Workflow solutions for current challenges in agricultural biotechnology

Jane Theaker, VP Science and Technology Development, LGC

Breeding program workflow *What is your challenge?*

	Sample collection	DNA extraction	Discovery, breeding, and association studies	SNP validation, QC, and routine screening	Bio-informatics
Challenges	Fit for purpose collection tools Automation for sample collection Sample tracking and synchronizing	Single protocol for PCR, sequencing, array genotyping, etc. Cost effective extraction with DNA quality sufficient for storage	Robust scoring of SSR markers Lowering cost for robust genotyping of 1000s of markers	Shortening trait to market time Time & throughput pressure of the breeding season.	Automating scoring Analysis of large datasets under time-pressure Finding robust methods for de-novo assemblies and imputation
Species specific challenges	Humidity, labour costs, logistics	High phenols, degradation, contamination	Inbreeding, no reference genome	Long breeding cycles, other	Genome size, ploidy
LGC solutions	Bespoke collection tools and LGC plant kit	Instruments, chemistries, and bespoke protocols	SSR to KASP GBS and sequencing solutions	KASP® and BHQ® SNPline, IntelliQube® and Nexar® Genotyping services	KRAKEN and bespoke algorithms Intellics software
Case study	Orion Biosains collection tool	AOCC training courses for sample collection and extraction	SSR to KASP conversion service	Bespoke customer SNP screening solution	Bespoke automated data scoring algorithm example

Sample collection – Orion Oil palm challenge

- **Crop** – 30 year lifespan, 6 years to first fruit
- **Ecosystem –** late breeding decisions can lead to unneccesary deforestation
- **Sampling environment –** heat, remote sites, humidity, logistics, and lack of sampling expertise

Oil palm plantation

Sample collection – Bespoke LGC solution

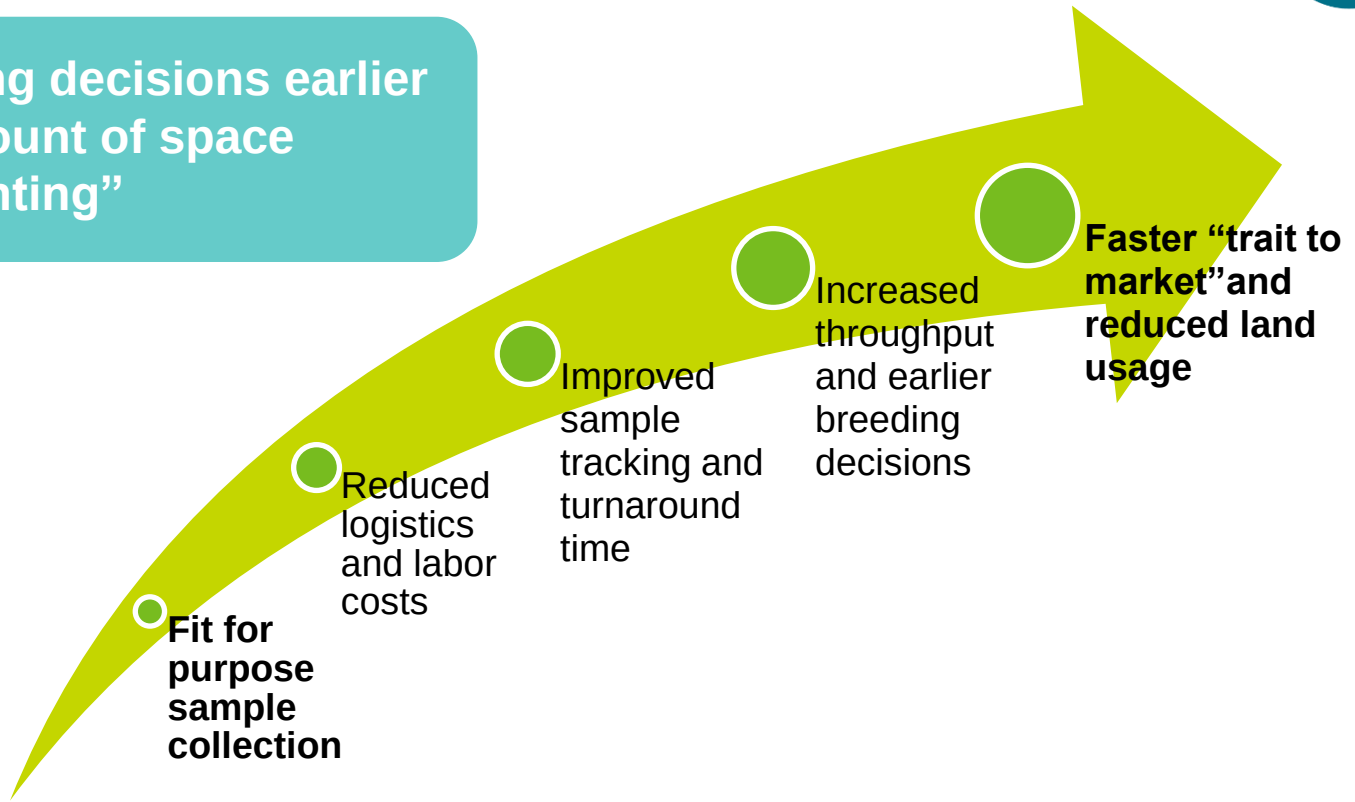
“The test will bring a level of scientific robustness into remote geographic regions for an industry which until now has largely relied on pot luck.”

- LGC developed in-field sampling / barcoding device streamlining sample collection and genotyping whilest maintaining sample integrity

Nathan Lakey, President and CEO, Orion Biosains

Sample collection – So what?

“Making breeding decisions earlier reduces the amount of space required for planting”



DNA extraction – AOCC challenge

- **Goal:** Improve the nutrition, productivity and climatic adaptability of 101 of Africa's most important "back garden" food crops
- **Method:** Sequence and annotate orphan crop genomes
- **Challenge:** Improve methods for collection and extraction

DNA extraction – Bespoke LGC solution

“LGC is a perfect partner for AOCC and its extensive African collaborators. This agreement allows breeders to directly incorporate the latest technologies into their breeding programs”

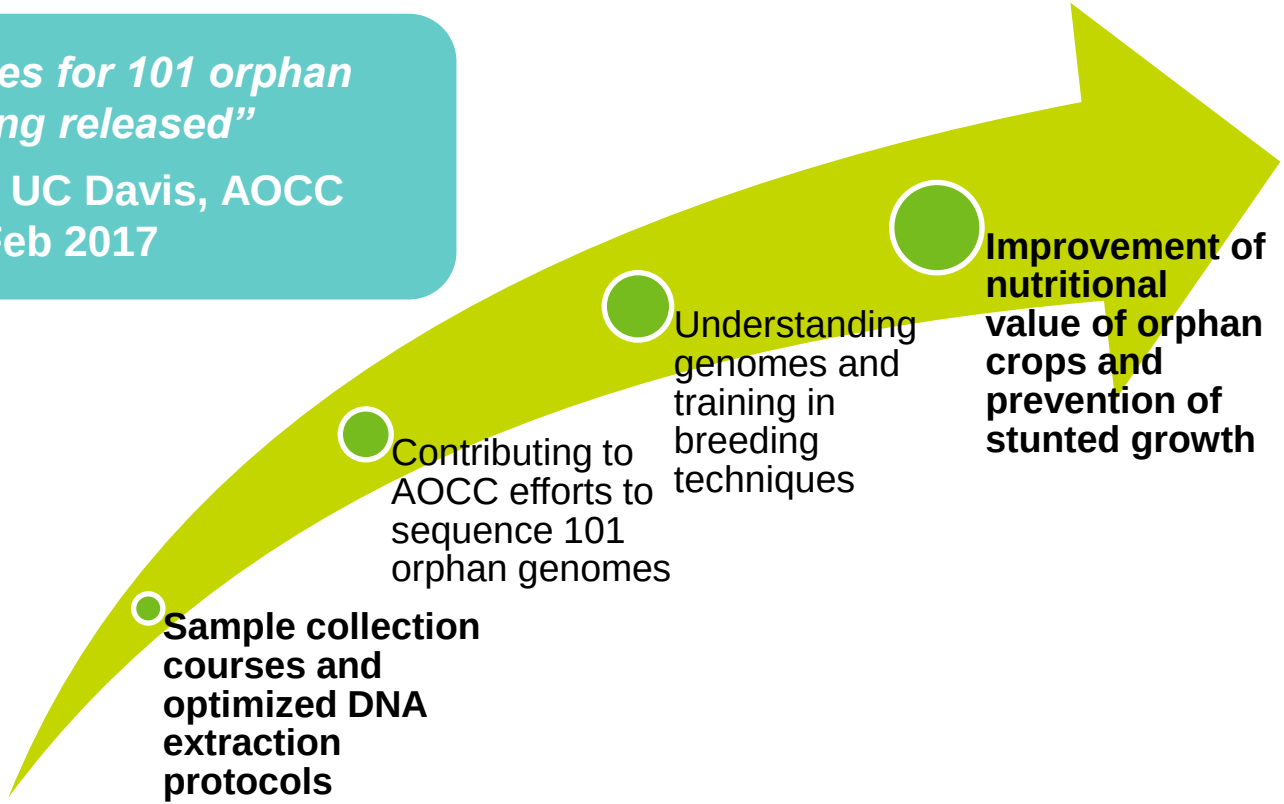
- LGC training course at AOCC African Plant Breeding Academy in Nairobi and optimized LGC extraction protocols for orphan crops.

LGC training course at AOCC in Nairobi

DNA extraction – So what?

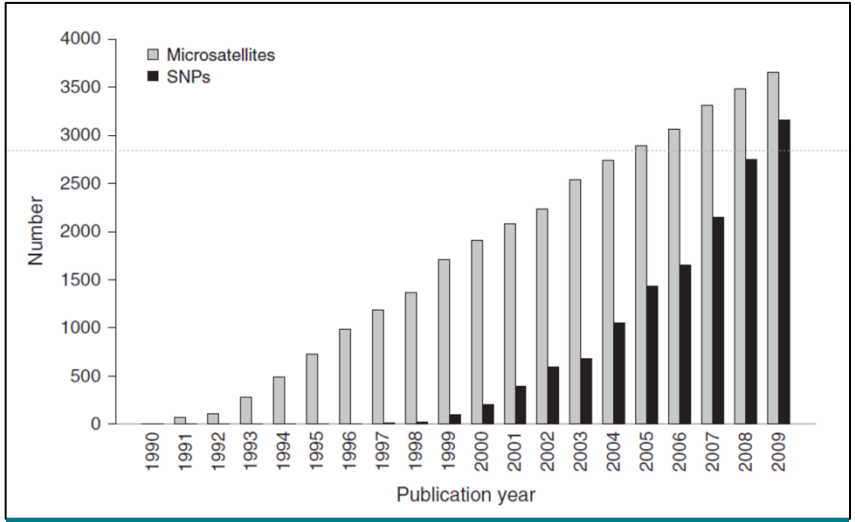
“Genome assemblies for 101 orphan crops currently being released”

- Allen van Deynze, UC Davis, AOCC Technical Leader, Feb 2017



SNP discovery – General challenge

- SSRs are extensively used in plant breeding
- High costs per analysis
- Analysis times slow – not scalable to high-throughput
- Robust and reproducible scoring can be challenging

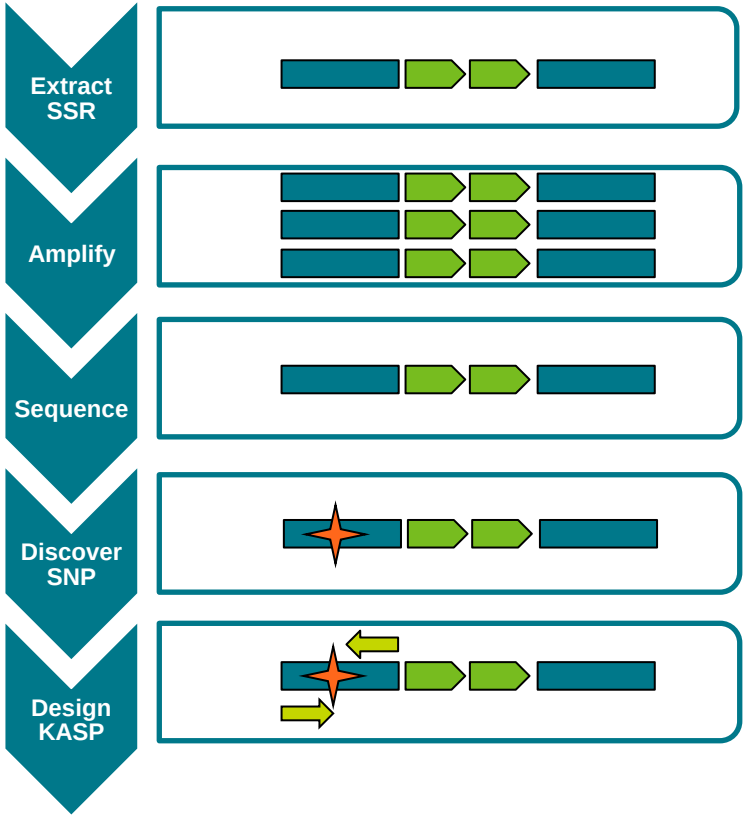


Microsatellites are extensively used

SNP discovery – Bespoke LGC solution

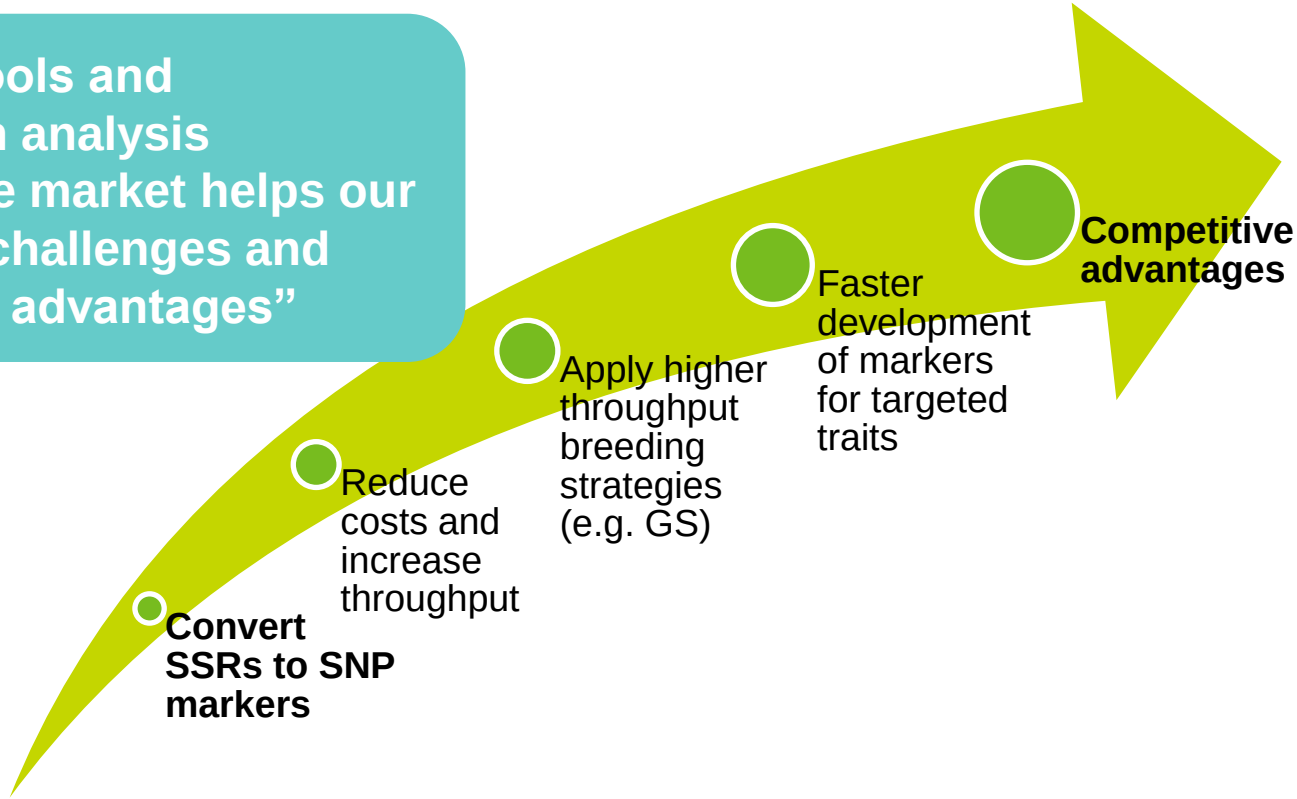
“SNPs are more robust & reproducible, faster in analysis & scalable to higher throughput and cost savings of over 44% per sample can be achieved”

- LGC developed **SSR conversion service** launched in January 2017.



SNP discovery – So what?

“Bringing new tools and advancements in analysis techniques to the market helps our customers face challenges and gain competitive advantages”



Validation and screening – Challenge

Challenge

- Set up a high throughput genotyping laboratory in Asia, currently no genotyping performed on site
- Genotype the first 80 million datapoints within 6 months

Oil palm plantation

Validation and screening – LGC solution part 1

“The LGC service laboratory is the largest commercial PCR genotyping laboratory in the world”

LGC service laboratory project for initial 80 million datapoints in **London**

Validation and screening – LGC solution part 2

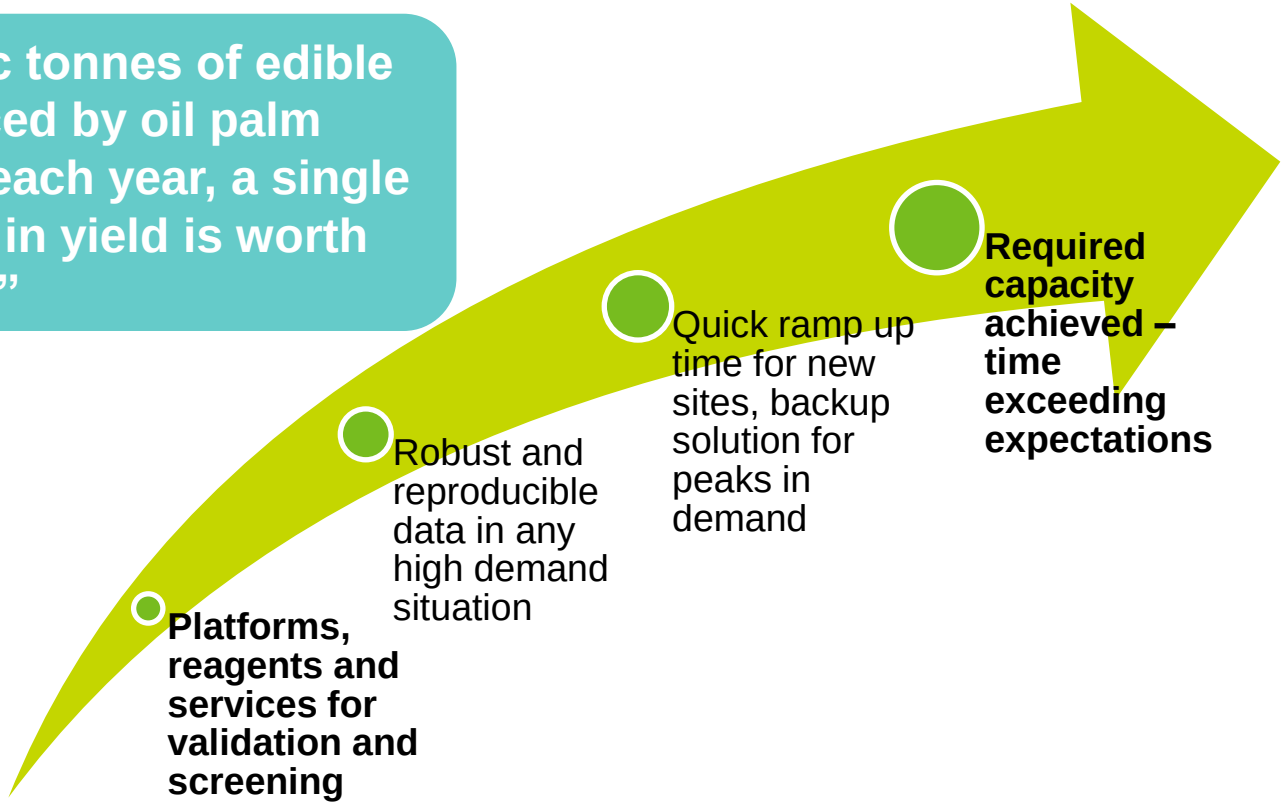
- Simultaneously in **Asia,** SNPline installed on site and Paul (Senior LGC Technician) supported customer on-site for 6 months

“LGC is the only genomics company globally to offer genotyping instruments as well as reagents and services to fully support customers in any situation”

Paul (Senior LGC Technician) supporting on site

Validation and screening – So what?

“62 million metric tonnes of edible oil will be produced by oil palm trees worldwide each year, a single percent increase in yield is worth as much as $1bn”



Bioinformatics – Challenge

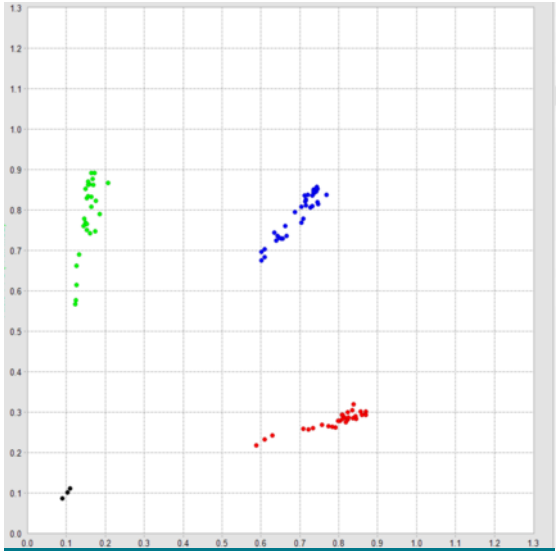
LGC SNPline - Pherastar fluorescent readers

- Multiple fluorescence readers with different settings used for genotyping
- Comparing and overlaying data from different projects over each other, there was no way to score the data

Bioinformatics – LGC solution

“All data represented as a value between 0 and 1 to allow comparison”

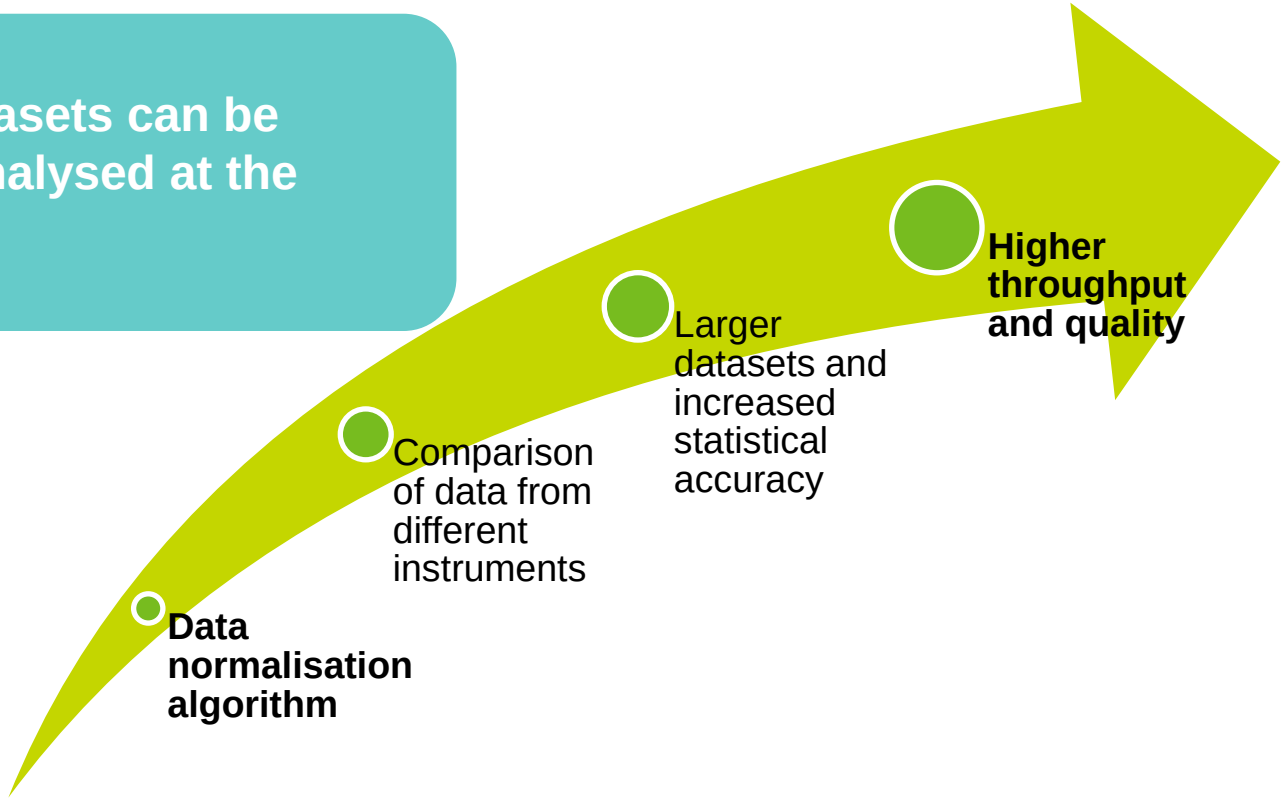
- LGC scientific support team developed algorithm for normalising customer data



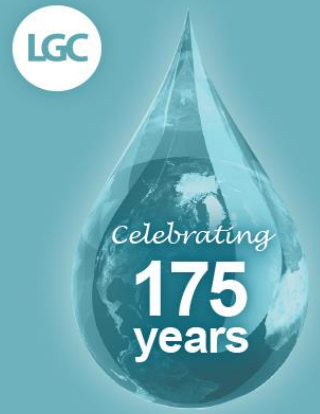
Normalized KASP data

Bioinformatics – So what?

“Much larger datasets can be compared and analysed at the same time”



175 years of experience helping our customers solve their challenges...



Science for a safer world

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What is your challenge?