AHDB
POTATOES

INTERIM REPORT

Potato variety dormancy ranking trial 2019-20

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1. Summary

The loss of CIPC for the control of sprouting during storage has placed greater emphasis on the other tools available to store managers that include alternative sprout suppressants, variety choice and store management practices.

Long, or longer dormant, varieties can reduce the reliance on sprout suppressants. Dormancy of potato varieties varies widely and is governed by genetic factors, timing of tuber initiation and by multiple other physiological and environmental factors during crop growth and storage. Unfortunately, the availability of independent data on dormancy scores for commonly grown varieties is both sparse and conflicting.

The objective of this project is to provide relative dormancy data for varieties to guide storage decisions and potential timings for sprout control. In this second year of the project, a collective total of thirty-nine varieties used for fresh, chip or crisp markets were planted at two different sites. Nine additional varieties were planted at one of the sites (SPot West). Following harvest, tubers were stored under common conditions at Sutton Bridge CSR with sprouting assessed on a weekly basis.

Dormancy was ranked relatively in order of date from approximate tuber initiation, or from harvest, to 50% sprouting (>3mm).

2. Experimental section

2.1 Introduction

There are numerous varieties that could be used for the different potato markets. However choice must take into account customer preference, potential yield, ease of agronomy, disease resistance, storage etc. The markets most affected by the loss of CIPC are those of chip and crisp processing.

Knowledge of the expected or typical dormancy duration of a variety provides a guide to how long the tubers can be stored before sprout development is initiated. This informs choice of variety for different durations of storage, planning for sprout control interventions and for sale of the crop. Longer dormant varieties offer the potential of higher tuber quality over long-term storage and with reduced need for sprout control.

Tubers, or more strictly the buds, may pass through three phases of dormancy:

- *Endodormancy* is a period of deep dormancy in which sprouting does not occur even under favourable conditions due to internal physiological factors.
- *Ecodormancy* in which sprouting could occur under favourable conditions but is inhibited by unfavourable external factors for example low temperature.
- *Paradormancy* is the physiological control of lateral buds by the apical bud - apical dominance.

This project is largely concerned with endodormancy. Dormancy break occurs before sprout development. There is no simple method for determining actual dormancy break so, for this project, visible sprouting is used as a proxy for dormancy break and is of itself an important quality parameter requiring management.

Numerous factors affect the duration of dormancy including the genetic background, conditions during tuber growth and storage conditions. The dormancy of varieties can be ranked if identical conditions of field and store are maintained. In this year the opportunity has been taken to grow various varieties in trials at two different Spot Farms with storage at SBCSR. This provides data on the variation that might be expected under different field conditions.

2.2 Material and methods

The varieties used in the trial are listed in Table 1; additional varieties were planted at SPot West. The seed was randomly drawn from the same stock for planting at each trial site.

Tuber seed was planted on the SPot North trial site, courtesy of Will Gagg and RJ and AE Godfrey, Brigg, North Lincolnshire on 26th April 2019. Tuber initiation (TI) was estimated to have occurred on 6th June 2019. Harvest took place on 17th October 2019.

Additionally, seed was planted on the SPot West trial site, courtesy of Heal Farms, Child's Ercall, Shropshire on 29th April 2019. Tuber initiation (TI) was estimated to have occurred on 6th June 2019. Harvest took place on 14th September 2019.

The trial sites received the same crop inputs and protection as the surrounding field crop. At least 50 tubers, between 35-55 mm, were taken from each variety, placed into 15°C and 95% RH within a controlled environment room for the duration of storage.

The sprouting of fifty tubers of each variety was assessed weekly and judged to have occurred when a sprout reached 3mm in length. The number of days to 50% sprouting was taken from the line of best fit (by eye) for each varieties sprouting curve. Dormancy was recorded as days from estimated TI (or for practicality from harvest and then adjusted) to 50% sprouting. The detailed dormancy protocol is described in Appendix 4.2.

Table 1. Varieties, by likely market, used in dormancy trials 2019-20

Market		
French Fry (Chip)	Crisp	Fresh pack
Agria	Alcander	Desiree
Althea*	Arsenal	Estima
Alverstone Russet*	Babylon	Georgina*
Asterix	Brooke*	King Edward
Challenger	Corsica	Maris Peer
Desiree	Heraclea*	Melody
Innovator	Lady Clair	Mozart
Ivory Russet	Markies	Nectar
Jelly	Opal*	Panther
Lady Anna*	Pirol	Sunita
Lanorma	Shelford	
Laura	Sorentina	
Maris Piper*	Taurus	
Markies	Thalassa	
Pentland Dell	Titan	
Performer	Triple 7	
Ramos	VR808	
Rooster		
Royal		
Russet Burbank		
Sagitta		

* denotes varieties planted only in SPot West trial

2.3 Results

For varieties grown at both sites, the average time to 50% sprouting from estimated date of TI, and from date of harvest, is shown in Table 2. This data has been ranked in order of increasing dormancy and is presented as a histogram (Appendix Figure 4.2). It is evident from this figure that no straightforward division into specific dormancy groupings can be made. A relative ranking of each variety and possible market is shown in Table 3.

For some varieties, there was a large variation in the dormancy found when grown at the two different sites. These differences ranged from 0 – 47 days. However, there was no evident overall site effect (Appendix Table 4.3).

The average dormancy duration for all varieties at both sites was essentially identical, i.e. for SPot West 198.4 days and SPot North 198.1 days.

Table 2. Dormancy (Average of both trial sites) of varieties from estimated date of TI, and from date of harvest.

Variety	Average dormancy from tuber initiation (days)	Average dormancy from harvest (days)
Agria	202	84
Arsenal	200	82
Brooke	196	77
Challenger	194	76
Corsica	191	73
Desiree	264	147
Estima	206	88
Innovator	203	85
Jelly	202	84
King Edward	155	38
Lady Claire	202	83
Lanorma	224	106
Laura	180	62
Maris Peer	185	67
Markies	223	104
Melody	189	71
Mozart	213	95
Nectar	197	79
Pentland Dell	166	48
Performer	226	108
Pirol	184	65
Ramos	187	69
Rooster	196	78
Royal	212	94
Russet Burbank	207	89
Sagitta	195	77
Shelford	175	56
Sunita	200	82
Taurus	222	104
Titan	179	61
VR808	192	74

Table 3. Relative average ranking of dormancy for varieties in different markets. From top to bottom of the table, dormancies range from 160 – 260 days from TI (40 - 140 days from harvest) to 50% sprouting.

Fresh pack	French fry	Crisp
King Edward		
	Pentland Dell	
	Asterix	
		Thalassa
		Shelford
		Titan
		Heraclea*
	Laura	
		Pirol
Maris Peer		
SHC1010		
		Triple 7
		Opal*
	Ramos	
Melody		
		Corsica
	Maris Piper*	
		VR808
	Challenger	
	Sagitta	
		Brooke
	Rooster	
Nectar		
Sunita		
		Arsenal
		Babylon*
	Jelly	
		Lady Claire
	Agria	
	Innovator	
	Lady Anna*	
Estima		
	Russet Burbank	
		Alcander
	Alverstone*	
Georgina*		
Panther		
VDW 07-197*		
		Sorentina
	Royal	
Mozart		
	Althea*	
		Taurus
	Markies	
	Lanorma	
	Performer	
	Ivory Russet	
	Desiree	

* variety planted at SPot West only

2.4 Discussion

Numerous different methodologies have been, and are, used by different organisations and companies to provide data on the dormancy of varieties. Unfortunately, in many cases the methodology or description of dormancy rating is somewhat or entirely unclear. For example, the European Cultivated Potato Database (reference) records the dormancy of some varieties on a 1-9 dormancy scale but, unfortunately, the methodologies used by the various contributors are not described within the database.

The previous year's trial (2018-19) used fewer varieties and it was possible to allocate them into approximate short/medium and long dormancy categories. When the dormancy of the varieties in this years trial was plotted, it was very evidently a continuum (Appendix Figure 4.2) and the dormancy has significant variation (Appendix Table 4.3). No obvious division into dormancy categories presents itself. In this report we have provided data to provide a guide to the relative ranking of dormancy of different varieties without division into specific dormancy groupings (Table 3).

Dormancy is considered to be initiated at the time of *tuber initiation* (TI, Burton 1989). However, for most reports for which methodologies are available, dormancy was measured from the date of harvest. Here we have provided dormancy data both from estimated TI and from harvest. This discussion data is made on basis of dormancy relative to tuber initiation rather than harvest, because it allows results from the two sites to be compared irrespective of the differences in harvest date and weather conditions prior to the Spot North harvest. . It should be noted that various factors influence TI and its duration, discussed by O'Brien *et al*. (1998).

A surprisingly large variation was found in the dormancy for some varieties grown at the two different sites (Appendix Table 4.3). The reason for such variation is unclear as there was no apparent overall site effect and the seed was randomly drawn from the same stock for planting at each trial site.

Relative dormancies were approximately maintained for the varieties common to both trial years to date (2017-18 and 2018-19), shown in Appendix Table 4.4. However, three varieties had differences in dormancy of 20 days or more. Markies and Taurus had an approximately 9% shorter duration in 2018-19 compared to 2017-18. However, the differences between years was less than the differences between sites for the same year (Appendix Table 4.3). Royal had a difference of 35 days between years. Although large, this is less than the difference in Mozart grown at two sites in a single year (47 days).

Unexpectedly, Desiree was very long dormant. The reason for this result is not immediately apparent. The seed and growing plants were not subject to any different treatments to the other varieties in the trial and similar dormancy durations were found at both growing sites.

Burton (1989) noted that unusually cold or hot weather during tuber development in the field often resulted in long or short dormancy respectively. Wang *et al*. (2016) presented data on year-to-year variations in dormancy although there were also differences in planting date, and therefore of TI, and harvest dates. The authors attributed the variation to different environmental conditions during the growing season and seasonality. However, these factors do not readily explain the site variations found in this trial. Reasons for this variation may include a complex interaction of site, TI and maturity. The variation found in this trial may confound comparison of variety dormancy ratings published or available elsewhere.

In this second year of this project, the range of varieties has been extended to include a broader range of varieties for both processing markets. Additionally, the same seed stock of each variety was planted at two sites, SPot Farms North and West, to gauge the effect of different growing environments on dormancy. These results can provide growers with more robust information on dormancy for variety choice.

2.5 References

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Claassens M. M. J. and Vreugdenhil D. (2000). Is dormancy breaking of potato tubers the reverse of tuber initiation? Potato Research, **43**: 347–369

European Cultivated Potato Database https://www.europotato.org/

HZPC website https://www.hzpc.com/potatoes-markets/potatoes

O'Brien P. J., Allen E. J. and Firman D. M. (1998). A review of some studies into tuber initiation in potato (*Solanum tuberosum*) crops. Journal of Agricultural Science, (Cambridge) **130**: 251–270

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Wang Y., Brandt T. L. and Olsen N. L. (2016). A historical look at Russet Burbank potato (*Solanum tuberosum* L.) quality under different storage regimes. Am. J. Potato Res. **93**: 474-484

3. Summary of knowledge transfer

11, 16 and 18 July 2019: presentations at AHDB SPot Farm events SPot, West (Shropshire), SPot North (Lincolnshire) and SPot East (Suffolk) respectively.

20 November 2019, BP2019 event, Harrogate, Yorks

Other sprout suppression KT events.

4. Appendices

Appendix 4.1. SBCSR dormancy assessment protocol

Place sampled tubers in a labelled paper sack and place in the nominated store at 15C (±0.5C) and 95% relative humidity.

Assess individual tubers as soon as possible and thereafter at approximately 1 week intervals (or at intervals specified in the study plan). Storage should take place with samples held in paper sacks.

On each assessment occasion record the date, and the number of tubers with sprout(s) greater than or equal to (≥) 3mm. Sprouted tubers should then be discarded.

Continue assessment until all tubers have sprouted.

Some potato diseases (e.g. soft-rotting) may influence sprout growth. Tubers developing rot in store should be discarded and the reason recorded. Some tubers may not sprout even after an extended period and can be discarded as instructed by the study director.

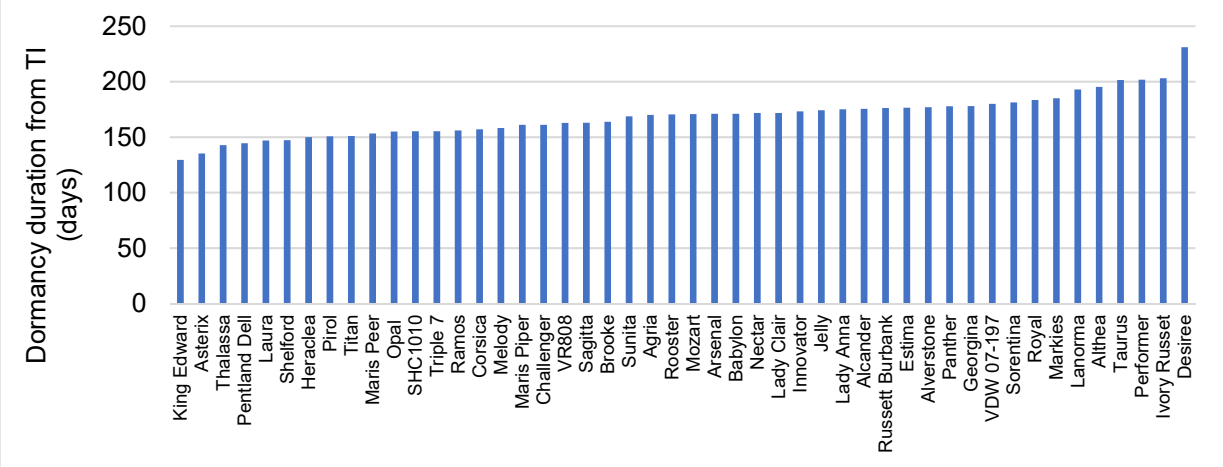
Discarded tubers should be excluded from the data used to estimate dormancy.

The dormant period (50% intercept), measured in days, is estimated after plotting the cumulative proportion of tubers with sprouts ≥ 3mm against days in store or harvest date.

Appendix 4.2.

Figure 4.2. Dormancy ranking of all varieties

The relative ranking based on the average dormancy found for both trial sites.



Appendix 4.3.

Table 4.3. Differences in dormancy between SPot sites

Variety	SPot West, days to 50% sprouting	SPot North, days to 50% sprouting	Differences in dormancy duration between sites (days)
Agria	206	198	8
Alcander	210	204	6
Arsenal	198	202	4
Asterix	175	162	13
Brooke	199	192	7
Challenger	200	188	12
Corsica	199	183	16
Desiree	270	258	12
Estima	205	207	2
Innovator	201	204	3
Ivory Russet	233	233	0
Jelly	196	207	11
King Edward	146	164	18
Lady Claire	201	202	1
Lanorma	220	228	8
Laura	186	174	12
Maris Peer	187	182	5
Markies	239	207	32
Melody	189	188	1
Mozart	236	189	47
Nectar	186	207	21
Panther	210	207	3
Pentland Dell	149	183	34
Performer	228	224	4
Pirol	189	178	11
Ramos	189	185	4
Rooster	187	205	18
Royal	209	215	6
Russett Burbank	207	206	1
Sagitta	199	191	8
SHC1010	183	186	3
Shelford	169	180	11

Variety	SPot West, days to 50% sprouting	SPot North, days to 50% sprouting	Differences in dormancy duration between sites (days)
Sorentina	209	212	3
Sunita	201	198	3
Taurus	203	241	38
Thalassa	175	172	3
Titan	175	183	8
Triple 7	183	186	3
VR808	189	194	5
Average dormancy	*198.4*	*198.1*	

Appendix 4.4

Table 4.4. Comparison of dormancy duration between years of this trial

The average dormancy duration in days from TI, for varieties grown in both years of the trial (2017-2018 and 2018-2019).

Variety	Duration of dormancy 2018-19 (days from TI)	Average duration of dormancy 2019-20 (days from TI)	Difference in dormancy between years 2018 and 2019
Triple 7	172	185	13
Maris Peer	175	185	10
Melody	175	189	14
Royal	177	212	35
Nectar	182	197	15
Sagitta	185	195	10
Laura	185	180	-5
Challenger	186	194	8
VR808	189	192	3
Estima	190	206	16
Alcander	191	207	16
Panther	191	209	18
Innovator	193	203	10
Sunita	195	200	5
Brooke	214	196	-19
Performer	221	226	5
Lanorma	229	224	-5
Mozart	229	213	-17
Taurus	243	222	-21
Markies	245	223	-22