Automating DNA Extraction

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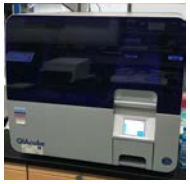
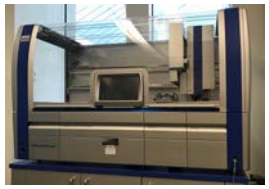
DNA Extraction Automation Analysis

- Current GenomeTrakr Labs

  → each perform between 500 – 1000 DNA extractions annually

- Assessment based on these 2 sample numbers.

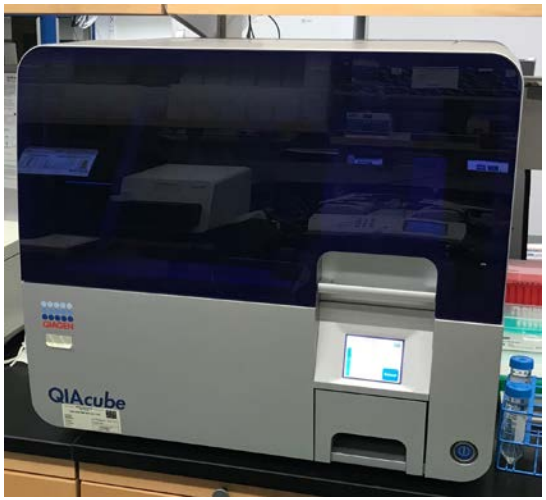
Comparisons between performing:

- Manual extraction, 
- 1 QIAcube, 
- 2 QIAcubes,  
- 1 QIAsymphony. 

QIAcube and QIAsymphony Comparison

COST AND TIME

Cost Analysis



QIAcube
($20,727.00)

QIAsymphony
($102,443.00)

Sunk Cost

→ The cost that has already been incurred and cannot be recovered.

Cost analysis

Total Cost =

Fixed Costs
→ stay the same regardless of the amount of production

Example:
Utilities, Employee salaries

+

Variable Costs
→ change depending on the amount of production

Example:
Production materials

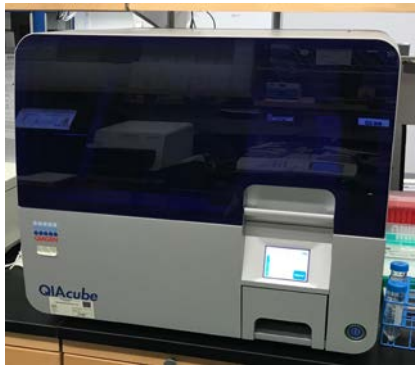
For our comparisons, we will let utilities and employee salaries (fixed costs) be the same so our equation becomes:

Total Cost = Variable Cost

Materials Used in Production

Item	CAT#	Cost/Unit
DNeasy Blood & Tissue Kit (250)	69506	$700.00

Materials Used in Production

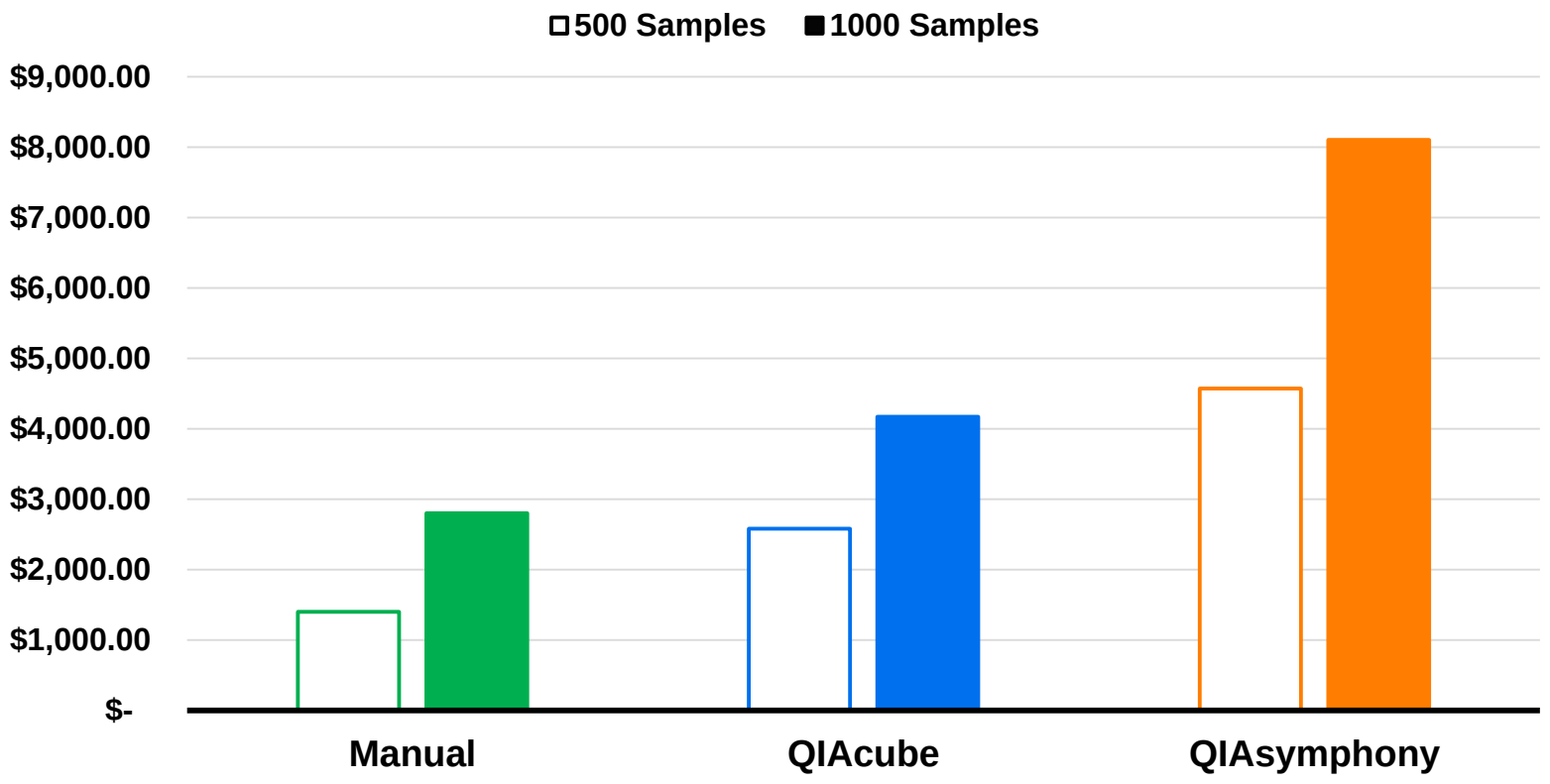


Item	CAT#	Cost/Unit
Filter Tips, 200ul (1024)	990332	$97.80
Filter Tips, 1000ul (1024)	990352	$98.70
QIAamp DNA mini QIAcube Kit (240)	51326	$795.00
Includes rotor adaptors, proteinase k, and buffers		

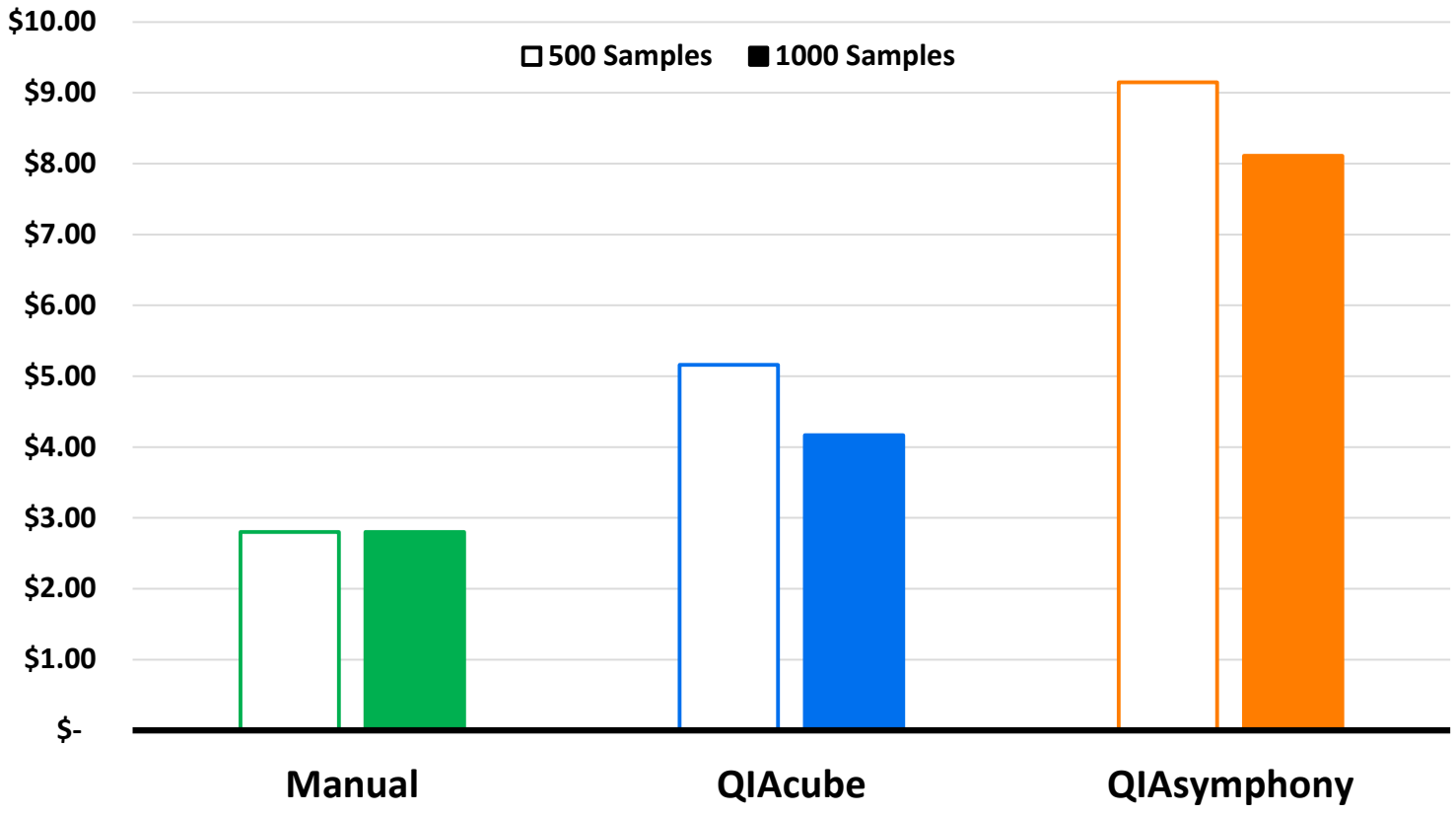
Materials Used in Production

Item	CAT#	Cost/Unit
Filter Tips, 200ul (1024)	990332	$97.80
Filter Tips, 1500ul (1024)	997024	$123.00
Elution Microtubules CL (24 x 96)	19588	$588.00
Sample-Prep Cartridges (8-well) (336)	997002	$137.00
8-rod covers (144)	997004	$96.50
QIAsymphony DSP Virus/Pathogen Mini Kit (192)	937036	$1,035.00

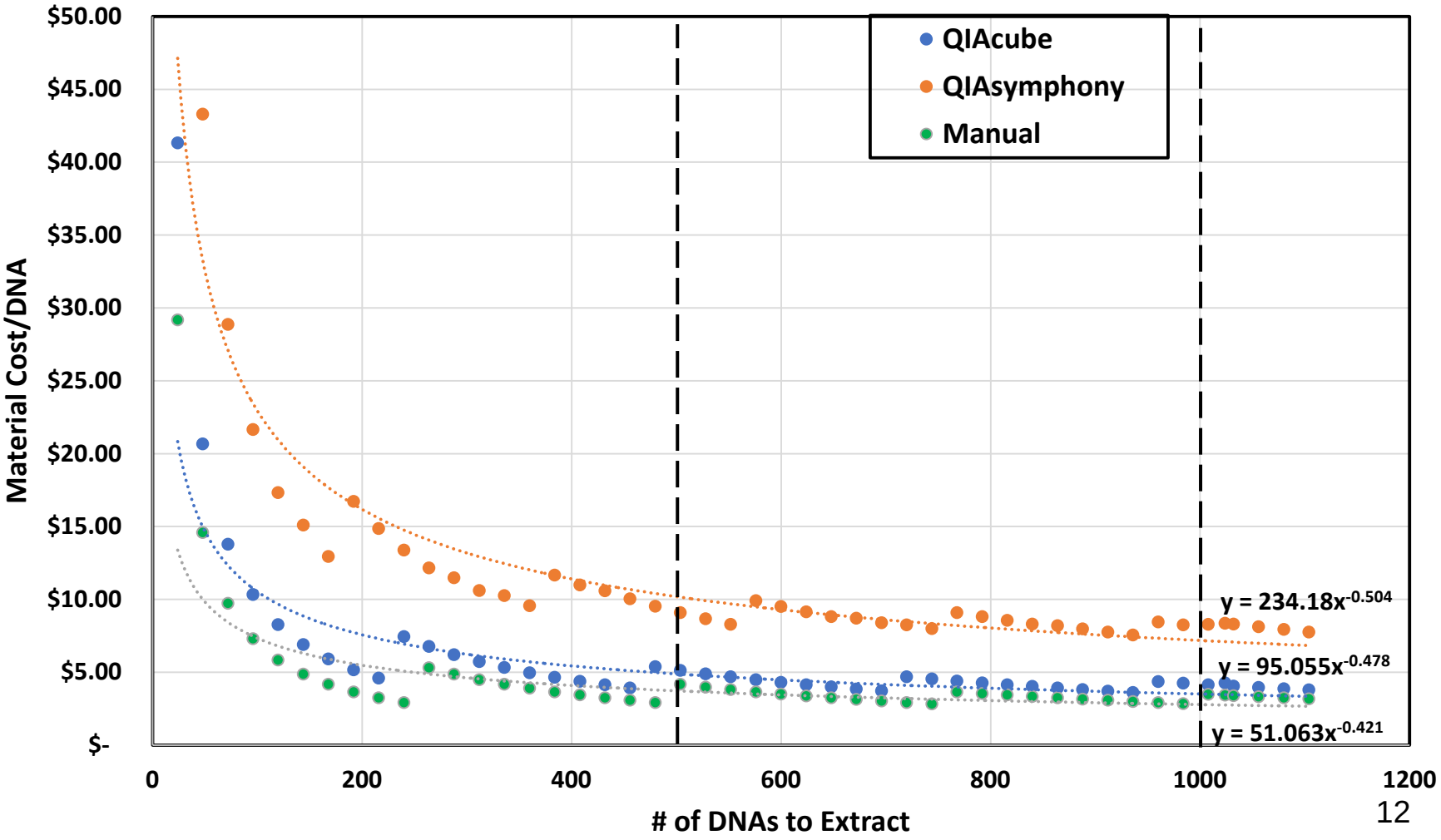
Total Material Cost vs Extraction Method



Cost/Unit vs Extraction Method



Material Cost/DNA vs # of DNAs to Extract



Estimated Cost/Unit

Manual	$\text{Cost/Unit} = 51.063x^{-0.421}$
QIAcube	$\text{Cost/Unit} = 95.055x^{-0.478}$
QIAsymphony	$\text{Cost/Unit} = 234.18x^{-0.504}$

- These equations show *estimated* costs/unit, not exact
- QIAsymphony cost/unit will never reach → equal cost with the QIAcube cost/unit
- Manual cost/unit will equal the QIAcube cost/unit at approximately *50,000 DNAs!*

QIAcube and QIAsymphony Comparison

COST AND TIME

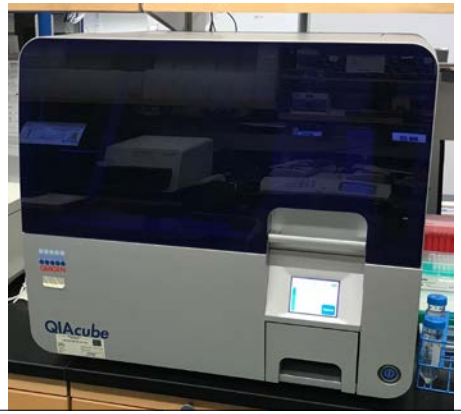
Hourly Production Rate

$$\text{Hourly Production Rate} = \frac{\text{\# of Produced Units}}{\text{\# of Production Hours/day}}$$

For our purposes:

- "produced units" are ***DNAs*** and
- "production hours/day" is ***8 hours***

Instrument Sample Prep Times



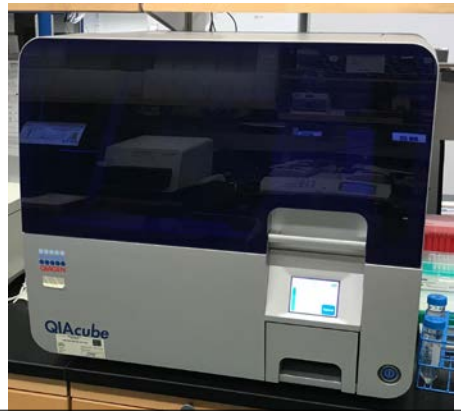
QIAcube

- Lysis done during run (on-instrument)
- Total Sample/Machine Prep Time
- (1 run of 12): ***~40 minutes***

QIAsymphony

- Has a 45 minute extra lysis step, regardless of species (lysis off-instrument)
- Total Sample/Machine Prep Time
- (1 batch of 24): ***~1hr 45 minutes***
- (96 samples) : ***~3hrs 30 minutes***

Instrument Run Times



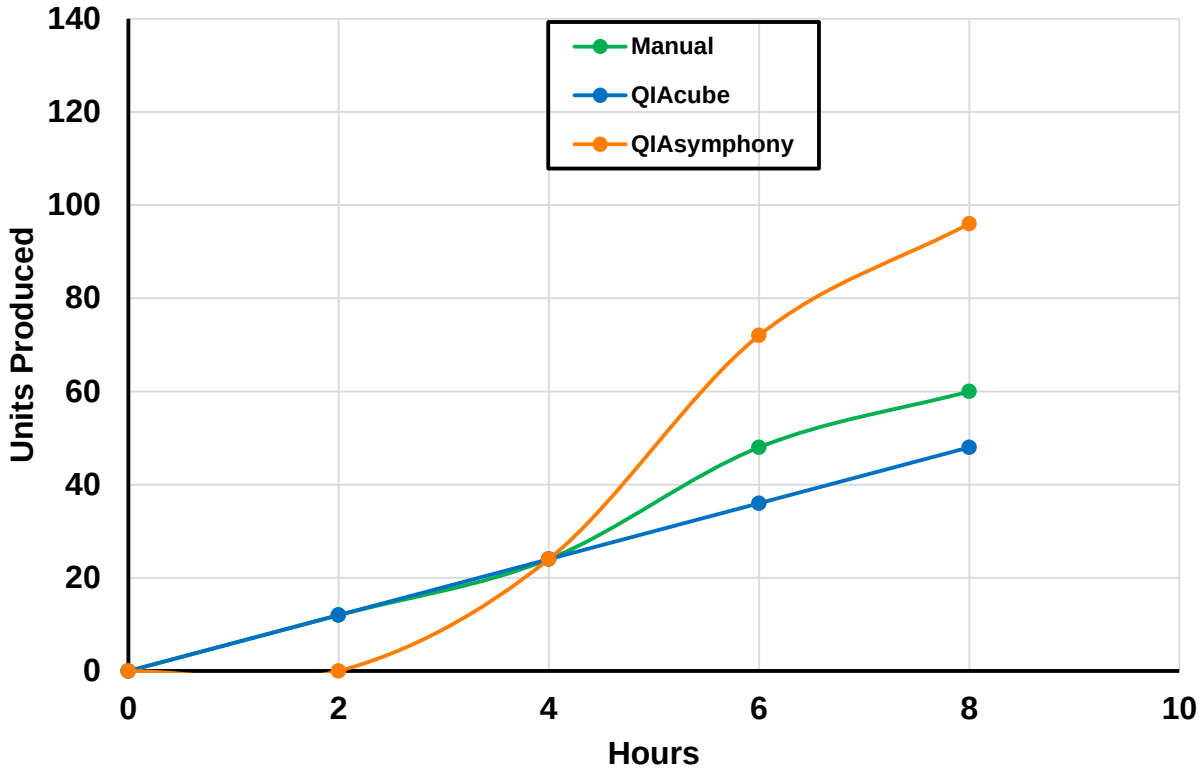
QIAcube
Full run of 12 samples
→ ***75 minutes***

QIAsymphony
Batch of 24 samples → ***55 min***

Full run of 96 samples
→ ***3hrs and 40 min***

Units Produced vs Hours

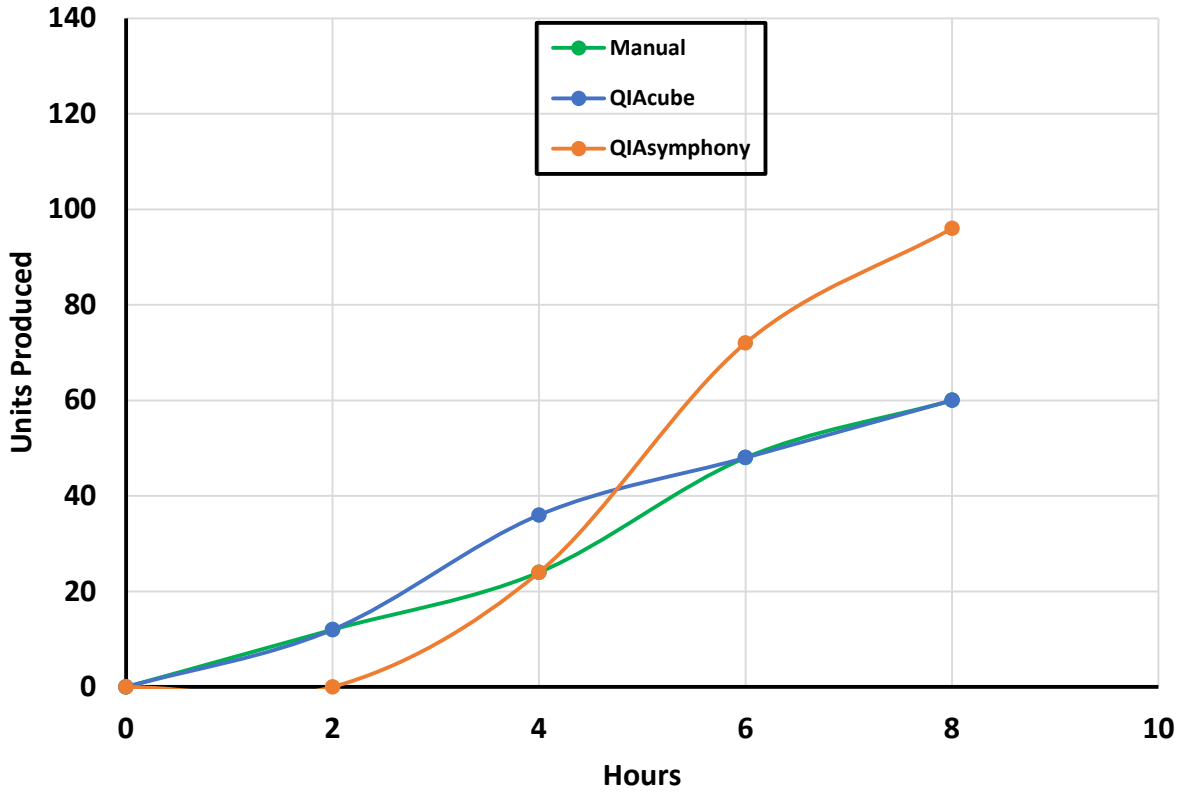
(1 QIAcube, 1 QIAsymphony - without prep in between runs)



	Manual	1 QIAcube	1 QIAsymphony
Hourly Production Rate	7.5 DNAs/hr	6 DNAs/hr	12 DNAs/hr

Units Produced vs Hours

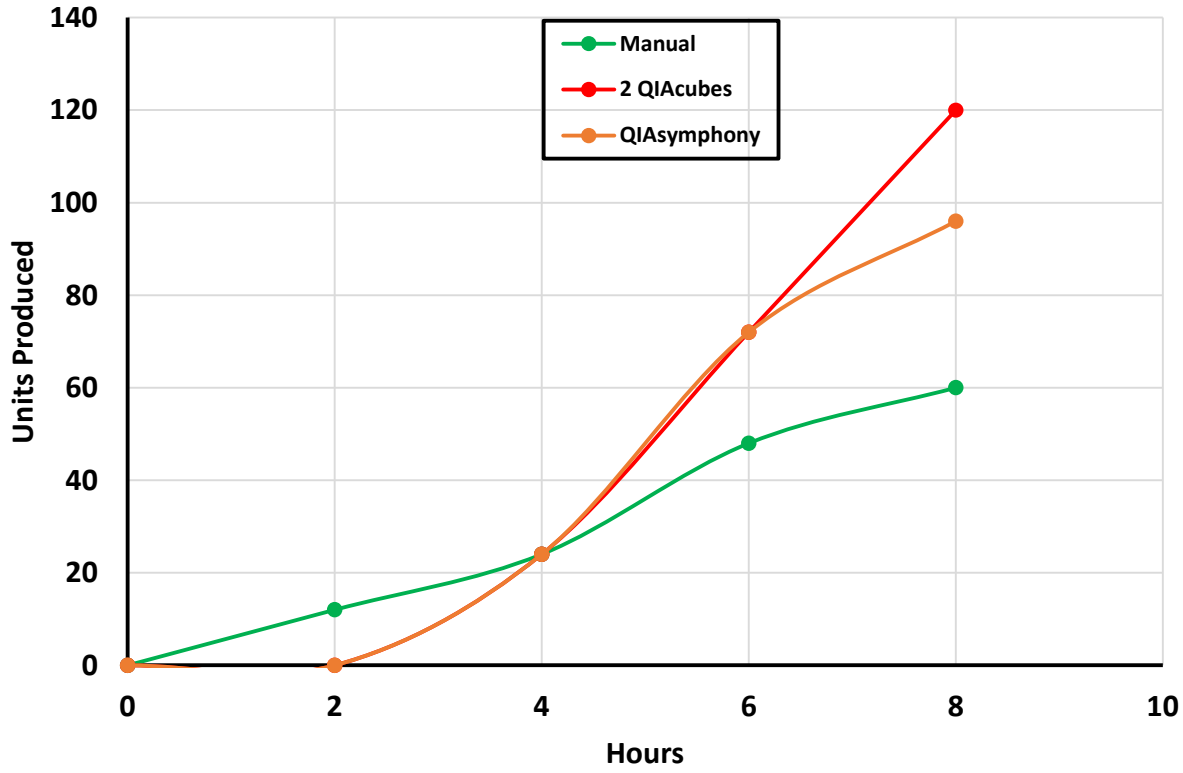
(1 QIAcube, 1 QIAsymphony - with prep in between Runs)



	Manual	1 QIAcube	1 QIAsymphony
Hourly Production Rate	7.5 DNAs/hr	7.5 DNAs/hr	12 DNAs/hr

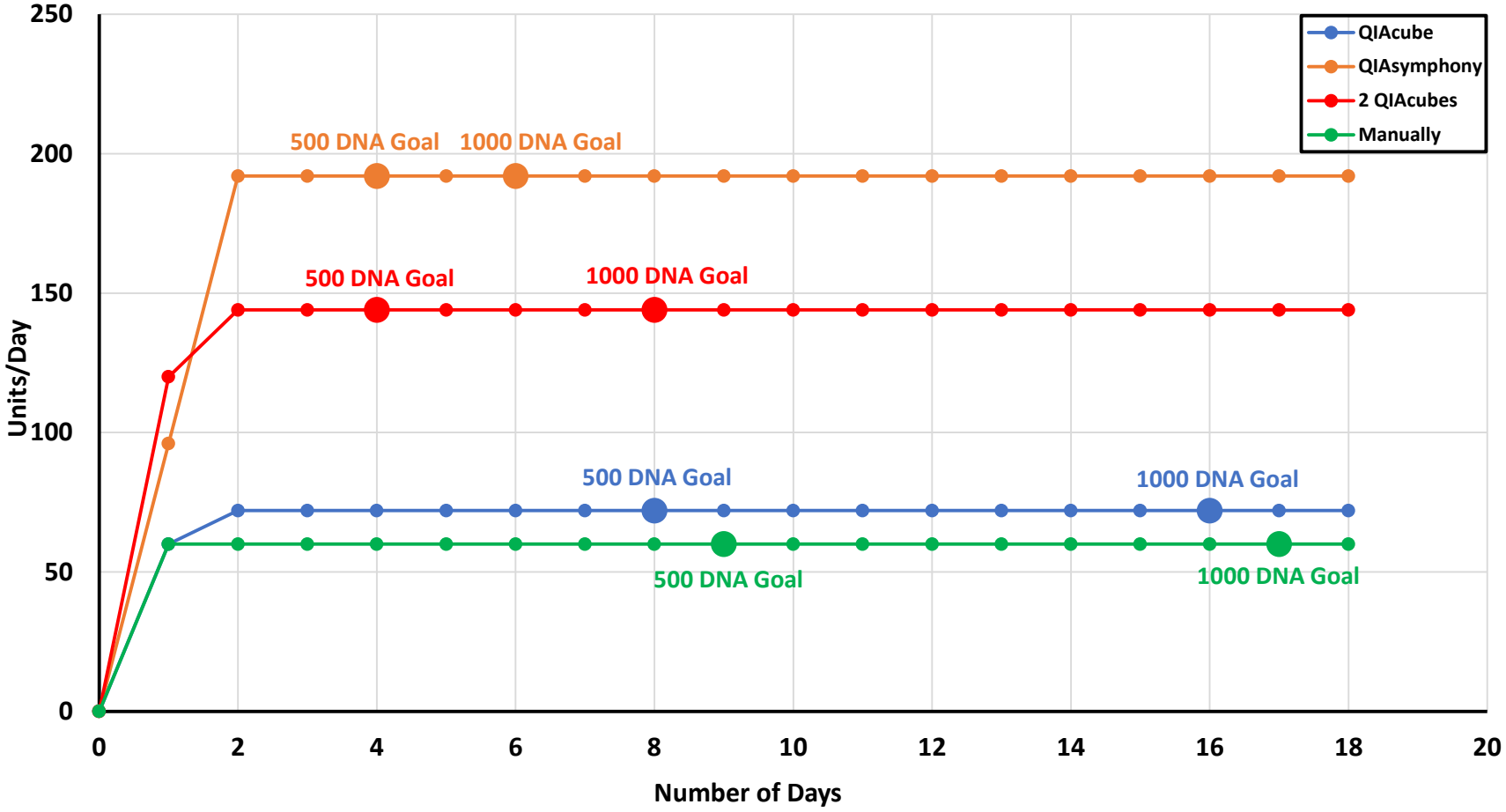
Units Produced vs Hours

(2 QIAcubes, 1 QIAsymphony - with prep in between Runs)

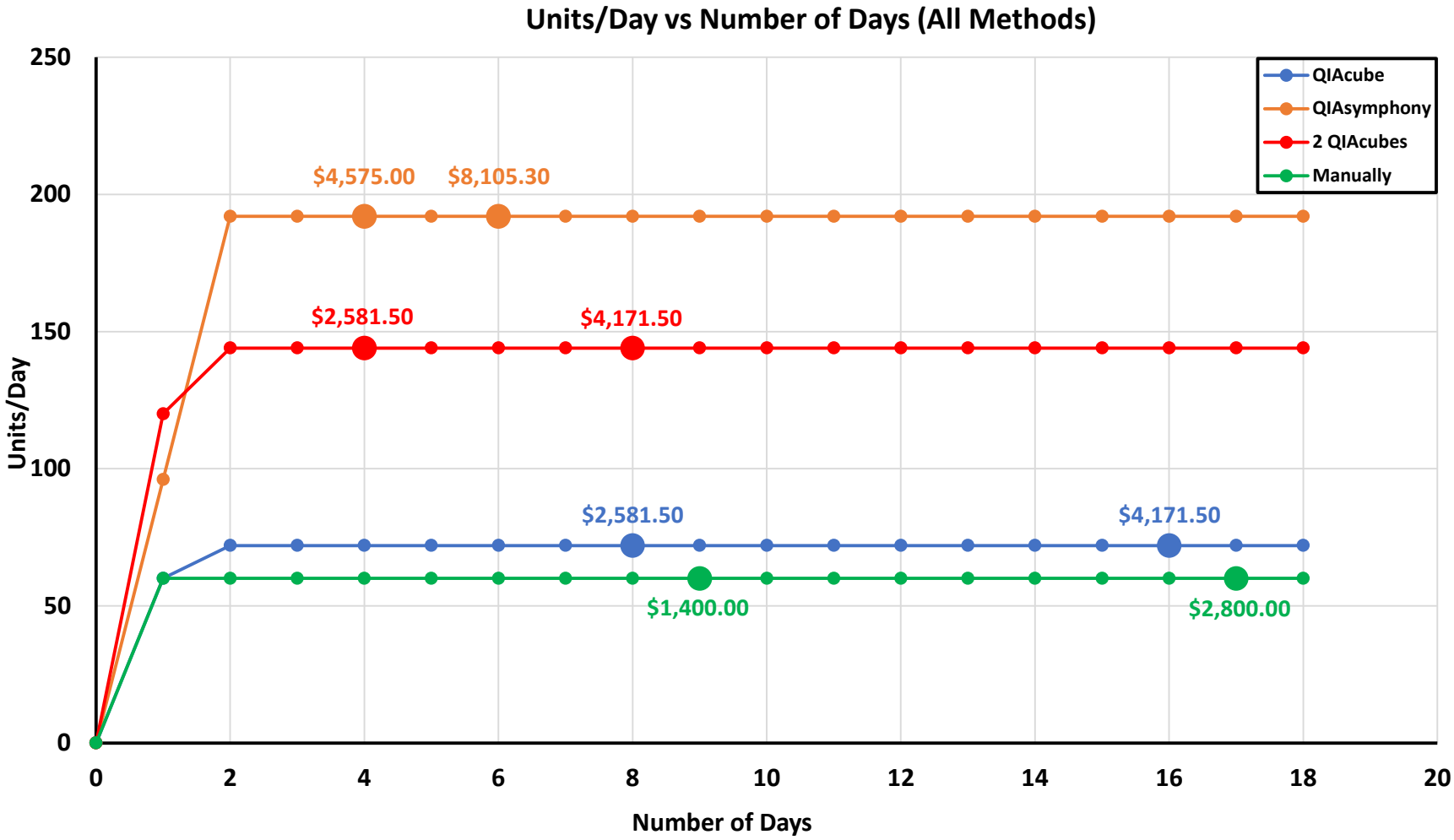


	Manual	2 QIAcubes	1 QIAsymphony
Hourly Production Rate	7.5 DNAs/hr	15 DNAs/hr	12 DNAs/hr

Units/Day vs Number of Days (All Methods)



Units/Day vs Number of Days (All Methods)



Conclusions -1

QIAsymphony →

- made with high throughput production in mind
- up to consumer to make the decision to buy
- cost to run is around double the QIAcube's cost to run
- this cost never goes lower than the QIAcube's cost to run

Conclusions -2

Choice of QIAsymphony:

→if needing a large amount of samples extracted in a short period of time (e.g. work week)

→for production greater than 144 DNAs daily output

If time is not a factor:

→ manual extraction or QIAcube should always be chosen.

Conclusions -3

One disadvantage is that

↓

the QIAsymphony has more materials that are consumed (6 vs 3) at different rates,

↓

therefore, if not careful,

↓

materials could run out before performing the following run.

Any Questions?