

Project title: Carrots - Independent assessment of agronomy trials and carrot breakage assessments

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Key staff: NIAB

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[The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.]

AUTHENTICATION

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

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Headlines

- There are many commercially suitable varieties resistant to breakage during handling
- The seed rate trial demonstrated that too high or too low rates are likely to result in more defects and not just more size out grades
- Seed treatments to enhance establishment are an important consideration in optimising performance

Background

The Carrot Demonstration Day, organised by BCGA in October is an annual event which is usually attended by over 200 visitors, exhibitors and seedsman - just about the whole UK carrot industry. The event is an ideal opportunity for growers to bring themselves up to speed with the latest developments. Restrictions due to covid-19 resulted in the event being virtual in 2020 but the industry was still represented and knowledge transferred to growers through the online format and through BCGA committee and membership communications.

In 2020 there were 73 variety plots from 8 different seed companies, a selection of which (approx. 50 varieties) were tested for breakage characteristics. Additional trials investigated the effect of seed rate on yield and of seed treatment on yield.

British Carrot Growers Chairman, Rodger Hobson said “This unique event brings together grower, packers and the wider carrot industry to see the latest developments in varieties and machinery. It has something for everyone and with the numbers attending it shows how important it is for UK carrots.”

Methods

- carrot breakage
- effect of seed rate on yield
- Comparison of three seed treatments

The trials were on the same site as the BCGA demo plots.

Hosted by Fresh Gro courtesy of Martin Brittain and Martin Evans on land farmed by Tim Hardstaff.

Carrot breakage methods

A selection of varieties (approx. 50 varieties) were screened to see how prone to breakage they were.

The screening was conducted the day after harvest and is only an indication of variety breakage performance. Carrots are individually dropped from a fixed point and any breakages counted and recorded.

This work was also carried out in 2019.

Seed rate trial methods

In order to demonstrate the effect of seed rates on yield a randomised complete block trial of 7 seed rates, 3 replicates was drilled and taken to yield.

Yield fractions and un-marketable product was recorded.

Table 1. Seed rate trial drilling rates

Seed rate /ac	Seed rate /ha
350,000	870,000a
450,000	1,175,000
550,000	1,495,000
650,000	1,635,000
750,000	1,920,000
850,000	2,160,000
950,000	2,385,000

Seed treatment trial methods

The seed treatment trial compared a single seed lot that had either been:

- Primed
- BMOX treated
- Wakil treated

The treatments were looked at as single treatments but they would often be applied together with another treatment.

The trial investigated the difference in establishment and crop development throughout the season and final yield.

Results

Carrot breakage results

As only a small sample of each variety was tested it is only possible to loosely group the varieties.

The following performed as well as or better than Nairobi in the breakage test.

Full data are available in the Appendix.

Table 2. Carrot percentage breakages – 2019 and 2020 results

		2019	2020	mean
variety	company	% breakage	% breakage	% breakage
Caribou	Seminis	0.0	0.0	0.0
Nerac	Elsoms	0.0	0.0	0.0
CA 6572 F1	Agriseeds	0.0	2.0	1.0
Berdina	Agriseeds	0.0	2.2	1.1
Octavo	Hazera	1.0	2.0	1.5
Elegance	BASF	4.0	0.0	2.0
Nun 13095	BASF	4.0	0.0	2.0
VAC111	Hazera	2.0	2.0	2.0
Volcano	Hazera	2.0	2.0	2.0
Melodio	Hazera	3.0	4.0	3.5
Nairobi	Elsoms	4.0	4.0	4.0
Stromboli	Clause	0.0	n/a	n/a
SVDN7396	Seminis	n/a	2.0	n/a

Carrot seed rate results

The seed rate trial was drilled at the second drill timing and like the rest of the field drilled at this time suffered from blow. It may also have been affected by herbicide applications.

Due to the loss of plants individual plot scores rather than means are reported.

Table 3. Carrot seed rate final populations

target population plants/ac	Harvested Population plants/ac	Harvested Population plants/ha
350,000	236842	585000
350,000	277328	685000
350,000	206478	510000
450,000	360324	890000
450,000	317814	785000
450,000	327935	810000
550,000	421053	1040000
550,000	299595	740000
550,000	404858	1000000
650,000	437247	1080000
650,000	538462	1330000
650,000	471660	1165000
750,000	483806	1195000
750,000	453441	1120000
750,000	459514	1135000
850,000	526316	1300000
850,000	506073	1250000
850,000	576923	1425000
950,000	556680	1375000
950,000	524291	1295000
950,000	516194	1275000

Chart 1. Carrot seed rate – mean of establishment per drill rate v final percentage of establishment

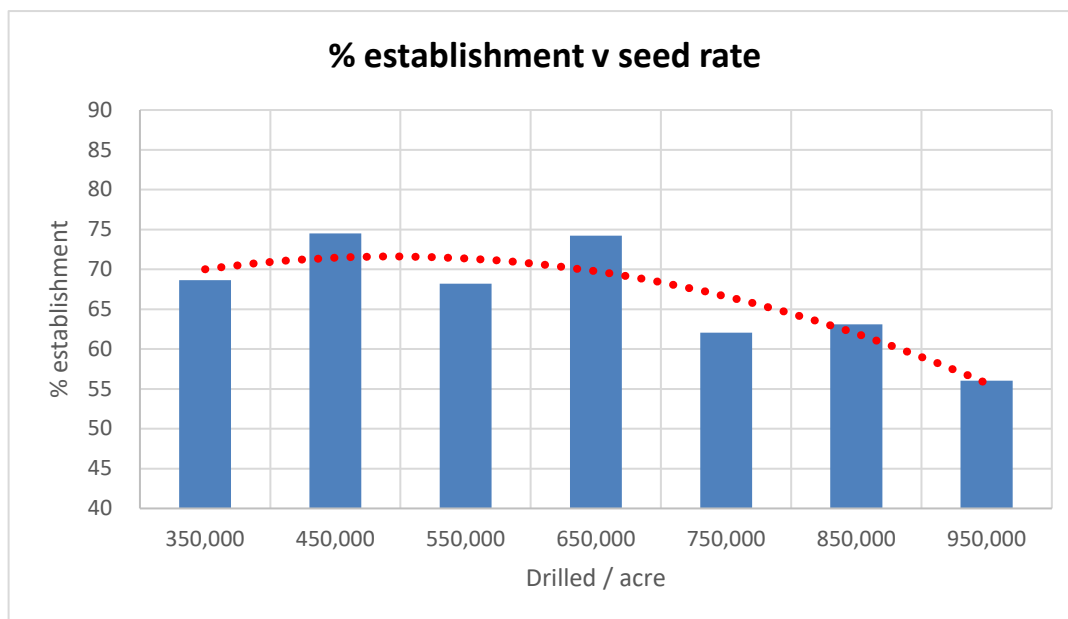


Table 4. Carrot seed rate – plot data (sorted low to high harvested population)

Population	Nett	yield	yield	yield	%defects
plants/m2	total	20-	30-	>45mm	
plants/m2	t/ha	t/ha	t/ha	t/ha	%defects
51.0	88.3	37.7	67.9	6.8	5.9
58.5	95.9	11.0	43.4	41.5	8.5
68.5	95.0	62.9	40.4	3.0	8.8
74.0	93.1	38.6	62.0	7.5	2.0
78.5	114.9	38.8	51.7	1.4	2.5
81.0	105.8	51.2	47.8	3.1	2.5
89.0	91.9	42.2	54.8	5.1	3.9
100.0	113.0	19.5	68.4	27.1	2.5
104.0	109.4	26.8	74.3	8.3	5.3
108.0	102.1	45.9	61.8	2.6	1.4
112.0	108.1	15.8	72.9	6.3	4.0
113.5	84.8	20.7	74.1	11.0	6.2
116.5	107.3	18.9	67.0	7.2	5.6
119.5	112.4	46.8	56.1	4.2	5.4
125.0	96.1	40.1	43.1	1.6	7.6
127.5	111.8	40.1	71.7	0.0	2.0
129.5	107.1	31.9	72.8	2.6	3.1
130.0	102.1	30.3	65.4	17.4	5.4
133.0	110.3	45.1	51.0	0.0	5.3
137.5	106.3	47.1	69.8	9.0	5.1
142.5	125.9	8.3	45.7	34.3	4.2

Chart 2. Carrot seed rate – yields (t/ha) of plot harvested populations (plants/m²)

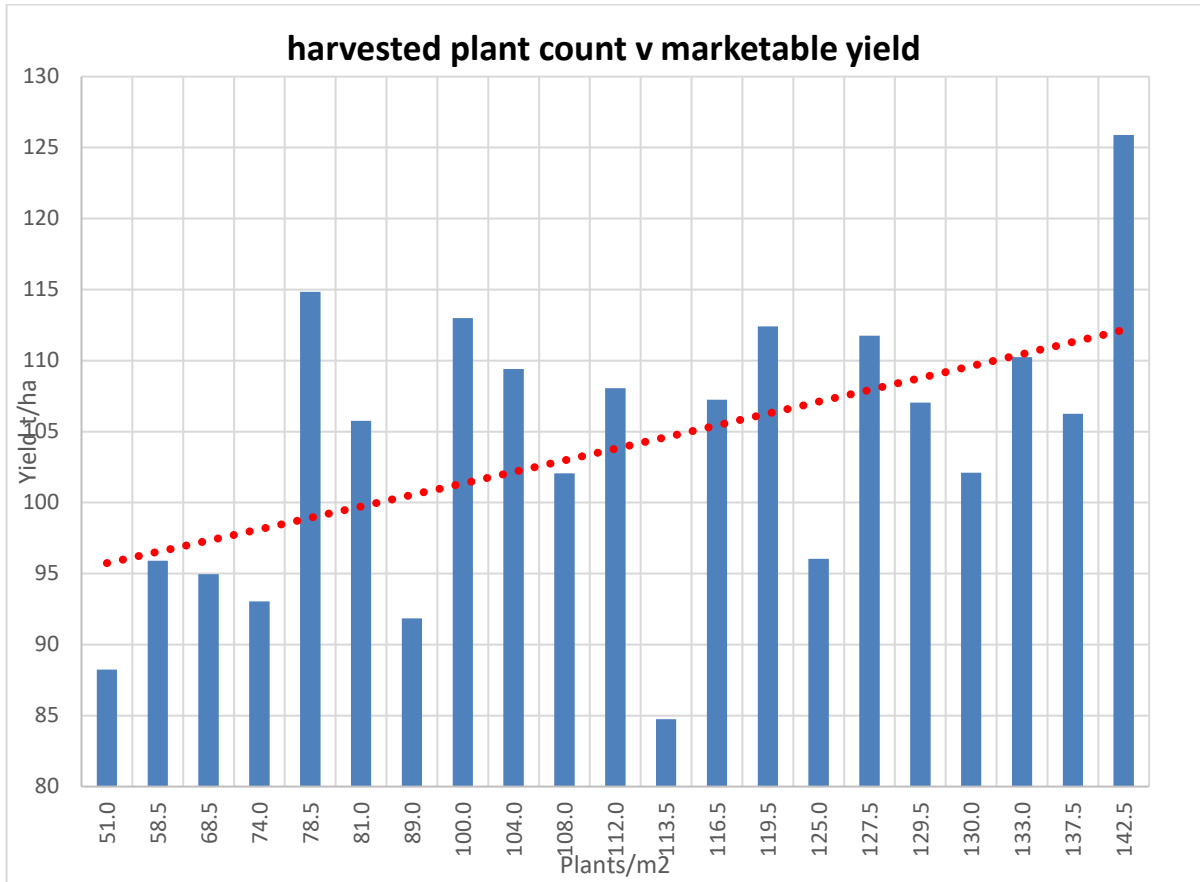
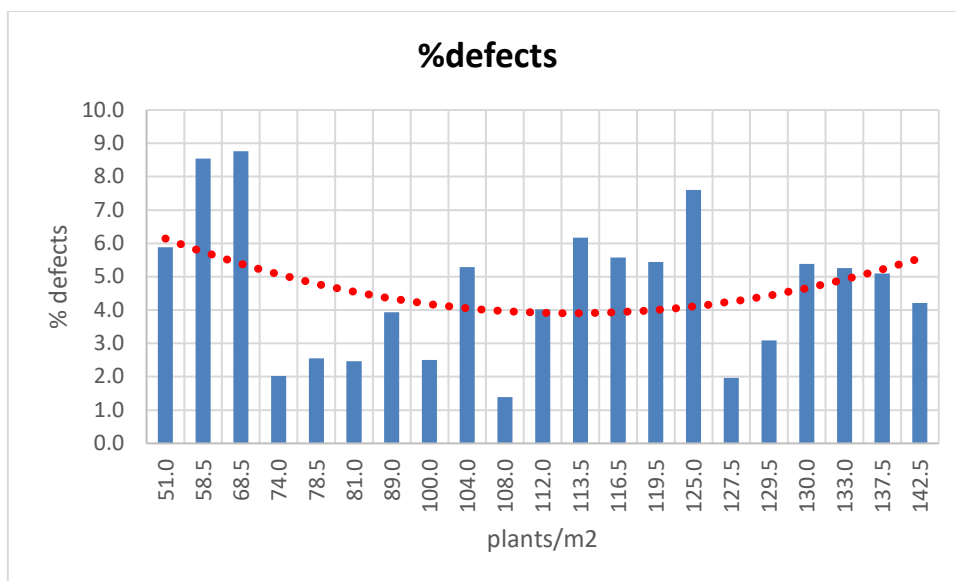


Chart 3. Carrot seed rate – percentage of defects at plot harvested populations (plants/m²)



Carrot seed treatment results

The seed treatment trial development assessments used the following key:

Date of assessment	assessment	Growth stage
1 st June 2020	emergence	1-5 scale 1=1TL, 3=2TL, 5=3TL
15 th June 2020	emergence	1-7 scale 1=1TL, 3=2TL, 5=3TL, 7= 4TL
29 th June 2020	emergence	1-11 scale 1=1TL, 3=2TL, 5=3TL, 7=4TL, 9=5TL, 11= 6TL
20 th July 2020	vigour	9=12" 5-6TL, 5=6" 5-6TL
22 nd October 2020	foliage maturity	1=yellow/brown 9=green

Chart 4. Carrot seed treatment – development stages and maturity by date

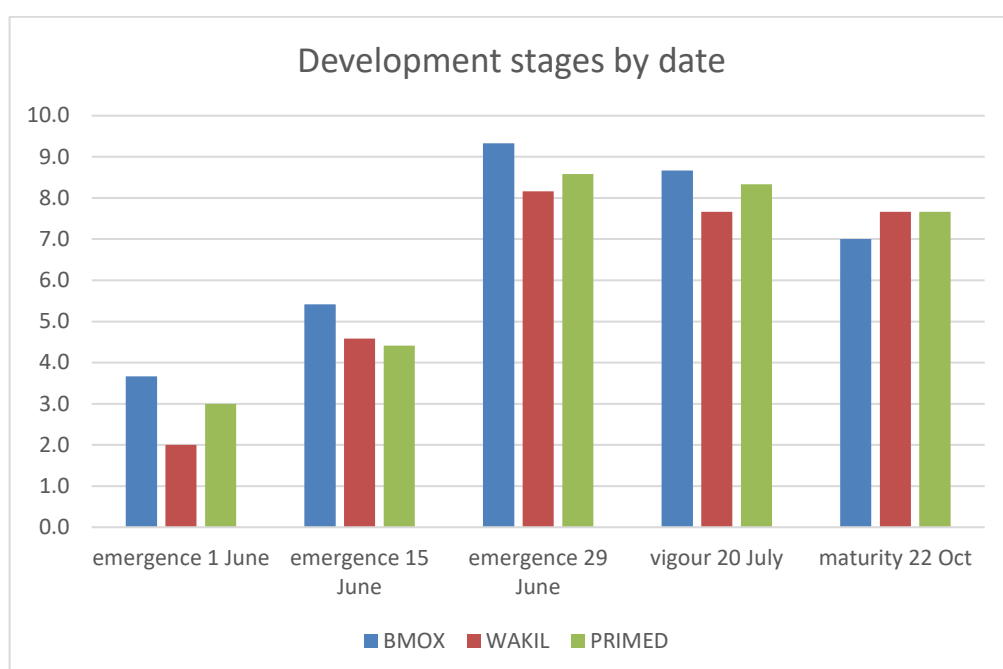
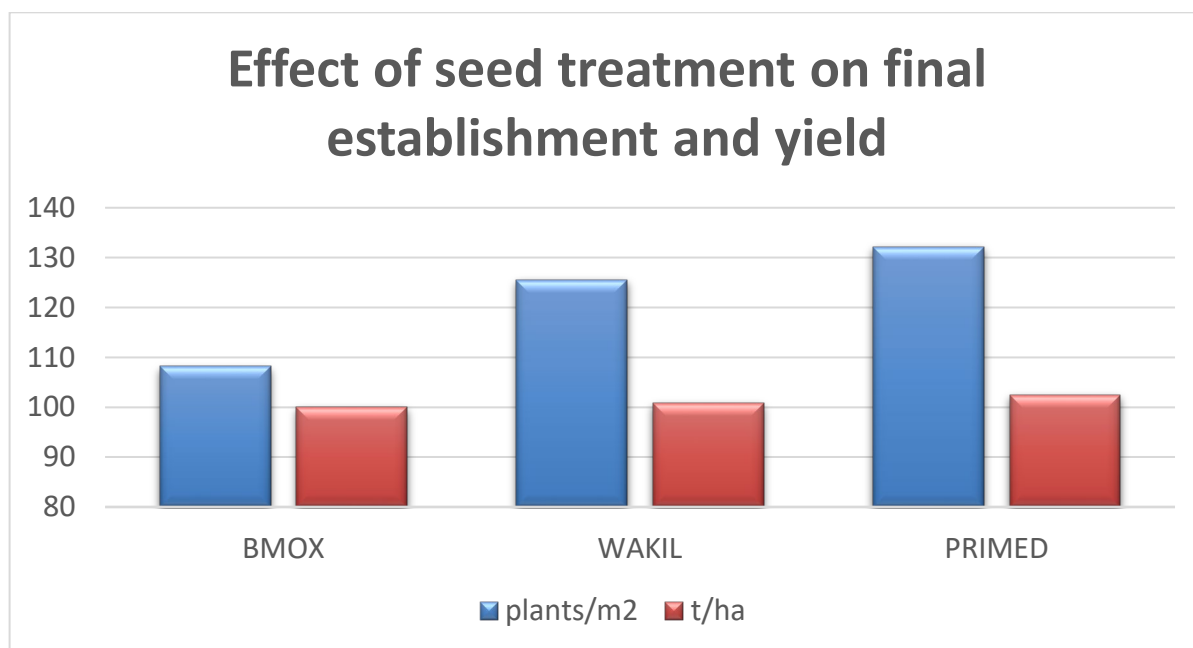


Chart 5. Carrot seed treatment – yields and harvested plant densities by seed treatment



Discussion

Carrot breakage

For many years Nairobi has dominated the area grown in part due to its reputation that it is very strong. Newer varieties have struggled to gain market share even where they have greater uniformity and other desirable characteristics.

The results have shown that there are a good selection of varieties that display similar or better strength than Nairobi. While the samples were relatively small varieties have consistently shown good strength across 2 years and the plan is to repeat this work in 2021.

Carrot seed rate

Growers face many challenges and establishing the crop is not always simple to achieve. Even with germination data for the seed lot it is then reliant on local knowledge to have a best estimate of projected establishment and plant densities when selecting drilling rates.

Plot establishment was uneven due to blow and planting later than the farm crop.

Individual plot data been shown in the charts as these were more indicative than the means of the harvest populations of the drilled rates.

There is a general trend towards higher yield from higher drill rates but this would need investigating further to give more robust data and to see if the trend line should be more of a curve. It was expected that at the highest rates the curve would have flattened out.

The grading fractions are listed but have not been analysed as the data set is too small and variable to draw a firm conclusion.

There were more defects at the lower drill rates and a slight increase towards the higher drill rates but again the data set is too small and variable to draw a firm conclusion.

Seed treatment

The seed treatment trial had been drilled more as a demo with some supporting data and therefore had too few replicates to draw any firm conclusions.

The BMOX material got away fastest but did not out yield the Wakil treated seed. Wakil and BMOX together are likely to have a cumulative effect as BMOX is a seed enhancer rather than a fungicide hence it would be more likely to be co-applied.

Primed material was the second fastest to emerge and highest marketable yields. Similarly priming would more commonly be in addition to a fungicide seed.

Financial Benefits

- More varieties that are less prone to breakage, at harvest, are available to select from
- Higher drill rates should give bigger yields but more work is needed to define optimal drill rates
- Priming and the seed enhancer, BMOX, give better early establishment than seed only treated with a fungicide – this investment should be considered on slow starting crops e.g. in cold soils.

Action Points

- Consider the additional variety choices if harvest breakage is an issue
- Seek variety data performance at different seed rates
- Evaluate the cost benefits of different seed treatments both alone and if applied together

Technology Transfer

- AHDB/BCGA virtual event (approx. 40 attendees)
- Presentation of results to BCGA committee
- Circulation of presentation to BCGA membership
- Trial coverage in The Vegetable Farmer

Appendix

Carrot breakage data

		2019	2020	mean
variety	company	% breakage	% breakage	% breakage
Belveta	Seminis	20.0	8.0	14.0
Caribou	Seminis	0.0	0.0	0.0
Nerac	Elsoms	0.0	0.0	0.0
CA 6572 F1	Agriseeds	0.0	2.0	1.0
Berdina	Agriseeds	0.0	2.2	1.1
Octavo	Hazera	1.0	2.0	1.5
Elegance	BASF	4.0	0.0	2.0
Nun 13095	BASF	4.0	0.0	2.0
VAC111	Hazera	2.0	2.0	2.0
Volcano	Hazera	2.0	2.0	2.0
Nazareth	Elsoms	6.0	0.0	3.0
Nipomo	Elsoms	6.0	0.0	3.0
Olimpo	Hazera	0.0	6.0	3.0
Melodio	Hazera	3.0	4.0	3.5
Eskimo	Hazera	2.0	6.0	4.0
Fidra RZ	Rijk Zwn	2.0	6.0	4.0
Nairobi	Elsoms	4.0	4.0	4.0
Naval	Elsoms	6.0	2.0	4.0
Nun 13096	BASF	2.0	6.0	4.0
Norwich	Elsoms	8.0	2.0	5.0
Polydor	Clause	0.0	10.0	5.0
Romance	BASF	6.0	4.0	5.0
Speedo	Hazera	4.0	6.0	5.0
SVDN 5865	Seminis	4.0	6.0	5.0
Miami	Elsoms	10.0	2.0	6.0
Natuna	Elsoms	10.0	2.0	6.0
Norfolk	Elsoms	10.0	4.0	7.0
Carruba	Seminis	10.0	6.0	8.0
Nominator	Elsoms	8.0	8.0	8.0
Nun 13098	BASF	2.0	14.0	8.0
Carrillon	Agriseeds	10.0	8.0	9.0
SV1140DN	Seminis	12.0	6.0	9.0
Subito	Hazera	10.0	10.0	10.0
Caravel	Agriseeds	18.0	8.0	13.0
Maestro	Hazera	18.0	8.0	13.0
CAR02251	Sakata	22.0	12.0	17.0
Bengala	Agriseeds	16.0	18.0	17.0
Viva	Agriseeds	26.0	12.0	19.0
Calibra	Agriseeds	24.0	16.3	20.2
Stromboli	Clause	0.0	n/a	n/a
YMER RZ	Rijk Zwaan	16.0	0.0	8.0
SVDN7396	Seminis	n/a	2.0	n/a
VH133	Hazera	n/a	4.0	n/a
Sirkana	BASF	n/a	4.4	n/a