Cannabis Dry Module

OUR CLIENTS WANTED

REAL-TIME DATA COLLECTION

- A system that would collect critical control and process control data automatically with actionable insights

BUSINESS INTELLIGENCE DELIVERY

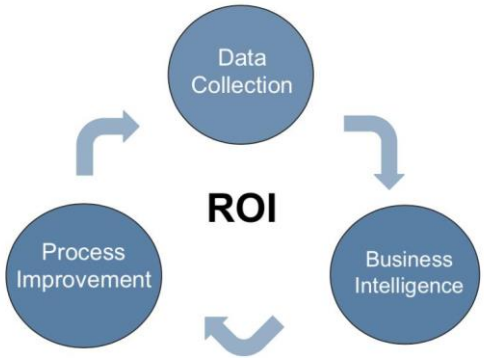
- Deliver the real-time visibility of the dry cure process through business intelligence dashboards

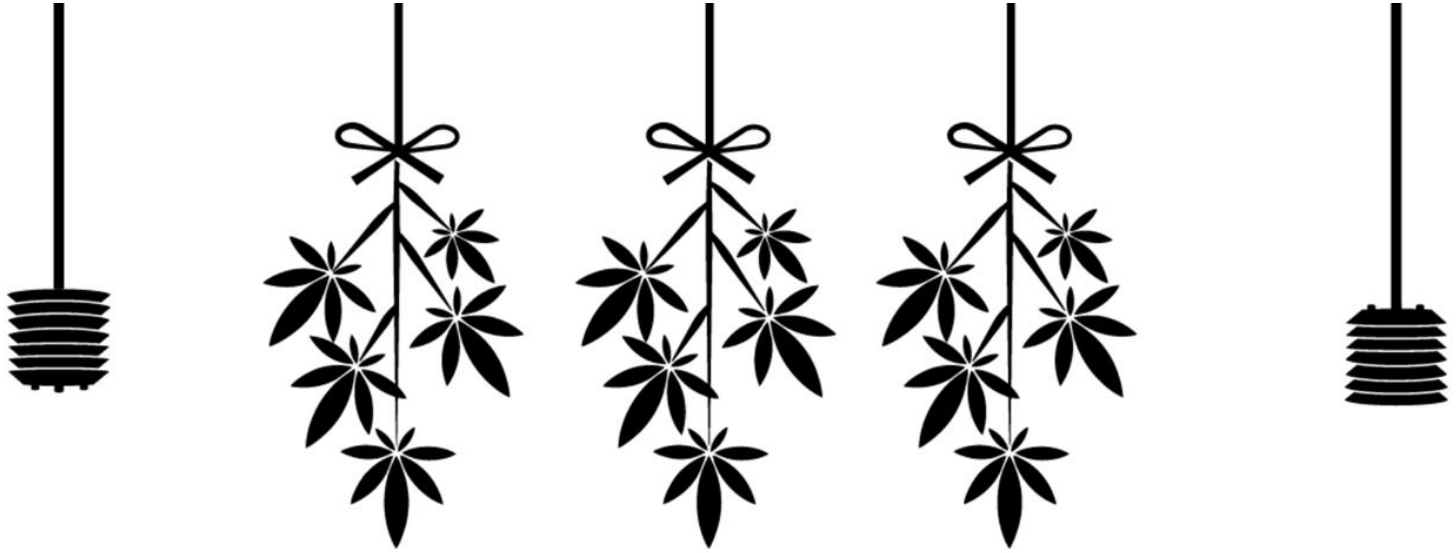
CONTINUOUS IMPROVEMENT

- To reduce waste, increase efficiency, enhance quality,
- And do more with less

SAVINGS: FAST ROI

- ROI ranging from 1 to 6 months

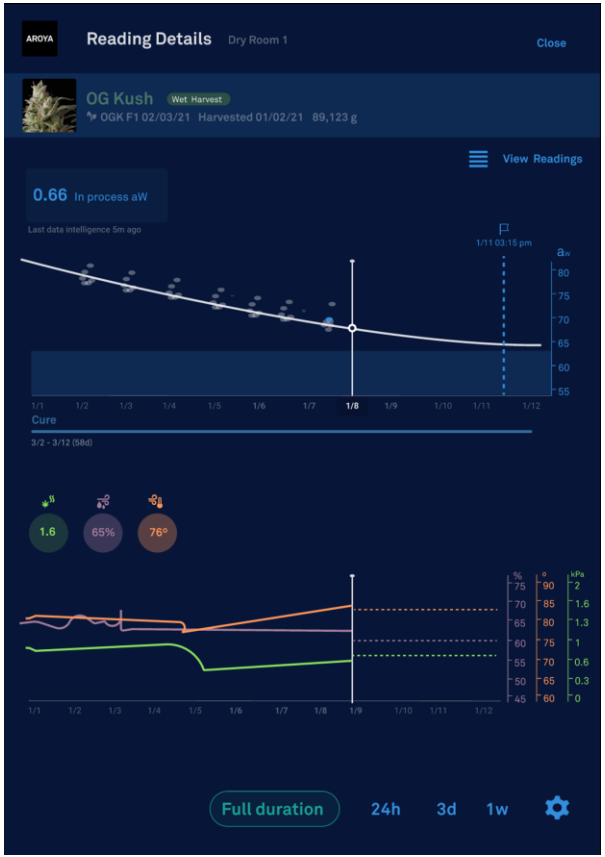




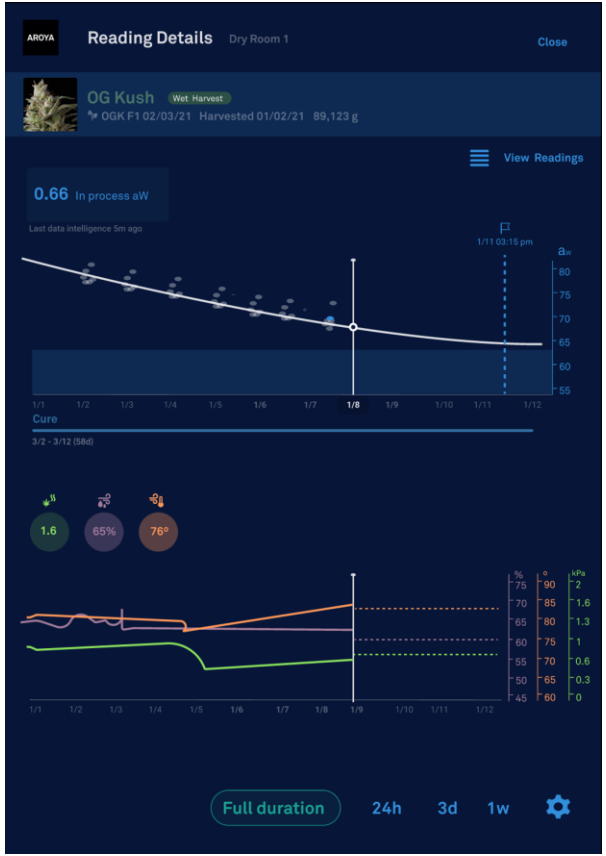
DRY MODULE DASHBOARD (REAL-TIME)

DRILL DOWN

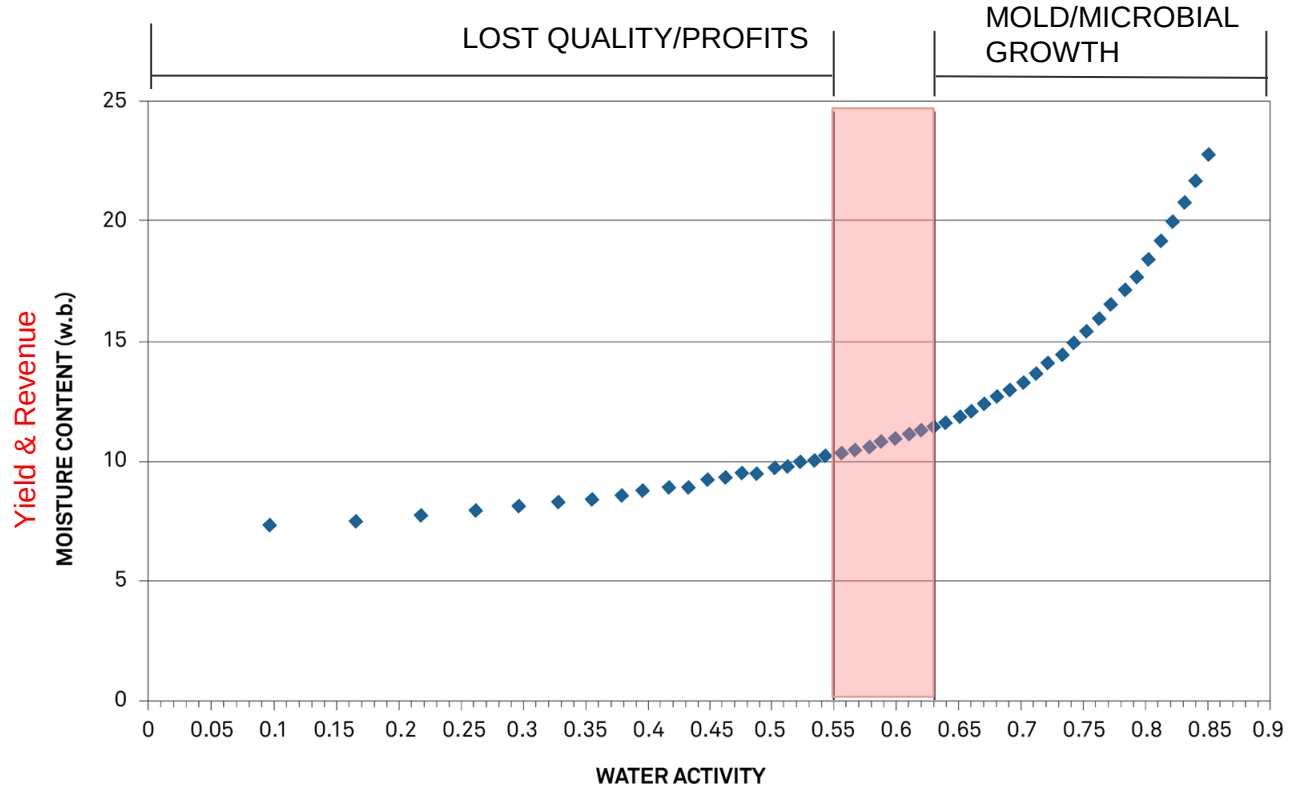

AROYA
Dry Room 1
Log in
0.66 aw
0.65 aw
In Process aW
Fri Jan 12 1:00pm
Temp Air
80°
Fahrenheit
VPD
1.0
k/Pa
RH
70
%
Cultivar ID (5)
Time in
Latest reading
Collapse List
OG Kush
89,123 g
Wet Harvest
OGK F1 02/03/21
8d
Since 01/02/21
0.64 aw
Yesterday
Wedding Cake
89,123 g
Wet Harvest
OGK F1 02/03/21
8d
Since 01/02/21
0.64 aw
Yesterday
Trophy Wife
89,123 g
Wet Harvest
OGK F1 02/03/21
8d
Since 01/02/21
0.64 aw
Yesterday


AROYA
Reading Details
Dry Room 1
Close
OG Kush
Wet Harvest
OGK F1 02/03/21 Harvested 01/02/21 89,123 g
View Readings
0.66 In process aW
Last data intelligence 5m ago
1/11 03:15 pm
Cure
3/2 - 3/12 (58d)
1.6
65%
76°
Full duration
24h
3d
1w

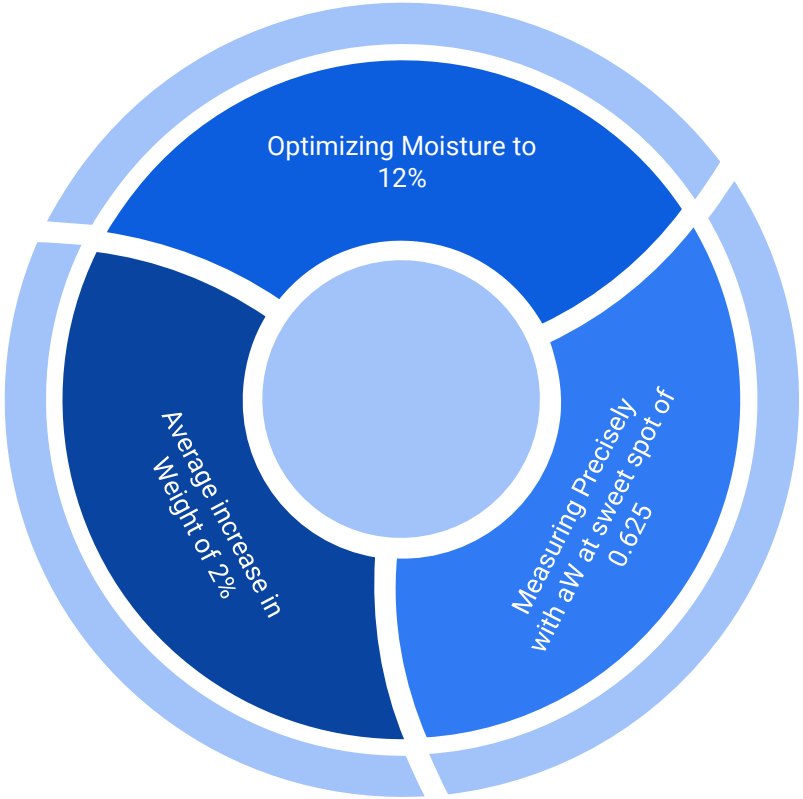
LIVE ROOM DATA



SWEET SPOT


LOST QUALITY/PROFITS
MOLD/MICROBIAL GROWTH
Yield & Revenue
MOISTURE CONTENT (w.b.)
25
20
15
10
5
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9
WATER ACTIVITY
Safety & Quality

AN INVESTMENT THAT PAYS FOR ITSELF



Assuming: 50,000 lbs/year
Moisture optimized 2%
Sale Price/Lbs=$2,000

ANNUAL EXPECTED INCREASE = $2,000,000

SENSORS AND OTHER INFO

THE IMPORTANCE OF 0.60 WATER ACTIVITY

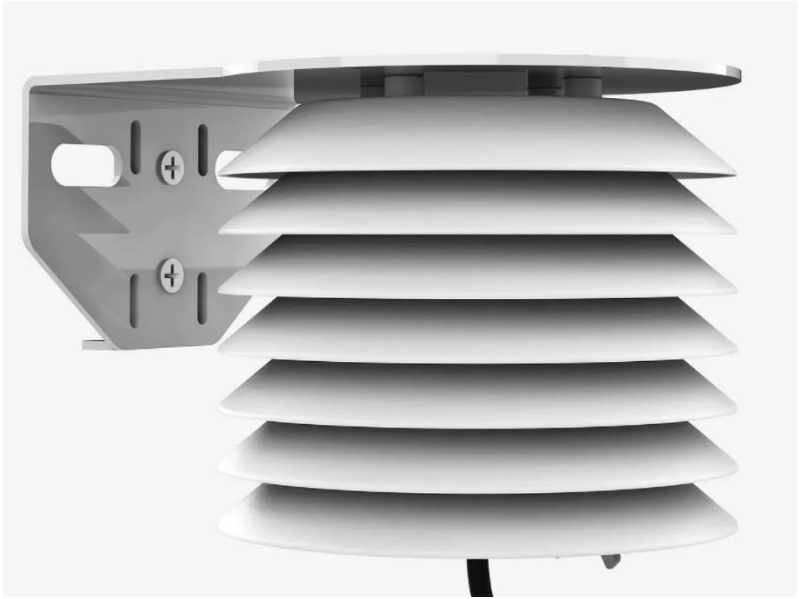
RANGE OF WATER ACTIVITY	MICROORGANISMS GENERALLY INHIBITED BY WATER ACTIVITY IN THIS RANGE
0.95-1.00	**Pseudomonas,** Escherichia, Proteus, Shigella, Klebsiella, Clostridium perfringens, Clostridium botulinum, and Salmonella
0.90-0.95	**Saccharomyces cerevisiae**, Vibrio parahaemolyticus, Serratia, Lactobacillus, Pediococcus, Bacillus cereus, and Listeria monocytogenes
0.85-0.90	**Staphylococcus aureus,** Micrococcus and many yeasts (Candida and Torulopsis)
0.85 AND HIGHER	POTENTIALLY HAZARDOUS PRODUCTS
0.80-0.85	**Mycotoxigenic pennicilia** (Penicillum expansum, Penicillum islandicum), and some yeasts (Saccharomyces bailii and Debaromyces hansenii)
0.75-0.80	**Halophilic bacteria,** and mycotoxigenic Aspergilli (Aspergillus niger, Aspergillus ochraceous, and Aspergillus candidus)
0.65-0.75	**Xerophilic molds** (Erotium chevalieri, Erotium amstelodami, Wallemia sebi), and Saccharomyces bisporus
0.65	ACCEPTED LIMIT FOR CANNABIS
0.60-0.65	**Osmophilic yeasts** (Zygosaccharomyces rouxii), **and a few molds** (Aspergillus enchulatus **and** Monascus bisporus)
< 0.60	NO MICROBIAL GROWTH

The accepted limit for cannabis is between 0.60 and 0.65. A very limited strain of aspergillus enchulatus can grow at 0.625.

AQUALAB 3

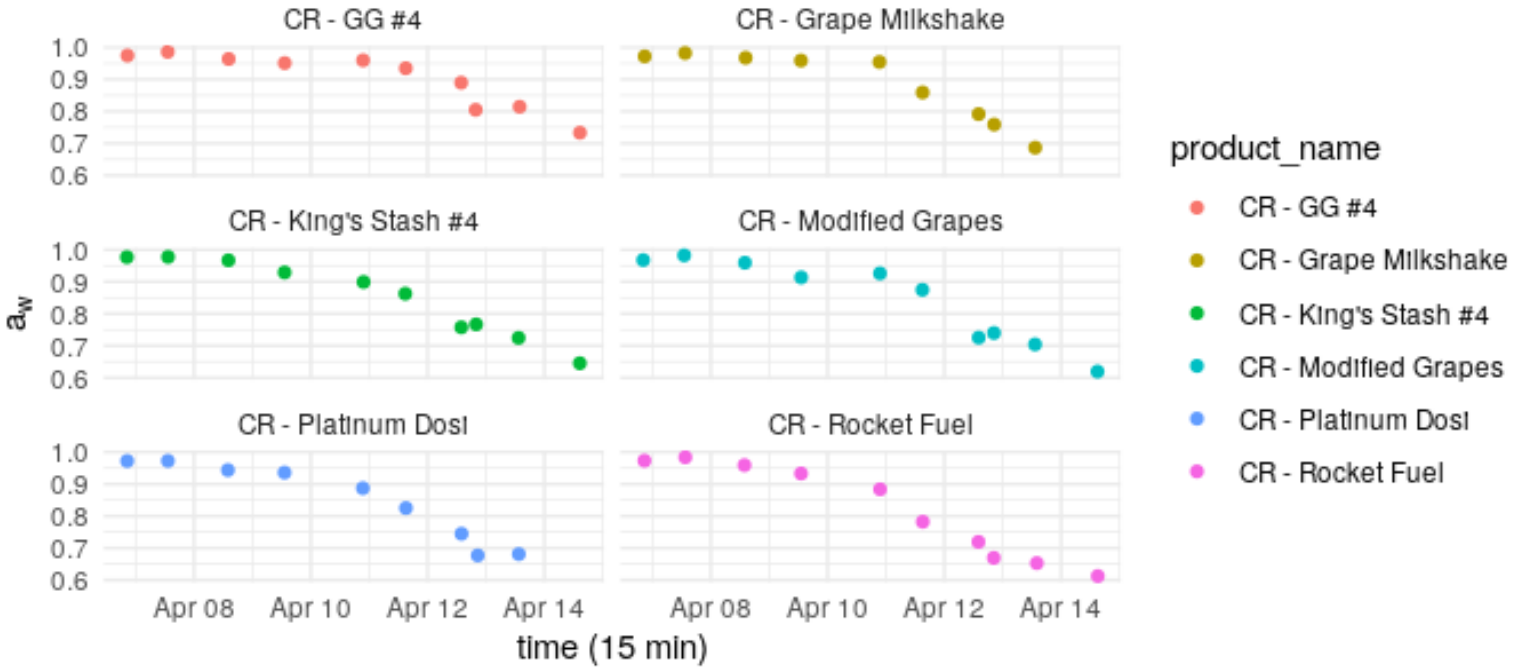
- **Methodology**
  - **aw:** chilled-mirror dew point
  - **MC%:** dew point (moisture sorption isotherm)
- **Temperature**
  - Controlled at 25C
- **Accuracy**
  - **aw:** +/- 0.005aw
  - **MC%**: +/- 0.02%
- **Additional Details:**
  - non-destructive
  - data automatically stored & available
  - iPad included

ATMOS14

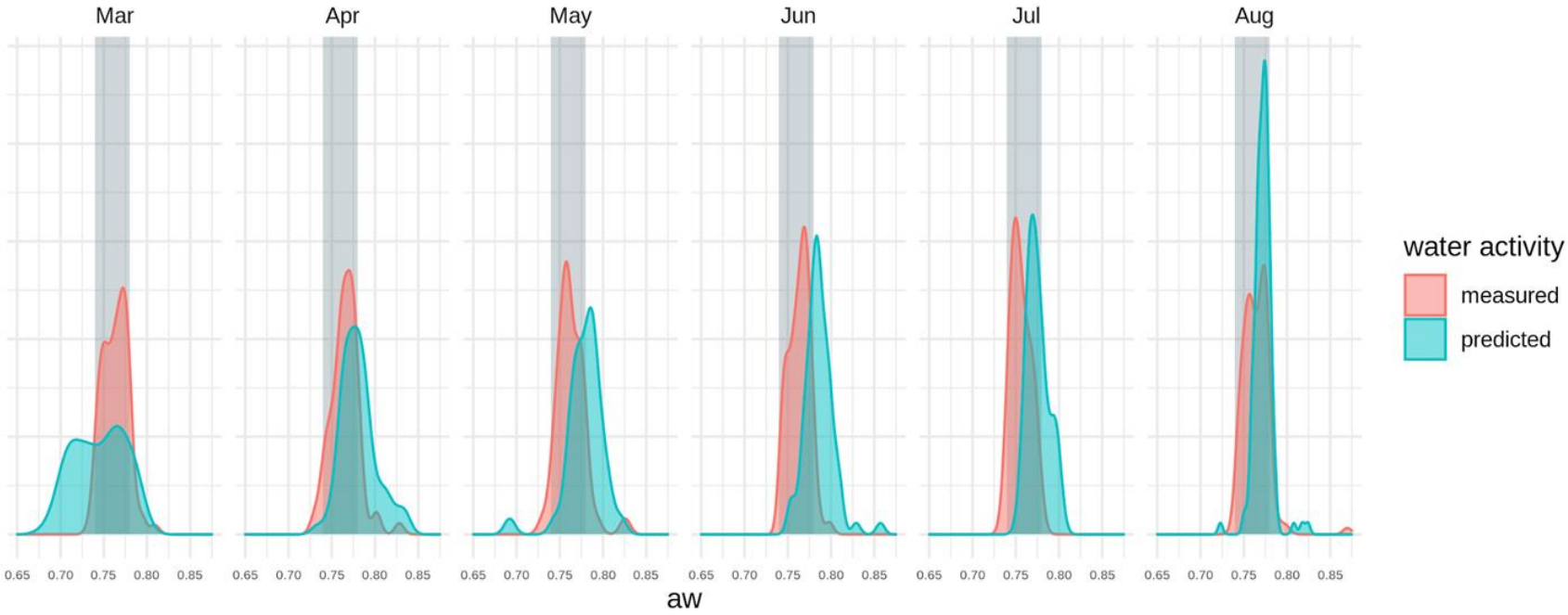


Temperature	Range: -40 – 80 °C
	Resolution: 0.1 °C
	Accuracy: ±0.2 °C
	Equilibration time (τ, 63%): < 165 s (response time in 1 m/s air stream)
	Long-term drift: <0.03 °C year, typical
Relative Humidity (RH)	Equilibration time (τ, 63%): < 25 s (response time in 1 m/s air stream)
	Hysteresis: ±0.8 % RH, typical
	Long-term drift: ±0.25 % RH/year, typical
	Range: 0 – 100 % RH (0.00-1.00)
	Resolution: 0.1 % RH
	Accuracy: Sensor measurement accuracy is variable across a range of RH. See specification chart.
Vapor Pressure	Range: 0 – 47 kPa
	Accuracy: Sensor measurement accuracy is variable across a range of temperatures and RH. See specification chart.
	Resolution: 0.01 kPa
Barometric Pressure	Equilibration time (τ, 63%): < 10 ms
	Long-term drift: < 0.1 kPa/year, typical
	Resolution: 0.01 kPa
	Range: 1 – 120 kPa
	Accuracy: ±0.05 kPa at 25 °C

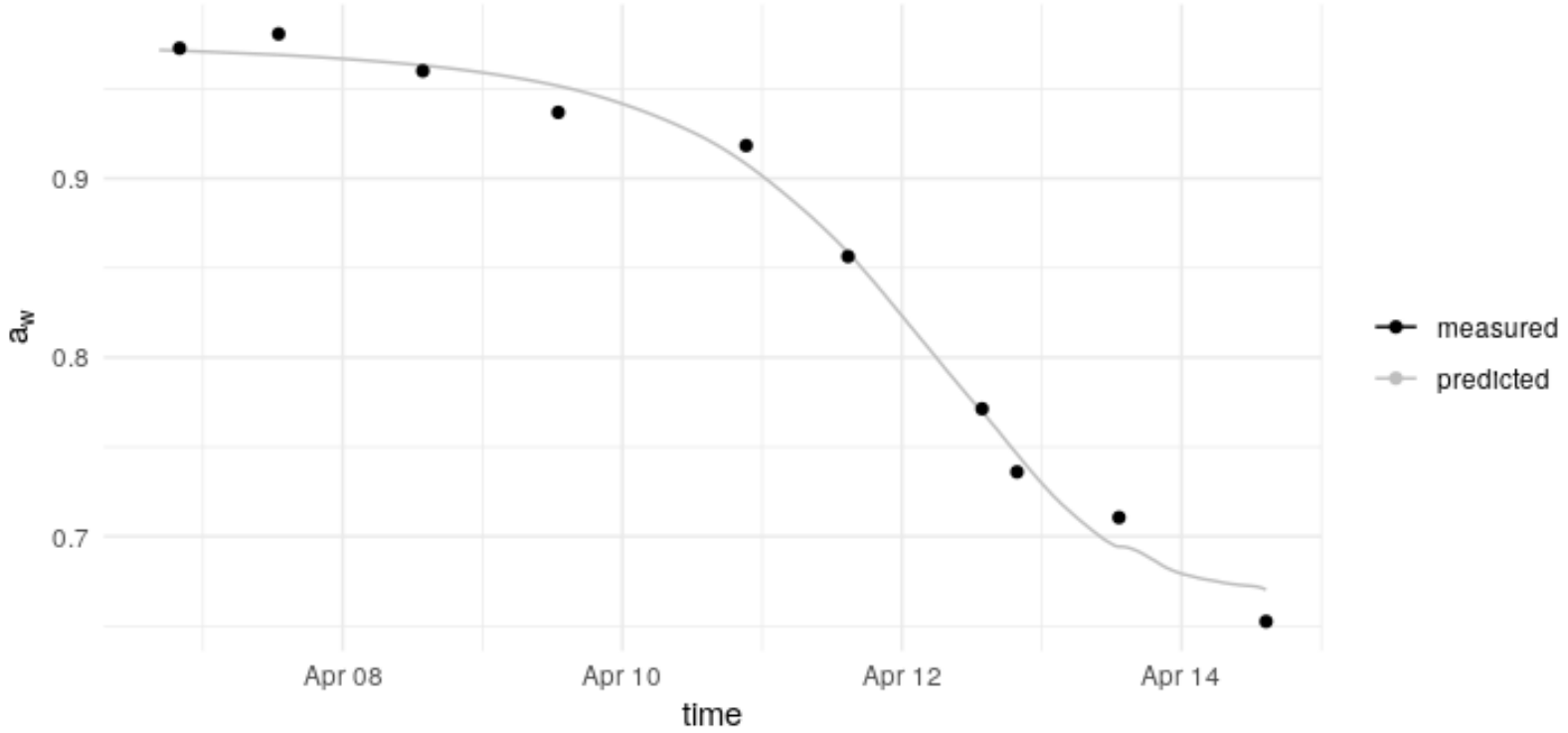
STRAIN SPECIFIC MODEL CREATION



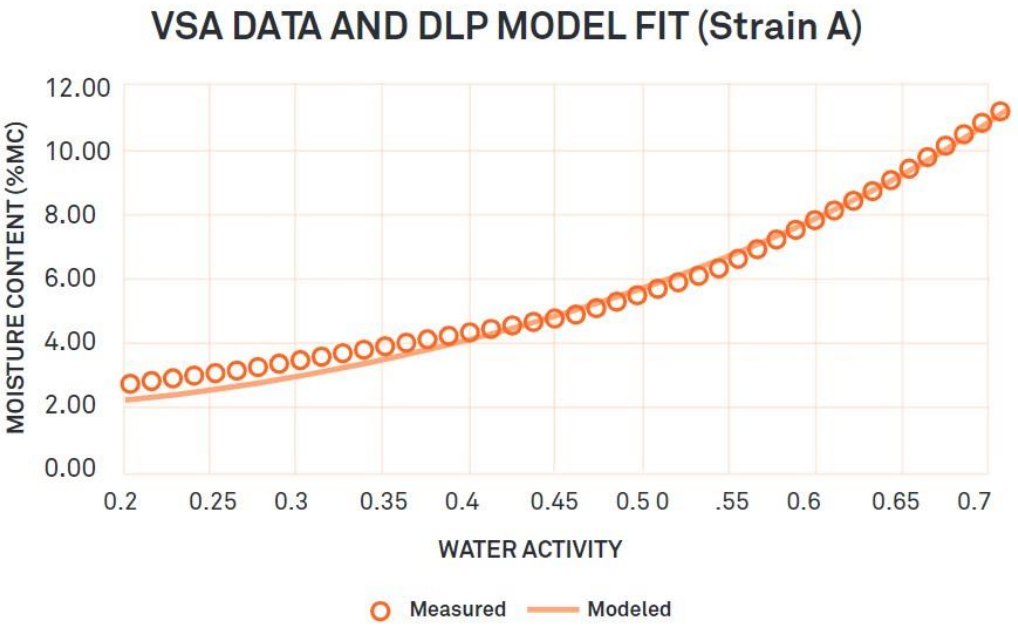
AI MODEL PRECISION



MACHINE LEARNING ENABLED PREDICTIVE MODELING



CANNABIS ISOTHERM



The Sweet Spot for Cannabis depends upon your standard deviation in the dry process. Our technology will measure and reduce your standard deviation so we can increase your target aW to optimize moisture around 0.625.

IMPORTANT DEFINITIONS

- **Moisture content** (M.C.) = quantitative measurement.

  Amount of water present; not reliable; 35 methods to measure

  Yield and revenue.

- **Water activity** (a_w) = qualitative measurement.

  Determines the physical, chemical and biological stability of a product; microbial growth, trichome deterioration; favorable characteristics such as color, aroma, texture, density, etc.

  Safety and quality.

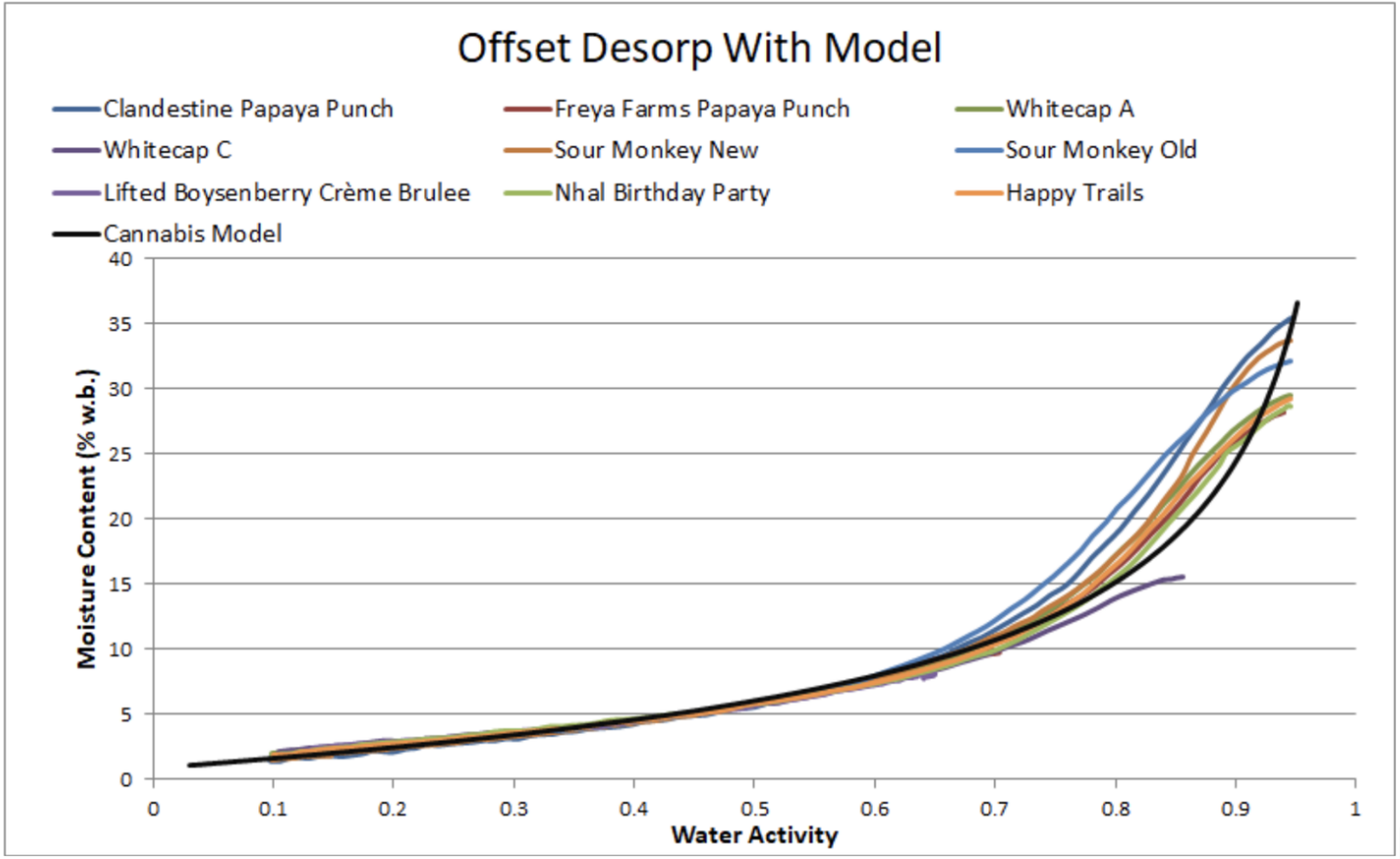
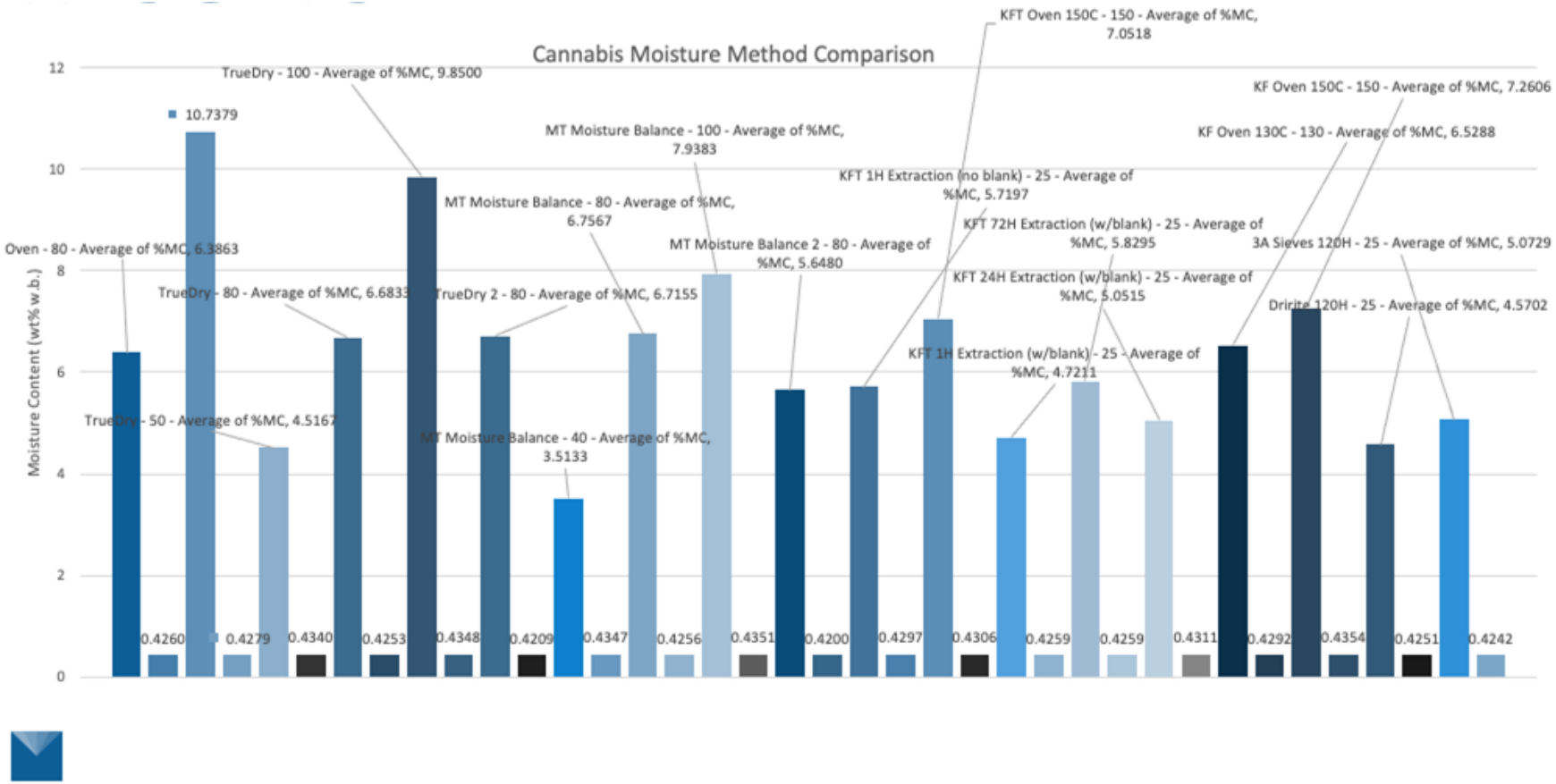


Fig 1. All desorption isotherm curves offset to match the moisture content at 0.50 a_w. The model is in black.

aW vs. MC%


Cannabis Moisture Method Comparison
Moisture Content (wt% w.b.)
0
2
4
6
8
10
12
Oven - 80 - Average of %MC, 6.3863
10.7379
TrueDry - 100 - Average of %MC, 9.8500
TrueDry - 80 - Average of %MC, 6.6833
TrueDry - 50 - Average of %MC, 4.5167
MT Moisture Balance - 100 - Average of %MC, 7.9383
MT Moisture Balance - 80 - Average of %MC, 6.7567
TrueDry 2 - 80 - Average of %MC, 6.7155
MT Moisture Balance - 40 - Average of %MC, 3.5133
MT Moisture Balance 2 - 80 - Average of %MC, 5.6480
KFT Oven 150C - 150 - Average of %MC, 7.0518
KFT 1H Extraction (no blank) - 25 - Average of %MC, 5.7197
KFT 72H Extraction (w/blank) - 25 - Average of %MC, 5.8295
KFT 24H Extraction (w/blank) - 25 - Average of %MC, 5.0515
KFT 1H Extraction (w/blank) - 25 - Average of %MC, 4.7211
KF Oven 150C - 150 - Average of %MC, 7.2606
KF Oven 130C - 130 - Average of %MC, 6.5288
3A Sieves 120H - 25 - Average of %MC, 5.0729
Drierite 120H - 25 - Average of %MC, 4.5702
0.4260
0.4279
0.4340
0.4253
0.4348
0.4209
0.4347
0.4256
0.4351
0.4200
0.4297
0.4306
0.4259
0.4259
0.4311
0.4292
0.4354
0.4251
0.4242

TOO WET

- Aspergillus
- Botrytis “grey mold”
- Penicillium
- Cladosporium
- Mucor
- Rhizopus

AROYA DELIVERS RESULTS

Case Studies:

Client A - Mid-Size AZ Facility

Able to narrow the actual water activity and move up the mean. As such, the customer increased water activity to 0.60 from 0.37 while optimizing process time and utility. ROI in 1.5 months with an annual increase on profitability equalling greater than $1.5M.

Client B - Large-Size CAN Facility

Process Cpk tripled with an RMSE of 0.02 and 100% first pass yield. Profitability increased by 3%. This is $8M savings in year 1.