HORTICULTURE RESEARCH INTERNATIONAL

STOCKBRIDGE HOUSE

**A REPORT TO THE HORTICULTURAL DEVELOPMENT COUNCIL,
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SAVOY CABBAGE: FROST SUSCEPTIBILITY (FV 93)

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Summary

Savoy cabbage were planted on two occasions, given two rates of nitrogen fertiliser and assessed for frost susceptibility during late autumn and early winter. Wintessa, Wirosa, Wivoy and Alaska were planted on 26 June and 12 July with 150 kg/ha N applied as a base application. On 8 August an additional 50 or 150 kg/ha N was applied.

The trial was harvested as each treatment matured. The first harvest was taken on 2 December. The cultivars Wivoy and Wirosa from the first planting date had matured but with only low levels of frost damage despite several air frosts in early November. The number of marketable heads was high, particularly for Wivoy. The results were similar for both nitrogen fertiliser treatments. The second harvest was taken on 6 January by which time 15 air frosts had been recorded. Both Alaska and Wintessa from the first planting date were severely affected by frost damage. Alaska and Wirosa from the second planting date were also mature and showed less frost damage. The number of marketable heads was lower due to poor head weight. The final harvest was taken on 29 January when Alaska, Wintessa and Wivoy were cut. Further air frosts during late January had increased frost damage but the levels were similar for both fertiliser treatments. Marketable yield was again low due to a high proportion of small heads. Overall the levels of frost damage did not appear to be affected by the rate of nitrogen fertiliser. This confirms the results from a preliminary study undertaken in 1990. Further work should be undertaken to assess the affect of crop maturity on plant susceptibility to frost damage by increasing the number of planting dates using a range of cultivars.

Introduction

Savoy cabbage have traditionally been regarded as one of the hardiest of the winter vegetable crops. New varieties have been bred which have greater uniformity and better quality. In late autumn of 1988 and 1989 sharp frosts in many areas severely damaged crops making many heads unmarketable. Frost damage can disrupt supplies and reduce the potential for marketing crops between October and April.

A preliminary study was undertaken at Stockbridge House in 1990. The results showed that the planting date had a greater influence on the susceptibility of heads to frosting than did the rate of nitrogen applied as a top dressing. The later planting date was less susceptible to frost damage but the heads were smaller and this reduced the number of marketable heads for certain varieties.

This trial compared similar planting dates to those used in 1990 and evaluated two nitrogen fertiliser regimes using an increased range of varieties to assess the interaction between planting date, cultivar and fertiliser rate.

Objective

To assess the effect of planting date and rate of nitrogen fertiliser on the susceptibility of savoy cabbage to frost damage using four commonly grown cultivars.

Materials and Methods

Site

HRI Stockbridge House, Cawood, Selby, North Yorkshire YO8 0TZ.

Soil Type

Sandy loam of the Quorndon Series.

Design

The experimental design was a split plot with sowing dates at the main plot level and with cultivar and rate of nitrogen fertiliser at the sub-plot level. This design was selected so that each planting date could be managed separately. There were 3 rows of plants at 50 cm spacing per 1.83 m bed with a spacing of 40 cm between plants in the row. A total of 96 plants were planted per plot with 30 heads harvested from the middle row of each plot.

Treatments

1. Planting Date:

   A. 26 June
   B. 12 July

2. Cultivar:

   A. Wintessa
   B. Wirosa
   C. Wivoy
   D. Alaska

3. Rate of Nitrogen Fertiliser:

   A. 200 kg/ha as 150 kg/ha as a base dressing and 50 kg/ha as a top dressing in early August.

   B. 300 kg/ha as 150 kg/ha as a base dressing and 150 kg/ha as a top dressing in early August.

Husbandry

Seed of all cultivars was sown on 15 and 27 May in Hassy 308 module trays and propagated in an unheated glasshouse. Fertiliser was applied on 20 June to the whole trial site prior to planting on 26 June. Plants from the second sowing were planted on 12 July and the whole trial irrigated to aid establishment.

The extra 50 or 150 kg/ha of nitrogen was applied by hand on 8 August as appropriate. The trial received standard commercial inputs for pest and disease control (Appendix I).

Assessments

1. Number of frost damaged heads at full crop maturity or at the end of January (based on 30 heads/plot).

2. Yield and quality at crop maturity or at the end of January (based on 30 heads/plot).

Statistical Analysis

The results were not subjected to any statistical tests due to the different harvest dates. The data is therefore presented for each harvest date. The marketable yields have been combined into one table but again it was considered inappropriate to perform any analysis due to the affect of harvest date on crop yield.

Results

The plots were harvested as they matured with frost damage assessments taken at each harvest. The harvest dates were 2 December, 6 and 29 January. The results are presented separately for each harvest date.

The first treatments to mature were Wivoy and Wirosa from the first planting date of 26 June, Table 1.

Table 1: Number of heads with frost damage (%), marketable (%) and small (%) on 2 December.

Cultivar and Fertiliser Rate (N kg/ha)		No. of Heads Frost Damage (%)	No. of Heads Marketable (%)	No. of Heads Small (%)
Wivoy	150 + 50	11	67	19
	150 + 150	9	68	13
Wirosa	150 + 50	14	44	28
	150 + 150	14	58	22

All treatments had a similar number of frost damaged heads at crop maturity. The higher rate of nitrogen had not increased the plant's susceptibility to frosting. The number of marketable heads was high for Wivoy but lower for Wirosa due to a higher number of undersized heads. The Wirosa grown with a total of 300 kg/ha gave a higher number of marketable heads than where only 200 kg/ha had been applied.

The results for the treatments which had matured by 6 January are given in Table 2.

Table 2: Number of heads frosted (%), marketable (%) and small (%) on 6 January 1992

Cultivar and Fertiliser Rate (N kg/ha)		No. of Heads Frost Damage (%)	No. of Heads Marketable (%)	No. of Heads Small (%)
Planted on 26 June				
Alaska	150 + 50	51	28	14
	150 + 150	71	17	11
Wintessa	150 + 50	59	23	10
	150 + 150	43	34	14
Planted on 12 July				
Alaska	150 + 150	21	42	30
Wirosa	150 + 50	9	46	37
	150 + 150	17	40	38

By the second harvest the number of air frosts had increased from only 5 prior to 2 December to a total of 15, with the lowest temperature of -9.1 °C recorded on 11 December (Appendix II). These frosts had caused severe damage to Alaska but not to Wintessa. The number of marketable heads was low due to the severity of the frost damage.

The treatments planted on 12 July appeared to suffer less from frost damage. The number of marketable heads were also higher than for those treatments planted on 26 June. However, the delayed planting date did increase the number of small heads.

The results for the treatments harvested on 29 January 1992 are given in Table 3.

Table 3: Number of heads frosted (%), marketable (%) and small (%) on 29 January 1992

Cultivar and Fertiliser Rate (N kg/ha)		No. of Heads Frost Damage (%)	No. of Heads Marketable (%)	No. of Heads Small (%)
Planted on 12 July				
Alaska	150 + 50	33	18	48
Wintessa	150 + 50	33	20	44
	150 + 150	37	8	51
Wivoy	150 + 50	17	16	66
	150 + 150	22	16	62

By this final harvest the number of air frosts had increased to 30, with air temperatures falling to below -5 °C on five nights in the week prior to harvest.

The number of frost damaged heads was particularly high in the Wintessa and Alaska compared to Wivoy. The number of marketable heads was low with a high proportion of undersized heads.

The marketable yields at the respective harvest dates are given in Table 4.

Table 4: Marketable yield (t/ha)

Cultivar and Rate of Nitrogen (N kg/ha)	Marketable Yield (t/ha) Planted on 26 June	Planted on 12 July
Wintessa 150 + 50	10.0	6.8
150 + 150	15.6	2.6
Wirosa 150 + 50	24.2	18.6
150 + 150	30.1	16.3
Wivoy 150 + 50	32.1	6.5
150 + 150	35.9	6.8
Alaska 150 + 50	11.5	7.5
150 + 150	6.1	17.7

The marketable yield was highest for the Wirosa and Wivoy which had matured by early December. The cultivars Wintessa and Alaska were slower to mature and this increased the risk of frost damage and the associated reduction in marketable yield.

Discussion

The weather in October and November was generally mild with no significant air frosts until the second week of December.

The two planting dates showed great differences in the number of frosted heads due to the effect on crop maturity. Those early maturing cultivars planted on 26 June were mature and had been harvested before the onset of the cold weather. Those planted on 12 July took longer to mature and did not reach their full yield potential.

The cultivars showed differences in frost susceptibility due mainly to their maturity period. Wivoy and Wirosa matured the earliest and as a result had been harvested before the series of air frosts in December. Wirosa from the second planting date performed well and better than Alaska and Wintessa from the first planting date and produced more marketable heads with a lower number of frosted heads.

The effect of the rate of nitrogen on frost damage was not consistent across each harvest date. However, the marketable yield was higher where 300 kg/ha N had been used compared to just 200 kg/ha N. These results confirm those from the preliminary study undertaken in 1990 which compared similar rates of nitrogen to those used in 1991.

Conclusions

1. The choice of planting date is crucial to ensure that the cultivar is mature before the onset of severe frosts.

2. In this trial the rate of nitrogen had little effect on the plants susceptibility to frost damage.

3. The planting date for each cultivar should be decided according to its maturity period. Selecting a planting date which allows the plants to mature before December may reduce the risk of frost damage.

Recommendation for the Future

1. The trial should be repeated with different planting dates according to the maturity period. Late maturing cultivars should be planted earlier than those which are faster to mature.

2. Two harvest techniques should be used; one at crop maturity and a second one taken at the end of January so that the results are directly comparable.

3. The nitrogen fertiliser rates should take into consideration the levels of residual nitrate in the soil. Soil samples prior to planting will therefore need to be taken.

APPENDIX I: TRIAL DIARY

Cultivations:	19 June	Ploughed after previous crop of lettuce.
	20 June	Bedded
Propagation:	15 May	Cultivars sown in Hassy 308 trays for Planting Date 1.
	27 May	Cultivars sown in Hassy 308 trays for Planting Date 2.
Planting:	26 June	Planting Date 1.
	12 July	Planting Date 2.
Fertilisers:	20 June	150 kg/ha N; 60 kg/ha P_2O_5; 250 kg/ha K_2O
	8 Aug	50 or 150 kg/ha as appropriate
Insecticides:	26 June	Dursban drench at 100 mls/15 l/10,000 modules (Planting Date 1).
	9 July	Dursban drench at 100 mls/15 l/10,000 modules (Planting Date 2).
	19 July	Metasystox 55 at 560 ml + Ambush C at 250 ml/1120 l/ha water.
	2 Aug	Ambush C at 250 ml + Aphox at 420 g/1120 l/ha water.
	22 Aug	Ambush C at 250 ml + Aphox at 420 g/1120 l/ha water.

	11 Sept	Ambush C at 250 ml + Aphox at 420 g/1120 l/ha water.
	24 Sept	Ambush C at 250 ml + Aphox at 420 g/1120 l/ha water.
	9 Oct	Metasystox 55 at 560 ml + Ambush at 250 ml in 1120 l/ha water.
	31 Oct	Metasystox 55 at 560 ml/1120 l/ha water.
Herbicides:	27 June	Ramrod at 9 l/ha + Dacthal at 6 kg/ha in 1120 l/ha water (Planting Date 1).
	18 July	As above (Planting Date 2).
Irrigation:	15 July	15 mm
Harvest:	2 Dec	Wirosa and Wivoy (Planting Date 1).
	6 Jan	Alaska and Wintessa (Planting Date 1). Alaska and Wirosa (Planting Date 2).
	29 Jan	Alaska, Wintessa and Wivoy (Planting Date 2).

APPENDIX II: WEATHER DATA

	November		December		January	
	Grass Min	Air Min	Grass Min	Air Min	Grass Min	Air Min
1	4.8	9.1	1.0	5.0	- 0.4	8.6
2	3.9	9.4	1.9	5.8	2.6	8.0
3	0.5	6.0	5.2	7.1	4.3	8.9
4	- 6.0	0.6	- 0.6	3.0	- 2.0	4.4
5	- 3.0	3.0	- 6.2	1.8	- 2.0	3.9
6	- 8.2	0.5	- 1.1	4.6	1.0	4.0
7	1.4	5.5	- 9.3	- 2.6	- 0.3	5.4
8	2.0	7.5	- 12.0	- 4.5	1.9	6.5
9	- 7.1	3.5	- 12.0	- 5.8	- 0.7	4.9
10	- 10.3	- 0.6	- 11.4	- 5.4	- 6.2	- 0.6
11	0.5	3.3	- 13.3	- 8.1	- 6.0	- 3.5
12	- 2.5	3.2	- 11.9	- 7.1	NR	- 2.5
13	- 4.5	2.2	- 9.1	- 5.5	NR	1.2
14	- 7.0	0.2	- 5.1	1.4	NR	- 2.9
15	- 5.9	2.0	- 7.2	- 2.0	NR	- 2.8
16	- 8.6	- 1.6	- 5.3	- 1.0	NR	- 1.1
17	- 8.7	- 2.3	- 2.0	1.5	NR	- 1.2
18	- 4.9	- 2.2	- 1.0	5.0	NR	0.1
19	0.3	5.5	0.4	5.3	NR	2.2
20	4.1	1.9	- 3.5	1.5	NR	4.6
21	- 9.6	- 1.2	- 3.8	0.8	NR	- 0.7
22	- 2.0	2.4	1.5	4.9	NR	- 8.2
23	- 0.6	5.4	6.7	11.7	NR	- 7.1
24	- 2.0	3.1	- 4.0	2.0	- 3.2	- 3.3
25	- 0.9	3.8	- 9.0	- 1.8	- 14.0	- 5.5
26	0	4.0	- 3.0	1.8	- 6.5	- 1.9
27	- 6.1	1.3	- 7.8	0.5	- 9.0	- 5.2
28	- 2.0	3.5	- 7.6	0.8	- 9.5	- 5.6
29	2.9	8.0	- 2.6	5.1	- 4.6	- 5.1
30	1.5	5.2	- 0.7	5.2	- 1.6	- 2.2
31	-	-	0.7	5.4	- 2.0	- 2.0

NR Not Recorded