Project title:	Onions - Independent assessment of field and storage potential of varieties
Project number:	FV 348d
Project leader:	Bruce Napier, NIAB
Report:	Annual Report 2016
Previous report:	
Key staff:	Bruce Napier Shaun Coleman
Location of project:	NIAB, Cambridge Drilled trials: Essex and Norfolk
Industry Representative:	Tom Will, VCS
Date project commenced:	01 April 2015
Date project completed (or expected completion date):	30 July 2018

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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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GROWER SUMMARY

Headline

- New varieties add positively to the choices available to growers offering excellent storage potential; a broader range of red varieties; and mildew resistance.

Background

The aim of the work is to provide independent assessment of the yield, quality and storage potential of new onion varieties propagated from seed. There are direct comparisons of new and established varieties and growers have the opportunity to inspect the trials at key stages.

Plant breeders continue to develop improved varieties with characteristics that meet grower requirements e.g. high yield, disease resistance, good quality and storability.

Drilled onions account for approximately 70% of the area grown in the UK. Early maturing varieties such as Hybing, Centro and Vision are popular. Hybound is a promising new early variety that continues to gain popularity. Maincrop and late maturing varieties still hold a large proportion of the acreage e.g. varieties such as Hytech and Armstrong are still important in extending the harvest window. Red Baron still commands a large percentage of the red area with Redspark also being popular.

Overwintered onions are still grown on a small scale but there are not enough varieties to warrant evaluation trials.

Results of the Variety Trials

Drilled Onions

Trial records and data collected –onion trials drilled from seed

Table A shows key areas of interest – maturity, marketable yield and storage data.
A full set of data tables is appended to the full report.

Trial site details

Sites were agreed with AHDB Horticulture/BOPA through a steering group, storage was at NIAB in an ambient store and at P G Rix in commercial Controlled Environment (CE), cold store.

The trials were hosted by (with thanks) and located as follows:
- Raker Farms, Croxton, Norfolk – drilled onions
- P G Rix Farms, nr Colchester, Essex – drilled onions

The trials were harvested on 10th September (Norfolk) and 11th September (Essex). The 2015 season maturities were approx a week earlier than the 10 year averages while 2014 season was 3 weeks earlier than the average. Establishment conditions were good and the season as a whole didn't have too many extremes of temperature. This contrasted starkly with 2014 where mean temperatures above the long term averages for the months March to July contributed to the earlier maturities. Mildew was not a major problem in either trial.

Table A. NIAB Spring Sown Onion Trials drilled from seed 2015 – Varieties, Maturities, Yield & Storage

Varieties in maturity order (mean of both sites); Main 3 replicates; *Preliminary 2 replicates of data*

Variety	Source	Maturity Date of 80% foliage fallover	Yield marketable (t/ha)	Ambient Storage % sound bulbs at end May	CE Storage % sound bulbs at end July
BROWNS					
Hybound	Bejo/DGS	14-Aug	85.4	68	60
BGS298	*Bejo/DGS*	*16-Aug*	90.5	54	78
Hypark	Bejo/DGS	16-Aug	88.0	41	45
Hybing	Bejo/DGS	17-Aug	91.5	51	50
Hytune	*Bejo/DGS*	*17-Aug*	98.5	49	67
Medaillon	Syngenta	19-Aug	81.9	71	62
SV3557ND	Seminis	19-Aug	85.1	51	61
Centro	Hazera	20-Aug	87.2	48	56
Vision	Syngenta	20-Aug	84.2	66	85
SV8528ND	*Seminis*	*20-Aug*	79.1	60	75
RS 07751481	Seminis	21-Aug	85.8	35	35
Hytech	Bejo/DGS	21-Aug	91.2	47	47
Napoleon	Syngenta	21-Aug	87.2	59	32
Wellington	Syngenta	24-Aug	80.6	52	86
SV3700ND	Seminis	24-Aug	85.1	57	40
Motion	Syngenta	26-Aug	84.3	72	67
Hysky	Bejo/DGS	26-Aug	89.8	60	68
Arthur	Hazera	27-Aug	86.8	35	48
SV1332ND	*Seminis*	*28-Aug*	83.3	49	47
Hyfive	*Bejo/DGS*	*28-Aug*	81.3	55	53
Chico	Hazera	29-Aug	78.6	53	71
Paradiso	Hazera	30-Aug	74.7	50	57
Hyway	*Bejo/DGS*	*30-Aug*	85.7	60	69
Progression	Syngenta	01-Sep	85.6	48	72
Santero	Hazera	07-Sep	77.1	43	32
Means		**23-Aug**	**85.1**	**53**	**59**
REDS					
Red Light	Bejo/DGS	15-Aug	92.1	4	65
Red Tide	Bejo/DGS	19-Aug	75.7	56	45
Redspark	Bejo/DGS	27-Aug	74.4	48	53
Retano	Hazera	28-Aug	71.3	45	49
NIZ 37-110	*Hazera*	*28-Aug*	71.1	38	50
ABS 212	*Allium Seeds*	*29-Aug*	71.1	65	41
ABS 217 (Red	*Allium Seeds*	*30-Aug*	73.7	31	33
Garnet	*Allium Seeds*	*31-Aug*	71.7	33	38
Red Baron	Bejo/DGS	31-Aug	73.4	40	38
Means		**28-Aug**	**74.9**	**40**	**47**

The following varieties are of most interest to the industry. Full information on all varieties can be found in the 'Full Trial Report'.

There is a good range of maturities allowing growers to spread their harvest period. In cooler years, such as 2013, the opportunities to harvest later maturing varieties can run over into October which can result in bulbs being harder to dry.

For organic growers and for high disease pressure years the mildew resistant varieties offer potential – Santero was the highest yielding variety on the mildew affected Norfolk site in 2014 – neither of the 2015 trials had significant levels of mildew.

Establishment was good. Seed beds were generally of a good quality; cold temperatures in March and April meant that growth was slow; a dry spring meant that there wasn't much damping off but the dry conditions meant some commercial crops were susceptible to and suffered from blow. June was also dry but a wet late July and early August helped with bulb filling.

Hybound, BGS298 (Drytan), Hytune, Hypark and Hybing were the earliest maturing brown varieties of the drilled trials. Red Light and Red Tide were the earliest of the reds. Vision, and Centro are also consistently at the earlier end of the spectrum.

The mean of trial yields in Norfolk was 69t/ha browns and 62t/ha reds, some early competition from weeds and the dry weather on a sandy soil may have contributed to the yields not achieving more.
The Essex trial had record yield means of 102t/ha browns and 88t/ha reds. A good start on virgin onion land with minimal disease pressure all contributed to showing the upper end of the yield potential of the varieties.

The highest yielding brown varieties were Hybing, BGS298 (Drytan), Hytune and Hytech.
Red Light was the highest yielding red variety.

There were a minimal number of rots in the harvested material and this was reflected in the storage results too. Some commercial crops still had issues with Fusarium.

Hytune, SV8528ND, SV1332ND, SV3700ND, Hyfive, Chico, Hyway, Progression and ABS217 were the best of the varieties for having high percentages of single centres.
Hybound, Hybing, Hypark, Hysky, Progression, Chico, AF1.11 and Red Planet all performed well in 2014. Hypark, Hysky and Chico in 2013.

Storage assessments in an ambient store, were recorded in late-April and late-May 2016.

Storage potential continues to be a key factor for drilled crops. As in 2012/13, 2013/14, 2014/15 Vision had above average percentages of sound bulbs at the late-May assessment. Hybound, Medaillon and Motion also performed above average in 2015/16.
Red Tide and ABS212 performed well in the reds. Redspark was average but had performed above average in previous years.

Stored bulb quality was generally very good throughout most of the varieties.

The highest percentage of sound bulbs from the controlled environment store was from Vision, as in previous years, others which performed above the average in 2015/16 and 2014/15 were Wellington and Chico.
BGS298, SV8528ND, Hyway and Progression were all above average in 2015/16.
Red Light had the highest percentage of sound bulbs in the reds.

Main Conclusions

Drilled Trials

In the drilled trials there was approx. 24t/ha between the highest and lowest yields (mean of both trials).

Drilled material showed a difference of over 65%, between the best and worst storage potential from ambient store and of approx. 50% from CE cold storage.

Mildew resistant varieties require fewer and or cheaper fungicide programmes.

Action Points

- Select a range of varieties according to soil type, desired harvest period, habit vigour and disease tolerance.
- Select varieties best suited to your storage facilities.
- For varieties not suited to long term storage growers must be able to sell their produce quickly.
- In high disease pressure years growers should take advantage of material with disease resistance e.g. mildew resistance.

SCIENCE SECTION

Introduction

The aim of the work is to provide independent assessment of the yield, quality and storage potential of new onion varieties, propagated from seed, that meet grower requirements i.e. high marketable yield, disease resistance, good quality and storability. These requirements need to be balanced and compared over a number of years as there can be a great deal of variation between seasons.
There are direct comparisons of new and established varieties.

Varieties can perform very differently in the United Kingdom from Holland and other parts of mainland Europe. Breeding companies have central breeding programmes and they trial their varieties in a number of countries to find the ones that are most suitable to the local conditions and growing practices. UK trials are essential to informing growers when selecting varieties.

Drilled onions account for approximately 70% of the area grown in the UK. Early maturing varieties such as Hybound, Hybing, Centro and Vision are popular. Maincrop and late maturing varieties still hold a large proportion of the acreage e.g. varieties such as Hytech and Armstrong are still important in extending the harvest window. Red Baron still commands a large percentage of the red area with Redspark also being popular.

Overwintered onions as still grown on a small scale but there are not enough varieties to warrant evaluation trials.

Varieties and numbered selections included

Table B. NIAB Spring Sown Onion Trials drilled from seed 2015 – Varieties, Maturities, Yield & Storage

Varieties in maturity order (mean of both sites); Main 3 replicates; Preliminary 2 replicates of data

Variety	Source	Maturity Date of 80% foliage fallover	Yield marketable (t/ha)	Ambient Storage % sound bulbs at end May	CE Storage % sound bulbs at end July
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Hytech	Bejo/DGS	21-Aug	91.2	47	47
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Hyfive	*Bejo/DGS*	*28-Aug*	81.3	55	53
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Hyway	*Bejo/DGS*	*30-Aug*	85.7	60	69
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Santero	Hazera	07-Sep	77.1	43	32
Means		**23-Aug**	**85.1**	**53**	**59**
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Red Light	Bejo/DGS	15-Aug	92.1	4	65
Red Tide	Bejo/DGS	19-Aug	75.7	56	45
Redspark	Bejo/DGS	27-Aug	74.4	48	53
Retano	Hazera	28-Aug	71.3	45	49
NIZ 37-110	*Hazera*	*28-Aug*	71.1	38	50
ABS 212	*Allium*	*29-Aug*	71.1	65	41
ABS 217 (Red	*Allium*	*30-Aug*	73.7	31	33
Garnet	*Allium*	*31-Aug*	71.7	33	38
Red Baron	Bejo/DGS	31-Aug	73.4	40	38
Means		**28-Aug**	**74.9**	**40**	**47**

Trial site details

Sites were agreed with AHDB Horticulture/BOPA through a steering group, storage was at NIAB in an ambient store and at P G Rix in commercial Controlled Environment (CE), cold store.

The trials were hosted by (with thanks) and located on open aspect, commercial fields as follows:

- Raker Farms, Croxton, Norfolk – drilled onions on a Breckland soil
- P G Rix Farms, nr Colchester, Essex – drilled onions on a silty soil

Both trials followed local commercial agronomy. No maleic hydrazide was applied.

Production details

The trials were drilled in good conditions on 18th March (Norfolk) and 17th March (Essex).
The trials were harvested on 10th September (Norfolk) and 11th September (Essex).

Trial design

The trial designs were randomised complete block.
The main trials had 3 replicates and the preliminary varieties only 2 replicates which were randomised with the first two replicates of the main trial.

Trial records and data collected

The 2015 season maturities were approx a week earlier than the 10 year averages while 2014 season was 3 weeks earlier than the average. Establishment conditions were good and the season as a whole didn't have too many extremes of temperature. This contrasted starkly with 2014 where mean temperatures above the long term averages for the months March to July contributed to the earlier maturities. Some commercial crops were severely affected by blow in the spring. June was dry in many areas but late July to mid August were wet which helped with bulb filling.
Mildew was not a major problem in either trial.

Key varieties are discussed below and summarised in Table B. Full data summaries are appended.

Discussion

There is a good range of maturities allowing growers to spread their harvest period. In cooler years, such as 2013, the opportunities to harvest later maturing varieties can run over into October which can result in bulbs being harder to dry.

For organic growers and for high disease pressure years the mildew resistant varieties offer potential – Santero was the highest yielding variety on the mildew affected Norfolk site in 2014 – neither of the 2015 trials had significant levels of mildew. The mildew was at low enough levels to be kept under control by regular fungicide applications.
Plant breeders continue to breed mildew resistance into commercially viable new varieties.

Establishment was good. Seed beds were generally of a good quality; cold temperatures in March and April meant that growth was slow; a dry spring meant that there wasn't much damping off but the dry conditions meant some commercial crops were susceptible to and suffered from wind blow. June was also dry but a wet late July and early August helped with bulb filling.

Hybound, BGS298 (Drytan), Hytune, Hypark and Hybing were the earliest maturing brown varieties of the drilled trials. Red Light and Red Tide were the earliest of the reds. Vision, and Centro are also consistently at the earlier end of the spectrum. However some varieties will mature in a different sequence in seasons with different environmental factors such as the cooler 2013 season, Medaillon was earlier in both 2015 and 2014 than in 2013.

The mean of trial yields in Norfolk was just above the 10 year average (69t/ha browns and 62t/ha reds in 2015 compared with respective averages of 64t/ha and 54t/ha) some early competition from weeds and the dry weather on a sandy soil may have contributed to the yields not achieving more.
The Essex trial had record yields well above the 10 year average (102t/ha browns and 88t/ha reds in 2015 compared with respective averages of 71t/ha and 60t/ha). A good start on virgin onion land with minimal disease pressure all contributed to showing the upper end of the yield potential of the varieties.

The highest yielding brown varieties were Hybing, BGS298 (Drytan), Hytune and Hytech.
Red Light was the highest yielding red variety.

There were a minimal number of rots in the harvested material and this was reflected in the storage results too. Some commercial crops still has issues with Fusarium.

The following varieties had higher than average numbers of bulbs with single centres in 2015: Hytune, SV8528ND, SV1332ND, SV3700ND, Hyfive, Chico, Hyway, Progression and ABS217.
Hypark, Hysky and Chico had higher than average numbers of single centres in 2013 and 2014.

Storage assessments in an ambient store, were recorded in late-April and late-May 2016.

Storage potential continues to be a key factor for drilled crops. As in 2012/13, 2013/14, 2014/15 Vision had above average percentages of sound bulbs at the late-May assessment. Hybound, Medaillon and Motion also performed above average in 2015/16.
Red Tide and ABS212 performed well in the reds. Redspark was average but had performed above average in previous years.

Stored bulb quality was generally very good throughout most of the varieties.

The highest percentage of sound bulbs from the controlled environment store was from Vision as in previous years. Others which performed above the average in 2015/16 and 2014/15 were Wellington and Chico.
BGS298, SV8528ND, Hyway and Progression were all above average in 2015/16.
Red Light had the highest percentage of sound bulbs in the reds.

Conclusions

The yield potential of varieties can vary greatly. In the drilled trials this was approx. 24t/ha between the highest and lowest yields (mean of both trials).

The yield data in the drilled trials is a good starting point for selecting varieties but other factors need to be considered.
Varieties should be selected on:

- maturity (to stagger the harvest season);
- storage potential (to extend the availability of UK onions) and yield out of store;
- disease resistance (i.e. mildew resistance);
- single centres (for onion ring production which attracts a premium).

Selected varieties have been commented on in the discussion section.

Drilled Varieties.

Hybound and BS298 were the earliest maturing varieties.
The highest yielding brown varieties were Hytune and Hybing. Hybing had been the highest yield in 2014 yielding on both sites. Red Light was the highest yielding red.
Vision, Hybound, Medaillon, Motion, Red Tide and ABS212 all had better than average storage potential in ambient store.
Vision, Wellington, Chico, BGS298, SV8528ND, Hyway, Progression and Red Light all had better than average storage potential under controlled environment storage.

Financial Benefits

The yield potential of varieties can vary greatly. In the drilled trials this was approx 24t/ha between the highest and lowest yields (mean of both trials).

Yield out of store is also important. Drilled material show a difference of over 35% and 65% between the best and worst storage potential from ambient storage in the browns and reds respectively. From CE cold storage the differences were approx. 50% and 30% for browns and reds.

Mildew resistant varieties require fewer and or cheaper fungicide programmes.

Action Points

- Select a range of varieties according to soil type, desired harvest period, habit vigour and disease tolerance.
- Select varieties best suited to your storage facilities.
- For varieties not suited to long term storage growers must be able to sell their produce quickly.
- In high disease pressure years growers should take advantage of material with disease resistance e.g. mildew resistance.

Technology transfer

Updates of trial data were circulated to levy payers by AHDB Horticulture and also to sponsoring breeders and seed companies.

Open days and events were also hosted on three occasions:

1. Drilled crop field open day in Norfolk – August 2015
2. Drilled crops harvested produce open day at NIAB, Cambridge – November 2015
3. Carrot and Onion Conference 2015 at Peterborough – November 2015

These events were well attended by a number of growers, seed trade, agronomists, research providers, etc. The farming press always attend the open days and there was significant coverage of the results – particularly in The Vegetable Farmer and Horticulture Week.

Appendices

Table 1. NIAB Spring Sown Onion Trials from seed 2015 – varieties

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (mean of both sites)

Preliminary varieties 2 replicates of data

			Maturity		
			Date of 80% foliage fallover		
Variety	Status	Source	Essex	Norfolk	Mean
BROWNS					
Hybound	R	Bejo/DGS	17-Aug	12-Aug	14-Aug
BGS298	*P*	*Bejo/DGS*	*16-Aug*	*16-Aug*	*16-Aug*
Hypark	R	Bejo/DGS	19-Aug	13-Aug	16-Aug
Hybing	C	Bejo/DGS	20-Aug	14-Aug	17-Aug
Hytune	*P*	*Bejo/DGS*	*21-Aug*	*13-Aug*	*17-Aug*
Medaillon	4	Syngenta	20-Aug	19-Aug	19-Aug
SV3557ND	2	Seminis	21-Aug	17-Aug	19-Aug
Centro	C	Hazera	19-Aug	21-Aug	20-Aug
Vision	C	Syngenta	22-Aug	18-Aug	20-Aug
SV8528ND	*P*	*Seminis*	*23-Aug*	*18-Aug*	*20-Aug*
RS 07751481	3	Seminis	20-Aug	22-Aug	21-Aug
Hytech	C	Bejo/DGS	22-Aug	20-Aug	21-Aug
Napoleon	R	Syngenta	24-Aug	19-Aug	21-Aug
Wellington	R	Syngenta	23-Aug	24-Aug	24-Aug
SV3700ND	1	Seminis	25-Aug	23-Aug	24-Aug
Motion	R	Syngenta	27-Aug	25-Aug	26-Aug
Hysky	2	Bejo/DGS	28-Aug	25-Aug	26-Aug
Arthur	C	Hazera	26-Aug	28-Aug	27-Aug
SV1332ND	*P*	*Seminis*	*28-Aug*	*29-Aug*	*28-Aug*
Hyfive	*P*	*Bejo/DGS*	*31-Aug*	*26-Aug*	*28-Aug*
Chico	3	Hazera	31-Aug	28-Aug	29-Aug
Paradiso	3	Hazera	31-Aug	29-Aug	30-Aug
Hyway	*P*	*Bejo/DGS*	*31-Aug*	*29-Aug*	*30-Aug*
Progression	1	Syngenta	05-Sep	29-Aug	01-Sep
Santero	4	Hazera	07-Sep	07-Sep	07-Sep
Means			**24-Aug**	**22-Aug**	**23-Aug**
REDS					
Red Light	3	Bejo/DGS	15-Aug	16-Aug	15-Aug
Red Tide	R	Bejo/DGS	20-Aug	19-Aug	19-Aug
Redspark	C	Bejo/DGS	30-Aug	25-Aug	27-Aug
Retano	R	Hazera	27-Aug	29-Aug	28-Aug
NIZ 37-110	*P*	*Hazera*	*30-Aug*	*26-Aug*	*28-Aug*
ABS 212	*P*	*Allium Seeds*	*29-Aug*	*29-Aug*	*29-Aug*
ABS 217 (Red Baron)	*P*	*Allium Seeds*	*01-Sep*	*29-Aug*	*30-Aug*
Garnet	*P*	*Allium Seeds*	*02-Sep*	*29-Aug*	*31-Aug*
Red Baron	C	Bejo/DGS	03-Sep	28-Aug	31-Aug
Means			**29-Aug**	**27-Aug**	**28-Aug**

** ABS 217 (Red Baron)was sown with untreated seed*

Table 2. NIAB Spring Sown Onion Trials from seed 2015- Yield data

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (mean of both sites)

Preliminary varieties 2 replicates of data

	Population & Yield											
Variety	**plant pop. (plants / sq. m)**			**marketable yield (t/ha)**			**% bulbs by weight >60mm**			**total % defects (excl. rots)**		
	Rix	**Raker**	**Mean**	**Rix**	**Raker**	**Mean**	**Rix**	**Raker**	**Mean**	**Rix**	**Raker**	**Mean**
BROWNS												
Hybound	65.1	62.0	63.5	103.8	66.9	85.4	86.8	50.9	68.9	0.0	0.2	0.1
BGS298	*61.6*	*58.1*	59.9	*107.2*	*73.8*	90.5	*90.9*	*68.9*	79.9	*0.4*	*0.2*	0.3
Hypark	62.8	62.2	62.5	104.6	71.5	88.0	88.1	56.9	72.5	0.0	0.5	0.2
Hybing	57.7	54.9	56.3	107.3	75.7	91.5	92.7	71.4	82.0	0.3	0.8	0.5
Hytune	*53.4*	*52.9*	53.2	*113.4*	*83.6*	98.5	*95.4*	*87.4*	91.4	*0.4*	*0.2*	0.3
Medaillon	57.4	53.6	55.5	98.2	65.6	81.9	91.2	61.4	76.3	0.1	0.1	0.1
SV3557ND	60.6	58.6	59.6	101.5	68.7	85.1	87.2	63.4	75.3	0.2	0.2	0.2
Centro	61.0	57.2	59.1	103.2	71.1	87.2	88.6	68.8	78.7	0.1	1.3	0.7
Vision	61.5	52.8	57.2	99.9	68.6	84.2	87.5	74.2	80.8	0.3	0.7	0.5
SV8528ND	*59.1*	*55.4*	57.3	*93.2*	*65.0*	79.1	*85.7*	*61.1*	73.4	*0.0*	*0.8*	0.4
RS 07751481	56.9	54.3	55.6	100.3	71.2	85.8	90.8	69.8	80.3	0.4	1.0	0.7
Hytech	57.6	58.5	58.0	111.1	71.4	91.2	93.1	63.0	78.1	0.0	0.4	0.2
Napoleon	63.5	59.4	61.5	104.9	69.4	87.2	85.4	61.9	73.6	0.2	0.5	0.3
Wellington	57.1	48.7	52.9	99.2	62.1	80.6	87.9	70.7	79.3	0.2	0.7	0.5
SV3700ND	60.3	60.0	60.2	98.7	71.4	85.1	87.3	61.1	74.2	0.0	0.5	0.2
Motion	54.6	48.9	51.8	102.8	65.8	84.3	95.0	71.3	83.2	0.0	0.6	0.3
Hysky	57.0	57.1	57.0	109.8	69.8	89.8	93.1	66.7	79.9	0.0	0.1	0.1
Arthur	53.7	49.6	51.7	104.7	69.0	86.8	93.5	79.6	86.5	0.4	3.2	1.8
SV1332ND	*59.6*	*55.6*	57.6	*96.0*	*70.6*	83.3	*88.9*	*65.3*	77.1	*0.4*	*1.0*	0.7
Hyfive	*53.7*	*52.3*	53.0	*97.4*	*65.1*	81.3	*89.9*	*65.2*	77.6	*0.0*	*0.4*	0.2
Chico	53.8	46.2	50.0	93.2	63.9	78.6	89.9	74.6	82.2	0.2	1.1	0.7
Paradiso	53.1	47.8	50.5	94.1	55.3	74.7	90.5	57.9	74.2	0.1	0.6	0.4
Hyway	*61.7*	*53.7*	57.7	*102.4*	*69.1*	85.7	*87.9*	*69.7*	78.8	*0.2*	*1.4*	0.8
Progression	63.8	56.2	60.0	99.9	71.2	85.6	86.9	66.6	76.7	0.1	0.8	0.4
Santero	51.9	46.9	49.4	95.1	59.0	77.1	91.2	65.9	78.6	0.1	0.9	0.5
Means	**58.2**	**54.5**	**56.4**	**101.6**	**68.6**	**85.1**	**89.8**	**67.0**	**78.4**	**0.2**	**0.7**	**0.5**
REDS												
Red Light	54.0	49.8	51.9	107.6	76.6	92.1	95.0	85.5	90.3	0.1	2.4	1.3
Red Tide	53.3	49.5	51.4	88.7	62.7	75.7	86.3	64.8	75.5	0.0	0.9	0.5
Redspark	54.4	48.7	51.5	87.5	61.3	74.4	86.6	64.4	75.5	0.3	1.3	0.8
Retano	56.5	50.6	53.6	84.7	58.0	71.3	81.4	55.5	68.4	0.3	0.6	0.4
NIZ 37-110	*56.7*	*50.4*	53.6	*85.0*	*57.2*	71.1	*78.9*	*57.6*	68.3	*0.2*	*2.0*	1.1
ABS 212	*57.0*	*48.7*	52.9	*83.2*	*58.9*	71.1	*79.3*	*53.0*	66.1	*0.2*	*0.7*	0.4
ABS 217	*56.2*	*45.6*	50.9	*90.1*	*57.4*	73.7	*86.6*	*71.3*	79.0	*0.2*	*0.7*	0.4
Garnet	*57.3*	*53.1*	55.2	*81.6*	*61.7*	71.7	*78.3*	*63.5*	70.9	*0.0*	*0.6*	0.3
Red Baron	52.0	46.0	49.0	86.0	60.8	73.4	86.2	72.5	79.3	0.3	0.4	0.4
Means	**55.3**	**49.2**	**52.2**	**88.3**	**61.6**	**74.9**	**84.3**	**65.3**	**74.8**	**0.2**	**1.1**	**0.6**

Table 3. NIAB Spring Sown Onion Trials from seed 2015- rots by category

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (mean of both sites)

Preliminary varieties 2 replicates of data

	Population & Yield											
Variety	**% Base Rots**			**% Neck Rots**			**% bacterial rots**			**% Penicllium**		
	Rix	**Raker**	**Mean**	**Rix**	**Raker**	**Mean**	**Rix**	**Raker**	**Mean**	**Rix**	**Raker**	**Mean**
BROWNS												
Hybound	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BGS298	*0.0*	*0.4*	0.2	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0
Hypark	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Hybing	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hytune	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0
Medaillon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
SV3557ND	0.0	1.4	0.7	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0
Centro	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
Vision	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
SV8528ND	*0.0*	*0.2*	0.1	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0
RS 07751481	0.0	0.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hytech	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Napoleon	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Wellington	0.0	0.4	0.2	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0
SV3700ND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Motion	0.0	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hysky	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Arthur	0.0	0.5	0.2	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
SV1332ND	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0
Hyfive	*0.0*	*0.9*	0.4	*0.0*	*0.0*	0.0	*0.2*	*0.0*	0.1	*0.0*	*0.0*	0.0
Chico	0.0	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paradiso	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hyway	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.2*	0.1
Progression	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Santero	0.0	0.1	0.1	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Means	**0.0**	**0.2**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
REDS												
Red Light	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Red Tide	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
Redspark	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Retano	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NIZ 37-110	*0.0*	*0.2*	0.1	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0
ABS 212	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0
ABS 217	*0.0*	*0.5*	0.2	*0.0*	*0.0*	0.0	*0.0*	*0.5*	0.2	*0.0*	*0.0*	0.0
Garnet	*0.0*	*0.2*	0.1	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0	*0.0*	*0.0*	0.0
Red Baron	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Means	**0.0**	**0.1**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**

Table 4. NIAB Spring Onion Trials from seed 2015 – Bulb Quality data

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (mean of both sites)

Preliminary varieties 2 replicates of data

	Bulb Quality (1-9)														
Variety	**Skin Colour 1=pale 9=dark**			**Skin Protection 1=poor 9=good**			**Bulb Shape 1=flat 5=round 9=elongate**			**Uniformity 1=poor 9=good**			**Firmness 1=poor 9=good**		
	Rix	**Raker**	**Av**	**Rix**	**Raker**	**Av**	**Rix**	**Raker**	**Av**	**Rix**	**Raker**	**Av**	**Rix**	**Raker**	**Av**
BROWNS															
Hybound	5.5	5.5	5.5	7.0	7.0	7.0	5.0	5.0	5.0	6.5	6.5	6.5	7.0	7.0	7.0
BGS298	*5.5*	*5.5*	*5.5*	*7.0*	*7.0*	*7.0*	5.0	5.0	5.0	6.5	7.0	6.8	*7.0*	*7.0*	*7.0*
Hypark	5.5	5.5	5.5	7.0	7.0	7.0	4.5	4.5	4.5	6.5	6.5	6.5	7.0	7.0	7.0
Hybing	5.5	5.5	5.5	7.0	7.0	7.0	5.0	5.0	5.0	6.5	6.5	6.5	7.0	7.0	7.0
Hytune	*5.5*	*5.5*	*5.5*	*7.0*	*7.0*	*7.0*	5.5	5.0	5.3	7.0	6.5	6.8	*7.0*	*7.0*	*7.0*
Medaillon	5.5	5.5	5.5	7.0	7.0	7.0	5.0	4.5	4.8	7.0	6.5	6.8	7.0	7.0	7.0
SV3557ND	5.5	5.5	5.5	7.0	7.0	7.0	5.0	5.0	5.0	6.5	7.0	6.8	7.0	7.0	7.0
Centro	5.5	5.5	5.5	7.0	7.0	7.0	5.0	5.0	5.0	7.0	6.5	6.8	7.0	7.0	7.0
Vision	5.5	5.5	5.5	7.0	7.0	7.0	5.0	5.0	5.0	6.5	7.0	6.8	7.0	7.0	7.0
SV8528ND	*5.5*	*5.5*	*5.5*	*7.0*	*7.0*	*7.0*	5.0	5.0	5.0	7.0	7.0	7.0	*7.0*	*7.0*	*7.0*
RS 07751481	5.5	5.5	5.5	7.0	7.0	7.0	5.0	4.5	4.8	6.5	6.5	6.5	7.0	7.0	7.0
Hytech	5.0	5.5	5.3	7.0	7.0	7.0	5.5	5.0	5.3	6.5	6.5	6.5	7.0	7.0	7.0
Napoleon	5.0	5.0	5.0	7.0	7.0	7.0	5.0	4.5	4.8	6.5	7.0	6.8	7.0	7.0	7.0
Wellington	5.5	6.0	5.8	7.0	7.0	7.0	5.0	4.5	4.8	6.5	6.0	6.3	7.0	7.0	7.0
SV3700ND	5.5	5.5	5.5	7.0	7.0	7.0	5.5	5.0	5.3	6.5	6.5	6.5	7.0	7.0	7.0
Motion	5.0	5.5	5.3	7.0	7.0	7.0	5.0	4.5	4.8	7.0	7.0	7.0	7.0	7.0	7.0
Hysky	5.5	5.5	5.5	7.0	7.0	7.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0	7.0
Arthur	5.0	5.5	5.0	7.0	7.0	7.0	5.0	5.0	5.0	7.0	6.5	6.8	7.0	7.0	7.0
SV1332ND	*6.0*	*5.5*	*5.8*	*7.0*	*7.0*	*7.0*	5.0	5.0	5.0	7.0	7.0	7.0	*7.0*	*7.0*	*7.0*
Hyfive	*5.5*	*5.5*	*5.5*	*7.0*	*7.0*	*7.0*	5.0	5.0	5.0	6.5	7.0	6.8	*7.0*	*7.0*	*7.0*
Chico	5.5	6.0	5.8	7.0	7.0	7.0	5.5	5.0	5.3	6.5	7.0	6.8	7.0	7.0	7.0
Paradiso	5.5	5.5	5.5	7.0	7.0	7.0	5.0	4.5	4.8	6.5	6.5	6.5	7.0	7.0	7.0
Hyway	*5.0*	*5.0*	*5.0*	*7.0*	*7.0*	*7.0*	5.0	4.5	4.8	7.0	7.0	7.0	*7.0*	*7.0*	*7.0*
Progression	5.5	6.0	5.8	7.0	7.0	7.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0	7.0
Santero	5.5	6.0	5.8	7.0	7.0	7.0	5.0	4.5	4.8	7.0	6.5	6.8	7.0	7.0	7.0
Means	5.4	5.5	5.5	7.0	7.0	7.0	5.1	4.8	4.9	6.7	6.7	6.7	7.0	7.0	7.0
REDS															
Red Light	6.5	6.5	6.5	6.0	6.0	6.0	5.0	4.5	4.8	6.5	6.5	6.5	7.0	7.0	7.0
Red Tide	7.0	6.5	6.8	6.5	6.0	6.3	5.0	4.5	4.8	6.5	6.5	6.5	7.0	7.0	7.0
Redspark	7.0	7.0	7.0	6.5	6.5	6.5	5.0	4.5	4.8	6.0	6.5	6.3	7.0	7.0	7.0
Retano	7.0	7.0	7.0	6.5	6.5	6.5	5.0	4.5	4.8	6.5	6.5	6.5	7.0	7.0	7.0
NIZ 37-110	*6.5*	*6.5*	*6.5*	*6.5*	*6.5*	*6.5*	5.5	5.0	5.3	6.5	6.0	6.3	*7.0*	*7.0*	*7.0*
ABS 212	*7.0*	*7.0*	*7.0*	*6.5*	*6.0*	*6.3*	4.5	4.5	4.5	6.0	6.5	6.3	*7.0*	*7.0*	*7.0*
ABS 217	7.0	7.0	7.0	*6.5*	*6.5*	*6.5*	4.5	5.0	4.8	6.5	6.5	6.5	*7.0*	*7.0*	*7.0*
Garnet	7.0	7.0	7.0	*6.5*	*6.5*	*6.5*	4.5	5.0	4.8	6.5	6.5	6.5	*7.0*	*7.0*	*7.0*
Red Baron	7.0	7.0	7.0	6.5	6.0	6.3	5.0	5.0	5.0	6.0	6.5	6.3	7.0	7.0	7.0
Means	6.9	6.8	6.9	6.4	6.3	6.4	4.9	4.7	4.8	6.3	6.4	6.4	7.0	7.0	7.0

Table 5. NIAB Spring Sown Trials from seed 2015 – vigour and plant characteristics

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (mean of both sites)

Preliminary varieties 2 replicates of data

Both trials had a full fungicide programme so mildew is only recorded as present or absent at Norfolk and as the maximum percentage recorded in Essex

	Early vigour 1-9 9=vigorous			**Establishment %**			**Habit/density (July) 1-9 9=dense**		
variety	**Rix**	**Raker**	**Mean**	**Rix**	**Raker**	**Mean**	**Rix**	**Raker**	**Mean**
BROWNS									
Hybound	8.0	8.0	8.0	>90%	>90%	>90%	6.0	6.0	6.0
BGS298	*7.0*	*7.0*	*7.0*	>90%	>90%	>90%	*5.0*	*6.0*	*5.5*
Hypark	7.3	7.7	7.5	>90%	>90%	>90%	6.0	5.7	5.8
Hybing	7.3	8.0	7.7	>90%	>90%	>90%	5.0	5.7	5.3
Hytune	*7.5*	*7.5*	*7.5*	>90%	>90%	>90%	*5.5*	*6.0*	*5.8*
Medaillon	7.0	7.0	7.0	>90%	>90%	>90%	6.3	6.7	6.5
SV3557ND	7.0	7.0	7.0	>90%	>90%	>90%	5.3	6.0	5.7
Centro	7.7	7.0	7.3	>90%	>90%	>90%	5.7	5.3	5.5
Vision	7.7	7.3	7.5	>90%	>90%	>90%	5.3	5.3	5.3
SV8528ND	*7.5*	*8.0*	*7.8*	>90%	>90%	>90%	*5.5*	*5.5*	*5.5*
RS 07751481	7.3	7.7	7.5	>90%	>90%	>90%	5.3	6.0	5.7
Hytech	7.0	8.0	7.5	>90%	>90%	>90%	6.0	7.0	6.5
Napoleon	7.0	7.0	7.0	>90%	>90%	>90%	6.3	6.7	6.5
Wellington	7.0	7.0	7.0	>90%	>90%	>90%	5.7	6.0	5.8
SV3700ND	7.7	7.0	7.3	>90%	>90%	>90%	5.7	6.0	5.8
Motion	7.3	7.0	7.2	>90%	>90%	>90%	5.7	6.7	6.2
Hysky	7.3	7.3	7.3	>90%	>90%	>90%	5.7	6.0	5.8
Arthur	7.0	7.0	7.0	>90%	>90%	>90%	5.3	5.3	5.3
SV1332ND	*8.0*	*8.0*	*8.0*	>90%	>90%	>90%	*5.5*	*6.0*	*5.8*
Hyfive	*7.0*	*7.5*	*7.3*	>90%	>90%	>90%	*6.0*	*6.5*	*6.3*
Chico	7.0	7.0	7.0	>90%	>90%	>90%	5.7	6.0	5.8
Paradiso	7.0	7.3	7.2	>90%	>90%	>90%	5.3	7.3	6.3
Hyway	*7.0*	*7.0*	*7.0*	>90%	>90%	>90%	*6.5*	*6.0*	*6.3*
Progression	7.3	7.3	7.3	>90%	>90%	>90%	5.3	5.3	5.3
Santero	7.0	7.0	7.0	>90%	>90%	>90%	5.3	6.3	5.8
Mean	**7.3**	**7.3**	**7.3**				**5.6**	**6.1**	**5.8**
REDS							4.3	6.3	5.3
Red Light	7.7	8.0	7.8	>90%	>90%	>90%	5.0	6.0	5.5
Red Tide	7.7	8.0	7.8	>90%	>90%	>90%	4.7	5.0	4.8
Redspark	7.7	8.0	7.8	>90%	>90%	>90%	6.7	7.7	7.2
Retano	7.0	7.0	7.0	>90%	>90%	>90%	5.0	5.5	5.3
NIZ 37-110	*7.0*	*7.0*	*7.0*	>90%	>90%	>90%	*4.5*	*5.0*	*4.8*
ABS 212	*7.0*	*7.0*	*7.0*	>90%	>90%	>90%	*4.5*	*5.0*	*4.8*
ABS 217	*7.0*	*7.5*	*7.3*	>90%	>90%	>90%	*4.0*	*5.0*	*4.5*
Garnet	*7.0*	*7.0*	*7.0*	>90%	>90%	>90%	*5.3*	*5.3*	*5.3*
Red Baron	7.3	7.0	7.2	>90%	>90%	>90%	**5.0**	**5.6**	**5.3**
Mean	**7.3**	**7.4**	**7.3**				6.0	6.0	6.0

Table 6. NIAB Spring Sown Onion Trials from seed 2015 - Onion Ring Data

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (mean of both sites)

Preliminary varieties 2 replicates of data

	% Bulbs with single centres		
Variety	**Essex**	**Norfolk**	**Mean**
BROWNS			
Hybound	64.4	80.0	72.2
BGS298	*73.3*	*50.0*	*61.7*
Hypark	57.8	55.6	56.7
Hybing	62.2	68.9	65.6
Hytune	*80.0*	*86.7*	*83.3*
Medaillon	48.9	71.1	60.0
SV3557ND	66.7	66.7	66.7
Centro	71.1	48.9	60.0
Vision	57.8	55.6	56.7
SV8528ND	*80.0*	*86.7*	*83.3*
RS 07751481	68.9	53.3	61.1
Hytech	40.0	68.9	54.4
Napoleon	28.9	57.8	43.3
Wellington	51.1	57.8	54.4
SV3700ND	66.7	88.9	77.8
Motion	64.4	80.0	72.2
Hysky	48.9	62.2	55.6
Arthur	44.4	40.0	42.2
SV1332ND	*76.7*	*83.3*	*80.0*
Hyfive	*73.3*	*83.3*	*78.3*
Chico	75.6	75.6	75.6
Paradiso	62.2	57.8	60.0
Hyway	*63.3*	*90.0*	*76.7*
Progression	80.0	71.1	75.6
Santero	60.0	60.0	60.0
Means	62.7	68.0	65.3
REDS			
Red Light	62.2	40.0	51.1
Red Tide	60.0	62.2	61.1
Redspark	51.1	46.7	48.9
Retano	46.7	64.4	55.6
NIZ 37-110	*23.3*	*26.7*	*25.0*
ABS 212	*43.3*	*46.7*	*45.0*
ABS 217	*66.7*	*70.0*	*68.3*
Garnet	*53.3*	*53.3*	*53.3*
Red Baron	53.3	62.2	57.8
Means	51.1	52.5	51.8

Table 7. NIAB Spring Sown Onion Trials from seed 2015 – Storage data (Ambient) Assessments April/May 2016

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (mean of both sites)

Preliminary varieties 2 replicates of data

	% sound Late April			% sound Late May			% sound CE storage late July
Variety	**Rix**	**Raker**	**Mean**	**Rix**	**Raker**	**Mean**	**Mean**
BROWNS							
Hybound	97	96	97	76	60	68	60
BGS298	99	98	99	54	54	54	78
Hypark	97	85	91	51	31	41	45
Hybing	91	94	92	54	49	51	50
Hytune	95	93	94	58	40	49	67
Medaillon	96	97	97	73	69	71	62
SV3557ND	96	87	92	59	42	51	61
Centro	95	89	92	49	48	48	56
Vision	98	97	97	70	61	66	85
SV8528ND	94	92	93	63	57	60	75
RS 07751481	85	84	85	30	41	35	35
Hytech	95	94	94	47	48	47	47
Napoleon	97	95	96	59	58	59	32
Wellington	95	95	95	56	48	52	86
SV3700ND	96	92	94	62	52	57	40
Motion	95	97	96	76	68	72	67
Hysky	96	96	96	62	59	60	68
Arthur	86	80	83	40	30	35	48
SV1332ND	94	91	93	52	46	49	47
Hyfive	96	94	95	64	45	55	53
Chico	93	88	91	60	47	53	71
Paradiso	87	90	88	56	45	50	57
Hyway	97	94	96	57	63	60	69
Progression	81	90	86	46	50	48	72
Santero	93	88	91	53	33	43	32
Means	**94**	**92**	**93**	**57**	**50**	**53**	**59**
REDS							
Red Light	32	28	30	6	1	4	65
Red Tide	91	94	92	56	56	56	45
Redspark	93	88	91	48	48	48	53
Retano	90	88	89	43	46	45	49
NIZ 37-110	90	81	85	34	43	38	50
ABS 212	96	96	96	68	61	65	41
ABS 217	90	86	88	32	30	31	33
Garnet	87	82	84	32	35	33	38
Red Baron	84	88	86	40	41	40	38
Means	**84**	**81**	**82**	**40**	**40**	**40**	**47**