

## APRC Project Report

**Project SP 117:** Maximise the potential of A931/15 (Meridian) and E11/20 for UK conditions

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**Date:** Report to 31<sup>st</sup> March 2000

### Optimum Picking dates and Storage Regimes for Meridian

As described in the September 1999 Report, two sites growing Meridian on M.9 rootstock, were chosen for this experiment; one site was situated near Faversham in East Kent and the other in Suffolk. The trees used were three years old.

Although the plan was to pick fruits at each of three harvest times from each of the sites, only two dates were possible at the Suffolk site and a late fourth picking was included from the Faversham site. Four storage regimes were compared. Two of these were air storage at either 0°C or 3°C. These were compared with two CA regimes, one of which was similar to the common storage conditions recommended for Cox (<1.0% CO<sub>2</sub> + 1.2% O<sub>2</sub> or 0/1), and the other more similar to the conditions used for Bramley's Seedling (5.0% CO<sub>2</sub> + 1.0% O<sub>2</sub> or 5/1). Both of these CA regimes were run at a temperature of 3.5<sup>o</sup>-3.8<sup>o</sup>C.

The fruits from the air storage regimes were removed from store and assessed on 16<sup>th</sup> December 1999 and the CA stored fruits on 8<sup>th</sup> March 2000. The size, firmness, soluble solids content and internal quality (incidence of storage disorders) of fruit was measured immediately post storage and also after holding fruits for 7 days at 20°C to simulate shelf life. Samples of fruits from the CA storage regimes were displayed at the EMRA Members' Day held at HRI- East Malling on 23<sup>rd</sup> March, 2000.

Some of the results of the pre-storage assessments were presented in the September 1999 report. The full storage assessments are presented in the following tables.

Table 1 shows that the starch levels in the Meridian fruits remained very high at the first three picking dates from the Faversham site and at both dates from the Suffolk site. Only at the fourth picking date from the Faversham site did starch levels drop to <80% and by this time the fruits were already showing signs of greasiness. Ethylene evolution was also very low in fruits sampled at all the picking dates. This information suggests that in 1999 neither starch levels nor ethylene evolution were suitable indicators of optimum picking date for this variety.

Table 2 shows that the mean size of fruits harvested from the two sites were very good, at >70mm. This is not altogether surprising taking account of the relatively young age of the trees. Weight loss of fruits in store were variable (1 to 13%) with most loss shown in fruits from the latest picking date from the East Kent site. Weight losses during the shelf life simulation were small (1.9-3.3%) (data not presented).

Even though the starch levels were very high at the first three picking dates from the Faversham site and at both dates from the Suffolk site, the firmness of fruits at harvest was only approximately 70 Newtons or 7kg (Tables 3 and 4). Firmness was measured with an automated penetrometer fitted with an 11mm probe. The firmness of fruits had fallen considerably when removed from air storage in December; fruits from the 0°C regime ranged from 57-61 Newtons and fruits from the 3°C regime were even softer and generally below 50 Newtons. CA stored fruits from the first two picking dates from the Faversham and Suffolk sites, stored at 0% CO<sub>2</sub> + 1.2% O<sub>2</sub> (0/1), were of acceptable firmness (>60N) as shown in the Tables. Surprisingly, fruits from the first two picking dates at Faversham, when stored in the 5/1 regime, were slightly softer than similar fruits stored in the other CA regime. Fruits from the Suffolk site retained its firmness much better than fruits from the Faversham site and showed little differences in firmness between the two CA regimes (Table 4). Fruit from the Suffolk site lost 4% - 12% of its firmness during the shelf life simulation tests and there were no consistent differences between fruits from the different storage regimes. Loss of firmness was higher during shelf life of fruits from the Faversham site that was air stored (7%-15%) but only 2%-5% for fruits from the CA storage regimes.

The soluble solids contents were quite high (11.5% to 14%) in fruits from both sites at the time of harvest (Tables 5 and 6). Fruits harvested from the Suffolk site were slightly lower in soluble solids than fruits from the Faversham site at approximately the same picking dates. As expected, fruits from all of the treatments increased slightly in soluble solids content (by approximately 2%) during storage.

The incidences of bitter pit in the fruits from the different treatments are shown in Tables 7 and 8. Fruits from the Faversham site were particularly affected with 8% - 70% of fruits exhibiting symptoms. The fruits worst affected were those stored in air at 3°C, with an average of 46% of fruits showing symptoms (Table 7). However, fruits from the other three storage regimes also showed significant amounts of bitter pit. Average incidence of bitter pit in air at 0°C and CA in 5/1 and 0/1 was 15, 21 and 29% respectively.

Fruits harvested from the Suffolk site showed much less bitter pit and fruits from the second harvest date were unaffected when stored in air at 0°C or in CA at 5/1 (Table 8). As noted with fruits from the Faversham site, those stored in air at 3°C developed most bitter pit (5%-16%).

Variable amounts of flesh breakdown were recorded in the Meridian fruits. This was worst in fruits from the second pick at the Suffolk site in fruit that were air stored at 0°C, where 12% breakdown was recorded. Under the same storage regime, lower percentages of breakdown (<5%) were recorded in fruits from the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> harvests at the East Kent site and no fruits from the first harvest date showed flesh breakdown.

Significant core flush (12-15%) was noted in fruits from the Suffolk site, especially in fruits from the first harvest date. Very little core flush was recorded in the East Kent site fruits and only in fruits harvested at the latest date. Internal CO<sub>2</sub> injury (10%) was recorded in fruits (post shelf life simulation) from the latest pick at the East Kent site, when stored in the 5/1 regime.

On this preliminary evidence fruit firmness seemed to be the best indicator of optimum harvesting date for Meridian in 1999. Harvesting at 70 to 75 Newtons would appear to have produced the best fruits ex storage. Neither of the air storage regimes were suitable for the

storage of Meridian until December. Both of the CA regimes seemed acceptable for fruits from the Suffolk site but the low CO<sub>2</sub> regime produced the best results for fruits from the Faversham site.

#### Trials on E11/20

Insufficient cropping trees are currently available at HRI or on grower's farms to allow meaningful agronomic trials on the selection E11/20. To remedy this shortfall new trees have been raised on M.9 and planted at HRI-East Malling.

Table 1: Influence of harvest date and site on the starch coverage (% black) and ethylene concentration (ppb) in Meridian fruits in 1999

East Kent			Suffolk		
Harvest Date	Starch	Ethylene	Harvest Date	Starch	Ethylene
1/9/99	97	86	3/9/99	95	46
8/9/99	91	89	10/9/99	88	93
15/9/99	90	25			
22/9/99	76	91			

Table 2: The mean diameter of Meridian fruits at the times of harvest from an East Kent and a Suffolk site in 1999  
(Mean fruit diameter (mm))

Site			
East Kent		Suffolk	
Harvest Date	Mean Diameter	Harvest date	Mean Diameter
1/9/99	73	3/9/99	74
8/9/99	76	10/9/99	75
15/9/99	79		
22/9/99	79		

Table 3: Influence of picking date, storage regime and simulated shelf life on the firmness of Meridian fruits harvested from an East Kent site

(Firmness (Newtons))

Harvest Date	At harvest	Air stored +				CA stored #			
		0°C		3°C		5% CO <sub>2</sub> + 1% O <sub>2</sub>		0% CO <sub>2</sub> + 1.2% O <sub>2</sub>	
		Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*
1/9/99	70.9	58.6	50.4	49.8	43.6	58.9	58.5	62.6	60.9
8/9/99	68.8	61.4	53.4	48.2	43.4	56.4	55.2	60.4	57.2
15/9/99	69.4	57.0	47.9	49.3	45.8	55.3	52.8	55.1	53.2
22/9/99	65.7	57.9	46.9	46.3	40.3	59.6	56.3	55.3	52.7

+ until 16/12/99

# at 3.5-3.8°C until 08/03/00

\* after 7 days at 20°C.

Table 4: Influence of picking date, storage regime and simulated shelf life on the firmness of Meridian fruits harvested from a Suffolk site

(Firmness (Newtons))

Harvest Date	At harvest	Air stored +				CA stored #			
		0°C		3°C		5% CO <sub>2</sub> + 1% O <sub>2</sub>		0% CO <sub>2</sub> + 1.2% O <sub>2</sub>	
		Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*
3/9/99	71	61	57	49	43	67	61	67	62
10/9/99	75	58	51	46	44	63	60	61	59

+ until 16/12/99

# at 3.5-3.8°C until 08/03/00

\* after 7 days at 20°C.

Table 5: Influence of picking date, storage regime and simulated shelf life on the sugar content of Meridian fruits harvested from an East Kent site

(% soluble solids)

Harvest Date	At harvest	Air stored +				CA stored #			
		0°C		3°C		5% CO <sub>2</sub> + 1% O <sub>2</sub>		0% CO <sub>2</sub> + 1.2% O <sub>2</sub>	
		Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*
1/9/99	12.7	14.4	14.3	14.1	14.5	15.1	15.0	15.2	15.0
8/9/99	13.2	15.2	16.2	14.4	14.1	14.8	14.9	14.7	14.7
15/9/99	14.0	15.2	14.9	15.0	15.3	15.0	14.8	14.9	15.0
22/9/99	13.8	15.6	16.0	14.8	14.9	14.1	15.4	14.7	14.9

+ until 16/12/99

# at 3.5-3.8°C until 08/03/00

\* after 7 days at 20°C.

Table 6: Influence of picking date, storage regime and simulated shelf life on the sugar content of Meridian fruits harvested from a Suffolk site

(% soluble solids)

Harvest Date	At harvest	Air stored +				CA stored #			
		0°C		3°C		5% CO <sub>2</sub> + 1% O <sub>2</sub>		0% CO <sub>2</sub> + 1.2% O <sub>2</sub>	
		Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*
3/9/99	11.5	13.4	13.0	13.0	13.3	13.4	13.7	13.1	13.4
10/9/99	12.2	14.1	13.7	12.6	12.8	13.6	13.5	13.4	12.9

+ until 16/12/99

# at 3.5-3.8°C until 08/03/00

\* after 7 days at 20°C.

Table 7: Influence of picking date, storage regime and simulated shelf life on the incidence of bitter pit in Meridian fruits harvested from an East Kent site

(%)

Harvest Date	Air stored +				CA stored #			
	0°C		3°C		5% CO <sub>2</sub> + 1% O <sub>2</sub>		0% CO <sub>2</sub> + 1.2% O <sub>2</sub>	
	Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*
1/9/99	19.7	30.0	40.6	50.0	20.0	15.0	15.0	20.0
8/9/99	7.8	10.0	31.7	5.0	15.0	20.0	20.0	30.0
15/9/99	20.8	15.0	60.0	70.0	20.0	15.0	40.0	25.0
22/9/99	10.0	5.0	51.7	60.0	30.0	20.0	40.0	35.0

+ until 16/12/99

# at 3.5-3.8°C until 08/03/00

\* after 7 days at 20°C.



Table 8: Influence of picking date, storage regime and simulated shelf life on the incidence of bitter pit in Meridian fruits harvested from a Suffolk site

(%)

Harvest Date	Air stored +				CA stored #			
	0°C		3°C		5% CO <sub>2</sub> + 1% O <sub>2</sub>		0% CO <sub>2</sub> + 1.2% O <sub>2</sub>	
	Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*	Ex store	After shelf life*
3/9/99	3.5	5.0	16.1	5.0	5.0	0	10.0	0
10/9/99	0	0	5.3	20.0	0	0	5.0	5.0

+ until 16/12/99

# at 3.5-3.8°C until 08/03/00

\* after 7 days at 20°C.

