Agricultural Development and Advisory Service

Report to: Horticultural Development Council
18 Lavant Street
Petersfield
Hants GU32 3EW

ADAS Contract Manager: Peter C Rickard
Arthur Rickwood Experimental Husbandry Farm
Mepal
Ely
Cambs CB6 2BA
Tel: 03543 2531

Period of investigation: January - August 1990
Date of issue of report: September
No. of pages in report: 34
No. of copies of report: 6 (3 held by ADAS)
This is ADAS Copy No.: 2

CONTRACT REPORT
C900206
No. AR/90/3

Celery: early production of green celery under film covers.

Undertaken on behalf of HDC.
HDC ref No FV/50
Year 1

Commercial - In Confidence

ADAS

PRINCIPAL WORKER

Julian S Davies BSc Horticultural Advisor (author of report)

AUTHENTICATION

I declare that this work was done under my supervision according to the procedures described herein and that this report represents a true and accurate record of the results obtained.

..... Date 26 Oct 90

P C Rickard Contract Manager

Report authorised by:

.....

Dr David Hughes
Head Research and Development Services
Ministry of Agriculture Fisheries and Food
Room 314
Nobel House
17 Smith Square
LONDON
SW1P 3HX
Tel: 071 238 5962

Commercial - In Confidence

CONTENTS

Commercial - In Confidence

CELERY: EARLY PRODUCTION OF GREEN CELERY UNDER FILM COVERS

Summary

Eight varieties of the green type of celery were propagated at two different temperature regimes, planted and assessed during the growing season until harvest. The varieties Claret, Fenlander, RS664B, TZ8827, TZ8848, TZ8849, TZ8937, and Utah 1 strain were sown on 7 February and raised at 21°C before being pricked out on 28 February into 4.3 cm peat blocks and then placed at either 16 or 21°C minimum propagation temperature. The trial was planted on 10 April and covered with an Agryl P17 film crop cover until 5 June.

At planting there were only minimal differences between the sizes of plants from the two propagation regimes. The variety Utah 1 strain appeared to lack vigour at both temperatures but the reason for this was unclear.

The first heads were cut on 6 July from Utah 1 strain, Claret, TZ8848, TZ8849 and TZ8827. Quality was excellent particularly for Utah 1 strain and TZ8848. There was no consistent effect of propagation regime on either date of maturity or yield. RS664B and TZ8937 were slightly later to mature, followed by Fenlander.

Utah 1 strain, Claret, TZ8848 and TZ8849 had moderately long petioles (mean 252 mm) which were smooth but wide at the base, which enabled the 450 g minimum weight to be achieved earlier than those varieties such as TZ8937 and RS664B which produced long slender petioles. The colour of the petioles varied between the varieties with Utah 1 strain and RS664B producing light green sticks. In this season which was characterised by warm weather in late spring and early summer the levels of bolting were low. Claret had very low levels of bolting in July but by mid August both Claret and TZ8848 had higher levels of bolting (9% and 6%

Commercial - In Confidence

ADAS

respectively) and showed that they were more susceptible than the others included in this trial.

This trial was arranged too late in the season to obtain a full set of varieties, so plants were obtained of Greensleeves and Multipak from a commercial plant raiser and grown alongside varieties in the trial but these were not included in any of the statistical analysis. These varieties were raised in small peat blocks and could not be realistically compared with the varieties in the main body of the trial.

ADAS

Introduction

The green type of celery has recently been encouraged during the autumn production period in this country and it already accounts for a large proportion of imported celery during the winter months. The supermarkets are now requesting the green type in addition to self blanching celery during a long period of the year.

Most green types have been bred from the Tall Utah strains which originate from California. These varieties are generally very susceptible to bolting but advances in plant propagation and the film crop cover technique make early production a possibility. Also several of the new varieties do include some different genotypes and are thus considered more reliable than some of the older varieties.

The aim of the trial was to evaluate early field production of a range of both named and numbered varieties following propagation at either 16 or 21°C. An early April planting date was used in order to provide a severe test of resistance to bolting.

ADAS

Objective

To assess the effect of two propagation regimes on a range of green celery varieties. At present there is very limited information on the early production of green celery and the aim of the trial is to gather information so that outdoor producers can achieve high quality celery in late June or July whilst minimising the risk from bolting.

ADAS

Materials and Methods

Site

The trial was conducted on the Arthur Rickwood Experimental Husbandry Farm, Mepal, Ely, Cambridgeshire. The soil type is a loamy peat (60 cm) (with 26% organic matter) over sand and gravel. (Adventurers' Shallow). Bridge Ground.

Design

The experiment was of a randomised block design with three replicates. Plot size was 9.07 m^2 with 5 rows 300 mm apart per 1.68 m bed. Each plot consisted of 90 plants with 30 plants cut and assessed at harvest. (See Appendix III for plan of trial).

Treatments

Temperature during propagation

a. 16°C minimum glasshouse temperature
b. 21°C minimum glasshouse temperature

Varieties

a. Claret	(Royal Sluis)
b. Fenlander	(Tozer)
c. RS664B	(Royal Sluis)
d. TZ8827	(Tozer)
e. TZ8848	(Tozer)
f. TZ8849	(Tozer)
g. TZ8937	(Tozer)
h. Utah 1 strain	(Tozer)

The varieties Greensleeves (NIZ) and Multipak (NIZ) were also included in the trial but were propagated by a commercial plant raiser.

Commercial - In Confidence

ADAS

Husbandry

Seed of all the varieties was sown on 7 February into Correx trays and germinated at 21°C. On 28 February the seedlings were pricked out into 4.3 cm peat blocks and grown at either 16°C or 21°C according to treatment. Liquid feeding according to ADAS recommendation commenced from pricking out and was continued until planting.

At planting the standard spacing of 300 x 300 mm was used and the fibrous film cover of Agryl P17 laid. The film cover was removed for hoeing on 15 May and then replaced until 5 June when an increasing number of aphids were found within the crop, despite the cover remaining relatively intact, and a full insecticide spray programme commenced. The trial received standard commercial inputs thereafter until the final harvest (Appendix II).

Assessments

Each plot was regularly assessed from early July and when the majority of heads were of the correct size (minimum trimmed weight of 450 g) the plot was harvested. At harvest 30 heads/plot were cut, field trimmed and then weighed. The quality assessments undertaken included stick length, shape, colour of petioles, presence of internal basal side shoots and petiole smoothness. A simple taste test was also carried out.

Statistical analysis

Each plot was harvested as it matured and so it was not possible to statistically analyse all the data due to the effect of harvest date. However, the quality data was subjected to a factorial analysis of variance using the FACOVAY computer program developed by the ADAS Computer Development Unit.

Commercial - In Confidence

ADAS

Results and Discussion

During propagation there were no visible differences between the varieties in terms of leaf colour or plant size until early April. After that time plants of Utah 1 strain started to go very yellow at both propagation temperatures whilst the remainder of the varieties continued to produce strong green foliage.

The first heads were cut on 6 July. The harvest dates for the varieties and propagation treatments are given in Table 1.

Table 1. Harvest dates (meaned across the 3 replicates).

Variety	Propagation regime 16°C	21°C
Claret	9 July	6 July
Fenlander	25 July	28 July
RS664B	14 July	10 July
TZ8827	6 July	16 July
TZ8848	6 July	6 July
TZ8849	6 July	6 July
TZ8937	14 July	14 July
Utah 1 strain	6 July	14 July
Greensleeves	21 July	-
Multipak	29 July	-

The earliest varieties to mature were Utah 1 strain, TZ8848, TZ8849 followed by Claret, TZ8827, and RS664B. The two varieties supplied by a commercial plant raiser were much later to mature and this was probably due to the combination of a smaller plant size at planting and the use of a small peat block. Fenlander also took longer to mature.

Commercial - In Confidence

ADAS

The effect of the two propagation regimes was difficult to determine. It appeared to make no difference for most varieties except Utah 1 strain and TZ8827 where a delay in maturity occurred following propagation at a minimum of 21°C. However, it should be remembered that the weather conditions after planting were very favourable to plant growth and that very little bolting was observed in 1990 celery crops.

The number of marketable heads is given in Figure 1.

The two propagation regimes used gave similar results with no apparent benefit from using the higher and more costly 21°C regime. There were significant ($P<.05$) differences between the varieties with Claret and TZ8849 producing over 80% marketable heads in early July. The varieties Fenlander and Greensleeves performed less well and took longer to mature.

The mean head weights are given in Table A, Appendix V.

The main head defects were lack of weight (below 450 g) and poor shape, particularly for the later maturing varieties, table 2. The poor head shape was mainly due to the twisting of either the outer or inner petioles.

ADAS

Fig 1 : Number of Marketable heads (%)

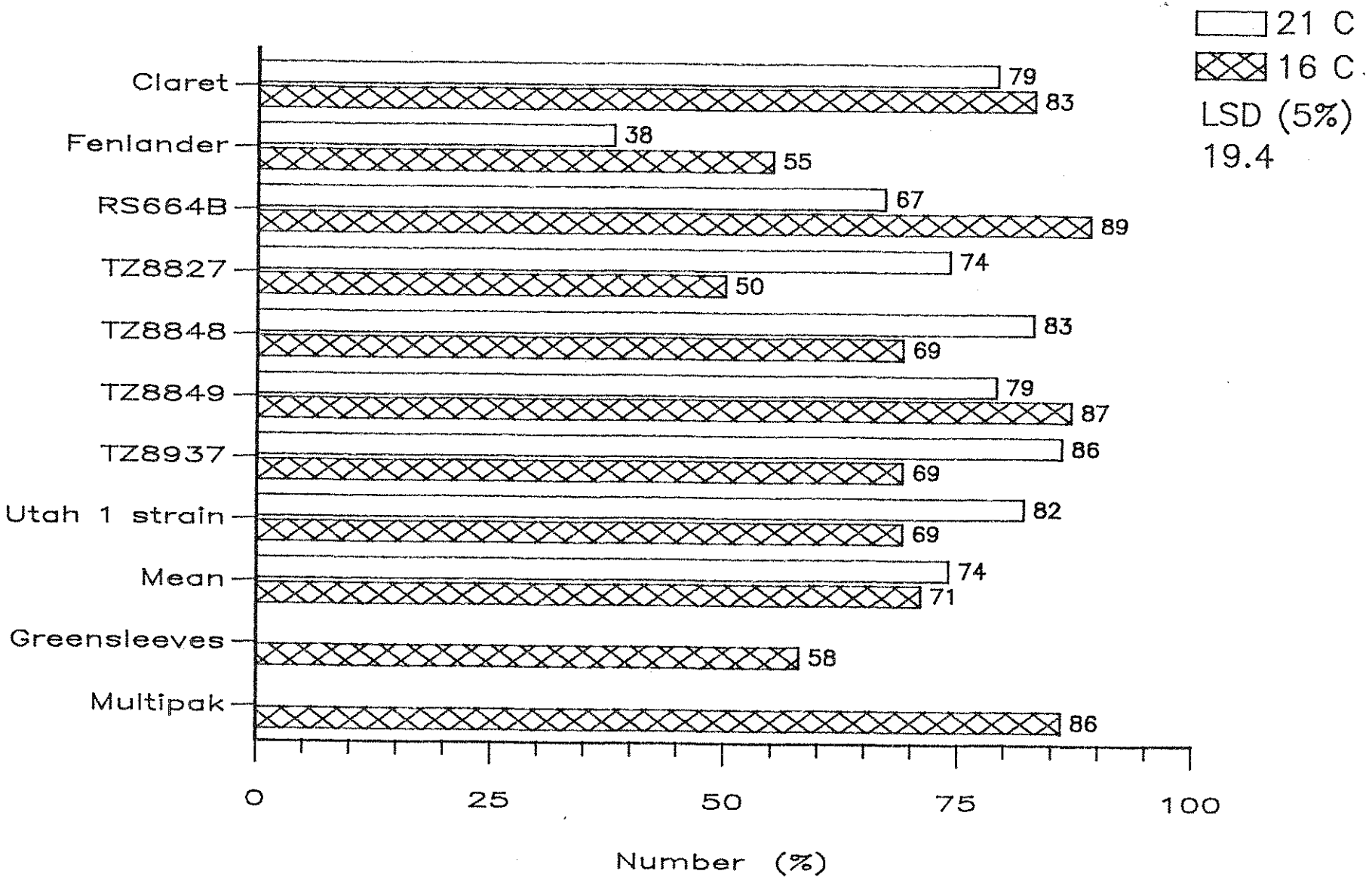


Table 2. Head defects (%).

Variety	Small (%)			Poor shape (%)		
	16°C	21°C	Mean	16°C	21°C	Mean
Claret	15	21	18	0	3	2
Fenlander	39	17	28	6	41	24
RS664B	9	32	21	2	1	2
TZ8827	50	26	38	0	0	0
TZ8848	30	17	23	1	0	1
TZ8849	13	21	17	0	0	0
TZ8937	31	13	22	0	1	1
Utah 1 strain	31	18	25	0	0	0
Mean	27	21	24	1	6	4
Greensleeves	38	-		4	-	-
Multipak	12	-		2	-	-

The number of small heads was generally low but for some varieites it was high and this often reflected a harvest date slightly ahead of the optimal date of maturity.

The number of poorly shaped heads was very low over all varieties but was a particular problem for Fenlander which had a tendency to produce heads which were open and thus difficult to place into the polythene celery sleeves.

Commercial - In Confidence

ADAS

The number of bolted plants in the trial during July was almost neglible. The remaining plants were assessed on 14 August by which time the levels of bolting had increased for Claret (mean 9%) and also to a lesser extent for TZ8849 (mean 6%). However, it should be remembered that by this date they were very overmature.

A description of each variety is given in Appendix IV.

The quality related assessments were meaned for both propagation regimes and are given in Table 3.

Table 3. Quality assessments taken at harvest.

Variety	Mean stick length (mm)	Colour (1-9)*	Smoothness (1-9)*	Internal leafyness (1-3)≠
Claret	242	4.2	3.4	1.5
Fenlander	249	4.2	4.1	1.1
RS664B	276	3.5	2.9	1.9
TZ8827	264	4.0	4.4	1.4
TZ8848	251	4.4	3.8	1.6
TZ8849	254	4.2	3.7	1.7
TZ8937	274	4.0	4.2	1.4
Utah 1 strain	259	3.7	2.6	1.9
Mean	259	4.0	3.7	1.6
Greensleeves#	275	3.3	3.6	1.1
Multipak#	265	3.8	3.7	1.0
CV %	4	10	10	30
SED (30 df) for comparing variety means	8.9	0.33	0.30	0.38

not included in the analysis

* 1 = very light/smooth
  9 = very dark/very ribby

≠ 1 = no inside leaves at base
  3 = inside leaves visible at base

Commercial - In Confidence

ADAS

The two propagation regimes gave similar mean stick lengths but there were differences ($P<.05$) between the varieties. The Utah 1 strain and RS664B gave the longest sticks. Claret, TZ8848 and TZ8849 were shorter: their petioles were wider at the base which resulted in heavier sticks but they were still easy to pack into standard commercial polythene sleeves.

The varieties Utah 1 strain, RS664B and Greensleeves produced heads which were light green in colour. Both TZ8848 and TZ8849 produced sticks which could be described as 'apple green' in colour.

Several varieties produced sticks which were almost smooth. These included Utah 1 strain, Claret, RS664B and TZ8848 and TZ8849. The later maturing varieties generally had petioles which were more ribbed and thus more susceptible to damage during harvesting.

ADAS

Conclusions

1. The trial has shown that high quality green celery can be produced in early July.

2. The two propagation regimes appeared to give similar results although in some cases the 16°C treatment did advance maturity by several days. However this was not a good year to test susceptibility to bolting.

3. The choice of variety is critical and those that show promise for harvesting in early July include Utah 1 strain, Claret, TZ8848 and TZ8849. RS664B and TZ8827 took longer to mature but were earlier than TZ8937 and Fenlander.

4. The best quality celery was produced by Utah 1 strain, Claret and TZ8848 which produced smooth petioles of generally light green colour. They also required very little trimming and were easy to place into polythene sleeves.

ADAS

Recommendations

1. The trial should be repeated in 1991 as the weather in late spring was atypical of our normal climate.

2. Other varieties should be included especially those which have bolt-resistance and are of the light green type. Seed companies will be asked to submit their selections.

3. More extensive taste and shelf life testing should be conducted on several occasions to properly evaluate each variety. These assessments will follow the procedures used by other research institutes involved in sensory analysis.

4. Field standing ability should be assessed and this should also give information on bolt susceptibility in the event of a repeat of the warm spring and early summer weather conditions experienced in 1990.

ADAS

Acknowledgements

We gratefully acknowledge the help and support of local celery growers and in particular John Shropshire for providing plants of Greensleeves and Multipak for use in this trial.

Storage of data

The raw data will be stored by ADAS at the Arthur Rickwood Experimental Husbandry Farm for a period of 10 years. The Horticultural Development Council will be consulted before disposal.

Contract between ADAS (hereinafter called the "Contractor") and the Horticultural Development Council (hereinafter called the "Council") for a research/development project.

PROPOSAL

Contract No: FV/50

1. TITLE OF PROJECT

CELERY: EARLY PRODUCTION OF GREEN CELERY UNDER FILM COVERS

2. BACKGROUND AND COMMERCIAL OBJECTIVE

The Supermarkets are now requesting the green type of celery in addition to the traditionally favoured self-blanching ones. The green types are well suited to mid and late season production and this trial should give growers information on how to achieve early production using a combination of high termperature in propagation and film covers laid at planting.

3. POTENTIAL FINANCIAL BENEFIT TO THE INDUSTRY

This trial was started at the request of two large local celery producers who expressed a need for varietal evaluation of the increasing range of green varieties now available. Green varieties are better flavoured and there may be a price premium over the self-blanching types commonly grown.

4. SCIENTIFIC/TECHNICAL TARGET OF THE WORK

The work will concentrate on propagation regime and varieties. Two propagation regimes, 16 degrees celsius and 21 degrees celsius minimum temperatures will be compared using both existing and new numbered varieties. The target will be to determine the optimal husbandry inputs and best varieties for this early production period. flavour and field standing ability will also be recorded.

5. CLOSELY RELATED WORK

No work on this subject has been carried out before on green varieties. Previous HDC and MAFF funded work has concentrated on maximising earliness of the self-blanching celery types but these have a different genotype to the green celery types. There is no current MAFF work being conducted on this subject.

6. DESCRIPTION OF THE WORK

1990 Preliminary cultivar screening.

Two propagation regimes (16 degrees celsius and 21 degrees celsius) are being compared using Fenlander, Utah 1 Strain, Claret, Greensleeves, Multipak, RS664B, TZ8848, TZ8849, TZ8827.andTZ8837

The trial was planted in mid April and covered with an Agryl P17

Commercial - In Confidence

A D A S

film cover. The film covers will remain on the crop for as long as possible. At harvest the quality, flavour, standing ability and yield will be recorded.

1991 and 1992

The information on varietal performance obtained in 1990 will be used to provide a basis on which to build. It is envisaged that eight varieties will be grown and raised at two different temperature regimes.

Harvesting will be along similar lines to 1990.

7. COMMENCEMENT DATE AND DURATION

Year 1 - 1990 (Preliminary study)
Year 2 - 1991 Full trial
Year 3 - 1992 Subject to HDC approval

8. STAFF RESPONSIBILITIES

Project Leader: Peter Rickard
Arthur Rickwood EHF

9. LOCATION

Arther Rickwood EHF
Mepal
ELY
Cambs CB6 2BA

10. COSTS

1990	£1500
1991	£3900
1992	£4150 (subject to HDC approval)

11. PAYMENT

On each quarter day the HDC will pay the contractor in accordance with the following schedule

QUARTER/YEAR	1990	1991	1992 (subject to review)
1	--	--	--
2	750	2000	2000
3	750	1900	2150
4	--	--	--

Commercial In Confidence

TERMS AND CONDITIONS

The Council's standard terms and conditions of contract shall apply.

Signed for the Contractor (s)

Signature.....

Position R&D Programme Manager

Date 9-7-90

Signed for the Contractor (s)

Signature.....

Position.....

Date.....

Signed for the Council

Signature.....

Position.....

Date 3.7.90

Commercial - In Confidence

HORTICULTURAL DEVELOPMENT COUNCIL

STANDARD TERMS AND CONDITIONS OF CONTRACT

1. LIAISON AND SUPERVISION:

(a) The project leader as nominated in paragraph 8 shall be responsible for the scientific and technical supervision of the project as set out in the Proposal.

(b) In respect of the programme of research covered by the project and its execution, the Council's Project Officer (or such other person as may be authorised by the Council and notified to the Contractor(s)) alone shall issue instructions on behalf of the Council.

(c) The Contractor(s) shall afford to the Council's Project Officer and any other person or persons authorised by the Council reasonable access to the work and to documents relating directly and exclusively to the administrative and financial matters within the Contract.

(d) All claims for payment and communications relating to the contract, including any requests for a variation of the contract, shall be addressed to the Horticultural Development Council, 18 Lavant Street, Petersfield, Hants GU32 3EW.

FINANCIAL LIABILITY AND ARRANGEMENTS

2. Subject as hereinafter provided, the Council's financial liability is limited to the approved cost specified in the Contract or in any subsequent letter from the Council authorising a variation. Any increases attributable to nationally agreed pay awards or to increased rates for National Insurance or Superannuation after the first 12 months of the project, shall be the subject matter of negotiations for an increase in the price for the remainder of the project. Any request for a variation of the Contract price should be made by the Contractor(s) to the address given in paragraph 12(d) above.

3. a) Unless agreed otherwise, the Contractor(s) shall submit claims for payment in respect of the quarters ending on 31 March, 30 June, 30 September, and 31 December. The period covered by each claim shall be clearly stated on it. Each claim shall be submitted promptly after the end of the relevant quarter. The Contractor(s) shall maintain cost records for his work on a basis reasonably acceptable to the Council in the context of the provisions of this Contract and the details provided by the Contractor(s) prior to the date hereof and shall operate a system of financial management to monitor expenditure under the Contract. Such information shall be available to the Council on request.

b) All payments due under this Contract shall be made by the Council within one month of the receipt of the Council of a claim properly made in accordance with the terms of this Contract.

4. The Council shall not be liable for any costs incurred on visits to conferences or similar functions, or for any visits abroad, by the Contractor(s) in connection with the project other than as specified in the Contract or otherwise having the prior approval of the Council in writing.

5. The Contractor(s) shall submit the final claim within three months of the completion date unless previously agreed by the Council in writing. The Council reserves the right to withhold all or part of the final payment until the receipt of a final report satisfactory to the Council reporting the history of the project and the outcome of the work involved.

6. In the event of the Contract being terminated before the completion date the Contractor(s) shall negotiate a payment on the basis of work done from the date of the last statement (if any) up to the termination date. The Contractor(s) may also claim costs or other sums that they are legally bound to pay after the termination date as a result of commitments properly incurred before the date that he received notice of termination but shall not be entitled to any payment by way of compensation.

7. The Council reserves the right to withhold payment or part thereof in the event of a material breach by the Contractor(s) of any of their obligations under this Contract, and to recover from the Contractor(s) any payments which are subsequently found to have been improperly claimed.

EQUIPMENT

8. a) The Contractor(s) shall at the outset of the project provide such equipment as is deemed necessary for the project.

b) If during the duration of the Contract the parties deem it necessary that additional equipment be provided for the continued prosecution of the project then and in every case (subject to there being negotiated a proper charge for the provision thereof whether by rental hiring or other means of such equipment as an additional project cost) it shall be the duty of the Contractor(s) to arrange for the provision of such additional equipment.

STAFF, LIABILITY, CONDITIONS OF EMPLOYMENT ETC.

9. The Contractor(s) shall accept full responsibility as employer for all the staff engaged on the project.

10. The Contractor(s) agree to indemnify the Council against all claims against it arising out of the conduct of the project.

11. It is a condition of this Contract that all relevant employment and race relations legislation be complied with.

REPORTS AND REVIEWS

12. For information purposes the project leader shall produce and submit to the Council's Scientific Advisor quarterly progress reports and an annual report which will provide the basis for a review of the project. On completion of the project a final comprehensive report shall be provided.

THE RESULTS

13. a) Subject to any third party rights arising, any property (whether subject to patent, registered design, copyright, or other protection) in any invention, design, drawing, information, report or other work arising solely and directly out of the performance of this project (herein called the "Results") shall belong to the Council.

b) Joint funded projects. In the case of joint funded projects, the Results shall be freely available to and exploitable by any or either of joint sponsors.

c) The parties hereto undertake with each other to negotiate on a realistic basis for the apportionment between the parties of any royalty payments which may result from the use or publication of the results mentioned in this Clause.

14. (1) Subject to the provisions of sub-clause (2) hereof, the Contractor(s) shall not make any information arising from the project available generally unless:-

(a) the information has already been furnished to the Council in the form in which it is intended to release it; and

(b) the Council has within a period of four weeks from the receipt of the request by the Contractor(s) for permission to make such information available in writing that permission is not granted and the reasons therefore; and

(c) all such forms of publication include a statement that the project was supported by Council funds, and the results of the research are the property of the Council.

(2) Nothing herein contained shall prevent the Contractor(s) or any persons employed by the Contractor(s) making use in any future work of any knowledge obtained in the prosecution of the project or from doing work of a similar nature.

A D A S

(3) In any publicity by or at the instance of the Council of information relating to the project the identity nature and involvement of the Contractor(s) shall be clearly stated.

15. The Contractor(s) shall not enter into any arrangement with a third party which would adversely affect any of the provisions of the Contract without the prior consent of the Council.

16. The Contractor(s) shall without unreasonable delay disclose to the Council full details of any invention or novel know-how solely and directly derived from the work within the project and shall do all things that the Council may require for the purposes of obtaining patent or like protection in the name and at the expense of the Council.

17. The Contractor(s) shall at the expense of the Council give any assistance which the Council may reasonably require for the purposes of upholding the Council's right in the Results whether in the course of legal proceedings or otherwise.

18. a) Subject to the provisions of sub-clause (b) hereof upon all matters which, in this Contract, are subject to the approval, consideration or determination, of the Council, the decision of the Council shall be final and conclusive.

b) Any dispute arising hereunder shall at the instance of either party be submitted to arbitration by a single arbitrator to be agreed between the parties or (in default of such agreement within 28 days of the date of request for arbitration) to be appointed by the Secretary of the Headquarters Branch of the National Farmers' Union.

TERMINATION

19. The Contract may be terminated by agreement at any time or by either party by giving not less than three months notice in writing to the other party, such notice to be given only upon there being a valid reason. In the event of termination the terms laid down in paragraph 6 will apply.

20. Without prejudice to any other remedies, the Council reserves the right to terminate the Contract at any time without prior warning in the event of material breach by the Contractor(s) of any of their obligations under this Contract.

21. In the event of the Agriculture Ministers making an Order for the dissolution of the Council all further rights and obligations under this Contract are terminated as from the date of the Order coming into operation but without prejudice to all rights and obligations which may have arisen prior to the date of the Order coming into operation. In the event of termination the terms laid down in paragraph 6 above shall apply.

22. In the event of there being more than one Contract relating to the project the obligations and responsibilities of the Contractor(s) (party hereto) shall be limited to those specified herein.

Name signed on behalf of ADAS
May 1987.
P. Allington

Commercial - In Confidence

ADAS

Appendix II

Field	Bridge Ground	
Soil type	Loamy peat (60 cm) over sand and gravel (26% organic matter) Adventurers' Shallow.	
Previous cropping	1989 sugar beet 1988 winter wheat 1987 winter wheat	
Crop diary		
Cultivations	2 January	plough and furrow press
	5 March	cultivate using Kuhn rotary harrow
Propagation	7 February	seeds sown into Correx trays @ 21°C
	28 February	pricked out into 43 cm blocks @ 21 or 16°C
	4 April	plants moved to 5°C
Husbandry	10 April	planted and covered
	15 May	hoed
	5 June	hoed and cover removed not replaced
Insecticides	7 June	0.14 kg/ha ai pirimicarb as 280 g/ha cp Aphox in 1000 l/ha water
	25 June	0.14 kg/ha ai pirimicarb as 280 g/ha cp Aphox + 0.025 kg/ha ai cypermethrin as 250 mls/ha Ambush C + 250 mls Agral in 1000 l/ha water
	12 July	0.025 kg/ha ai cypermethrin as 250 mls/ha Ambush C in 1000 l/ha water
Fertiliser	23 Nov 1989	157 kg/ha P_2O_5 + 314 kg/ha K_2O
	29 March	180 kg/ha N^2
Trace elements	10 May	9 kg/ha $MnSO_4$ in 250 l/ha water
	6 June	as above
	27 June	as above
Irrigation	12 April	25 mm
	26 April	20 mm
	4 May	25 mm
	17 May	25 mm
	21 May	25 mm
	29 May	25 mm

Commercial - In Confidence

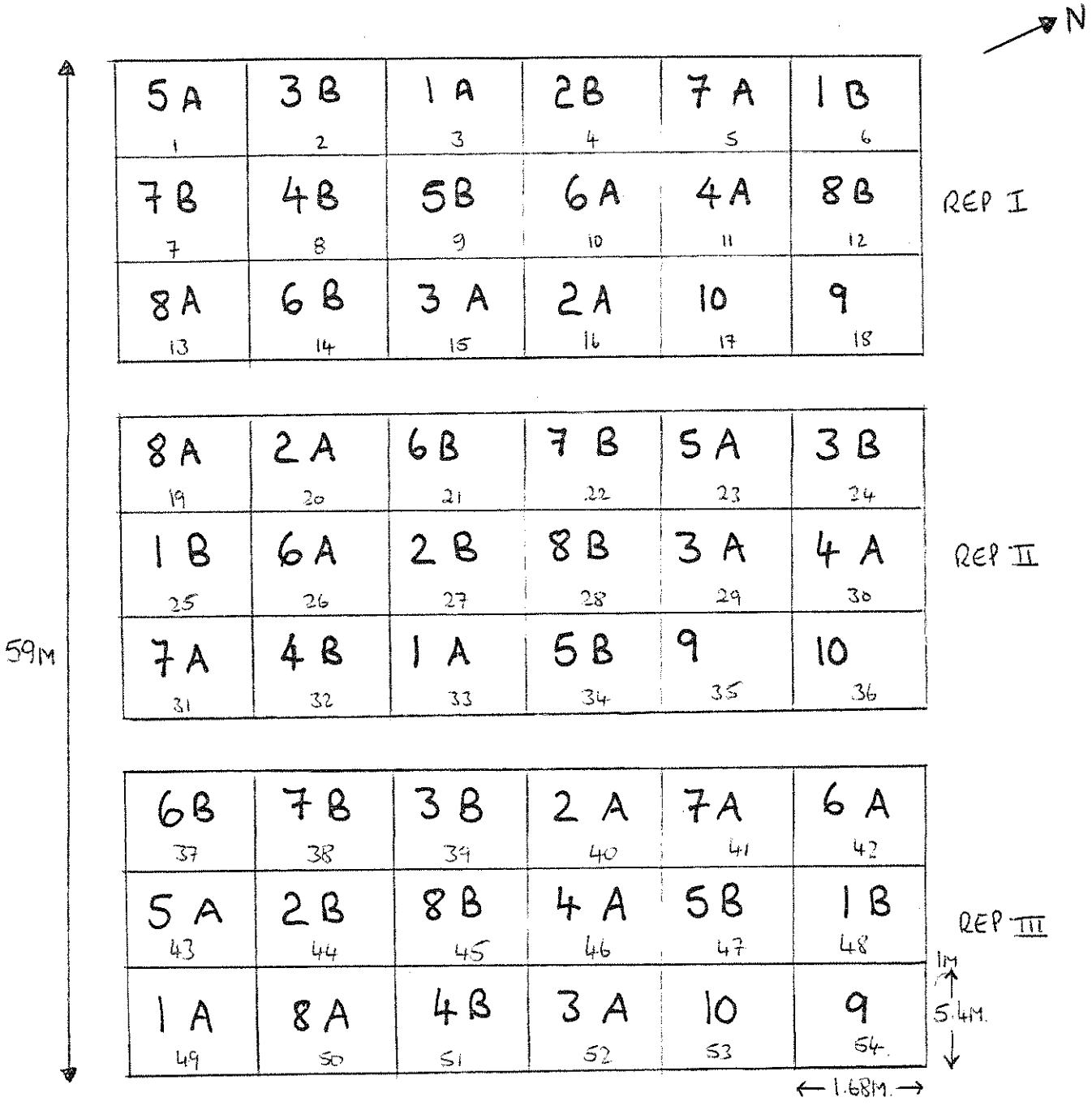
ADAS

	7 June	25 mm
	13 June	25 mm
	14 June	25 mm
	20 June	25 mm
	28 June	25 mm
	2 July	25 mm
	13 July	25 mm
	16 July	25 mm
	19 July	25 mm
	23 July	25 mm
	28 July	25 mm
	30 July	25 mm
Harvest dates	6 July	first harvest
	11 July	
	19 July	
	26 July	
	31 July	final harvest
	14 August	assessment of bolting

ADAS

CELERY : EARLY PRODUCTION OF GREEN CELERY

1990



Varieties

1. Fenlander
2. Utah 1 strain
3. Claret
4. RS 6648
5. TZ 8848
6. TZ 8849
7. TZ 8827
8. TZ 8937
9. Greensleeves
10. Multipak

Temp regime

A. 16 °C
B. 21 °C

PLOT LAYOUT

5 ROWS @ 300 MM
18 PLANTS @ 300 MM

90 PLANTS / PLOT.

Note 9+10 obtained from plant raiser, all at 16°C regime.

Commercial - In Confidence
ADAS

Appendix IV

Description of each variety.

Claret	An early variety with attractive appearance. The petioles were fairly smooth and required only a minimal amount of trimming. Levels of bolting were low in July but it would appear to be more susceptible to bolting than the other varieties in the trial.
Fenlander	The last variety to mature in late July. The heads were generally of poor shape with short petioles and a tendency for some outer petioles to be twisted. The petioles were dark green in colour, ribbed and generally not very attractive.
RS664B	A medium-early variety with light green coloured smooth petioles. However, there was a tendency for the outer petioles to be twisted and many of the heads had inner side shoots which reduced the attractiveness of the variety.
TZ8827	A medium-early variety producing fairly attractive heads. The colour tended to be quite variable with some quite dark green heads produced. The petioles were fairly ribbed and this made them look crisp and not as fleshy as many of the others.

Commercial - In Confidence

ADAS

TZ8848	A very early variety of excellent quality. The petioles were long with virtually no trimming required. The petioles were almost smooth, quite chunky but visually very attractive.
TZ8849	An early variety which produced high quality heads. The petioles were slightly ribbed, needed trimming and had a tendency to be blanched at the base. The shape was not as good as that of TZ8848 but still very acceptable.
TZ8837	A late variety of generally poorer quality with the heads quite open. The petioles were fairly ribbed and needed much trimming. Overall the colour was darker and altogether it was not a very attractive variety.
Utah 1 strain	A medium-early variety. The petioles were smooth, light green in colour and fairly long. The base of the petioles was wide and heads required very little trimming.
Greensleeves	Similar to TZ8827 producing fairly attractive heads which required minimal trimming.
Multipak	Performed well and required little trimming.

Commercial - In Confidence

ADAS

Appendix V

Table A. Mean head weights (g).

Variety	Propagation regime 16°C	21°C	Mean
Claret	595	508	552
Fenlander	471	532	502
RS664B	598	511	554
TZ8827	449	532	491
TZ8848	522	570	546
TZ8849	610	560	585
TZ8937	506	569	538
Utah 1 strain	516	581	549
Mean	533	545	539
Greensleeves#	498	-	-
Multipak#	637	-	-

not included in the analysis

CV %	10
SED (30 df) for comparing propagation regime means	16.0
SED (30 df) for comparing variety means	32.0
SED (30 df) for comparing propagation regime x variety means	45.2

There were no significant ($P<.05$) differences between either propagation regimes or varieties.

Commercial - In Confidence ADAS

Appendix VI

Table B. Weather data recorded during the trial.

Week commencing	Air temperature Max	Min	Mean	Soil temps (10 cm)	Accumulated day degrees 1990	1989	Rainfall (mm)
9 April	16.5	-1.4	9.2	7.8	18	20	5.7
16 April	13.8	-0.5	8.6	7.5	16	8	16.8
23 April	21.6	-0.5	12.7	10.4	33	24	1.0
30 April	26.6	3.9	16.9	15.1	68	49	0
7 May	18.8	3.7	13.0	13.7	37	32	16.1
14 May	21.2	4.4	14.2	14.0	46	64	0.2
21 May	21.0	-2.6	14.9	14.8	40	63	0
28 May	24.2	1.0	15.2	16.2	59	28	5.9
4 June	18.0	3.1	13.2	13.3	39	43	12.0
11 June	22.4	4.5	17.1	12.0	49	88	0
18 June	21.6	6.0	18.7	16.0	60	77	15.9
25 June	24.9	7.9	15.1	18.1	82	62	8.1
2 July	24.4	2.8	18.4	14.8	61	85	13.8
9 July	28.9	6.0	21.4	18.3	79	83	0
16 July	31.2	7.4	19.2	21.0	93	101	0
23 July	25.6	3.4	23.3	19.1	72	90	10.0
Total					852	917	105.5

1. The mean air temperature are measured at 0.900 GMT
2. The accumulated day degrees are based on a temperature of 6°C and give a useful indication of growing conditions for comparison with other years.

Commercial - In Confidence

ADAS

Appendix VII

Table C. Temperatures under film cover from planting until the removal of the film cover.

Week commencing	Temperatures (°C) Minimum	Maximum	Weighted mean#
9 April	3	21	11
16 April	4	26	12
23 April	3	36	16
30 April	NR	NR	NR
7 May	7	29	16
14 May	10	38	17
21 May	7	38	19
28 May	10	33	18
4 June	7	25	15

Notes NR - not recorded
- weighted mean takes into account the time spent at each temperature rather than just the mean of the minimum and maximum temperatures.

The temperature readings were taken using a Casella thermograph which recorded the temperature at 50 mm above the soil surface.

Commercial - In Confidence

ADAS

Appendix VIII

A simple taste test was conducted using five people on 19 July. The overall comments are given below:-

Claret	Not strongly flavoured, quite sweet
Fenlander	Bland, rather bitter and overall not popular
RS664B	Bland, only a mild flavour
TZ8827	Stringy but sweet taste
TZ8848	Ordinary, rather bitter
TZ8849	Sweet, tasty, good
TZ8937	Tender, crisp and fairly strong taste
Utah 1 strain	Tasty but rather stringy, quite nice but slightly bitter
Greensleeves	Good flavour, but not very sweet
Multipak	Very strong, good flavour.

The results show that people often have different preferences for taste and flavour. Overall, Fenlander was the least liked possibly because it was under mature, whereas TZ8937, TZ8849 and Greensleeves were more popular.

Note: It is envisaged that in 1991 more detailed assessments will be undertaken after consultation with other research organisations.

Commercial - In Confidence

ADAS