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## 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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# ONIONS

## Headline

- New varieties add positively to the choices available to growers offering excellent storage potential; a broader range of red varieties; and mildew resistance.
- Herbicide choices need to be carefully evaluated – get as much “local” information as is available
- Options are changing for chemical control of Bean Seed Fly (BSF). Reduced rates of tefluthrin still give some control of BSF.

## Background

The aim of the work is to provide independent assessment of the growth habit, yield, quality and storage potential of new onion varieties, propagated from seed, to 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. Establish varieties are included to give comparison with newer varieties and to evaluate performance stability. Growers had the opportunity to inspect the trials at key stages.

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 trial field and storage data is essential for growers to make informed decisions when selecting varieties.

Drilled onions account for approximately 70% of the area grown in the UK. Early maturing varieties such as Hybing, Hybound, Centro and Vision are popular. New material is competing to take a share of the early maturing variety market. Early main crop varieties hold the majority of the acreage but mid-range and late maturing varieties still hold a proportion but in cool seasons are only likely to mature properly on fertile soils. A range of maturities can still play an important part in spreading the harvest window. Red Baron still commands a large but diminishing percentage of the red area with Red Tide and others gaining popularity.

Available herbicide active ingredients are constantly under threat. Alongside the work of SCEPTREplus, growers and agronomists an herbicide trial series was conducted to look at the performance of programmes targeted at the early season applications.

Bean Seed Fly (BSF) is a major pest of onion seedlings. Approximately 65% of all onion seed, drilled in the UK, is treated with (Force) tefluthrin against Bean Seed Fly attack. Severe attacks can reduce plant stands by >40%. All EAMU's for Force expire on 31/12/21 thus posing a significant risk to UK onion production (and other crops affected by BSF).

Re-registration of Force is likely to result in only 13g of a.s./ha being permitted from 2022 (the rate currently approved for sugar beet). Currently onions are treated at twice this concentration with 29g a.s./ha. This study is an initial look to discover if the reduced rate of Force will be effective for control.

## Results overview – Trial records and data collected from onion variety trials

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.

**Table A. NIAB Spring Sown Onion Trials drilled from seed 2021 – Varieties, Maturities, Yield & Storage (2020)**

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

Variety	Source	Maturity Date of 80% foliage fallover	Yield Marketable >40mm (t/ha)	Ambient Storage % sound bulbs at end June	Cold Storage % sound bulbs at end July
<b>BROWNS</b>					
Medusa	Takii	17-Aug	75.0	41	86
TEON 817	Takii	15-Aug	59.0	44	96
Nation	Syngenta	15-Aug	63.7	57	98
Shakito	Seminis	19-Aug	65.5	64	95
Vision	Syngenta	22-Aug	57.9	72	96
Fasto (37-104)	Hazera	20-Aug	67.5	55	95
Bruce (TEON 813)	Takii	23-Aug	56.0	55	90
37-119 (Bellesco)	Hazera	15-Aug	63.9	48	87
Novista	Takii	18-Aug	56.0	59	96
37-132	Hazera	20-Aug	66.1	55	95
Packito	Seminis	21-Aug	66.4	57	95
SG 8395	Syngenta	12-Aug	63.1	61	93
Hybing	Bejo/DGS	19-Aug	70.3	53	99
Hytech	Bejo/DGS	19-Aug	71.3	66	100
Rockito	Seminis	23-Aug	67.9	51	95
Hypark	Bejo/DGS	21-Aug	69.4	56	99
Hybound	Bejo/DGS	18-Aug	69.6	66	100
Centro	Hazera	22-Aug	63.2	64	96
Numbito	Seminis	22-Aug	66.1	60	88
37-129	Hazera	25-Aug	65.7	51	100
SVDN0233	Seminis	28-Aug	53.0	64	98
Hyroad	Bejo/DGS	21-Aug	64.0	53	99
37-131	Hazera	28-Aug	64.2	56	100
Klaria F1	ProVeg	28-Aug	68.2	52	80
Hyway	Bejo/DGS	28-Aug	65.1	54	99
Hylander	Bejo/DGS	28-Aug	56.5	65	97
Promotion	Syngenta	29-Aug	57.9	49	94
Motion	Syngenta	30-Aug	65.7	60	96
Aeneus	ProVeg	02-Sep	55.2	51	83
<b>Means</b>		<b>22-Aug</b>	<b>63.7</b>	<b>57</b>	<b>95</b>
<b>REDS</b>					
Redrover (37-222)	Hazera	19-Aug	47.6	65	94
TEON 505	Takii	22-Aug	54.7	70	88
37-219	Hazera	18-Aug	52.4	44	96
Ruby Star (TEON 502)	Takii	22-Aug	49.2	45	97
Redlander	Bejo/DGS	22-Aug	50.7	57	99
37-123	Hazera	20-Aug	50.5	53	98
Red Baron	Allium Seeds	24-Aug	54.7	64	97
Red Herald	Allium Seeds	26-Aug	48.8	59	100
Red Ray	Bejo/DGS	25-Aug	50.3	49	93
Red Tide	Bejo/DGS	25-Aug	51.3	54	100
37-175	Hazera	25-Aug	39.1	59	98
<b>Means</b>		<b>22-Aug</b>	<b>49.9</b>	<b>56</b>	<b>96</b>



## **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 cold store.

The trials were hosted by (with thanks) and located as follows:

- Raker Farms, Croxton, Norfolk – drilled onions on a Breckland soil (variety trial)
- P G Rix Farms, nr Colchester, Essex – drilled onions on a silty soil (variety trial)
- 3M Growers, nr Woodbridge, Suffolk – drilled onions on a sandy soil (BSF trial)
- G's Growers, nr Ely, Cambridgeshire – drilled onions on a fen soil (herbicide trial)

## **Production details**

The trials were drilled on 23<sup>rd</sup> March (Norfolk), 25<sup>th</sup> March (Essex) and 26<sup>th</sup> March (Suffolk) and were harvested on 20<sup>th</sup> September (Norfolk) and 6<sup>th</sup> 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.

The BSF trial design was 6 treatments x 4 replicate randomised complete block.

The herbicide trial plots were marked out in commercial crops – 8 treatments x 4 replicates, randomised complete block.

## **Trial records and data collected**

The 2021 season average maturities of brown and red onions were within a day of the 10 year averages but the Essex site was almost 2 weeks earlier than the 10 year average and the Norfolk site over a week later than the average.

A wet beginning to 2021 meant that growers were concerned about land preparation and gave limited windows of opportunity for drilling but in the end both trials were drilled around the “normal” time. Both trials established well but the weather in April turned cool and grey which slowed early growth and was ideal conditions for triggering bolting. By the summer equinox the trials were a week or two behind, for normal harvest maturity, with Norfolk plants at 4-5TL (true leaves) and Essex a bit closer to 5TL. The warmer weather in July and August

meant that the Essex trial caught up and finished early but the Norfolk trial was slower to mature.

Fusarium was not an obvious issue in the field – in stark contrast to 2018 – but grading data implies it may be an issue going into storage.

Mildew was starting to be a problem in August on the Norfolk trial but was controlled by the commercial fungicide programme.

All trials followed local commercial agronomy. Maleic hydrazide was not applied to either variety trial.

Key varieties are discussed below.

## **Varieties Discussion**

There is a range of maturities allowing growers to spread their harvest period but over half the brown varieties were at the early end of the spectrum. A series of warmer years has seen the average maturity date shifting to earlier in the year. This will also have been affected by an increased number of earlier maturing varieties coming through into trials and thus shifting the split of early to main crop varieties.

In the Essex trial the majority of varieties reached maturity as expected at the end of the summer and favourable conditions in early September allowed the trial to be harvested in a timely fashion. The Norfolk trial was later in maturing and wasn't harvested until 20<sup>th</sup> September. The quality of the Norfolk bulbs was lower than those of the Essex trial.

However, in cooler years, such as 2013, we see the maturity dates shifting later in the year and the opportunities to harvest later maturing varieties can run over into October which can result in bulbs having poorer initiation, being harder to dry and consequently inferior storage. Hotter summers are more likely to see storage issues not from harvest conditions but rather increases in issues such as Fusarium and bacterial rots as seen in 2018.

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 – there were no prolonged significant levels of mildew in the 2021 trials so the mildew resistant varieties or those with a degree of tolerance did not have a chance to outperform the others.

Plant breeders continue to attempt to breed mildew resistance into commercially viable new varieties. Getting the resistance genes into varieties that have high yields, good quality and good storage potential has proved a challenge with some success seen in brown varieties

but very limited success in the reds. There are concerns that as it is just a single resistance gene that many of the breeders are using that there is a chance it may breakdown.

Establishment was good in both trials. At drilling the conditions were mild but these soon turned to cool and grey which resulted in bolting issues, particularly on the Essex site. Crops matured earlier than the 10-year averages in Essex but in Norfolk they were later than the averages.

Medusa, and Bellesco showed the best early vigour in the browns; Reds Tide had good early vigour in the reds.

The best performing for mid-season vigour were Medusa, Hybing and Hytech in the browns and on the Essex site the red varieties: TEON 505 and Redlander.

Medusa was the earliest of the brown varieties. Other consistently early varieties are Shakito and Nation. Redrover, Ruby Star and the new variety TEON 505 were the earliest of the reds.

Bolting on the Essex site affected many varieties but with the majority showing less than 1% bolters. The worst affected varieties were Aeneus >15%, Klaria 1-5%, Hyway and Bellesco 1-2%.

The mean of trial yields in Norfolk was 56t/ha browns and 41t/ha reds, the trial yields were affected by Fusarium and doubles.

The Essex trial yield means were 72t/ha browns and 59t/ha reds. A few varieties were affected by bolters and doubles but the trial average yield was close to the 10 year averages.

Over the last 5 years the 10-year average of the mean marketable yield had been creeping up by approx. 1 t/ha as better varieties become available and agronomic practices change and improve. 2021 yields have caused a slight dip in the long-term averages but this may just be natural variation. Challenging seasons could cause greater variations in yield and make variety selection more important.

The highest yielding brown varieties (>60mm bulbs) were Medusa, Hybing, Motion and Fasto. TEON 505 was the highest yielding red variety.

Hybing, Rockito, Centro, Numbito, Hyroad and Hyway were the best of the established brown varieties for having high percentages of single centres. Bellesco, SG 8395, Aeneus, 37-132, and 37-131 showed promise. 37-219, Red Tide, Redlander and 37-123 were the best of the reds for single centres.

Storage assessments in an ambient store were recorded before the end of April and in late-June/July 2021. Cold storage assessments were recorded in July 2021.

Storage potential continues to be a key factor for drilled crops. Fusarium and bacterial rots in the field were expressed through loss of yield at grading and immediately going into storage. The major loss of bulbs was due to rots and thus the 2021/22 data should be treated with caution as some good varieties will have their true genetic potential compromised by the number of rotten bulbs which are more due to harvest conditions.

Varieties that did perform well in 2021/22 were Vision, Hytech, SVDN0233, Hylander, Hyroad, and Motion all performed significantly above average.

Numbito, Hybing, Hybound, Bruce, Vision, Fasto, Centro, Hyway, Hyroad, Motion and Hysky all performed significantly above average in 2020/21.

Motion, Hyway, Hyroad and Vision have consistently had above average percentages of sound bulbs at the late-May assessment.

Red varieties that did perform well in 2021/22 were TEON 505, Ruby Star and Red Tide. Redrover and Red Baron were close in performance to these three.

37-219, Ruby Star, 37-175, Redspark, Red Tide, Red Ray, Redlander and Red Baron performed well in 2020/21.

Red Tide, Red Baron and Ruby Star have consistently performed well.

In cold storage there was little to choose between varieties again with the rots being the major factor in the reduction of sound bulbs. In 2020/21 the varieties Nation, Vision and Hyroad were the best brown varieties, among many strong performers, for storage.

Ruby Star and Redlander were the best performing of the red varieties.

## **2021 Additional onion trials and KE events**

- Onion herbicide trial
- demonstration of the effective herbicides identified in SCEPTREplus in programmes
- BSF workshop hosted by Warwick Crop Centre

## 2021 Onion herbicide trial

The SCEPTREplus project work is recognised as a good mechanism for identifying and verifying new active ingredients that could be of use to onion growers and the wider vegetable industry as a whole. However, it is then down to the industry to incorporate the actives identified into commercial pesticide programmes. The sharing of this information may not disseminate to all growers and the robustness of the data could be strengthened by additional trialling. With this in mind AHDB and the BOPA R&D committee approved a herbicide trial for 2021 to update the treatment programmes and build upon the two trials delivered in 2020.

A replicated trial, in Cambridgeshire, looked at 10 different herbicide programmes.

The “commercial standard” was based on advice from the local agronomist and the other programmes adjusted to be comparable to the standard.

All treatments including the “untreated” control had a pre-emergence spray. There were three additional spray timings starting at post-crook, 1 true leaf (TL) and 2-3TL.

Population counts, weed counts and phytotoxicity were all recorded.

**Table B. NIAB Cambridgeshire Herbicide Trial - treatment programmes 2021**

tr. no.	Treatment	Pre-em	Post-crook	1TL	2-3TL
1	1	Commercial standard	0.5L Wing-P 0.1L Emerger	0.5L Wing-P 0.2L Emerger 0.1 Starane HL	0.35L Emerger 0.25 Starane HL 0.3kg Basagran
2	2	Commercial standard	0.5L Wing-P 0.1L Emerger	0.5L Wing-P 0.2L Emerger 0.1 Starane HL	0.35L Emerger 0.25 Starane HL 0.5kg Basagran
3	3	Commercial standard	0.5L Wing-P 0.1L Emerger	0.5L Wing-P 0.2L Emerger 0.1 Starane HL	0.35L Emerger 0.25 Starane HL 0.5kg Lentagran 0.3kg Basagran
4	4	Commercial standard	0.5L Wing-P 0.1L Emerger	0.5L Wing-P 0.2L Emerger 0.1 Starane HL	0.25 Starane HL 0.5kg Lentagran 0.3kg Basagran
5	5	Commercial standard	0.5L Wing-P 0.1L Efeckt	0.5L Wing-P 0.2L Efeckt 0.1 Starane HL	0.35L Emerger 0.25 Starane HL 0.3kg Basagran
6	6	Commercial standard	0.5L Wing-P 0.1L Efeckt	0.5L Wing-P 0.1L Efeckt 0.1 Starane HL	0.35L Emerger 0.25 Starane HL 0.5kg Lentagran
7	7	Commercial standard	0.5L Wing-P 0.1L Efeckt	0.5L Wing-P 1.0L Efeckt 0.1 Starane HL	0.35L Emerger 0.25 Starane HL 0.5kg Lentagran 0.3kg Basagran
8	8	Commercial standard	0.5L Wing-P 1.0L Efeckt	0.5L Wing-P 1.0L Efeckt 0.1 Starane HL	0.3L Emerger 0.25 Starane HL 0.5kg Lentagran
9	Control	Commercial standard	Untreated	Untreated	Untreated
10	Commercial standard	Commercial standard	0.75L Wing-P 0.1L Buctril*	0.75L Wing-P 0.1L Buctril*	0.2L Buctril* 0.2 Starane HL 0.2kg Basagran

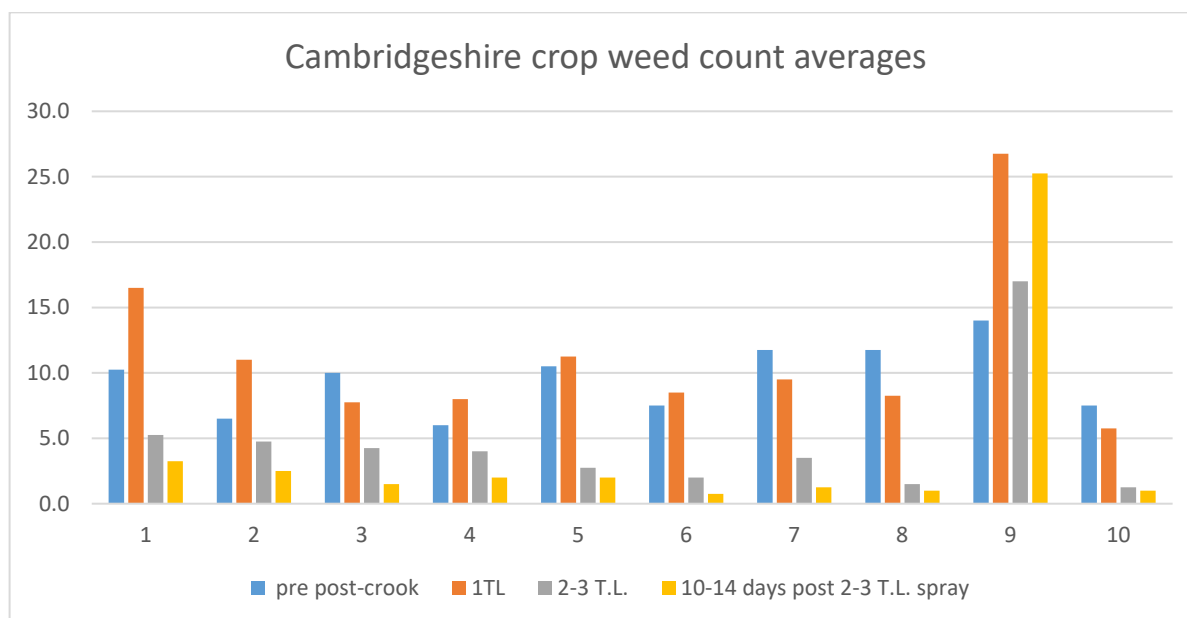
\* Buctril was withdrawn from the market 17 Sept 2021

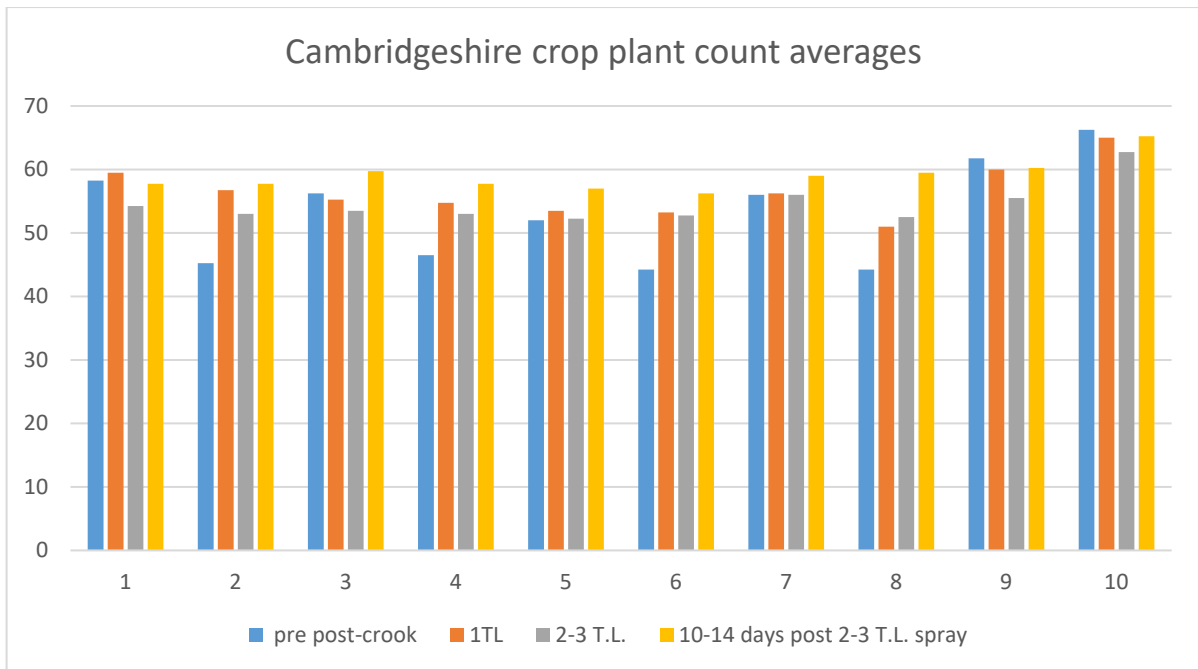
## Onion Herbicide Trial Results

**Table C. NIAB Cambridgeshire Herbicide Trial – plant counts, weed counts and phytotoxicity data 2021**

treatment	timing 1 = pre post-crook			timing 2 = 1TL			timing 3 = 2-3 TL			timing 4 = 10-14 days post 2-3 T.L. spray		
	Plants /m2	Weeds /m2	Phyto 10=none	Plants /m2	Weeds /m2	Phyto 10=none	Plants /m2	Weeds /m2	Phyto 10=none	Plants /m2	Weeds /m2	Phyto 10=none
1	58.3	10.3	10	59.5	16.5	10	54.3	5.3	10	57.8	3.3	10
2	45.3	6.5	10	56.8	11.0	10	53.0	4.8	10	57.8	2.5	10
3	56.3	10.0	10	55.3	7.8	10	53.5	4.3	10	59.8	1.5	10
4	46.5	6.0	10	54.8	8.0	10	53.0	4.0	10	57.8	2.0	10
5	52.0	10.5	10	53.5	11.3	10	52.3	2.8	10	57.0	2.0	10
6	44.3	7.5	10	53.3	8.5	10	52.8	2.0	10	56.3	0.8	10
7	56.0	11.8	10	56.3	9.5	10	56.0	3.5	10	59.0	1.3	10
8	44.3	11.8	10	51.0	8.3	10	52.5	1.5	10	59.5	1.0	10
9	61.8	14.0	10	60.0	26.8	10	55.5	17.0	10	60.3	25.3	10
10	66.3	7.5	10	65.0	5.8	10	62.8	1.3	10	65.3	1.0	10

**Graph A. NIAB Cambridgeshire Herbicide Trial – graphs of plant counts, weed counts and phytotoxicity data 2021**





No phytotoxicity was observed.

## Herbicide Trials Discussion

No phytotoxicity was observed and there was no significant impact on onion plant numbers. So called “hot” treatments had been selected but there were no major frost events, and it is these conditions that often accentuate any phytotoxic effects.

The untreated plots had the highest weed counts and the commercial standard was the most effective at controlling weeds (see table B and graph A above). Of the alternative programmes treatment 8 had the best cumulative effect.

However, weed pressure was not as high on the Cambridgeshire site as last season. The cool spring had resulted in few fresh flushes of weeds.

The choice of active ingredients is somewhat limited and there are restrictions on the total rate that can be applied.

A robust pre-emergence spray is favoured as it is least likely to have a phytotoxic effect on the crop but then it is a challenge to apply active ingredients at sufficient rates to control the weeds but to balance this against potential phytotoxic effects.

As weeds will continue to come through a little and often approach is favoured but this might not always be sufficient to control the weeds.

These results are only from a single year on a single specific site so should be treated with great caution but are valuable in building a picture of suitability of active ingredients in an herbicide programme.

Similarly it is not easy to pick out the affects of individual chemistry without looking at the broader set of data. Growers should review these with a BASIS qualified agronomist.

## **2021 Bean Seed Fly trial**

Bean Seed Fly (BSF) is a major pest of onion seedlings. Approximately 65% of all onion seed, drilled in the UK, is treated with (Force) tefluthrin against Bean seed fly attack. Severe attacks can reduce plant stands by >40%. All EAMU's for Force expire on 31/12/21 thus posing a significant risk to UK onion production (and other crops affected by BSF).

Re-registration of Force is likely to result in only 13g of a.s./ha being permitted from 2022 (the rate currently approved for sugar beet). Currently onions are treated at twice this concentration with 29g a.s./ha. This study was an initial look to discover if the reduced rate of Force would be effective for control.

Natural and pelleted brown onion seed was treated (courtesy of Elsoms seeds) with the current standard commercial rate (29g/ha) and reduced rate (13g/ha) Force along with an untreated control.

A fully randomised complete block, replicated trial was drilled in Suffolk hosted by 3Ms growers. The site was selected, by the local agronomist (James Klug), as having a high risk of infection.

The trial was drilled at 63.3 plants/m<sup>2</sup> on 26th March 2021 and bone meal was applied to the surface of all plots to attract BSF.

Plant count assessments on 2.75 m<sup>2</sup> area of each plot were completed at first emergence (approx. crook stage) and thereafter every 7-10 days to quantify plant losses due to BSF. The final (6<sup>th</sup>) assessment was recorded in early June.



BSF traps were located within the trial and posted off for identification and reported through the Pest Bulletin.

**Table D: list of seed treatments**

Treatment	Product	rate a.s. g/ha	seed type
1	untreated	0	natural
2	Force	13	natural
3	Force	29	natural
4	untreated	0	pellets
5	Force	13	pellets
6	Force	29	pellets

### **Bean Seed Fly Onion Trial Results and discussion**

The trial was drilled in good conditions into a fairly dry seed bed, on light sandy soils, but the trial was irrigated after drilling. Dry and cold conditions throughout April meant that establishment was slow and uneven, especially in the pelleted treatments. In general pelleted seed emerges slower than naked/coated seed. Some new plants were still emerging in at the time of the 3rd and 4th visits. The variability of establishment may have resulted in some plants escaping damage but this is not certain.

Ed Pissarro, Rix, was monitoring/trapping the crop for BSF and verbally reported on numbers he had spotted before sending samples to Fera - “I would say the end of April was very quiet and it was only in the last 10 days we have started trapping any number of flies. The last trap I sent off (10th May) looked like there were 10 BSF present.”

Table E shows that there is some improvement in plant densities with both half and full rate Force over the untreated. Or expressed another way that there is a reduction in plant density if the level of active ingredient is reduced. Table F shows this in a simpler format by expressing the plant densities as a percentage of the equivalent full rate Force treatment.

As early season BSF numbers were low then the level of damage and plant loss is not particularly high but the trend is there and higher BSF infestation would most likely start to stretch these differences and make the use of half rate Force a viable alternative to reduce the risk of crop loss.

**Table E: plant densities at early growth stages**

Product	rate g/ha	seed type	visit 1	visit 2	visit 3	visit 4	visit 5	visit 6
			23/4/21	30/4/21	9/5/21	18/5/21	25/5/21	2/6/21
			density /m2	density /m2	density /m2	density /m2	density /m2	density /m2
untreated	0	natural	52.5	56.2	56.0	55.1	55.3	54.8
Force	13	natural	53.6	57.8	56.7	57.2	57.2	57.4
Force	29	natural	58.5	63.1	62.7	61.9	62.5	62.5
untreated	0	pellets	47.2	57.6	55.7	56.7	56.5	56.2
Force	13	pellets	46.0	58.4	58.8	59.6	59.5	59.8
Force	29	pellets	56.0	61.4	58.8	59.7	60.5	60.1

**Table F: plant densities at early growth stages expressed as a percentage of the (equivalent full rate Force treatment)**

Product	rate g/ha	seed type	visit 1	visit 2	visit 3	visit 4	visit 5	visit 6
			Density %	Density %	Density %	Density %	Density %	Density %
untreated	0	natural	90	89	89	89	88	88
Force	13	natural	92	92	90	92	91	92
Force	29	natural	100	100	100	100	100	100
untreated	0	pellets	84	94	95	95	93	93
Force	13	pellets	82	95	100	100	98	100
Force	29	pellets	100	100	100	100	100	100

## Conclusions

The yield potential of varieties can vary greatly. In the drilled trials this was approx. 22 t/ha (31 t/ha and 27 t/ha in 2020 and 2019 respectively) between the highest and lowest yield means for brown varieties.

The trials yield data 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)
- tolerance to bolting.

Selected varieties have been commented on in the discussion section.

## **Varieties**

Varieties need to match the grower's requirements and ideally have two or more above average characteristics e.g. for early maturity and high green plot yields, Medusa, is a suitable choice; for green plot yield and post storage yields Motion, Fasto, Red Tide and Ruby Star performed well; Medusa performed well for early vigour and green plot yield. Fasto, Bruce, Numbito, Redrover, Ruby Star and Red Tide remain varieties to keep an eye on over the next couple of seasons. Nation is one of the newest varieties looking like a reliable choice but will need a couple more years of data to confirm this.

In the drilled trials there was approx. 35 t/ha between the highest and lowest yields (reds and browns, mean of both trials).

Drilled material (2021 trials) showed a difference of over 65%, between the best and worst storage potential from ambient store and similarly approx. 65% from cold storage.

Medusa, Shakito and Nation are consistently early maturing brown varieties. TEON 817 was the earliest of the new brown varieties.

Redrover is commonly one of the earliest reds; Ruby Star and 37-219 are also early maturing. TEON 505 is the earliest of the new varieties at the early end of the spectrum.

The highest yielding brown varieties (>60mm bulbs) were Medusa, Hybing, Motion and Fasto. TEON 505 was the highest yielding red variety.

Medusa, Motion, Hypark, Hytech and Hybound have consistently been amongst the higher yielders.

Hybing, Rockito, Centro, Numbito, Hyroad and Hyway were the best of the established brown varieties for having high percentages of single centres. Bellesco, SG 8395, Aeneus, 37-132, and 37-131 showed promise. 37-219, Red Tide, Redlander and 37-123 were the best of the reds for single centres.

Numbito, Hybing, Hybound, Bruce, Vision, Fasto, Centro, Hyway, Hyroad, Motion and Hysky all performed significantly above average in 2020/21.

Motion, Hyway, Hyroad and Vision have consistently had above average percentages of sound bulbs at the late-May assessment.

37-219, Ruby Star, 37-175, Redspark, Red Tide, Red Ray, Redlander and Red Baron performed well in the reds.

Red Tide, Red Baron and Ruby Star have consistently performed well.

In cold storage the varieties Nation, Vision and Hyroad were the best brown varieties, among many storage performers, for storage.

Ruby Star and Redlander were the best performing of the red varieties.

## **Herbicides**

Tailor your herbicide programme to known weed pressures and climate risks. Consult a BASIS registered agronomist.

The trial data is only a single year's worth of data in a season that was not very challenging from a weather point of view. Compare the data with other available sources.

## **Bean Seed Fly Control**

The seed treatment active ingredient tefluthrin, which gives control of bean seed fly (BSF), will no longer be available for application after 31 December 2021 but an EAMU application for a reduced rate application is being submitted for applications in 2023. Trial evidence indicates that some control of BSF is still achieved with reduced rates of tefluthrin and this evidence will support formal application for an EAMU.

BSF control by IPM/cultural methods has been investigated in other projects. Early indications are that increasing the gap between soil preparation and drilling to 2-3 weeks can aid in reducing BSF numbers.

## **Financial Benefits**

The yield potential of varieties can vary greatly. In the drilled trials this was approx. 29 t/ha and 16 t/ha between the highest and lowest yielding browns and reds respectively (mean of both trials).

Yield out of store is also important. Drilled material showed a difference of over 65% and 60% between the best and worst storage potential from ambient storage in the browns and reds respectively. From cold storage the differences were approx. 55% for browns and 10% for 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.
- Varieties should match the market and available storage facilities – longer storing varieties give more options.
- Consider varieties with good disease resistance e.g. mildew resistance, as they will act as an insurance if it is high disease pressure year – grow a range of varieties and use local knowledge of fields that could be disease hot spots.
- Seed cost (variety and seed treatment) is a factor in the selection of varieties
- Tailor herbicide programmes to be adaptive to the season and weed pressures
- As active ingredients are reduced look more towards IPM strategies

## **Technology transfer**

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

Open days and events were delivered on these occasions:

1. Drilled crop field open day in Essex – August 2021
2. Drilled crops harvested produce open day and technical presentations at NIAB, Cambridge – November 2021
3. BSF IPM workshop (virtual) – December 2021

All events were well attended by a number of growers, seed trade, agronomists, research providers, etc.

The farming press from The Vegetable Farmer, etc. attended and reported on events.

Trials and onion related updates are regularly featured on social media through twitter @AHDB\_Hort @basnapier @NIABTAG @BritishGrowers with a combined following of over 15,000 users.

BOPA monthly grower newsletters are also used to circulate key dates and information.

## Onion Appendices

**Table 1. NIAB Spring Sown Onion Trials from seed 2021 – varieties**

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (Essex site); *Preliminary varieties 2 replicates of data*

Variety	Status	Source	Maturity		
			Essex	Norfolk	Mean
			% foliage fall over		
<b>BROWNS</b>					
Medusa	2	Takii	09-Aug	25-Aug	17-Aug
TEON 817	P	Takii	09-Aug	22-Aug	15-Aug
Nation	1	Syngenta	09-Aug	21-Aug	15-Aug
Shakito	R	Seminis	10-Aug	27-Aug	19-Aug
Vision	C	Syngenta	10-Aug	04-Sep	22-Aug
Fasto (37-104)	R	Hazera	11-Aug	28-Aug	20-Aug
Bruce (TEON 813)	3	Takii	11-Aug	04-Sep	23-Aug
37-119 (Bellesco)	1	Hazera	12-Aug	18-Aug	15-Aug
Novista	1	Takii	12-Aug	25-Aug	18-Aug
37-132	1	Hazera	12-Aug	29-Aug	20-Aug
Packito	R	Seminis	12-Aug	30-Aug	21-Aug
SG 8395	P	Syngenta	12-Aug	13-Aug	12-Aug
Hybing	C	Bejo/DGS	12-Aug	26-Aug	19-Aug
Hytech	C	Bejo/DGS	12-Aug	27-Aug	19-Aug
Rockito	3	Seminis	12-Aug	02-Sep	23-Aug
Hypark	R	Bejo/DGS	13-Aug	29-Aug	21-Aug
Hybound	R	Bejo/DGS	13-Aug	22-Aug	18-Aug
Centro	C	Hazera	13-Aug	01-Sep	22-Aug
Numbito	R	Seminis	13-Aug	30-Aug	22-Aug
37-129	1	Hazera	14-Aug	05-Sep	25-Aug
SVDN0233	2	Seminis	15-Aug	10-Sep	28-Aug
Hyroad	3	Bejo/DGS	15-Aug	28-Aug	21-Aug
37-131	1	Hazera	15-Aug	10-Sep	28-Aug
Klaria F1	P	ProVeg	16-Aug	09-Sep	28-Aug
Hyway	R	Bejo/DGS	18-Aug	08-Sep	28-Aug
Hylander	R	Bejo/DGS	18-Aug	07-Sep	28-Aug
Promotion	1	Syngenta	18-Aug	08-Sep	29-Aug
Motion	R	Syngenta	19-Aug	11-Sep	30-Aug
Aeneus	P	ProVeg	23-Aug	12-Sep	02-Sep
<b>Means</b>			<b>13-Aug</b>	<b>31-Aug</b>	<b>22-Aug</b>
<b>REDS</b>					
Redrover (37-222)	R	Hazera	09-Aug	29-Aug	19-Aug
TEON 505	P	Takii	10-Aug	04-Sep	22-Aug
37-219	2	Hazera	11-Aug	25-Aug	18-Aug
Ruby Star (TEON 502)	2	Takii	11-Aug	03-Sep	22-Aug
Redlander	1	Bejo/DGS	11-Aug	03-Sep	22-Aug
37-123	P	Hazera	12-Aug	28-Aug	20-Aug
Red Baron	C	Allium Seeds	13-Aug	04-Sep	24-Aug
Red Herald	R	Allium Seeds	15-Aug	07-Sep	26-Aug
Red Ray	1	Bejo/DGS	15-Aug	04-Sep	25-Aug
Red Tide	C	Bejo/DGS	15-Aug	05-Sep	25-Aug
37-175	R	Hazera	16-Aug	03-Sep	25-Aug
<b>Means</b>			<b>12-Aug</b>	<b>02-Sep</b>	<b>22-Aug</b>

**Table 2. NIAB Spring Sown Onion Trials from seed 2021 - Yield data**

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (Essex site); *Preliminary varieties 2 replicates of data*

Variety	Population & Yield									% bulbs by weight >60mm		
	plant pop. (plants / sq. m)			marketable yield >40mm bulbs (t/ha)			marketable yield >60mm bulbs (t/ha)					
	Rix	Raker	Mean	Rix	Raker	Mean	Rix	Raker	Mean	Rix	Raker	Mean
<b>BROWNS</b>												
Medusa	54.3	52.7	53.5	85.4	64.7	75.0	76.6	47.3	62.0	89.6	72.7	81.2
TEON 817	51.2	41.9	46.5	64.6	53.3	59.0	43.1	40.3	41.7	66.6	75.9	71.2
Nation	57.8	44.9	51.4	70.1	57.3	63.7	44.4	44.4	44.4	62.8	77.9	70.3
Shakito	67.4	49.3	58.4	70.9	60.1	65.5	36.4	41.6	39.0	51.3	69.9	60.6
Vision	59.0	35.7	47.4	69.8	46.0	57.9	42.8	36.8	39.8	60.6	79.8	70.2
Fasto	53.0	47.4	50.2	74.3	60.8	67.5	57.1	44.1	50.6	76.3	72.5	74.4
Bruce	46.4	45.3	45.9	54.5	57.5	56.0	42.1	42.5	42.3	77.2	73.5	75.4
Bellesco	62.5	44.7	53.6	74.7	53.2	63.9	45.4	33.9	39.6	59.5	64.3	61.9
Novista	45.2	42.7	44.0	58.1	53.9	56.0	45.2	40.3	42.7	77.7	74.8	76.2
37-132	61.6	46.3	53.9	71.9	60.3	66.1	42.3	45.2	43.8	58.0	74.5	66.2
Packito	62.6	54.6	58.6	71.3	61.5	66.4	41.5	38.8	40.2	57.2	62.6	59.9
SG 8395	57.9	42.8	50.4	74.4	51.9	63.1	48.9	35.2	42.1	65.8	67.2	66.5
Hybing	56.4	51.3	53.9	77.1	63.4	70.3	57.1	44.6	50.8	73.9	69.8	71.8
Hytech	63.2	51.2	57.2	80.2	62.5	71.3	50.2	44.4	47.3	62.4	71.3	66.8
Rockito	59.6	50.7	55.1	70.4	65.3	67.9	41.0	50.1	45.5	57.9	76.7	67.3
Hypark	60.5	46.0	53.3	74.4	64.4	69.4	47.9	51.2	49.5	64.1	79.7	71.9
Hybound	65.9	50.1	58.0	77.8	61.3	69.6	45.9	42.9	44.4	58.5	70.7	64.6
Centro	57.5	49.1	53.3	72.2	54.3	63.2	46.6	33.9	40.2	64.5	62.2	63.3
Numbito	52.8	44.4	48.6	75.9	56.2	66.1	60.4	40.5	50.4	79.2	71.8	75.5
37-129	57.1	44.1	50.6	76.0	55.5	65.7	52.9	40.3	46.6	69.3	73.4	71.3
SVDN0233	37.0	22.7	29.8	66.9	39.2	53.0	62.4	35.6	49.0	93.3	91.0	92.2
Hyroad	48.1	47.3	47.7	70.6	57.4	64.0	56.8	41.3	49.1	79.7	71.9	75.8
37-131	58.1	40.3	49.2	72.4	55.9	64.2	46.3	43.4	44.8	63.5	77.3	70.4
Klaria F1	53.9	51.6	52.7	70.9	65.5	68.2	57.7	47.3	52.5	81.4	72.2	76.8
Hyway	60.0	39.6	49.8	75.8	54.4	65.1	50.8	42.7	46.7	67.0	78.5	72.7
Hylander	54.4	35.5	45.0	72.5	40.5	56.5	55.6	30.8	43.2	76.3	77.3	76.8
Promotion	51.6	37.1	44.4	67.5	48.2	57.9	47.3	39.4	43.3	68.5	81.8	75.1
Motion	51.6	38.6	45.1	72.1	59.3	65.7	55.0	52.0	53.5	75.8	87.5	81.7
Aeneus	53.3	39.8	46.6	59.4	51.0	55.2	37.3	39.4	38.4	62.1	76.8	69.5
<b>Means</b>	<b>55.9</b>	<b>44.2</b>	<b>50.0</b>	<b>71.5</b>	<b>56.0</b>	<b>63.7</b>	<b>49.5</b>	<b>41.4</b>	<b>45.5</b>	<b>69.0</b>	<b>74.3</b>	<b>71.6</b>
<b>REDS</b>												
Redrover	51.6	44.3	47.9	47.4	47.8	47.6	27.3	28.5	27.9	58.9	58.7	58.8
TEON 505	53.0	37.1	45.1	61.5	47.9	54.7	39.8	37.9	38.9	64.4	78.5	71.5
37-219	48.7	39.8	44.2	62.9	42.0	52.4	45.2	23.8	34.5	71.6	56.4	64.0
Ruby Star	46.7	37.0	41.8	63.1	35.3	49.2	46.1	19.0	32.5	72.5	47.4	59.9
Redlander	48.0	31.1	39.5	59.5	41.9	50.7	40.9	32.2	36.6	68.3	74.5	71.4
37-123	55.8	34.2	45.0	60.6	40.5	50.5	35.1	30.7	32.9	57.1	72.4	64.7
Red Baron	62.2	39.0	50.6	61.0	48.4	54.7	32.2	37.8	35.0	52.4	78.8	65.6
Red Herald	53.7	34.4	44.1	56.9	40.7	48.8	32.4	27.9	30.1	56.7	63.0	59.9
Red Ray	49.9	28.4	39.2	59.3	41.3	50.3	38.1	35.0	36.5	63.4	84.3	73.9
Red Tide	55.2	35.4	45.3	64.1	38.4	51.3	40.3	25.1	32.7	62.0	64.2	63.1
37-175	46.7	35.0	40.8	47.3	30.9	39.1	30.8	18.5	24.6	68.4	54.0	61.2
<b>Means</b>	<b>52.0</b>	<b>36.0</b>	<b>44.0</b>	<b>58.5</b>	<b>41.4</b>	<b>49.9</b>	<b>37.1</b>	<b>28.8</b>	<b>32.9</b>	<b>63.2</b>	<b>66.6</b>	<b>64.9</b>



**Table 3. NIAB Spring Sown Onion Trials from seed 2021 - rots by category**

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (Essex site); Preliminary varieties 2 replicates of data

Variety	Population & Yield														
	% Base Rots			% Neck Rots			% bacterial rots			% Penicillium			% other defects		
	Rix	Raker	Mean	Rix	Rak.	Mean	Rix	Rak.	Mean	Rix	Rak.	Mean	Rix	Rak.	Mean
<b>BROWNS</b>															
Medusa	1.4	1.3	1.3	2.0	0.0	1.0	0.3	0.0	0.1	0.1	0.0	0.1	7.7	5.8	6.8
TEON 817	0.0	1.9	0.9	1.5	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	2.3	3.3	2.8
Nation	0.2	4.9	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	3.2	2.4
Shakito	0.3	1.4	0.9	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	5.1	3.6	4.4
Vision	0.0	7.3	3.7	0.0	0.0	0.0	0.4	0.0	0.2	0.0	0.0	0.0	1.0	6.5	3.7
Fasto	0.1	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	5.2	3.2
Bruce	0.0	2.1	1.1	0.1	0.0	0.1	0.3	0.2	0.2	0.0	0.0	0.0	10.4	3.2	6.8
Bellesco	2.3	3.1	2.7	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.7	1.2
Novista	0.0	0.7	0.3	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	10.0	4.5	7.2
37-132	1.5	1.1	1.3	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.3	2.7	1.5
Packito	0.5	1.3	0.9	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	2.1	3.1	2.6
SG 8395	0.1	2.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	3.9	2.4
Hybing	1.4	1.4	1.4	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	1.0	4.5	2.7
Hytech	0.0	5.3	2.7	0.0	0.0	0.0	0.2	0.1	0.2	0.0	0.0	0.0	0.6	2.7	1.7
Rockito	0.1	1.0	0.5	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.7	3.6	2.1
Hypark	0.4	1.1	0.8	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	1.3	2.8	2.0
Hybound	0.1	4.9	2.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2.0	2.1	2.1
Centro	0.7	2.5	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.0	1.8
Numbito	0.5	0.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	4.6	2.9
37-129	0.7	3.9	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.9	1.1
SVDN0233	0.2	4.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	3.8	3.0
Hyroad	1.2	4.1	2.7	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.8	4.0	2.4
37-131	0.0	3.3	1.6	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	2.1	2.6	2.3
Klaria F1	8.7	0.4	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.6	2.0
Hyway	0.1	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	5.2	3.9
Hylander	0.1	12.8	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	5.4	3.6
Promotion	1.2	4.7	3.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	2.7	8.6	5.6
Motion	0.0	2.0	1.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	1.9	4.9	3.4
Aeneus	0.4	0.6	0.5	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0	4.0	3.7	3.8
<b>Means</b>	<b>0.8</b>	<b>3.0</b>	<b>1.9</b>	<b>0.1</b>	<b>0.0</b>	<b>0.1</b>	<b>0.1</b>	<b>0.0</b>	<b>0.1</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>2.5</b>	<b>3.9</b>	<b>3.2</b>
<b>REDS</b>															
Redrover	6.1	1.5	3.8	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	3.4	1.5	2.5
TEON 505	0.0	5.8	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	1.8	4.1
37-219	0.0	1.7	0.8	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	2.7	0.8	1.8
Ruby Star	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	2.4	2.4	2.4
Redlander	0.1	1.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.5	1.7	0.9	1.3
37-123	0.0	4.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.3	1.4	0.9
Red Baron	0.1	2.4	1.2	0.0	0.0	0.0	0.0	0.9	0.5	0.1	0.0	0.1	0.8	0.7	0.8
Red Herald	0.5	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	2.0	2.9	2.4
Red Ray	1.2	3.5	2.4	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	1.2	1.0	1.1
Red Tide	0.0	1.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.2	0.4	4.1	2.2
37-175	0.0	7.8	3.9	0.0	0.0	0.0	1.9	0.0	1.0	0.0	0.0	0.0	3.1	1.8	2.5
<b>Means</b>	<b>0.7</b>	<b>2.8</b>	<b>1.8</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.2</b>	<b>0.1</b>	<b>0.2</b>	<b>0.2</b>	<b>0.0</b>	<b>0.1</b>	<b>2.2</b>	<b>1.8</b>	<b>2.0</b>

**Table 4. NIAB Spring Onion Trials from seed 2021 – Bulb Quality data**

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (Essex site); Preliminary varieties 2 replicates of data

Variety	Bulb Quality (1-9)														
	Skin Colour 1=pale			Skin Protection 1=poor			Bulb Shape 1=flat			Uniformity 1=poor			Firmness 1=poor		
	Rix	Raker	Av	Rix	Raker	Av	Rix	Raker	Av	Rix	Raker	Av	Rix	Raker	Av
<b>BROWNS</b>															
Medusa	6.0	7.0	6.5	5.0	4.0	4.5	5.5	5.5	5.5	6.0	6.0	6.0	7.0	7.0	7.0
TEON 817	5.0	5.5	5.3	7.0	7.0	7.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0	7.0
Nation	5.0	5.5	5.3	7.0	7.0	7.0	5.0	5.0	5.0	6.5	6.5	6.5	8.0	7.0	7.5
Shakito	5.0	5.0	5.0	7.0	7.0	7.0	5.0	5.0	5.0	6.5	6.5	6.5	7.0	7.0	7.0
Vision	5.0	5.0	5.0	7.0	7.0	7.0	5.5	5.5	5.5	6.5	6.5	6.5	8.0	7.0	7.5
Fasto	5.0	5.5	5.3	7.0	7.0	7.0	5.0	5.0	5.0	7.0	6.0	6.5	7.0	7.0	7.0
Bruce	5.0	5.0	5.0	7.0	7.0	7.0	5.0	5.0	5.0	7.0	6.5	6.8	7.0	6.5	6.8
Bellesco	5.0	6.0	5.5	7.0	7.0	7.0	6.0	5.5	5.8	5.5	6.0	5.8	7.0	7.0	7.0
Novista	5.0	5.5	5.3	7.0	6.0	6.5	5.0	5.0	5.0	6.5	6.5	6.5	7.0	6.5	6.8
37-132	5.0	5.5	5.3	7.0	7.0	7.0	5.0	5.0	5.0	6.5	6.5	6.5	7.0	8.0	7.5
Packito	5.0	5.5	5.3	7.0	7.0	7.0	5.0	5.5	5.3	6.0	7.0	6.5	7.0	8.0	7.5
SG 8395	5.5	6.0	5.8	6.0	6.0	6.0	5.5	5.5	5.5	6.5	6.5	6.5	8.0	7.0	7.5
Hybing	5.0	5.0	5.0	7.0	7.0	7.0	5.0	5.0	5.0	7.0	6.0	6.5	7.0	7.0	7.0
Hytech	5.0	5.0	5.0	7.0	7.0	7.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0	7.0
Rockito	5.0	5.0	5.0	7.0	7.0	7.0	5.0	5.5	5.3	7.0	6.0	6.5	7.0	7.0	7.0
Hypark	5.0	5.0	5.0	6.0	7.0	6.5	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0	7.0
Hybound	5.0	5.0	5.0	7.0	7.0	7.0	5.0	5.0	5.0	7.0	6.5	6.8	7.0	6.5	6.8
Centro	5.0	5.0	5.0	7.0	7.0	7.0	5.0	6.0	5.5	6.0	6.0	6.0	7.0	7.0	7.0
Numbito	5.0	5.0	5.0	7.0	7.0	7.0	5.0	5.0	5.0	6.5	6.5	6.5	7.0	7.0	7.0
37-129	5.0	5.0	5.0	7.0	7.0	7.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0	7.0
SVDN0233	5.0	5.5	5.3	7.0	7.0	7.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0	7.0
Hyroad	4.5	5.0	4.8	7.0	7.0	7.0	5.0	5.0	5.0	6.5	7.0	6.8	7.5	7.0	7.3
37-131	5.0	5.0	5.0	6.5	7.0	6.8	5.0	5.0	5.0	7.0	7.0	7.0	7.5	7.0	7.3
Klaria F1	5.5	5.5	5.5	6.5	6.0	6.3	5.0	5.0	5.0	6.5	6.5	6.5	6.5	6.5	6.5
Hyway	<b>4.5</b>	<b>5.0</b>	4.8	<b>7.0</b>	<b>7.0</b>	7.0	<b>5.0</b>	<b>5.0</b>	5.0	<b>6.5</b>	<b>6.5</b>	6.5	<b>7.0</b>	<b>7.0</b>	7.0
Hylander	5.0	5.0	5.0	7.0	7.0	7.0	5.0	5.0	5.0	7.0	7.0	7.0	7.0	7.0	7.0
Promotion	5.0	<b>6.0</b>	5.5	<b>7.0</b>	<b>7.0</b>	7.0	<b>5.0</b>	<b>5.0</b>	5.0	<b>5.0</b>	<b>6.0</b>	5.5	<b>7.0</b>	<b>7.0</b>	7.0
Motion	<b>5.0</b>	5.0	5.0	7.0	7.0	7.0	5.0	5.0	5.0	7.0	7.0	7.0	7.5	7.0	7.3
Aeneus	6.0	7.0	6.5	7.0	7.0	7.0	5.0	5.0	5.0	6.5	6.5	6.5	7.0	6.5	6.8
<b>Means</b>	5.1	5.4	5.2	6.8	6.8	6.8	5.1	5.1	5.1	6.6	6.6	6.6	7.1	7.0	7.1
<b>REDS</b>															
Redrover	7.0	6.5	6.8	6.0	7.0	6.5	5.0	5.0	5.0	6.0	5.0	5.5	7.0	7.0	7.0
TEON 505	7.0	7.0	7.0	7.0	7.0	7.0	4.0	4.5	4.3	6.0	6.0	6.0	7.0	7.0	7.0
37-219	6.0	7.0	6.5	6.0	7.0	6.5	5.0	5.0	5.0	7.0	6.5	6.8	7.0	7.0	7.0
Ruby Star	7.0	7.0	7.0	6.0	7.0	6.5	4.5	4.5	4.5	6.0	5.5	5.8	7.0	7.0	7.0
Redlander	7.0	7.0	7.0	7.0	7.0	7.0	5.5	5.0	5.3	6.5	6.5	6.5	7.0	7.0	7.0
37-123	<b>6.5</b>	<b>7.0</b>	6.8	<b>5.0</b>	<b>5.0</b>	5.0	<b>6.0</b>	<b>5.5</b>	5.8	<b>6.0</b>	<b>7.0</b>	6.5	<b>7.0</b>	<b>7.0</b>	7.0
Red Baron	7.0	7.0	7.0	7.0	7.0	7.0	5.5	5.0	5.3	6.5	6.0	6.3	7.0	7.0	7.0
Red Herald	<b>7.0</b>	<b>7.0</b>	7.0	<b>7.0</b>	<b>7.0</b>	7.0	<b>5.0</b>	<b>5.0</b>	5.0	<b>7.0</b>	<b>7.0</b>	7.0	<b>7.0</b>	<b>7.0</b>	7.0
Red Ray	<b>7.0</b>	<b>7.5</b>	7.3	<b>7.0</b>	<b>7.0</b>	7.0	<b>5.5</b>	<b>5.5</b>	5.5	<b>7.0</b>	<b>6.5</b>	6.8	<b>7.0</b>	<b>7.0</b>	7.0
Red Tide	<b>7.0</b>	<b>7.5</b>	7.3	<b>7.0</b>	<b>7.0</b>	7.0	<b>5.0</b>	<b>5.0</b>	5.0	<b>6.5</b>	<b>6.5</b>	6.5	<b>7.0</b>	<b>7.0</b>	7.0
37-175	<b>6.5</b>	<b>7.0</b>	6.8	<b>7.0</b>	<b>7.0</b>	7.0	<b>4.5</b>	<b>4.5</b>	4.5	<b>6.0</b>	<b>6.0</b>	6.0	<b>7.0</b>	<b>7.0</b>	7.0
<b>Means</b>	<b>6.8</b>	<b>7.0</b>	<b>6.9</b>	<b>6.5</b>	<b>6.8</b>	<b>6.7</b>	<b>5.0</b>	<b>5.0</b>	<b>5.0</b>	<b>6.4</b>	<b>6.2</b>	<b>6.3</b>	<b>7.0</b>	<b>7.0</b>	<b>7.0</b>

**Table 5. NIAB Spring Sown Trials from seed 2021 – vigour and plant characteristics**

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (Essex site); Preliminary varieties 2 replicates of data

variety	Establishment %			Early vigour 1-9 9=vigorous			Mid-June vigour/density 1-9 9=vigorous/dense		
	Rix	Raker	Mean	Rix	Raker	Mean	Rix	Raker	Mean
<b>BROWNS</b>									
Medusa	95	95	95	8.7	8.0	8.3	8.3	7.0	7.7
TEON 817	95	95	95	6.5	7.0	6.8	7.0	7.0	7.0
Nation	95	95	95	7.0	6.0	6.5	7.0	7.0	7.0
Shakito	95	95	95	7.3	7.0	7.2	7.7	6.3	7.0
Vision	95	95	95	6.7	5.7	6.2	7.0	5.7	6.3
Fasto	95	95	95	7.0	7.0	7.0	6.7	7.0	6.8
Bruce	95	95	95	6.7	6.3	6.5	6.3	6.7	6.5
Bellesco	95	95	95	7.7	8.0	7.8	7.7	7.0	7.3
Novista	95	95	95	6.7	6.7	6.7	6.3	6.7	6.5
37-132	95	95	95	6.3	7.0	6.7	7.3	7.0	7.2
Packito	95	95	95	7.7	6.0	6.8	6.7	7.0	6.8
SG 8395	95	95	95	7.0	7.7	7.3	7.7	7.0	7.3
Hybing	95	95	95	7.0	6.3	6.7	7.3	7.3	7.3
Hytech	95	95	95	6.7	6.3	6.5	8.0	7.7	7.8
Rockito	95	95	95	7.0	6.3	6.7	6.7	7.0	6.8
Hypark	95	95	95	7.0	7.0	7.0	7.3	7.0	7.2
Hybound	95	95	95	6.7	6.3	6.5	7.3	7.0	7.2
Centro	95	95	95	7.3	6.3	6.8	7.0	6.3	6.7
Numbito	90	95	93	7.3	6.7	7.0	6.7	6.7	6.7
37-129	95	95	95	6.7	7.0	6.8	7.0	6.3	6.7
SVDN0233	90	73	82	5.3	5.7	5.5	6.7	5.7	6.2
Hyroad	95	95	95	6.0	6.3	6.2	7.0	7.0	7.0
37-131	95	95	95	7.0	7.3	7.2	6.7	6.3	6.5
Klaria F1	95	95	95	6.0	6.5	6.3	6.5	6.5	6.5
Hyway	95	95	95	6.7	6.0	6.3	7.7	6.7	7.2
Hylander	95	95	95	6.3	6.0	6.2	7.0	7.0	7.0
Promotion	95	95	95	7.0	7.3	7.2	7.0	6.7	6.8
Motion	95	95	95	7.0	7.0	7.0	7.0	6.0	6.5
Aeneus	95	95	95	7.0	6.5	6.8	6.0	4.5	5.3
<b>Means</b>	<b>95</b>	<b>94</b>	<b>94</b>	<b>6.9</b>	<b>6.7</b>	<b>6.8</b>	<b>7.1</b>	<b>6.7</b>	<b>6.9</b>
<b>REDS</b>									
Redrover	95	95	95	7.7	6.7	7.2	7.0	6.3	6.7
TEON 505	95	95	95	5.0	6.5	5.8	7.5	6.5	7.0
37-219	95	95	95	6.7	6.3	6.5	7.0	6.0	6.5
Ruby Star	95	90	93	6.0	6.0	6.0	7.0	4.3	5.7
Redlander	95	95	95	5.3	6.3	5.8	7.7	6.3	7.0
37-123	95	90	93	7.0	6.3	6.7	6.7	5.3	6.0
Red Baron	95	90	93	6.3	6.7	6.5	7.0	7.0	7.0
Red Herald	95	95	95	7.0	7.0	7.0	7.0	6.0	6.5
Red Ray	95	95	95	6.3	7.3	6.8	7.0	6.3	6.7
Red Tide	95	95	95	8.0	8.0	8.0	7.0	5.0	6.0
37-175	95	95	95	6.7	6.3	6.5	7.0	4.7	5.8
<b>Means</b>	<b>95</b>	<b>94</b>	<b>94</b>	<b>6.5</b>	<b>6.7</b>	<b>6.6</b>	<b>7.1</b>	<b>5.9</b>	<b>6.5</b>

**Table 6. NIAB Spring Sown Onion Trials from seed 2021 - Onion Ring Data**

Sites: Rix (Essex) and Raker (Norfolk)

Varieties in maturity order (Essex site); Preliminary varieties 2 replicates of data

Variety	% Bulbs with single centres		
	Essex	Norfolk	Mean
<b>BROWNS</b>			
Medusa	2	22	12
TEON 817	47	47	47
Nation	29	51	40
Shakito	20	36	28
Vision	40	58	49
Fasto	42	59	50
Bruce	48	40	44
Bellesco	78	84	81
Novista	23	60	42
37-132	84	58	71
Packito	44	53	49
SG 8395	87	69	78
Hybing	64	87	76
Hytech	53	80	67
Rockito	71	69	70
Hypark	60	62	61
Hybound	60	73	67
Centro	69	73	71
Numbito	69	77	73
37-129	80	89	84
SVDN0233	56	-	56
Hyroad	71	69	70
37-131	60	84	72
Klaria F1	40	37	38
Hyway	59	82	70
Hylander	64	73	69
Promotion	57	62	59
Motion	58	80	69
Aeneus	93	80	87
<b>Means</b>	<b>56</b>	<b>65</b>	<b>60</b>
<b>REDS</b>			
Redrover	46	64	55
TEON 505	7	10	8
37-219	53	91	72
Ruby Star	11	58	35
Redlander	64	84	74
37-123	71	70	71
Red Baron	56	72	64
Red Herald	20	58	39
Red Ray	38	77	57
Red Tide	64	91	78
37-175	58	-	58
<b>Means</b>	<b>44</b>	<b>68</b>	<b>56</b>

**Table 7. NIAB Spring Sown Onion Trials from seed 2021 – Storage data (Ambient at Rix and Raker) Assessments 2022 (cold storage July 2022)**

Sites: Rix (Essex) and Raker (Norfolk) and additional cold storage samples (Cold store)  
 Varieties in maturity order (mean of both sites) *Preliminary varieties 2 replicates of data*

Variety	% sound Pre-end April			% sound Late June/July			% sound cold storage late June/July
	Rix	Raker	Mean	Rix	Raker	Mean	Rix
<b>BROWNS</b>							
Medusa	52	45	48	28	55	41	86
TEON 817	87	88	88	76	12	44	96
Nation	88	71	79	85	29	57	98
Shakito	97	62	79	89	38	64	95
Vision	102	49	76	94	51	72	96
Fasto	87	76	81	87	24	55	95
Bruce	95	73	84	83	27	55	90
Bellesco	62	54	58	51	46	48	87
Novista	96	74	85	92	26	59	96
37-132	93	80	86	89	20	55	95
Packito	94	72	83	86	28	57	95
SG 8395	88	58	73	79	42	61	93
Hybing	100	86	93	92	14	53	99
Hytech	97	64	80	97	36	66	100
Rockito	99	91	95	94	9	51	95
Hypark	103	83	93	95	17	56	99
Hybound	99	62	80	94	38	66	100
Centro	95	64	79	92	36	64	96
Numbito	95	73	84	93	27	60	88
37-129	94	87	91	90	13	51	100
SVDN0233	99	69	84	97	31	64	98
Hyroad	98	87	92	93	13	53	99
37-131	94	77	86	89	23	56	100
Klaria F1	92	47	70	51	53	52	80
Hyway	95	82	89	89	18	54	99
Hylander	101	63	82	94	37	65	97
Promotion	87	81	84	80	19	49	94
Motion	96	76	86	97	24	60	96
Aeneus	64	41	52	43	59	51	83
<b>Means</b>	<b>91</b>	<b>70</b>	<b>81</b>	<b>83</b>	<b>30</b>	<b>57</b>	<b>95</b>
<b>REDS</b>							
Redrover	88	40	64	69	60	65	94
TEON 505	99	31	65	72	69	70	88
37-219	84	87	85	75	13	44	96
Ruby Star	102	92	97	83	8	45	97
Redlander	90	51	70	66	49	57	99
37-123	71	39	55	46	61	53	98
Red Baron	100	52	76	81	48	64	97
Red Herald	98	62	80	79	38	59	100
Red Ray	91	78	84	76	22	49	93
Red Tide	63	76	70	85	24	54	100
37-175	80	46	63	64	54	59	98
<b>Means</b>	<b>88</b>	<b>59</b>	<b>74</b>	<b>72</b>	<b>41</b>	<b>56</b>	<b>96</b>

**Table 8. NIAB Spring Sown Onion Trials from seed 2021 – Storage data (Ambient at Rix & Raker) Assessments 2022 (cold storage July 2022)**

Sites: Rix (Essex) and Raker (Norfolk) and additional cold storage samples (Cold store)  
 Varieties in maturity order (mean of both sites) *Preliminary varieties 2 replicates of data*

Variety	firmness (1-9) 1=soft early April (ambient)			Total % rots (ambient and cold store)		
	Rix	Raker	Rix	Rix	Rakers	Cold
<b>BROWNS</b>						
Medusa	6.7	-	6.7	71	11	11
TEON 817	8.0	-	8.0	24	10	4
Nation	7.3	-	7.3	13	23	2
Shakito	7.0	-	7.0	11	13	3
Vision	7.3	-	7.3	6	46	4
Fasto	7.7	-	7.7	13	9	4
Bruce	4.7	-	4.7	17	24	9
Bellesco	6.7	-	6.7	38	24	13
Novista	7.3	-	7.3	8	21	3
37-132	7.0	-	7.0	7	9	3
Packito	8.0	-	8.0	14	8	3
SG 8395	6.3	-	6.3	19	15	6
Hybing	6.7	-	6.7	8	9	1
Hytech	7.0	-	7.0	3	23	0
Rockito	6.3	-	6.3	5	3	1
Hypark	7.0	-	7.0	4	10	1
Hybound	7.0	-	7.0	6	34	0
Centro	6.7	-	6.7	6	17	2
Numbito	7.0	-	7.0	7	19	11
37-129	7.3	-	7.3	6	11	0
SVDN0233	7.7	-	7.7	3	15	2
Hyroad	7.0	-	7.0	7	12	1
37-131	7.0	-	7.0	6	18	0
Klaria F1	6.0	-	6.0	49	18	20
Hyway	7.0	-	7.0	11	8	0
Hylander	8.0	-	8.0	6	29	3
Promotion	7.3	-	7.3	20	15	6
Motion	8.0	-	8.0	3	22	4
Aeneus	6.5	-	6.5	57	31	17
<b>Means</b>	<b>7.0</b>	<b>-</b>	<b>7.0</b>	<b>16</b>	<b>18</b>	<b>5</b>
<b>REDS</b>						
Redrover	6.0	-	6.0	30	46	2
TEON 505	7.0	-	7.0	27	55	12
37-219	6.7	-	6.7	16	9	4
Ruby Star	6.7	-	6.7	17	7	2
Redlander	6.0	-	6.0	34	42	1
37-123	5.7	-	5.7	29	45	2
Red Baron	6.7	-	6.7	19	32	3
Red Herald	6.3	-	6.3	21	32	0
Red Ray	5.3	-	5.3	24	22	7
Red Tide	4.0	-	4.0	15	24	0
37-175	6.3	-	6.3	20	37	2
<b>Means</b>	<b>6.1</b>	<b>-</b>	<b>6.1</b>	<b>23</b>	<b>32</b>	<b>3</b>