
	(± 0.50)		(± 1.08)		
Mean	10.9	5.9	8.9	7.8	8.4

SE per plot (3df) = $\pm 2.15\%$ or 25.75% of GM.
 SE per sub plot (18df) = $\pm 1.96\%$ or 23.49% of GM.
 SE per sub, sub plot (24df) = $\pm 2.83\%$ or 33.87% of GM.

1. The proportion of small roots was highest where no hand work was involved and lowest from hand singling.