SPot Scotland Results Day 2018

Seed rates Mark Stalham





Depending on the customer, contracts will value some sizes of potato more than others. For example:

Ware size (mm)	Value (£/t)
< 20	0
20-40	30
40-65	100
65-80	200
> 80	30

How do we help growers maximise the value of their crops?

Model of tuber size distribution



50 t/ha, μ 55 mm, σ 10 mm

Travis 1987

Travis (1987)

$\mu = k \ge (Y/N)^{\frac{1}{3}}$

Where

- μ = mean tuber size (mm)
- k = dimensional factor dependent on tuber shape and density (e.g. 118-125)
- Y = total yield (t/ha)
- *N* = total number of tubers (000/ha)

Change in tuber size distribution in Estima



Source: CUF Reference Crop 1997

Relationship between 65-80 mm yield and total (>10 mm) yield



Calculations based on a tuber population of 300 000/ha



Data derived from two crops Sylvana

What controls tuber size distribution?



Seed rate and stem density

- Seed rate weight /area t/ha
- Planting density number / area
- Stem density function of
 - planting density
 - seed size
 - physiology
 - major determinant of number of tubers

Relationship between seed weight and number of stems (simple)



Measurement of seed age

- Chronological age
 - days from tuber initiation (emergence used as proxy)
- Physiological age
 - sprout development
 - Accumulated degree days after dormancy break (≥80% tubers with sprouts ≥3 mm)

 Σ (daily mean temperature - 4) °C



Growth of sprouts and stems

- Apical dominance
 - first (apical) sprout
 (s) inhibit growth of
 other sprouts
- 'Multi-sprouting'
 - growth of many sprouts encouraged
- NB sprouts ≠ stems





Effect of time of sprouting on sprout growth in Hermes



Sprouted at 15 °C to accumulate 300 Ddeg C

Effect of sprouting on emergence

- Interval from planting to emergence
 - >50 days for unsprouted seed in cold soil
 - <10 days for sprouted seed in warm soil
 - Delayed by very deep or very shallow (dry) planting



Leaf area index for sprouted and unsprouted seed



Chronological age





Relationship between seed weight and age on number of stems



Relationship between number of stems, seed age and tuber count

- Old seed produces more stems than younger seed of the same size
- The interval from emergence of the seed crop to planting the ware crop determines seed age
- Early emerging seed is older than later seed when planted on the same date
- Early seed (of most sizes) produces many stems and tubers unless planted at very wide spacings





Relationship between number of tubers and number of stems

- The number of tubers increases over a large range in stem population
- The rate of increase decreases at high stem populations
- Other factors can affect the number of tubers per stem

Firman & Shearman 2006 (Estima)



Relationship between yield and number of stems

- Total yield initially increases with increase in stem population
- At higher stem populations total yield does not increase but yield of large tubers decreases



Number of stems (000/ha)

Optimum Density and Replantable Area

- Biological Optimum
 - density at which total yield is maximized
- Economic Optimum
 - density at which net return is maximized
 - usually lower than Biological
 - as cost of seed increases, so Economic optimum decreases
 - Economic optimum reflects value of different-sized tubers
 & production requirements
- Replantable area
 - Area of ware that can be replanted from seed (per t).
 Alternative seed valuation system

Using the seed rate guide

1. Seed age

- to choose section early / standard / late (seed emergence date)
- 2. Tuber count
 - to choose row
- 3. Target yield and size
 - to choose columns
- 4. Red shaded regions
 - wide spacings (*c*. 44 cm+) avoid with late-produced seed

	50:05 A	45:50	eld (trhaj : 50:	Hean tu 60	bereize 60	mm) 50	70:	9 0	
Tuber ount 50kg	Plant density (000.hs)	Ge ed rate (t.ha	Plant density (000 hs)	Cand rate (that	Plant Sensity 000/h/4	Geed rate (t/ha)	Plant density (000hk)	Geed rate (t/ha)	
250	1.6.5	100	Early seed	d jamerg	d 15 April	9	10.00	100	
2400	31	0.64	35	0.75	45	0.94	57	1.19	
2000	29	0.72	33	0.63	43	1.07	54	1.35	
1000	27	0.65	31	0.95	39	1.23		1.55	
1000		1.00	21	1.10	80	1.60		2.00	
900	1	1.12		1.00	30	1.67	38	2.12	
800	19	1.20		1.57	28	1.77	35	2.23	
700	14	1.27	20	1.45	26	1.67	33	2.36	
600	10	1.24	18	1.54	24.	1.88	30	2.51	
500	1.00	1,40	10	1.04	1.41	2.11	27	2.67	
400	A DEBUG	1.63	terra and	1.76	CTN COL	2.00	10 - 20 - 10 - 10 - 10 - 10 - 10 - 10 -	2.56	3
-		0.00	itandard a	and (error	and 1 Ju	nel		1.00	
2000	-	1.00		1.15	80	1.45		1.47	
1600	37	1.16	42	1.33	15	1.71	69	2.16	
1200	33	1.36	35	1.56	48	2.01	61	2.55	
1000	30	1.50	54	1.72	44	2.21	55	2.80	
900	25	1.58	33	1.61	42	2.35	53	2.94	
800	27	1.66	81	1.91	39	2,46	50	3.11	
700		1.70	26	2.02	36	2,00	45	3.29	
500	20	1.50	25	2.26	29	2.94	37	3.72	
400	17	2.18	11 000	2.45	120	3.18	32	3.96	
	100501		Late eper	i jerneng	# 15 July	D.S.B.		12722	
2400	67	1.25	π	1.00	89	2.06	125	2.68	
2000	63	1.56	72	1.01	- 10	2.33	118	2.95	
1000		1.62	67	2.09	50	2.59	109	2.40	
1000		3.10		3.71	12	3.00		4.01	
000	2 M	240	-	2.45		3.07		404	
500	42	2.60	- 40	10.0	62	3.67	78	4.90	
700	39	2.76	10	3.19	57	4.10	75	5.16	
600	35	2.95	41	0.00	52	4.35	65	5.51	
500	31	3.14	36	3.61	46	4.64	59	5.67	
400	27	3,37	31.	3.26	40	4.97	60	6.26	

Seed rate for SPot Farm

- Maris Piper
- 45-80 mm packing contract (40-45 mm processing)
- Target mean tuber size (μ): 62.5 mm
- Seed size: 45 x 55 mm
- Tuber count: 580/50 kg
- Expected yield: 60 t/ha
- Seed emergence: late May 2016
- Planted: 13 April 2017
- Target population: 23,500/ha
- Target spacing: 47 cm

Actual vs planned

Planned	Actual
35 cm (14")	34.6 cm
40 cm (16")	40.9 cm
48 cm (19")	47.4 cm

SPot Scotland 2018 Seed spacing: tuber number, yield, DM and µ from hand harvests

No.	Spacing	No. plants (000/ ha)	No. stems (000/ ha)	Total no. (000/ ha)	S.E.	Total yield (t/ha)	S.E.	[DM] (%)	S.E.	Mean tuber size (μ,mm)	S.E.
1	35 cm	32	145	503	31.8	52.1	3.24	20.2	0.76	53.2	1.11
2	40 cm	27	111	482	59.3	59.1	4.31	19.4	0.35	56.0	1.17
3	48 cm	23	106	533	62.1	62.9	4.01	19.6	0.94	56.0	0.69

- Yield >40 mm reduced at narrow spacing
- µ very low (target >60 mm)

SPot Scotland 2018 Seed spacing: yield by grade



Packout (Albert Bartlett)

	Trial	1	2	3
Treatment	Spacing (cm)	35 (14")	40 (16")	48 (19")
Crop harvested	No. boxes	22	24	23
Graded product	Tonnes	14.81	14.11	13.81
Packout	%	69.6	59.3	60.5
Yield packed	t/ha	37.5	35.5	34.4