

OTHER WAYS TO GROW

Phaseolus coccineus and *Phaseolus vulgaris*

Outdoor Trial at Waltham St Lawrence, Berkshire

1 May 2020–2 October 2020

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Stephen Morton



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OTHER WAYS TO GROW
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OUTDOOR TRIAL AT WALTHAM ST LAWRENCE,
BERKSHIRE
01/05/2020–02/10/2020

ABSTRACT

This is the sixth in a series of six annual trials assessing various growing systems to achieve maximum yields from plants with apical dominance curbed.

Findings from earlier trials are described with Conclusions.

- There were nine sets, each six plants.
- The yields from plants in sets using non-peat composts were higher than those from plants in comparable sets grown in peat compost.
- Yields from these two sets met defined crop objectives – per plant and consecutive 28 days.
- An experiment in 2019 with *dwarf runner beans* was repeated with different results and will be attempted again in 2021.
- The use of liquid feeds when growing beans in was shown to increase yields and is probably essential when using non-peat compost.

The final trial next year will compare yields from further non-peat composts.

Anthony Boyd,
January 2021

Stephen Morton

1. PREAMBLE

1.1 The trial follows on from trials 2017, 2018, 2019) where climbing runner and climbing French beans were grown *with apical dominance curbed* and results compared from differing growing systems.

1.2 The height of plants traditionally grown to 6–8 feet makes them unsuitable for growing in a covered area – for instance a balcony.

1.3 There may also a case for growing outdoors in this way. Gardeners can pick while seated with no need to stand and stretch – a benefit for those with reduced mobility.

1.4 We have aimed to arrive at a system

(a) producing a crop sufficient for a 2–3 person household.

(b) growing at a height not exceeding 2 feet and area occupying no more than 4 square feet.

1.5 *Which? Gardening* defines a total yield of 6kg as “plenty” for an average family (Note 1.) and the grower may expect a yield per plant of not less than 0.5Kg. This matches the definition of a normal yield (Note 2.) as 1,000g per plant or 6,000g total for the set of plants (six) in the trials.

1.6 Responses from focus group indicate that a desirable yield might also be taken as at least one period of 28 continuous days @ 560g per week = 2240g equivalent to 2 x 280g packets.

1.7 Dwarf runner or dwarf French beans were originally not considered on account of reportedly small yields (Normally 440g per plant). (Note 2.)

1.8 Subsequently (2018 trial) we grew dwarf runners and yields were high enough to encourage a repeat of the experiment.

1.9 There were nine sets, each six plants, total 54 plants in the present trial. Seedlings in Set 9 failed to thrive* and, although recorded, (Table of Yields Attachment (4)) have not been used for purposes of comparison.

* Unfavourable positioning, damage.

2. AIMS AND OBJECTIVES OF TRIAL

(Original Scheme and Objectives Attachment (1))

2.1 For each set these were:

1, 2 Dwarf Runners Determine extent to which

- (a) Yields 2019 can be repeated
- (b) Liquid feeding contributes to yield

3. Coir compost (“GROWLITE”)

- (a) As for dwarf runners (a)
- (b) Evaluate reliance on liquid feeding.
- (c) Compare yield with yield from another brand of peat-free compost.

4. Dwarf French Beans

- (a) Graph pattern of cropping – regular or clusters.
- (b) Compare yield with dwarf runner beans and earlier yields from climbing French.

5, 6, 7. Frame

- (a) Measure difference in yield when plants grown for different distances.
- (b) Compare yields with 2019 (different space between plants).

8. Second brand of peat-free substrate (Miracle-Gro)

- (a) Measure yield against those from sets 3, 5, 6, 7.

9. Same cultivar as 8 – peat compost

- (a) Compare yield with yield from 8.

3. MATERIALS AND METHODS

See: Appendix (1) “Choice of Materials and Methods*
evidence from previous trials.”

Attachments: (1) Original Plan

(2) Cultivation

(3) Layout

(8) Journal

Photographs: Media, Equipment (1) – (2)

and Photographs: (3) and (4)

* Materials and Methods chosen for present (2020) trial are shown highlighted in green.

4. RESULTS

(See Table of Yields Attachment (4))

4.1. Comparisons from year to year

Overall, average yields per plant increased over the period covered by the trials (2015–2020). However, this was not consistent from one year to the next. Recorded yields fell in 2016 and 2020 due to less favourable environmental conditions (weather, disease, predation).

4.2. This Year (2020) vs 2019

Like-for-like comparisons:

System Wickes – John Innes 3 – Liquid feed – Vigoroot pot

2019

5,006g (with Tomorite) = Per plant: 834.3g

4,677g (with Maxicrop) = " " 779.5g

2020

3,600g (with Tomorite) = Per plant: 600.0g

3,665g (" ") = " " 610.8g

3,518g (" ") = " " 586.3g

System Incredicompost – Incredicrop – Tomorite – Vigoroot

2019

6,334g (" ") = " " 1,055.7g

2020

2,595g (" ") = " " 432.5g

2019 high yield not repeated.

System Growlite (Coir) – Tomorite – Vigoroot**2019**

4,592g Per Plant 765.3g

2020

5,011g Per Plant 835.2g

The peat-free system (coir) was the only system to show improvement over 2019.

4.3. **2020 Climbing runners – Most successful growing systems (See 1.4)**

Sets	System	Mean yield/plant (g)
3	Coir* – Tomorite – Vigoroot	835.2
	Best continuous 28 days	2,394.0
8	Peat-free Miracle-Gro – Tomorite – Vigoroot	777.5
	Best continuous 28 days	2,979.0
5,6,7	Wickes – John Innes 3 – Tomorite – Vigoroot	599.0
	Best continuous 28 days:	
Sets		
5		1,946.0
6		1,607.0
7		1,651.0

The two most successful used *peat-free* substrates.

The cultivar in the Set 8 growing system was “Moonlight F1” tried again on recommendation (See Acknowledgements).

4.4. **Dwarf cultivars (See Graph Attachment 5.)**

Runners “Hestia F1”

Set 1 Incredicompost – Incredicrop + one feed Tomorite

Yield: 1,835.0g

Set 2 Incredicompost – Incredicrop – Tomorite throughout.

Yield: 2,595.0g

French “Ferrari F1”

Yield: 1,311.0g

Before the trial we contacted horticulturists (See Acknowledgements) for suggestions on cultivars likely to give highest yields early rather than spread evenly throughout the harvest.

This proved not to be the case with Ferrari F1 (See Graph) Attachment (5) in the conditions of our trial.

4.4. New Frame

Introduced 2020. No comparable data (Differing environmental conditions 2019 and 2020).

Photos (3) and (4).

Sketch: Attachment (9)

4.5. Distances Grown

Set 5	94cm	Yield per plant:	600.0g
Set 6	128cm	Yield per plant:	610.8g

4.6. Space between plants (New frame) **2019:** 9cm **2020:** 20cm

No comparable data (See 4.4. above)

5. DISCUSSION AND CONCLUSIONS

5.1. Yields

(a) Climbing runner beans – See 4.3 and Table of Yields

Attachment (4)

It has been suggested that substrates containing peat may generally be expected to produce yields superior those from substrates without peat. We conclude that this may not necessarily be so.

The yields from sets using non peat composts (Sets 3 and 8) were higher than those from comparable sets grown in peat compost.

These two highest ranking Sets met the crop objectives given in 1.4.– per plant – and best 28 day in 1.5. Both were peat free.

(Although Set 8 grew a different *cultivar*, we think the comparison with other sets otherwise identically grown to be valid, the two cultivars in the trial having been shown previously to produce very similar yields).

(See Appendix 1 Materials and Methods 3.1. (a)).

The target for total yield 6Kg (1.4) would require more than the six plants (our set), although Set 3 at 5Kg came relatively close.

The normal yield quoted per plant at 1,000, we believe, refers to plants grown traditionally outdoors in soil, and we conclude that it may be unrealistic at this stage to expect the same yield from plants grown in containers with roots less free.

However, the *28-day target* was achieved and exceeded with six plants by both sets (Set 8 with *four* plants).

(Note: In 2019 the plants in the coir substrate began poorly and picked up only when fed (Photographs (5) and (6) and graph Attachment (6)). This was the same in 2020). This was not so with the other peat free (Miracle-Gro Set 8).

The coir product (Set 3) as sold is mixed with water (27 litres) to produce 60 litres of usable substrate, which may be a challenge for a novice small scale grower .

The peat-free used for Set 8 came in convenient-size bags of 12 litres.)

It is worth noting that these (Sets 3 and 8) results were achieved in a year when yields in the trial were generally down (See 4.1) compared to 2019 (See 4.2).

We believe it may be possible to improve yields further with increased protection for the plants and using other brands of peat free compost – basic growing system to remain the same (fertiliser, Vigoroot pots).

On evidence to date, it is possible to conclude that a grower may expect yields as follows ;

	Not less than Grams	Pods
One plant frame	834	54
Two plant frame	1,668	108
and with four plants a 28-day yield	2,240	

Note: Based on our previous data (See Appendix 1. 3.1.(c)(a)) we are assuming that yields from climbing French will be similar to those from climbing runners although the literature (Note 3.) puts the yield at 75%.

(b) Dwarf runners

It is difficult to find a satisfactory explanation for the considerable drop in yield compared to the unexpectedly high figure for 2019 reported in *Simply Vegetables* April 2020, p.23.

The only difference in management was a change of supplier for the seed. We found the beans to be of poor quality (Photo (7)).

it is necessary to repeat the experiment in the same location.

In the present trial we compared growing with and without liquid feed (Sets 1(without) and 2 (with)). Yield from Set 2 at 2595g was higher by 41.4% than Set 1 at 1,835.

Set 2 started below Set 1 then overtook (See Graph Attachment (7)).

(c) Dwarf French Appendix 3.1(a) (c)

Smaller yields than Dwarf runners. Pattern of yields level.

(Graph Attachment (5)). No need for further assessment.

5.2. Fertilisers

Although it is reported that fertilisers are not commonly used when growing beans, they (liquid feeds – (high potash)) have consistently proved their worth in our previous trials to date. However, their use may prove challenging (inconvenient) for the novice home grower and we need to compare results using granular sustained release fertilisers.

5.3. Frames

We will adopt the latest frame and grow plants along 92cm, there being no evidence that plants grown over a greater distance achieve better yields (See Appendix 1. 3. 2.(c)).

To save frame material we will cut back the space between plants from 20cm to 15cm.

6. AIMS AND OBJECTIVES FINAL TRIAL (7) 2021

- 6.1. **Compare yields** using further brands of peat free substrates (Climbing runners) and granular fertilisers. (Draft scheme of trial Appendix (2)).
- 6.2. **Repeat experiments** (Dwarf runners).
- 6.3. **Report and Review findings** Trials series 1–7.

Anthony Boyd
January 2021.

Stephen Morton

Attachment (1) Beans Trial 2020

Scheme and Objectives 29 April

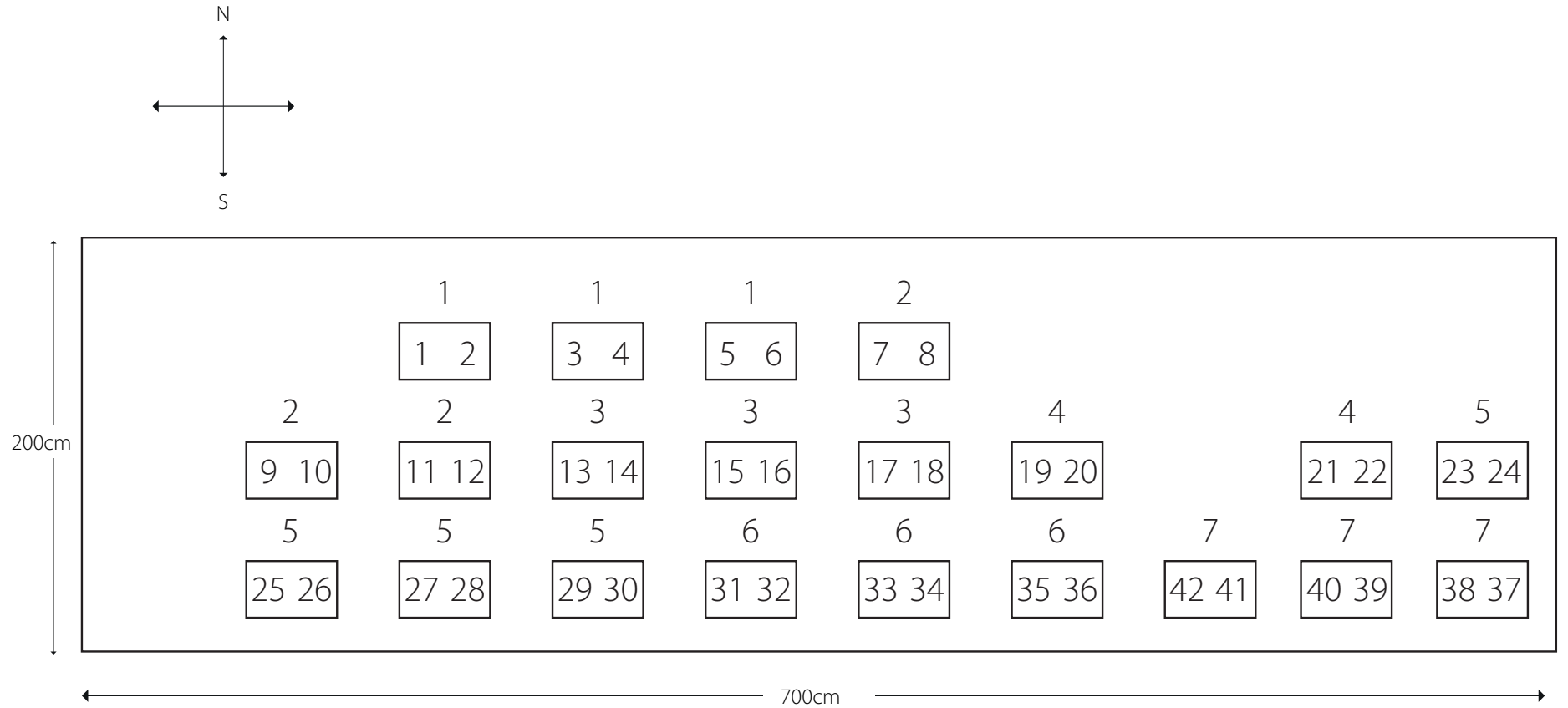
Each set six plants. Each pot 10 litre.								
Set	Plants	Cultivar	Type	Frame	Pot	Matrix	Feed	Objective
1	1–6	Hestia	Dwarf	Old	Vigoroot	Incredicompost*	None	Compare no feed with 2019
			Runner					and with Set 2 fed.
2	7–12	Hestia	Dwarf	Old	Vigoroot	Incredicompost* and John Innes 3 50/50 by volume	Tomorite*	See Set 1.
			Runner					
3	13–18	Benchmaster Runner	Runner	Old	Vigoroot	Growlite (Coir)	Tomorite*	Validate 2019 result.
4	19–24	Ferrari	Dwarf	New	Vigoroot	As Set 2	Tomorite	Compare with dwarf runners
			French					
5	25–30	Benchmaster	Runner	New	Vigoroot	As Set 2	Tomorite*	Compare with longer new frame
6	31–36	Benchmaster	Runner	New – Longer frame	Vigoroot	As Set 2	Tomorite*	Compare with shorter new frame
7	37–42	Benchmaster	Runner	New	Vigoroot	As Set 2	Tomorite*	Compare with 2019 old frame
8	43–48	Moonlight	Runner	New	Vigoroot	Miracle-Gro Premium peat-free	Tomorite*	Compare with Set 9
9	49–54	Moonlight	Runner	New	Vigoroot	As Set 2	Tomorite	Compare with Set 8
* With Incredicrop							* Concentrate version	

Attachment (2) Cultivation (See Photos 3–6)

- 1 Propagation** Seeds supplied by Thompson and Morgan.
Batch Numbers: Benchmaster 292833.
Mr Fothergills: Exp dates: Moonlight 2022Z Hestia 2022F# Ferrari 2022M
Sown 1/05/2019 (as 2018) into Sinclair seed compost in trays (as 2018).
Cultivars chosen for reported early high yields. (Recommendations See Attachment (References))
- 2 Planting** From 3" pots into 24cm Vigoroot pots filled to 10 litres substrate. No topping up thereafter.
The coir blocks were soaked in 27 litres water to make 60 litres substrate.
One pot per discrete frame. 20cm between plants (2018 9cm).
Single vertical frame – growing distance 94cm
Double vertical frame “ “ 128cm
Slug pellets (Doff organic ferric phosphate) were put down round pots when seedlings potted.
Slug damage observed to be more extensive than in 2019 (See Journal)
Blue and yellow granules seen in Miracle-Gro compost and in John Innes 3
- 3 Feeding** First liquid feeding 16 days after planting (as 2019). Last feeding 12 weeks after planting.
One gallon of diluted feed (20ml Tomorite®) per plant
Every seventh day.(all except Set 1)
Granular fertiliser (Incredicrop®) was mixed into the compost (Incredicompost®) at 3g per litre (Set 2).
Similarly (mixed in) the John Innes 3, 50% compost 50% when used.
Blue and yellow granules seen in Miracle-Gro compost and in John Innes 3
- 4 Watering** Plants were checked daily and watered as needed, each plant receiving the same amount of water – average one litre per plant daily (2.25 litres when fed with liquid feed). In warmest weather 2 litres morning, 1 litre evening.
Can spray at start then hose.
Dwarf cultivars received same amount water as the climbing cultivars.
Set 4. (Ferrari) received no rainfall.
- 5 Harvesting** Daily or every other day as needed.
Lengths of pods: Climbers as close to 20cm as possible(not less than 20cm being chefs' preferred length).
Hestia as close to 10cm (not less than 10cm) as possible.
(apart from the few pods containing a single bean)
Scales: Terailon (as 2019) Calibrated before trial and once during trial.

For further information, see Journal, Attachment (8).

Attachment (3) Layout 2020 Sets and Plants



Attachment (4) Table of Yields

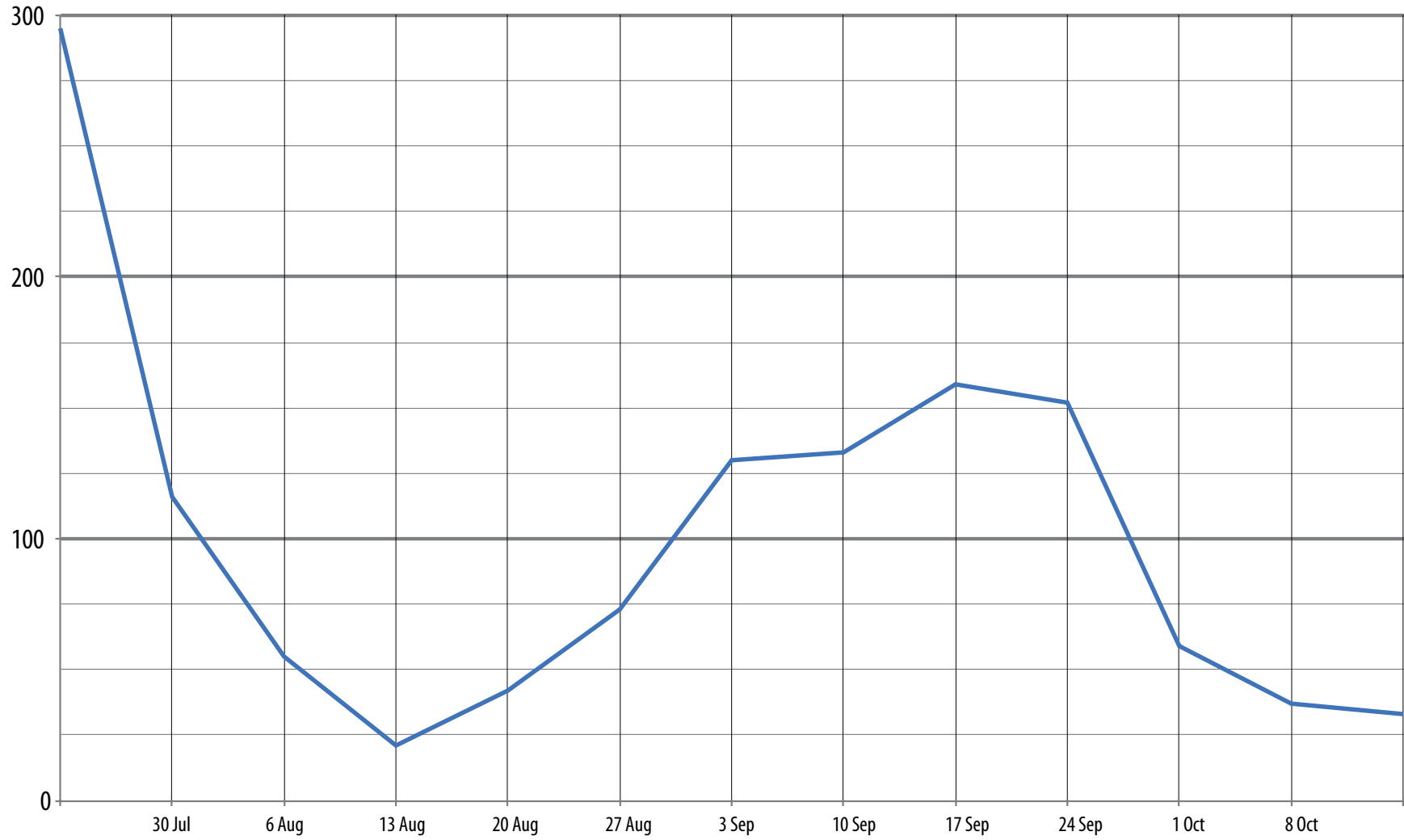
Set Number	Plant Numbers	Grams per plant	Ranking	Pods	Grams per pod	Substrate	Frame	Fertiliser	Pot
	1	261		34	7.8				
Hestia F1	2	261		38	6.9				
	3	278		38	7.3				
	4	243		27	9.0				
	5	430		53	8.1			Incredicrop (Tomorite)	
	6	362		46	7.9				
	TOTAL SET 1	1835		236	7.8	Incredicompost	2019	One feed only)	Vigoroot
	Grams mean/plant	305.8	8						
	2	138		15	8.2				
Hestia F1	8	596		95	6.3				
	9	717		116	6.2				
	10	387		73	5.3				
	11	345		44	7.8				
	12	412		74	5.6			Incredicrop Tomorite	
	TOTAL SET 2	2595		417	6.2	Incredicompost	2019		Vigoroot
	Grams mean/plant	432.5	6						
	3	1220		68	17.9				
Benchmaster 14	14	361		28	12.9				
F1	15	914		30	30.5				
	16	600		27	22.2				
	17	881		42	21.0				
	18	1035		30	34.5				
	TOTAL SET 3	5011		225	22.3	Growlite (coir)	2019	Tomorite	Vigoroot
	Grams mean/plant	835.2	2						
	4	162		42	3.9				
Ferrari F1	20	259		63	4.1				
	21	325		73	4.4				
	22	209		56	3.7				
	23	144		41	3.5				
	24	212		59	3.6				
	TOTAL SET 4	1311		334	3.9	Wickes *, John Innes 3	2020	Tomorite	Vigoroot
	Grams mean/plant	218.5	9						
	5	561		40					
Benchmaster	26	330		27					
F1	27	662		36					
	28	975		51					
	29	443		25					
	30	629		51					
	TOTAL SET 5	3600		230		Wickes *, John Innes 3	2020	Tomorite	Vigoroot
	Grams mean/plant	600.0	4						
	6	549		36					
Benchmaster	32	658		31					
F1	33	337		11					
	34	798		50					
	35	547		24					
	36	776		51					
	TOTAL SET 6	3665		203		Wickes *, John Innes 3	2020	Tomorite	Vigoroot
	Grams mean/plant	610.8	3				Longer		
	7	790		42					

Attachment (4) (contd.) Table of Yields

Benchmaster	38	479		27				
F1	39	492		35				
	40	399		20				
	41	523		25				
	42	835		61				
	TOTAL SET 7	3518		210	Wickes *, John Innes 3	2020	Tomorite	Vigoroot
	Grams mean/plant	586.3	5					
8	43	520		29				
Moonlight F1	44	892		48				
	45	731		39				
	46	809		35				
	47	853		41				
	48	860		50				
	TOTAL SET 8	4665		213	Miracle-Gro premium			
	Grams mean/plant	777.5	1		peat free*	2020	Tomorite	Vigoroot
9	49	423		19				
w	50	250		12				
	51	254		10				
	52	418		20				
	53	488		24				
	54	382		20				
	TOTAL SET 9	2215		105	Wickes *, John Innes 3	2020	Tomorite	Vigoroot
	Grams mean/plant	369.2	7					
* Multipurpose								

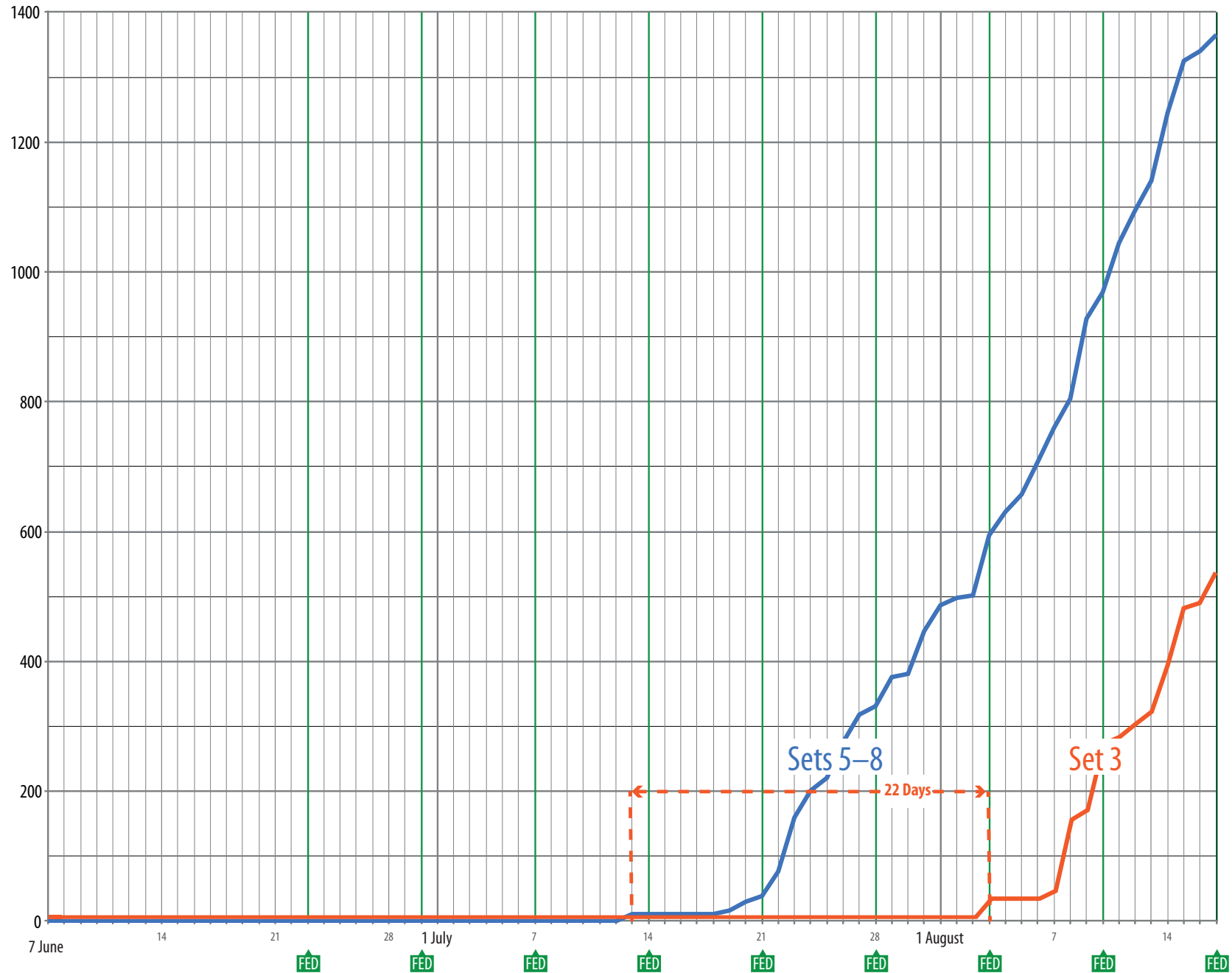
Attachment (5) Ferrari F1 Spread of Yields

Weekly totals



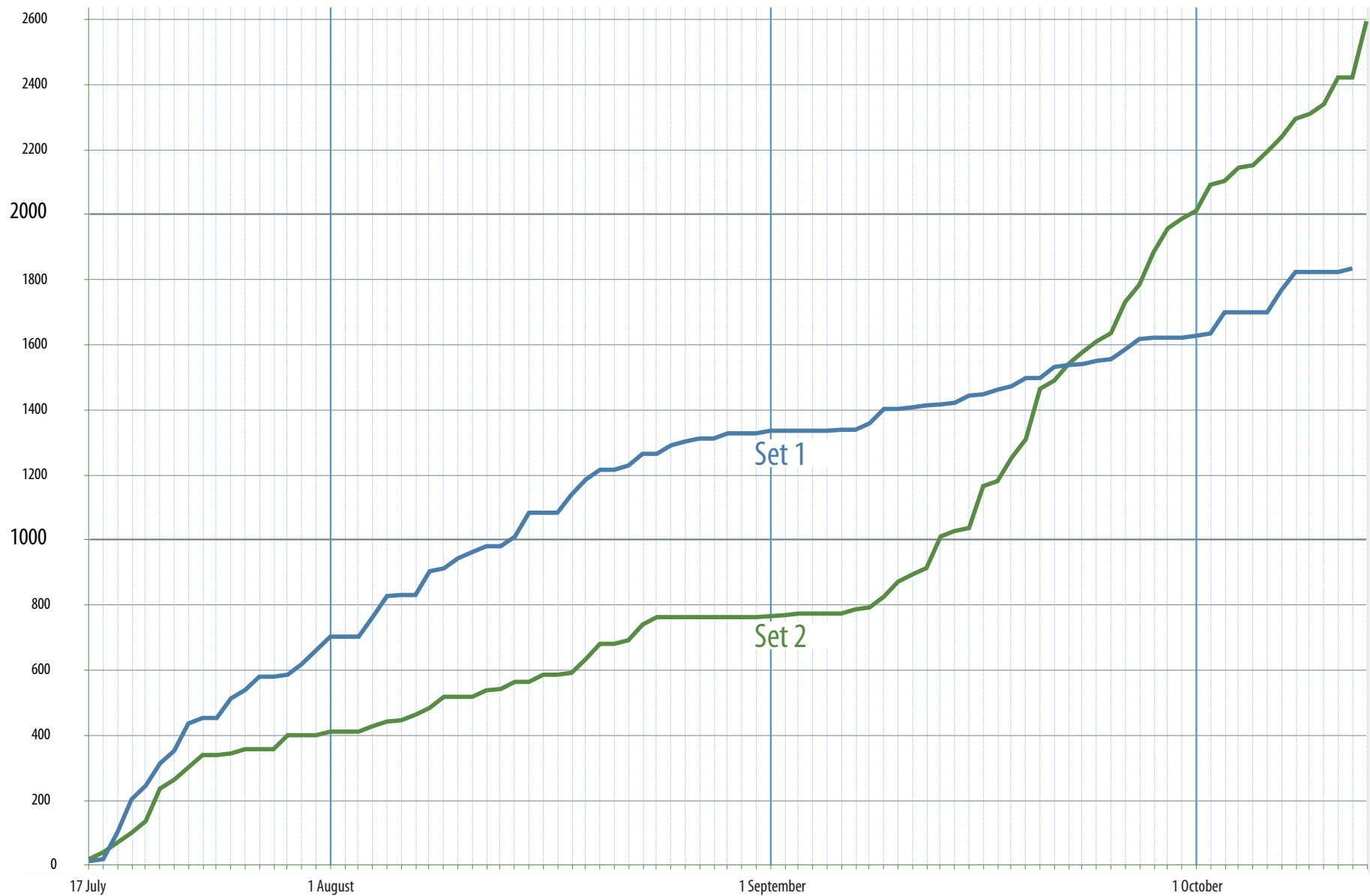
Attachment (6) Start of Harvests Set 3 (Coir) and Sets 5-8 (Peat)

All sets Fed weekly 23/06/2020 to 18/08/2020 (9 feeds)



Attachment (7) Sets 1 and 2 Dwarf Runner Beans "Hestia" Yields Cumulative

Set 1 One liquid feed 30/06/2020 Set 2 Fed weekly 30/06/2020 to 15/09/2020 (10 feeds)



Attachment (8) Beans Trial 2020 – JOURNAL

<i>Date</i>	<i>Day</i>	
May		
1		All seeds sown. Sinclair seed compost
June		Pots capacity 10L internal liquid measure.
		Some necrosis. Plants without selected first.
5	1	Sets 1 and 2 planted except Plants 9 and 2. Waiting on under delivered Incredicompost.
6	2	Sets 3 and 8 planted. Set 4 three plants. Needed 30 litres for the Grow-lite (2019 27). Mild, showers, max 20°C both days. Slug pellets round plants after planting (Ferric phosphate). Blue and yellow granules in Mircacle-Gro compost.
7	3	All rest planted. Blue and yellow granules in John Innes 3 (Bowyers). Weather same. Blue granules in Wickes. All into 24cm Vigoroot pots. Stated capacity 10 L. Each filled to 10L using liquid measuring jug.
9	5	One back up set planted – Moonlight in Wickes/JI3. Plinth under frames helps to avoid leaching. No slug or snail damage thus far.
10	6	Began tying up stems. Completed new frames (tying together). Weather cooler – heavy shower.
11	7	Last two plants (9 and 2) into pots with Incredicompost. Narrow line of necrosis on one leaf Plant2 – trimmed off. All seedlings went into the Vigoroot pots complete with their seedcompost surround. (in shape of interior of pot).
13	9	Another plant with line of necrosis trimmed. Dwarf French in Set 4 watered – do not receive rainfall. Continuing to tie stems along. Watered all (so far using can (spray) Two spares potted up – Benchmaster Wickes/JI3 Chose tallest of seedlings. Tying is with garden twine single reef knot or loose double. Warm 24°C 14.00. Breeze.
14	10	08.30 28°C 13.00 19°C. Dry. Chlorosis Plants 25, 26, 27. Potted up one further spare Benchmaster Wickes. All spares taken from largest seedlings. Watering at roughly 5 gallons per 18 plants (250ml) per plant. Evening Heavy Rain
15	11	Plant 38 reached end of horizontal.

Attachment (8) (*Contd.*)
Beans Trial 2020 – JOURNAL

<i>Date</i>	<i>Day</i>	
		(Moonlight/Miracle-Gro) Plant 38 reached end of horizontal.
18	14	Plant 48 healthy – good foliage but not climbing. Steady rain 31 some chlorosis and slug/snail damage. 32 some mild chlorosis.
20	15	Start of buds on Sets (1) and (2) – Hestia. Bud opening out and with blackfly Plant 6. Treated with acetamiprid. Plant 37, 34 reached ends of horizontals. Plants 31, 32 (See Trial Day 14) no chlorosis. All set 3 very chlorotic.
21	16	Plants 25, 26, 27 still chlorotic (See Day 10) Raining – showers and sunshine. 31, 42, 39 reached ends of horizontals. 43 still a healthy plant but smaller than rest (barely reached the horizontal).
22	17	42 now at top of vertical. 30, 36, 38, 42 reached ends of horizontals. Set 7 plants well developed. Set 8 not so well.
23	18	First feeding 40 reached end of horizontal.
24	19	Dead leaves from 40, 48. Some slug/snail damage 50 Very hot. Watered twice
25	20	Using hand held spray to water. Each set 1.8 litres per 20 seconds. 300cc per plant. Increase to one minute per set (5.4 litres = 900 litres per plant. If 50% reaching roots 450cc. Twice daily 900cc. Set 6 first with all plants reaching ends of horizontals.
26	21	First full blooms both Hestia sets. Full blooms on first climber 38. Buds on most of other sets. Set 3 Stems narrow, spindly.
27	22	Hestia plant 2 – brown patches. Plant 2 Chlorotic plants 25, 26, 27 replaced with plants 55, 56, 57 (already in pots). Replacement plants which had already grown beyond desired distance were cut back.
28	23	Same patches on Hestia one plant along. Plant 4 50 slug damage trimmed off. First stem partly severed in two places. Second stem tied on. 52 some slug damage 53 some slug damage and chlorosis – damaged leaves trimmed. Stem snapped midway on horizontal.

Attachment (8) (*Contd.*)
Beans Trial 2020 – JOURNAL

	<i>Date</i>	<i>Day</i>	
			No second stem as yet. 54 some slug damage. This set close to base of climbing shrub – now cut back. All plants treated on and round with slug pellets. 18 snapped spontaneously at top of vertical. 13 reached end of horizontal. Cool very breezy day. Diseased leaves cut from plants 2 and 4. Rust? Also one stem Plant 4 One stem in bloom Plant 10 cut to correspond. Both 2 and 4 covered to stay dry. Moonlight Set 8 (Miracle-Gro) plants noticeably lighter green than Set 9 (Wickes/Ji3). Sparsholt diagnosis necrotic spot No further spread. Small patch necrosis Plant 5 . Trimmed off.
	30	25	Incredicrop fed to Set 2. 5 scoops/plant. NPK: 15-9-16 + 19.8S03 with micro nutrients All plants fed including mistakenly Set 1. Plant 20 Ferrari quite severe slug damage. Put down pellets Secondary stem plant 47 severed to compensate Plant 53 (see Day 23). All dead leaves trimmed.
	Jul 1	26	Windy again. Mild. Showers. Some improvement colour of foliage and strength of stems Set 3. Plant 43 healthy plant but slowest grower in set. Each plant had 10L bag of Miracle-Gro. 43 at shadiest end of row.
	3	28	25, 26, 27 replacement plants looking poor.
	4	29	Set 3 No16 reached end (of horizontal) and no chlorosis. 13 already reached. end of horizontal. None of rest of Set 3 have reached, All plants Sets 37, 43, 49, 51, 52, 54 reached ends of horizontals. 53 N/a (broken on horizontal). Now mostly tying down second stems when not in flower. Left if in flower. 34 reached ground. Blackfly on 37. Treated.
	5	31	Blackfly on 34, 29. Treated. Damaged leaves trimmed 25, 26, 36 very weak.
	6	32	still on 34. 32 reached ground Moonlight in Miracle-Gro more early blooms than other Moonlight set though foliage lighter.
	7	33	Stems reluctant to grow down – curl. Blackfly 34, 52, 42. 55 chlorosis and slug damage. Set 3 15 reached end. Still very yellow. Also 18. FED
	8	34	Blackfly 36 and 13. Set 3 only 16 and 18 not reached to end of horizontals.
	9	35	31 blackfly. 50 reached end of horizontal.
	10	36	Blackfly on: 1,12,13,14, 30, 29, 36, 35, 33, 32, 42, 41, 48, 52

Attachment (8) (*Contd.*)
Beans Trial 2020 – JOURNAL

<i>Date</i>	<i>Day</i>	
		Slug damage 42, 19, 53 Cut most twine ties. No more tying down for now except Set 9. No blackfly on Ferrari. Sprayed all plants
11	37	Sprayed all plants
14	40	Picked first viable bean 11g. Plant 38 FED Still tying down. Still trimming ends
15	41	30, 42, 37 very bad blackfly, Set 3 one flower only (on 13).
18	44	Pots renumbered – on walls. Original 25–27 looking well. Reinstated in original positions.
19	45	Continued picking Set 1 foliage much lighter than dark green Set 2 (fed).
21	47	FED
25	51	Picking daily. Both peat free sets – leaves more yellow. Fully grown Hestia overhanging frames 75–100 cm from ground including 24cm high Vigoroot.
27	53	Ferrari foliage deteriorating – nearly finished?
28	54	FED
Aug 1	59	Very hot 33°C yesterday. Today 25°C. Watering Morning 2 litres approx/plant. Evening 1 litre.
4	62	FED. First viable beans Set 3. Hestia cumulatives about half of 2019, Still separating shoots, tying down, trimming ends.
6	64	No 11 looking poor. Also No 12 (less). No 11 had very bad blackfly earlier.
8	66	Set (1) to date fed once. Set (2) Seven times. Set (2) Yield Day 22 443 Set (1) Yield Day 21 1305 2019.
9	75	Last Ferrari picked. Very warm again. 18°C at 07.30. 36°C at 12.00 Very little bloom on Plants 11, 12 especially 11 None on 3 and 4. 16.30 34°C
11	77	Some Ferrai picked ! Plant 22. Still a heat wave FED
18	84	Showers last few days. Growlite set – individual plant yields not 1005 (grown close as last year).

Attachment (8) (*Contd.*)
 Beans Trial 2020 – JOURNAL

<i>Date</i>	<i>Day</i>	
		Same set thin pods – low weight. FED
25	91	FED. Wet windy (very) last days. 20°C.
30	96	Smaller crops from now. Hestia still plenty of bloom esp Set 2 Set 3 Growlite pods at 20cm thin, light.
Sep 1	103	FED
8	110	FED
12	114	Some Hestia pods as large as climbers Very warm again
15	116	FED Stopped tying down some time ago
22	123	Still warm. Revival Set 2 Hestia. FED
25	126	Checked scales with 200g weight. 100% accurate.
29	130	Watered . No feeding.
Oct 1	132	Last feed. Some small bloom Plant 32 only
2	133	Still picking. Cold and wet. Foliage trimmed off set 9 and one last bean removed.
3	134	Set 8 stripped
10	141	No longer watering. Started stripping rest of sets.

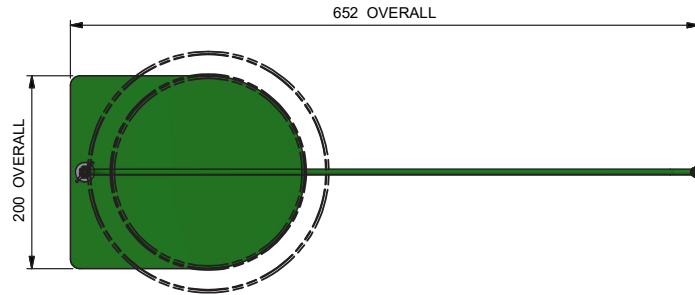
Attachment (9) Bean Homegrow Single Plinth And Frame Assembly

3rd ANGLE PROJECTION

DO NOT SCALE IF IN DOUBT ASK.

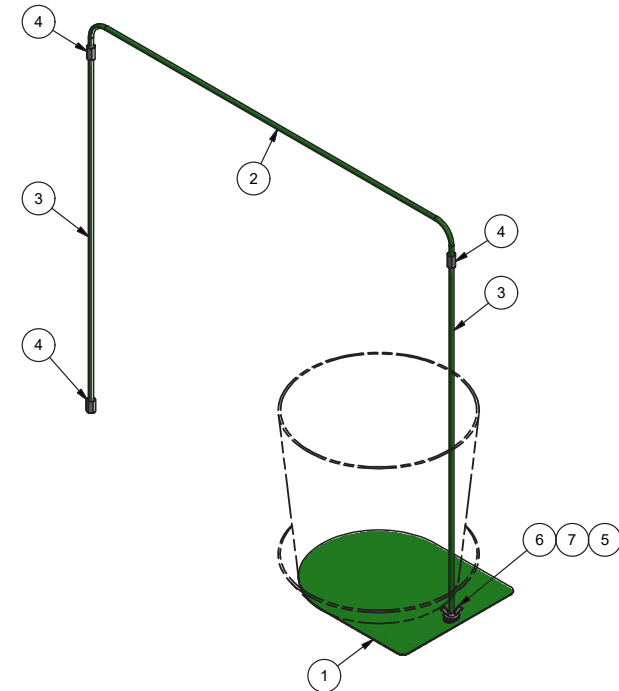
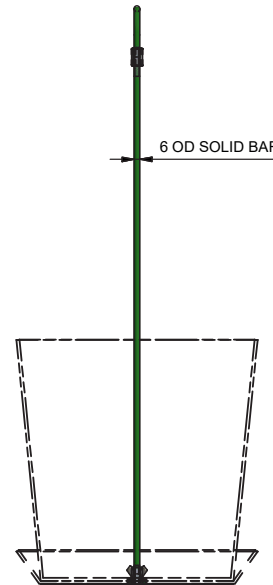
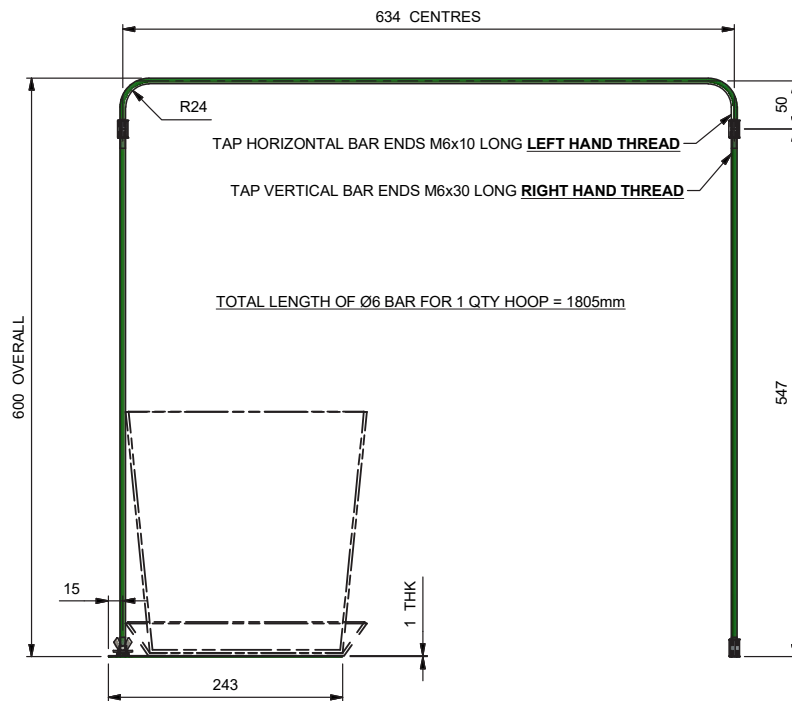
ALL DIMENSIONS IN mm.

REMOVE ALL BURRS & SHARP EDGES.



ITEM	PART NUMBER	DESCRIPTION	QTY	MATERIAL
1	TB-HG-RB-692	BEAN HOMEGROW PLINTH - SINGLE HOLE	1	Steel, Mild
2	TB-HG-RB-693	BEAN HOMEGROW HORIZONTAL FRAME	1	Steel, Mild
3	TB-HG-RB-694	BEAN HOMEGROW VERTICAL FRAME	2	Steel, Mild
4	TB-HG-RB-F01	M6 CONNECTOR 10 AF x 18 LG BZP	3	Steel, Mild
5	TB-HG-RB-F02	M6 THIN NUT BZP	1	Steel, Mild
6	TB-HG-RB-F03	M6 WING NUT BZP	1	Steel, Mild
7	TB-HG-RB-F04	M6 PENNY WASHER 20 DIA x 1.6 Thk BZP	1	Steel, Mild

FINISH : Polyester Powder Coat Plinth and Frames.
COLOUR : RAL 6002 (Leaf Green) Gloss.



Attachment (10) Yields ranked (Container/Substrate/Feed)

Plant	Yield (g)	Ranking	System	Container	Substrate	Feed
51	1195	1	9	V	C	T
50	938	2	8	V	C	M
70	787	3	13	V	I	None
9	779	4	2	P	C	M
54	777	5	9	V	C	T
10	708	6	2	P	C	M
12	666	7	2	P	C	M
39	627	8	6	PL	C	T
69	564	9	13	V	I	None
48	549	10	8	V	C	M
57	546	11	10	V	I	None
63	542	12	12	V	C	T
52	535	13	9	V	C	T
56	521	14	10	V	I	None
3	504	15	1	P	C	None
67	486	16	13	V	I	None
59	479	17	11	V	C	M
6	473	18	1	P	C	None
58	462	19	10	V	I	None
34	451	20	5	PL	C	M
5	440	21	1	P	C	None
20	369	22	3	P	C	T
23	359	23	4	P	I	None
61	346	24	11	V	C	M
32	324	25	5	PL	C	M
25	320	26	4	P	I	None
49	293	27	8	V	C	M
13	290	28	2	P	C	M
27	288	29	4	P	I	None
53	274	30	9	V	C	T
44	272	31	7	PL	I	None
35	248	32	6	P	C	None
28	247	33	4	P	I	None
7	245	34	1	P	C	M

Legend

- P** = Black plastic pot
- V** = Vigoroot pot
- PL** = Planter
- C** = Control
- I** = Incredicompost/crop
- M** = Maxicrop
- T** = Tomorite

Attachment (11) Photographs



1. Media used



2. Equipment



3. 11 June. All plants

Attachment (11) (Contd.) Photographs



4. On horizontals. 25 June.



5. Set 3. Chlorosis versus other sets. 22 June



6. Set 3. Less chlorosis after feed. 30 June



7. Hestia pods. 21 September.

Attachment (12) Notes and Acknowledgements

NOTES

- 1) Email from *Which? Gardening* 15/11/2019.

“Beans produce plentiful crops so to avoid being overwhelmed, the trick is to grow just the right amount of plants for your needs. In the *Which? Gardening* trial, most varieties produced at least 0.5kg per plant, and our Best Buy runner-bean varieties produced up to 1kg per plant in a season. So a single wigwam of a dozen plants would be plenty for a small household of 2–3 persons.”

- 2) Email from RHS Gardening Advice 4/1/2019.

“The yield of a dwarf runner bean is about 400g per plant. For climbing runner beans the figure is about 1000g per plant. Watering plants well when they are in flower (or failing to water well) will significantly influence yields.”

- 3) *Which? Gardening* and *RHS Vegetable & Fruit Gardening*, 2013, p. 242.
- 4) Original recommendation Neil Hope NVS and Elizabeth Otway NVS (Pumpkin.com).
- 5) Letter from Dr David Hessayon, 23/2/2016.

Letter from Garden Technical Development Manager, Westland Garden Health 9/2/2017.

ACKNOWLEDGEMENTS

Supply of material *pro bono*

Haxnicks International Limited – Vigoroot® pots, Growlite® substrate.

Thompson and Morgan – Seeds, Incredicompost®, Incredicrop®

Advice (Horticulture)

As mentioned above Notes (1) – (5) and:

Berkshire College of Agriculture: Sam Armitage

Capel Manor College: David Riddle

Dalefoot: Pauline Lewington

Growinginteractive: Benedict Vanheems

Kings Seeds: Andrew Tokely

Melcourt: Catherine Dawson

NVS: See Note 4 and Keith Hine. Kelvin Mason *Simply Vegetables* magazine

RHS: Jenny Bowden, *Gardening Advice*

Karen Robbirt, Trials Project Manager

Sparsholt College: Jamie Cryer

Susanne French

Kelvin Mason

University of Reading: Dr Tijana Blanusa (Principal Horticulture Scientist – RHS Fellow)

The Urban Vegpatch: Caro Shrive

Velagro: Shane Deaville

Which? Gardening: Gardening Help. Ceri Thomas. Matt Biggs

Advice (Design)

Andrew Evans Design: Andrew Evans

Technical-Design Services: James Reynolds

Appendix (1) – Materials and Methods

(Evidence for choices)

1. MATERIALS

(Comparisons like with like, one variable)

1. (a) Substrates and Fertilisers

2020 “Original” (See below) with liquid (Tomorite), Incredicompost with Incredicrop and Tomorite*, Coir (Growlite) with Tomorite, Miracle-Gro premium peat-free multipurpose compost with Tomorite. Sinclair seed compost.

Photograph (1).

* One feed only.

Note: Blue granules and yellow granules in John Innes 3

(Bowyers) and the Miracle-Gro compost. Blue granules in Wickes compost.

2015

Wickes Multipurpose Compost (*Which? Gardening* “Best Buy”) with John Innes 3 on recommendation (Note 4). Referred to as “Original”. Yields low

2016

As 2015 but John Innes removed. Quantity of Wickes increased correspondingly.

“Comparing yields Unit (1) 50% Wickes Multipurpose Compost, 50% John Innes No 3 with Unit (2) No John Innes 3: Tables (3) and (4) Unit (1) 3.03Kg

	grams
Unit 2 3.03 Kg	
Mean per plant	378.7
Unit 1 2.13 Kg	
Mean per plant	264.5
Difference: 114.2 g. Unit (1)	-30.2%

Yields low

2017

Original without John Innes but with liquid feed

Original:	2,087g Mean per plant	104.35g
Original with liquid feed:	3,282g Mean per plant	164.10g
		+57.2%

Trial Report Table Attachment 3.

Low yields accounted for by low amount of media per plant.

2018

Original with liquid feed. Per Plant 598.8g
 Incredicompost (*Which? Gardening* “Best Buy”) with granular fertiliser Incredicrop 404.5g
 Trial Report – Table 3.

2019

Incredicompost/crop with liquid feed used to grow
Dwarf runner beans (Hestia). Very good yields – 1,056g per plant.
 And climbing runner beans – yields per plant:

	Total (g)
Original with liquid feed (Tomorite)	834.3
Original with liquid feed (Maxicrop)	779.5
Coir substrate with Tomorite	765.3
Incredicompost/crop with Tomorite	581.2
Incredicompost/Incredicrop	499.2

Comparative yields using Tomorite and using Maxicrop per plant:

	Total (g)
Original – Vigoroot Tomorite	834.3
Original – Vigoroot Maxicrop	779.5
Difference (g)	54.8
Difference %	7.0

Incredicrop was only used mixed in with Incredicompost.
 No separate data Incredicompost without Incredicrop.
 Sinclair seed compost used from 2017.

1. (b) Containers

2020 Vigoroot pots

(a) Vigoroot pots

2018

Plants with the highest yields were mostly those grown in Vigoroot pots with relatively few in plastic pots. (See Chart Attachment(10))

2019

Yields from plants in Vigoroot pots were 40.1% higher than those in plastic pots.

Set4. Plastic pot – Wickes/Ji3 – Maxicrop	553.3g
Set 5. Vigoroot – Wickes/Ji3 – Maxicrop	779.5g

(b) Planters

2018

Plants with the lowest yields were mostly those grown in fabric planters (see(a) above) – Trial 2018 and chart (Attachment (10)).

(c) **Cultivars**

2020 Benchmaster F1, Moonlight F1, Hestia F1, Ferrari F1

(d) **Climbing runner beans**

2015

Grew “Wisley Magic F1” on recommendation of Mr Neil Hope FNVS.

2016

Benchmaster F1 and Moonlight F1. Comparison.

Yields from 27 plants of each cultivar were:

Cultivar	Total (g)	%
Benchmaster	7,694	50.3
Moonlight	7,688	49.7

2017–2019

Carried on with Benchmaster F1 alone.

(b) **Climbing French and Dwarf Runner beans**

2020 Dwarf runners F1 Hestia

2020 Dwarf Climbing French Ferrari F1

2018

Climbing French Mamba F1 Trial Abstract Average yield per plant 222.0g

Average yields from 6 plants **runner beans** with same Integrated System 237.6g

(A comparison was made in 2017 but data was weak)

2017

Report 3.10. Page 7.

“The runner bean crop from Unit (3) with sweet peas grown alongside was not significantly different from the crops of other units without sweet peas. Unit (3): 2,088 Unit (4): 2,250 Unit (5): 2,163g”

2. METHODS

2.2 (a) How grown

2020 With apical dominance curbed, space between plants 20cm, in new style frame, distances grown 94cm and 128cm. (See Sketch Attachment (3)), one plant per 24cm (10 litres) Vigoroot pot. Cultivation: (See Attachment (2)) and Trial Journal. Photograph (2)

(b) One per pot

2016

	Total (g)	%
One in a container: Yield per plant:	378.7	
Two in one container: Yield per plant:	270.9	-28.5%

(Same fill)

2017

Report Attachment 4

	Total (g)	%
One in a container: Yield per plant:	130.0	
Two in same container: Yield per plant:	87.3	-32.7

(Same fill)

2018

Yields per set:

	Total per set (g)	%
Grown one per pot		
Sets 8–10:	534.1	Plant?
Grown more than one per pot		
Sets 11–13:	344.4	
	-189.7	-35.5

(c) Distance grown

2015

Units 1(a) – 3(b) Plants grown over 180cm 367g and 150g. 354g. p. 7 5.4
 Less 3(b) " " " " " " " 478g " 485.9g "

2016

Units 3–4 grown over 150cm mean unit yield 2,169g
 Unit 5 " " 120cm " " " 2,163g

Trial Report p.7 3.10 and 2.11.

(d) Direction of growth

2016

Letters from professional horticulturists suggested that plants with apical dominance curbed would probably give yields superior to those from plants grown vertically.

See Note 5. Dr G Hessayon and Westland Garden Health.

Difference recorded did not appear significant.

Tables 3 and 4.

Mean yield per plant

	Total (g)	%
Grown with apical dominance curbed:	324.8g	
" vertically	: 296.7g	-8.6%

In subsequent trials attention shifted to improvements in the frame used for plants with apical dominance curbed.

Comparison was made in 2017 but data weak.

(e) Space between plants

2018

Increased from 5cm (2018) to 9cm (2019).

2019

Trial Report showed like for like yields were higher than those of 2018 but environmental conditions may have been more favourable.

(f) Positioning of plants (See Layout Attachment (3))

Sets 1–3 (repeated experiments) positioned as in 2019.

(g) Frame

2020: New frame – one per plant – See Sketch Attachment (9) except Sets 1–3 (repeat of 2019 experiment).

Photographs (3) and (4)

2015–2019: All in box shape frame.

Appendix (2)

Draft Scheme For Final Trials 2021

1. WALTHAM ST LAWRENCE

1.1. Repeat 2019 and 2020 Dwarf runner experiments.

2. NEW FARM – Climbing runners

2.1. Aim

Investigate extent to which

- (a) yields may be improved using wider range of peat-free substrates.
- (b) yields differ when not using fertiliser.
- (c) “ “ “ using (a) Liquid and (b) solid fertiliser.

2.2. Media

- (a) Peat-free brand as used in 2020 and further brands (TBA).
Sowing compost Sinclair.
- (b) Tomorite (concentrate) liquid feed and one solid fertiliser (TBA)

2.2. Container

Vigoroot pot 24cm 10-litre capacity. One per plant.

2.3. Frames

Latest frame (2020) – single rail – plants grown for 92cm and 15cm apart.
Protected from damage.

2.4. Cultivar

Benchmaster F1