

**FINAL REPORT
PROJECT FV 153**

**ASPARAGUS:
COMPARISON OF RATES OF PHOSPHATE
AND POTASH ON CROP PERFORMANCE
(ADAS CONTRACT XHACD)**

FINAL REPORT

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Project Leader: W J Dyer, ADAS Bury St Edmunds

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Bradbourne House
Stable Block
East Malling
Kent
ME19 6DZ

ADAS Contract Manager: W J Dyer

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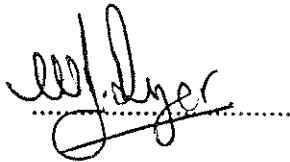
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Bury St Edmunds

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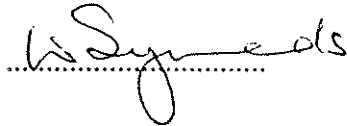
I declare that this work was done under my supervision according to the procedures described herein and that this report represents a true and accurate record of the results obtained.



W J Dyer, NDH
Contract Manager

Date: 30.1.97

Report authorised by:



Mr W Symonds
ADAS Kirton
24 Willington Road
Kirton
Boston
Lincs PE20 1EJ

Tel: 01205 722391

Date: 31.1.97

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Practical section for growers

Introduction

Recommendation on the rates of phosphate and potash needed for asparagus crops were laid down during the 1960s when poor yielding open pollinated varieties were grown in the UK, and at a time when demands for spear quality were not as strict as they are in the 1990s. No work has been carried out in the UK since the 1960s.

It is vital that growers produce satisfactory yields of good quality spears in order both to produce an early break-even point in the crop's life and maximise returns in each of the harvesting seasons. It is important that suitable levels of phosphate and potash are applied to ensure balanced growth and crop longevity of 15 years or more.

In discussion with Soil Scientists, it has been concluded that phosphate and potash levels need to be re-examined on the higher performing varieties being grown in the 1990s.

Treatments

This trial was laid down on a three year old, well managed crop of the all male variety, Franklim, in April 1993. A range of rates of phosphate and potash were applied over a 4 year period. 100%, 200% and 400% of the current ADAS recommendations were tested. Applications were applied 15 April 1993, 2 May 1994, 30 April 1995 and 21 April 1996. Soil samples were taken annually and yields recorded from 1994 to 1996 inclusive.

Summary of Results and Discussion

Yields - 1996

There were no significant differences between treatments of either phosphate or potash rates for numbers of spears or weight.

Yields - 1994-1996 - Please refer to tables 9 and 10

There were no significant differences between treatments of either phosphate or potash rates for numbers of spears or weight.

Comparison of Results with Standard Recommendations

At the start of this trial phosphorus levels were Index 3 and potash levels Index 2 in both the top soil and sub soil. Such levels would be regarded as maintenance levels for satisfactory asparagus production and typical of asparagus producing soils.

During the four year period of the trial phosphate levels at the highest level of application (200kg/ha/year) rose from Index 3 to Index 5 in the topsoil (0-15cms) but with no difference in the subsoil (15-30cms). Despite this increase, no yield

improvement was recorded, confirming that Index 3 is adequate for satisfactory growth and production.

Potash levels in both topsoil and subsoil fell slightly except when the highest rate (100kg/ha/year) was used. This suggests that crop removal is in excess of 50kg/ha of potash but less than 100kg/ha per year.

When the trial was started standard recommendations during the established phase of the crop were 50kg/ha phosphate at Index 3 and 25kg/ha of potash for Index 2 per year. As a result of this trial phosphate recommendations at Index 3 do not need to be changed, but in view of the change in soil potash levels it is recommended that the potash level be increased to 50kg/ha at Index 3. It must be borne in mind that revised recommendations are for an established crop.

Harvest data has been collected for three years. Any effects of treatments are likely to require a prolonged period of treatments and recording to evaluate accurately.

INTRODUCTION

Levels of phosphate and potash needed for successful production of asparagus crops have not been evaluated in the UK since the 1960s, when poor yielding open pollinated varieties were grown.

With the development of the higher yielding, all male varieties, which are now being planted, levels of the major nutrients need to be re-examined.

This study was started in spring 1993.

The crop was established in May 1990 with the Dutch, all male variety, Franklim.

A range of phosphate and potash applications were made in each spring for the period 1993 to 1996 inclusive. Soil samples were taken annually during the winter periods 1993-1996 inclusive, and crop yields taken from 1994 to 1996 inclusive.

OBJECTIVE

Asparagus - To measure the effects of a range of rates of phosphate and potash applied annually over a four year period on crop performance.

MATERIALS AND METHODS

Site

The experiment was carried out at Portwood Farm, Gt. Ellingham, Nr Attleborough, Norfolk. The soil type is a sandy loam with some stones, of approximately 30 cm (12 ins) depth, over a sandy clay loam (Wick Series). The site is well drained. Please refer to Appendix A for results of Soil Analysis.

Treatments applied in 1993, 1994, 1995 and 1996

Treatments	Rates - kg/ha (units/acre)
Phosphate - Soil Analysis - Index 3 A Nil B Current ADAS recommendations C 200% of current ADAS recommendations D 400% of current ADAS recommendations	Phosphate 0 50 (40) 100 (80) 200 (160)
Potash - Soil Analysis - Index 2 E Nil F Current ADAS recommendations G 200% of current ADAS recommendations H 400% of current ADAS recommendations	Potash 0 25 (20) 50 (40) 100 (80)

Consideration was given to the fact that rates may need to have been adjusted each year on the basis of soil analysis results of each treatment, but the ratios of 100%, 200% and 400% of current ADAS recommendations were maintained. As 1996 soil analysis results were similar to those in 1993, 1994 and 1995, similar rates of phosphate and potash were applied for each treatment.

1. All phosphate treatments were applied with 25 kg/ha of potash.
2. All potash treatments were applied with 50 kg/ha of phosphate.

Phosphate applied as Triple Superphosphate.

Potash applied as Muriate of Potash.

Treatments were applied 15 April 1993, 2 May 1994, 30 April 1995 and 21 April 1996.

Husbandry

The crop was planted in May 1990 using the Dutch, all male variety, Franklim. It was established from container raised transplants planted in single rows at 1.50 m (5 feet) centres with an in row spacing of 27 cm (11 ins), giving a plant population of 23,750 per hectare (9,500 per acre).

The first harvests were taken in 1992 from 1 to 20 May. The first full harvest year was 1993, when the crop was harvested for the period 1 May to 18 June.

Routine levels of nitrogen were applied to the trial area at rates according to ADAS recommendations. Applications of 50 kg/ha (40 units/acre) were made pre harvest (15 April), post harvest (21 June) and in the fern growing period (19 August) in 1993, 2 May, 24 June and 19 August 1994, 30 April, 27 June, and 22 August 1995 and 21 April, 22 June and 16 August 1996. (A total of 150 kg/ha in each year).

Assessments

No assessments were made during the reporting period in 1993.

During the winters of 1993-94, 1994-95 and 1995-96 soil samples were taken and analysed for phosphate and potash levels. Details in Appendix A.

Harvests were recorded in 1996 when the crop was assessed for numbers and weights of spears above and below 10mm diameter, and spears in the blown and twisted category.

Design and analyses

The trial design consists of randomised blocks with 4 replications.

Plot size - 12 m x 6 m (4 single rows) totalling 72 sq m with the number of plants planted being 178.

Recordable area - 10 m x 3 m (2 single rows) totalling 30 sq m with the number of plants planted being 74.

All data has been statistically analysed.

RESULTS AND DISCUSSION

Harvest Data

Table 1 Total number of spears ('000/ha) and total weight (t/ha) including blown and twisted spears in 1996.

Treatment	Number ('000/ha)	Weight (t/ha)
Phosphate		
A	249.1	5.71
B	257.7	5.77
C	246.5	5.79
D	240.3	5.41
Potash		
E	247.8	5.71
F	256.8	6.05
G	241.5	5.60
H	244.6	5.75
Mean	248.0	5.72

SED (21 df)	13.52	0.385
LSD (P=0.05)	28.12	0.801
CV%	7.7	9.5

Comment

There were no significant differences ($P=0.05$) between treatments for either the phosphate or potash treatments in terms of numbers of spears or total weight.

RESULTS AND DISCUSSION

Harvest Data

Table 2 Total number of spears ('000/ha) and total weight (t/ha) excluding blown and twisted spears in 1996

Treatment	Number ('000/ha)	Weight (t/ha)
Phosphate		
A	215.5	3.84
B	224.7	3.82
C	211.3	4.03
D	205.8	3.63
Potash		
E	213.0	3.94
F	221.2	4.12
G	208.5	3.78
H	212.6	3.98
Mean	214.1	3.90

SED (21 df)	12.51	0.377
LSD (P=0.05)	26.02	0.784
CV%	8.3	13.7

Comment

There were no significant differences ($P=0.05$) between treatments for either the phosphate or potash treatments in terms of numbers or weight of good quality spears.

RESULTS AND DISCUSSION

Harvest Data

Table 3 Total number of spears ('000/ha) and total weight (t/ha) of blown and twisted spears in 1996

Treatment	Number ('000/ha)	Weight (t/ha)
Phosphate		
A	33.6	0.59
B	33.0	0.61
C	35.2	0.65
D	34.6	0.63
Potash		
E	34.8	0.64
F	35.7	0.70
G	33.0	0.64
H	32.0	0.61
Mean	34.0	0.63

SED (21 df)	3.54	0.084
LSD (P=0.05)	7.37	0.175
CV%	14.7	18.9

Comment

There were no significant differences ($P=0.05$) between treatments for either the phosphate or potash treatments in terms of numbers and weight of blown and twisted spears.

RESULTS AND DISCUSSION

Harvest Data

Table 4 Total number of spears ('000/ha) and weight (t/ha) below and above 10mm spear diameter, excluding blown and twisted spears in 1996

Treatment	Number ('000/ha)		Weight (t/ha)	
	<10mm diam.	>10mm diam.	<10mm diam.	>10mm diam.
Phosphate				
A	119.2	96.3	1.87	3.25
B	127.3	97.3	1.95	3.22
C	111.2	100.2	1.76	3.38
D	115.1	90.7	1.78	3.00
Potash				
E	113.2	99.7	1.77	3.31
F	120.2	101.0	1.93	3.43
G	114.1	94.4	1.81	3.15
H	113.2	99.3	1.77	3.37
Mean	116.7	97.4	1.83	3.26

SED (21 df)	9.36	8.44	0.133	0.332
LSD (P=0.05)	19.47	17.56	0.276	0.690
CV%	11.3	12.3	10.3	14.4

Comment

There were no significant differences ($P=0.05$) between any of the treatments for either numbers or weights of spears below or above 10mm diameter for the phosphate or potash treatments.

RESULTS AND DISCUSSION

Harvest Data

Table 5 Weekly pattern of numbers ('000/ha) of small (<10mm diam.) spears harvested in 1996

Week No	Phosphate				Potash				Mean
	A	B	C	D	E	F	G	H	
1	2.42	3.50	3.00	2.33	1.83	2.17	2.33	2.08	2.46
2	7.42	8.92	9.17	7.08	8.92	8.00	7.42	9.33	8.28
3	12.50	15.67	11.50	15.17	12.25	13.17	12.08	14.33	13.33
4	29.75	24.75	25.25	24.75	23.33	27.33	27.33	21.33	25.48
5	30.75	35.42	27.92	31.50	32.67	34.17	30.50	30.92	31.73
6	31.00	34.17	29.00	30.00	28.83	29.58	29.33	31.08	30.37
7	5.33	4.92	5.33	4.25	5.42	5.75	5.08	4.17	5.03
Total	119.17	127.35	111.17	115.08	113.25	120.17	114.07	113.24	116.68

RESULTS AND DISCUSSION

Harvest Data

Table 6 Weekly pattern of weight (t/ha) of small (<10mm diam.) spears harvested in 1996

Week No	Phosphate				Potash				Mean
	A	B	C	D	E	F	G	H	
1	0.038	0.054	0.042	0.039	0.026	0.034	0.042	0.027	0.038
2	0.112	0.123	0.139	0.098	0.129	0.122	0.116	0.138	0.122
3	0.166	0.204	0.168	0.223	0.175	0.178	0.168	0.190	0.184
4	0.468	0.385	0.399	0.378	0.370	0.457	0.442	0.347	0.406
5	0.522	0.579	0.483	0.520	0.537	0.572	0.515	0.512	0.530
6	0.482	0.535	0.455	0.469	0.454	0.484	0.460	0.498	0.480
7	0.081	0.068	0.070	0.053	0.074	0.080	0.071	0.056	0.069
Total	1.869	1.948	1.756	1.779	1.765	1.926	1.813	1.769	1.828

RESULTS AND DISCUSSION

Harvest Data

Table 7 Weekly pattern of numbers ('000/ha) of large (>10mm diam.) spears harvested in 1996

Week No	Phosphate				Potash				Mean
	A	B	C	D	E	F	G	H	
1	1.17	2.58	2.25	2.83	2.08	2.00	2.08	3.25	2.28
2	10.33	13.50	12.42	10.42	12.83	12.67	12.00	10.58	11.84
3	32.92	35.58	32.67	29.92	32.58	32.58	27.92	32.67	32.10
4	25.92	22.17	24.75	25.58	25.58	28.00	26.17	26.08	25.53
5	12.17	11.58	13.25	8.92	12.58	11.50	11.33	13.08	11.80
6	13.00	10.67	12.83	11.83	13.08	13.00	13.58	12.00	12.50
7	0.83	1.25	2.00	1.17	1.00	1.25	1.33	1.67	1.31
Total	96.34	97.33	100.17	90.67	99.73	101.00	94.41	99.33	97.36

RESULTS AND DISCUSSION

Harvest Data

Table 8 Weekly pattern of weight (t/ha) of large (>10mm diam.) spears harvested in 1996

Week No	Phosphate				Potash				Mean
	A	B	C	D	E	F	G	H	
1	0.043	0.094	0.081	0.094	0.068	0.065	0.078	0.127	0.081
2	0.383	0.450	0.450	0.365	0.435	0.425	0.405	0.372	0.411
3	1.110	1.201	1.131	1.015	1.105	1.147	0.952	1.145	1.101
4	0.898	0.743	0.843	0.853	0.883	0.970	0.902	0.879	0.871
5	0.399	0.369	0.440	0.293	0.397	0.373	0.360	0.422	0.382
6	0.389	0.325	0.383	0.353	0.388	0.411	0.409	0.378	0.379
7	0.024	0.033	0.055	0.031	0.030	0.035	0.040	0.049	0.037
Total	3.246	3.216	3.381	3.003	3.306	3.427	3.148	3.371	3.262

RESULTS AND DISCUSSION

Harvest Data

Table 9 Total number of spears ('000/ha) including blown and twisted spears 1994-96 inclusive

Treatment	Number ('000/ha)		
	1994	1995	1996
Phosphate			
A	220.3	248.7	249.1
B	222.3	247.2	257.7
C	213.3	246.7	246.5
D	214.3	243.6	240.3
Potash			
E	219.1	244.7	247.3
F	218.7	256.4	256.8
G	213.7	243.1	241.5
H	218.9	236.3	244.6
Mean	217.6	245.8	248.0

SED (21 df)	8.68	13.48	13.52
LSD (P=0.05)	18.05	28.04	28.12
CV%	5.6	7.8	7.7

Comment

There were no significant differences (P=0.05) between treatments for either phosphate or potash in any of the years in terms of total numbers of spears.

RESULTS AND DISCUSSION

Harvest Data

Table 10 Total weight (t/ha) including blown and twisted spears
1994-1996 inclusive

Treatment	Weight (t/ha)		
	1994	1995	1996
Phosphate			
A	5.15	5.05	5.71
B	5.14	4.93	5.77
C	5.15	5.01	5.79
D	5.08	4.99	5.41
Potash			
E	5.16	4.97	5.71
F	5.32	5.40	6.05
G	5.13	5.01	5.60
H	5.20	4.97	5.75
Mean	5.17	5.04	5.72

SED (21 df)	0.297	0.383	0.385
LSD (P=0.05)	0.618	0.797	0.801
CV%	8.1	10.7	9.5

Comments

There were no significant differences (P=0.05) between treatments for either phosphate or potash in any of the years in terms of total weight.

APPENDIX A

Results of Soil Analyses

Field name: Alderscroft

Soil Classification - Wick Series

Samples analysed by the Analytical Chemistry Departments at ADAS Cambridge in 1993 and ADAS Wolverhampton 1994, 1995 and 1996.

Sampling date - 25 February 1993

	pH	Lime t/ha	Phosphorus mg/l (Index)	Potassium mg/l (Index)	Magnesium mg/l (Index)
Topsoil 0-15cms	7.3	0	41 (3)	211 (2)	39 (1)
Subsoil 15-30cms	7.6	0	38 (3)	167 (2)	51 (2)

Sampling date - 14 March 1994. All plots sampled.

Phosphate

Treatment	Topsoil 0-15cms mg/l (Index)	Subsoil 15-30cms mg/l (Index)
A	40 (3)	30 (3)
B	40 (3)	42 (3)
C	51 (4)	42 (3)
D	48 (4)	26 (3)

Potash

Treatment	Topsoil 0-15cms mg/l (Index)	Subsoil 15-30cms mg/l (Index)
E	192 (2)	114 (1)
F	180 (2)	127 (2)
G	157 (2)	48 (1)
H	263 (3)	100 (1)

Sampling date - 30 March 1995. All plots sampled.

Phosphate

Treatment	Topsoil 0-15cms mg/l (Index)	Subsoil 15-30cms mg/l (Index)
A	37 (3)	41 (3)
B	47 (4)	34 (3)
C	50 (4)	42 (3)
D	59 (4)	40 (3)

Potash

Treatment	Topsoil 0-15cms mg/l (Index)	Subsoil 15-30cms mg/l (Index)
E	193 (2)	166 (2)
F	213 (2)	137 (2)
G	192 (2)	131 (2)
H	225 (2)	164 (2)

Sampling date - 19 March 1996. All plots sampled.

Phosphate

Treatment	Topsoil 0-15cms mg/l (Index)	Subsoil 15-30cms mg/l (Index)
A	52 (4)	43 (3)
B	55 (4)	40 (3)
C	54 (4)	42 (4)
D	74 (5)	45 (3)

Potash

Treatment	Topsoil 0-15cms mg/l (Index)	Subsoil 15-30cms mg/l (Index)
E	157 (2)	124 (2)
F	165 (2)	106 (1)
G	190 (2)	113 (1)
H	221 (2)	150 (2)