

# Environmental Impact on Liquid Handling

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# Experiment with three input variables

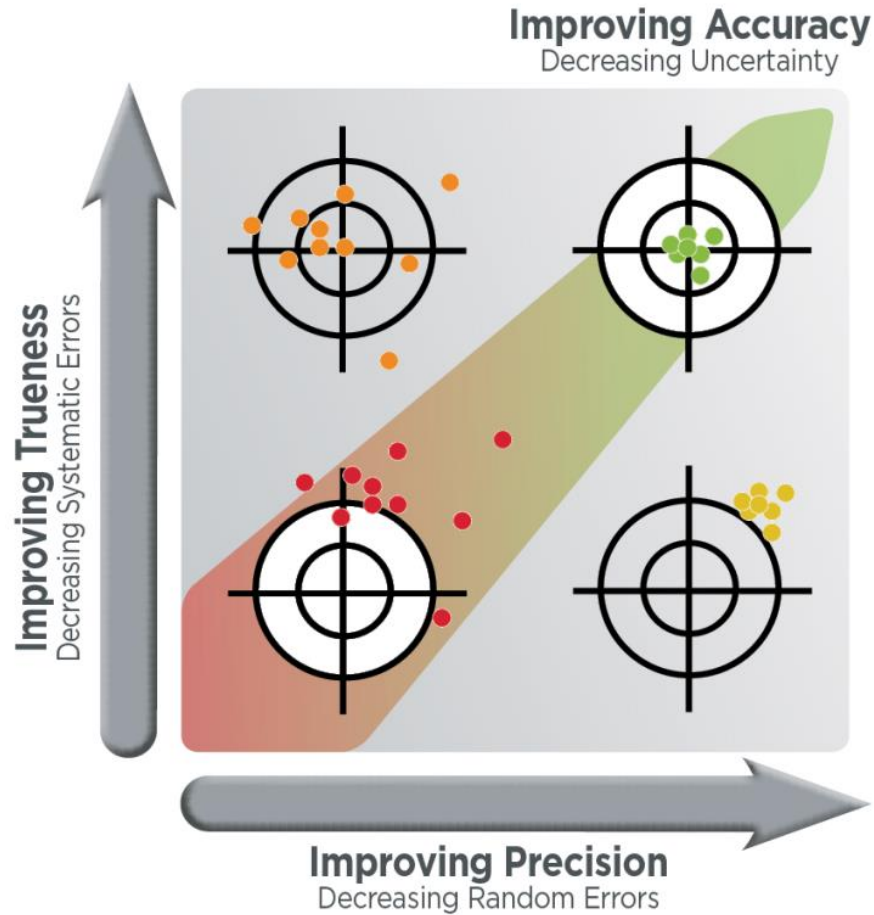
- Temperature – quantitative
- Relative Humidity - quantitative
- Volume Arrangements - categorical

# And six volume arrangements

	Configuration	
Code	Tip Size	Volume
V1	1000	200
V2	200	100
V3	200	25
V4	200	10
V5	50	25
V6	50	10

# And two quantitative responses

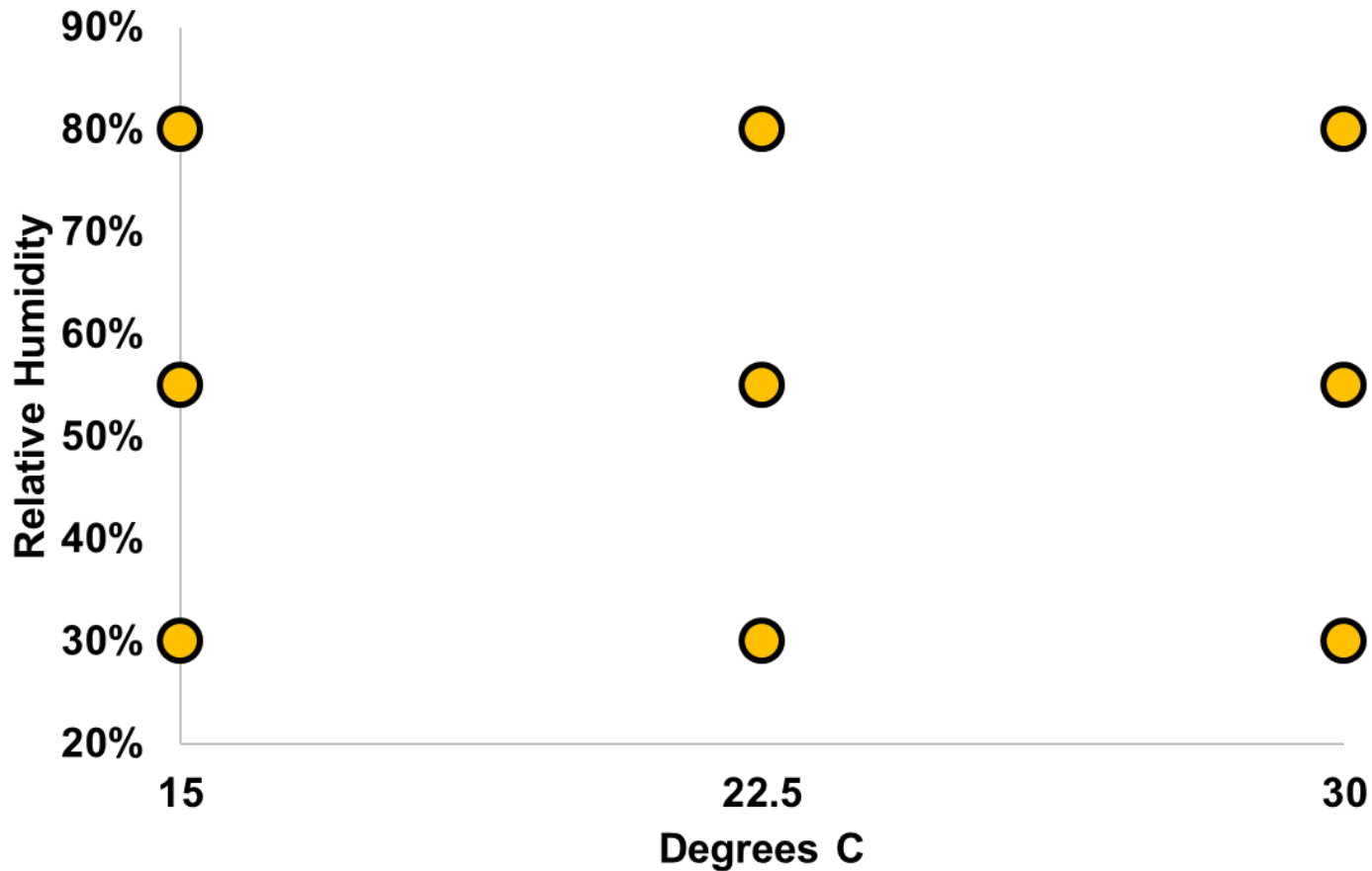
- Precision (percent CV)
- Trueness (percent systematic error)



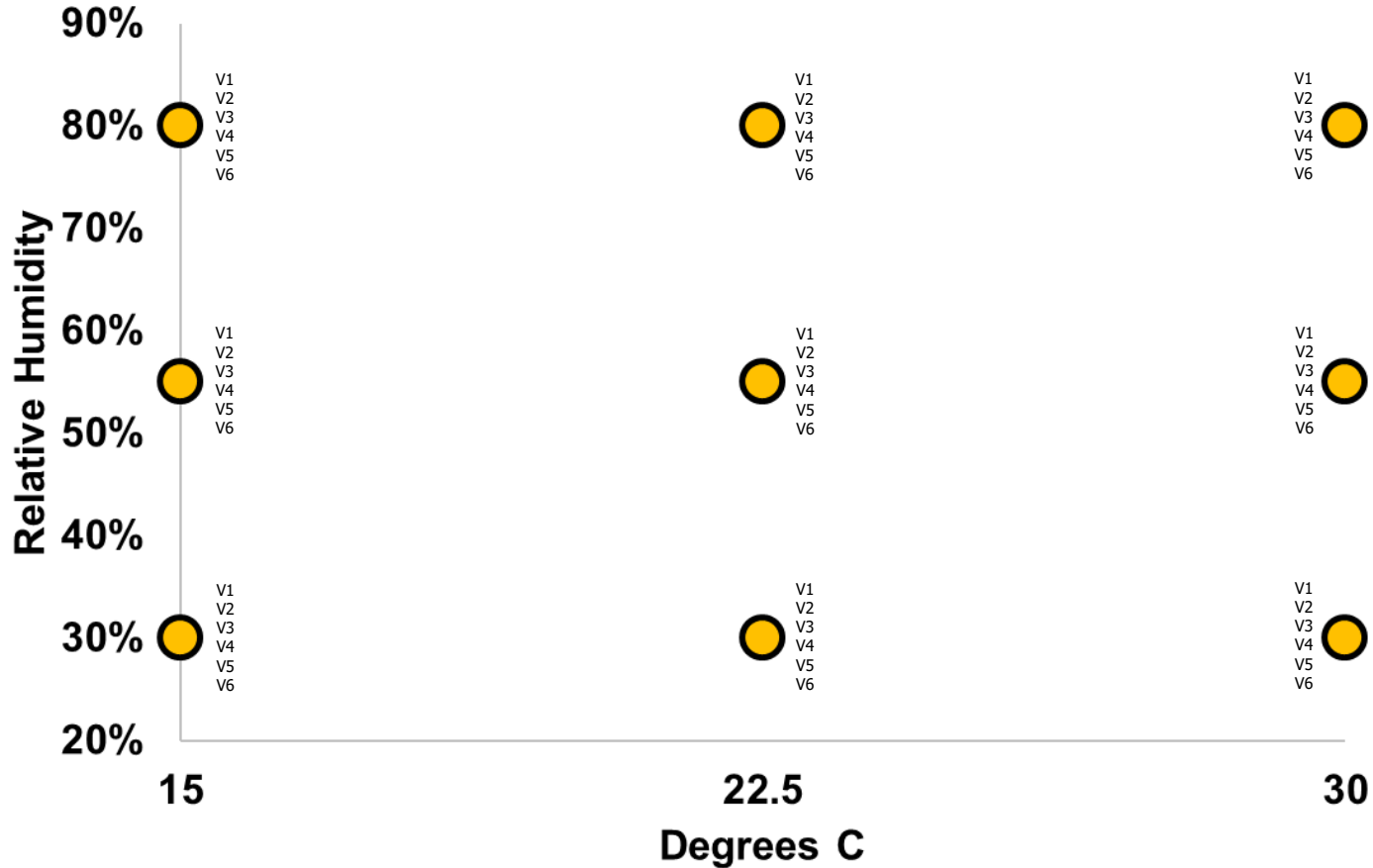
# Nine Environments

- Temperature Three Levels
  - 15, 22.5, 30 °C
- Relative Humidity Three Levels
  - 30, 55, 80 %RH

# Nine Environments

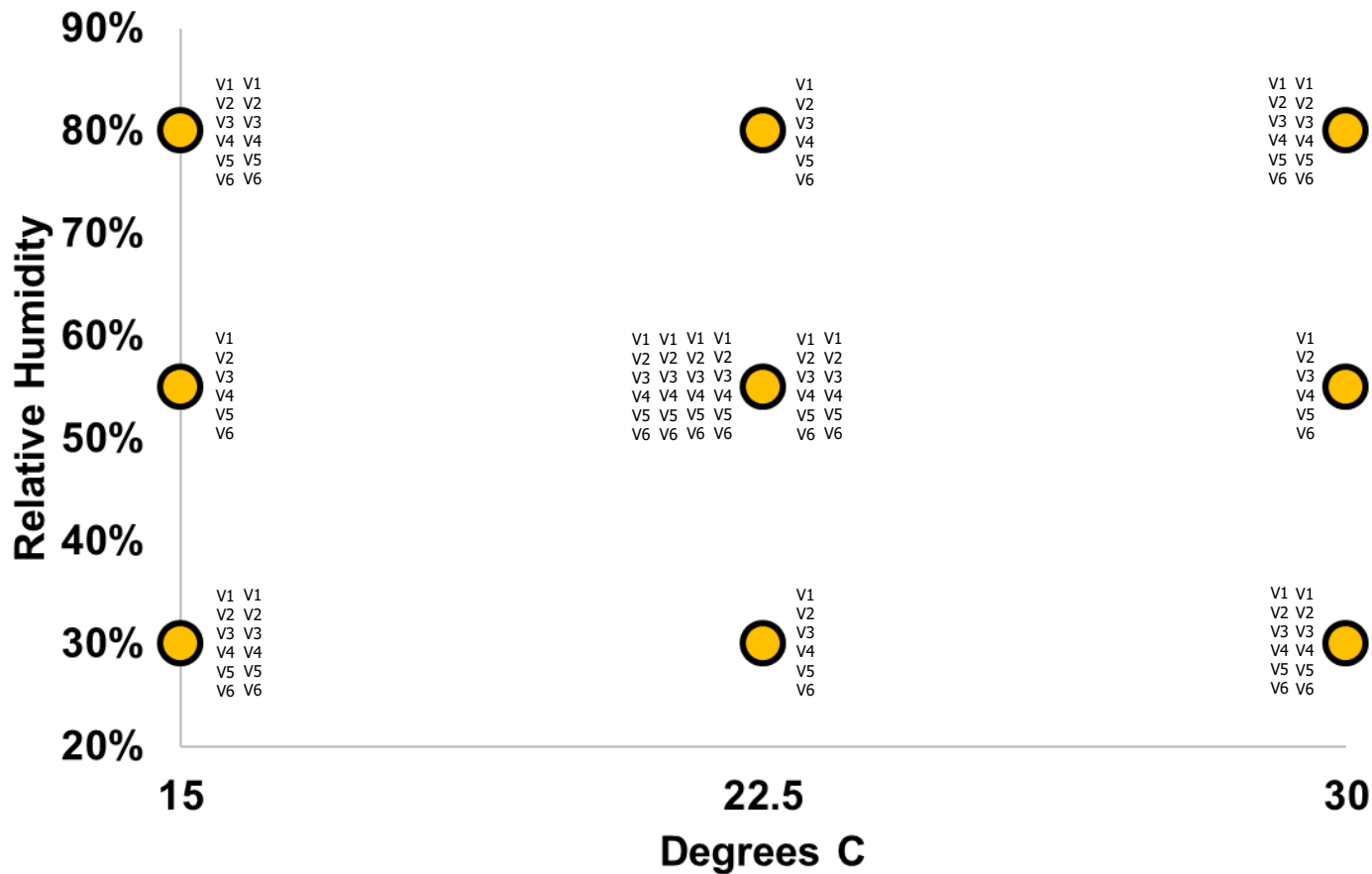


# Six Volumes at Each Environment





# Plus Replicates



# Example of one QC Kit test result

	1	2	3	4	5	6	7	8	9	10	11	12
A	202.3	202.1	202.2	202.6	202.5	202.3	202.7	202.4	201.9	201.9	201.7	199.9
B	203	203.1	202.7	202.5	202.6	202.8	202.4	202.8	202.3	202.5	202.1	202
C	202.2	202.2	202.2	202.4	202.3	202.6	202.4	202.6	202.1	202.4	201.7	202.3
D	201.1	200.6	200.5	200.8	201	200.9	201.3	201.3	201.1	200.7	200.5	200.8
E	201.6	201.5	201.5	201.7	201.9	202.5	202	202	202.1	202.1	201.3	202.5
F	201.6	201.3	201.5	201.7	202.1	202.1	202.6	201.8	201.8	201.6	201.5	202.2
G	202.6	202	201.9	202.8	203.1	202.8	203.1	203.4	202.7	202.9	201.8	203.3
H	201.3	200.9	200.7	201.3	201.2	201.9	201.5	200.9	201.1	201.7	201.3	201.7

## Precision

Std Dev = 0.71  $\mu\text{L}$

CV = 0.35%

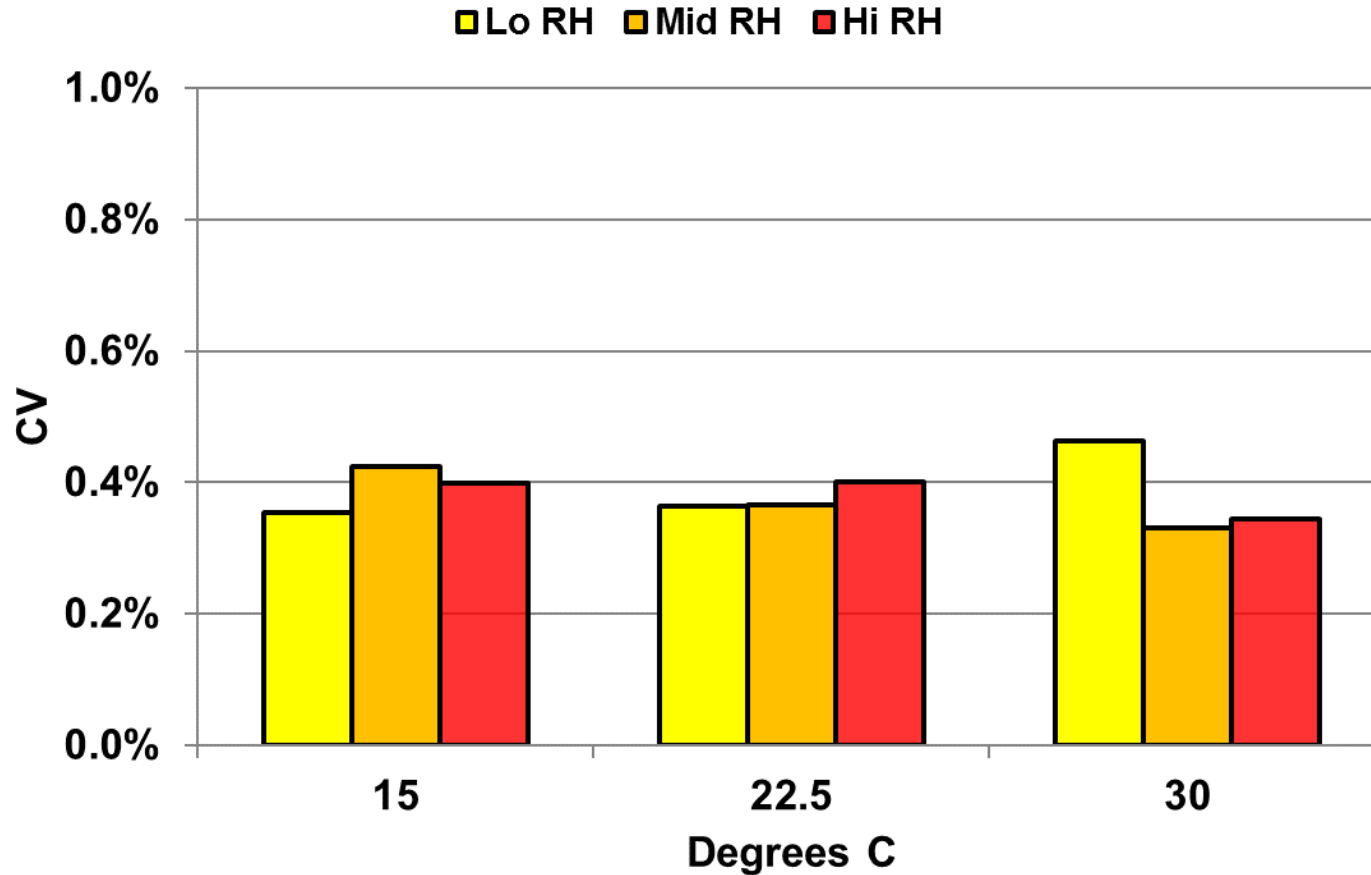
## Trueness

Mean Volume = 201.93  $\mu\text{L}$

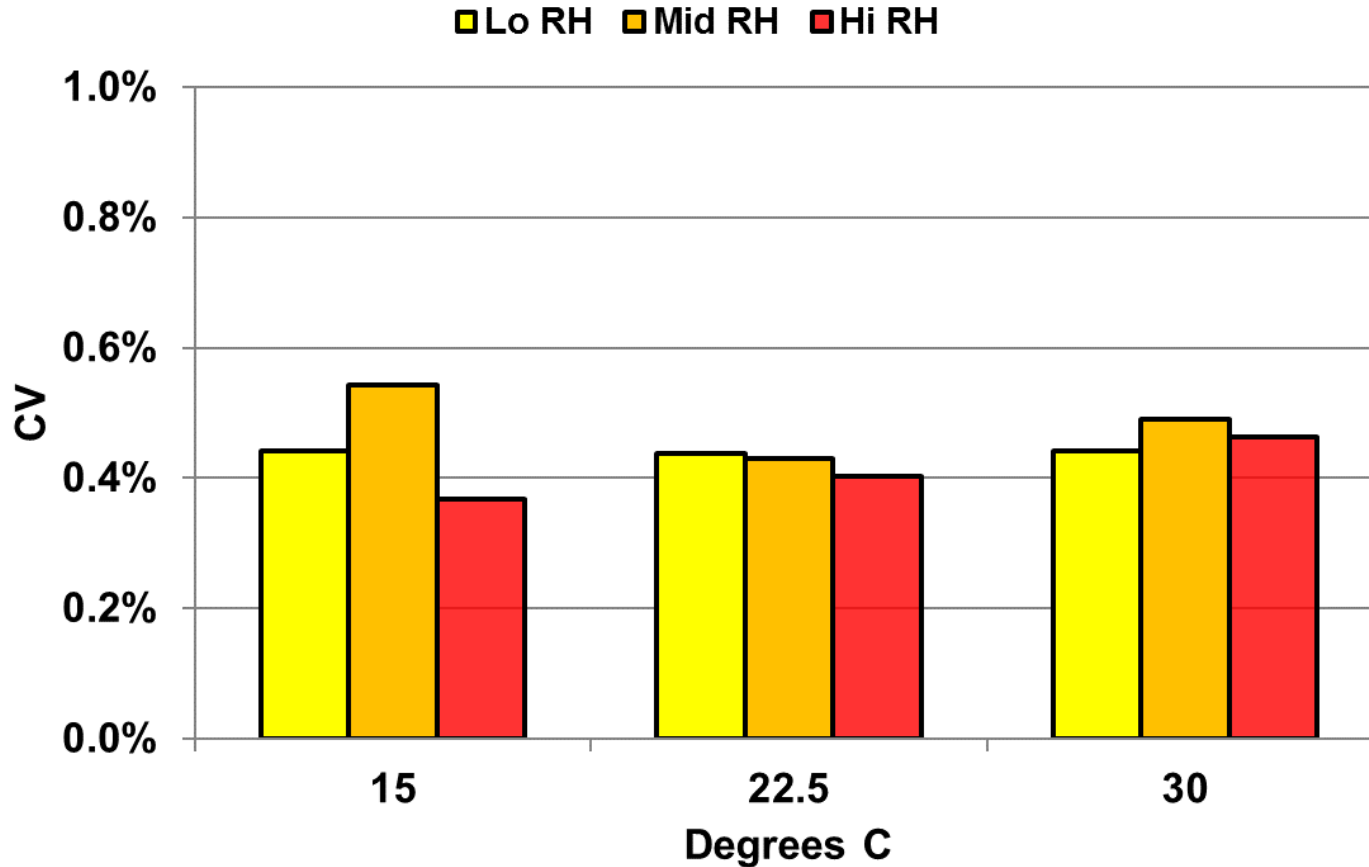
Systematic Error = + 0.97%

# Precision

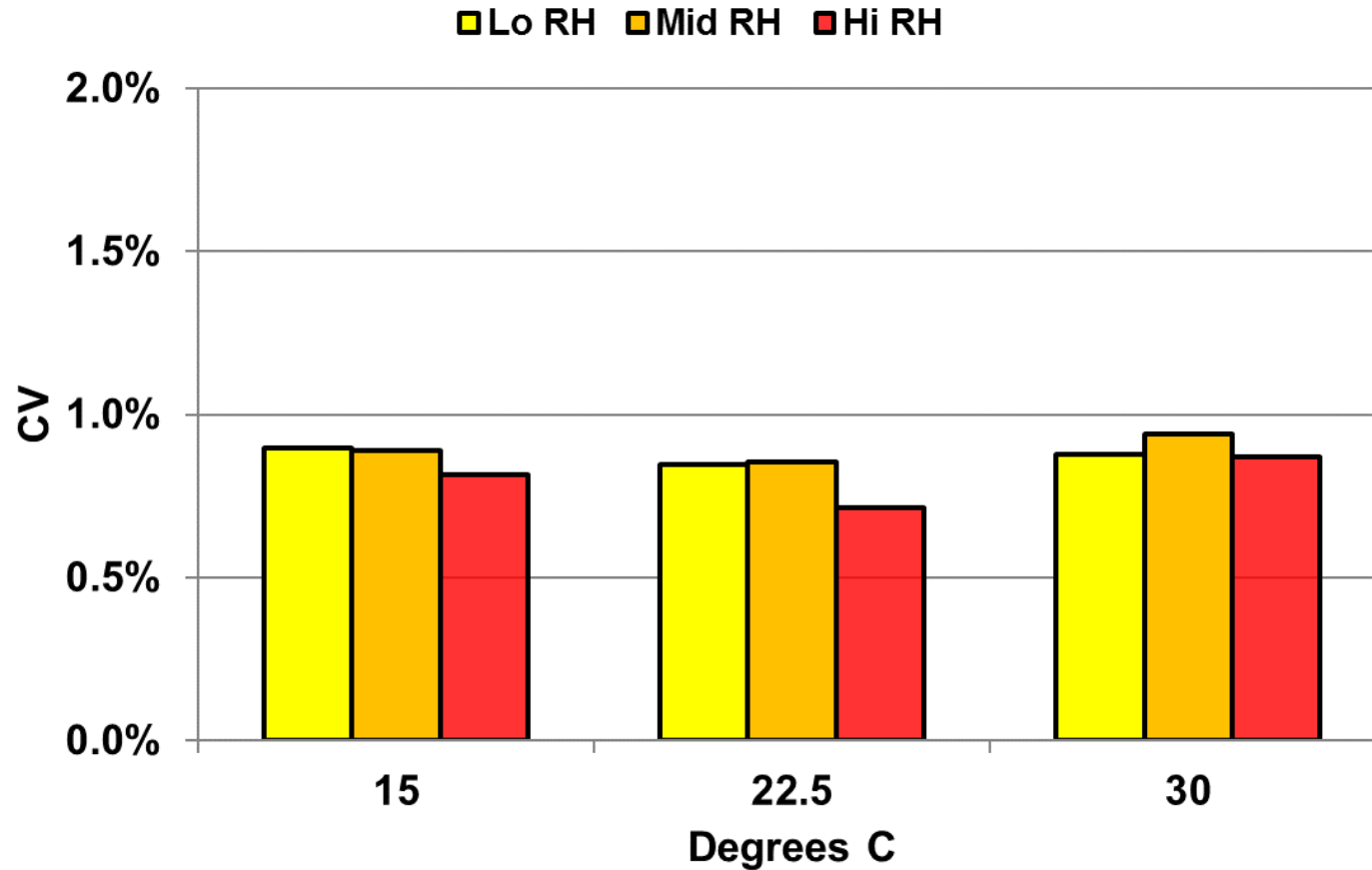
## 1000 $\mu\text{L}$ tips delivering 200 $\mu\text{L}$



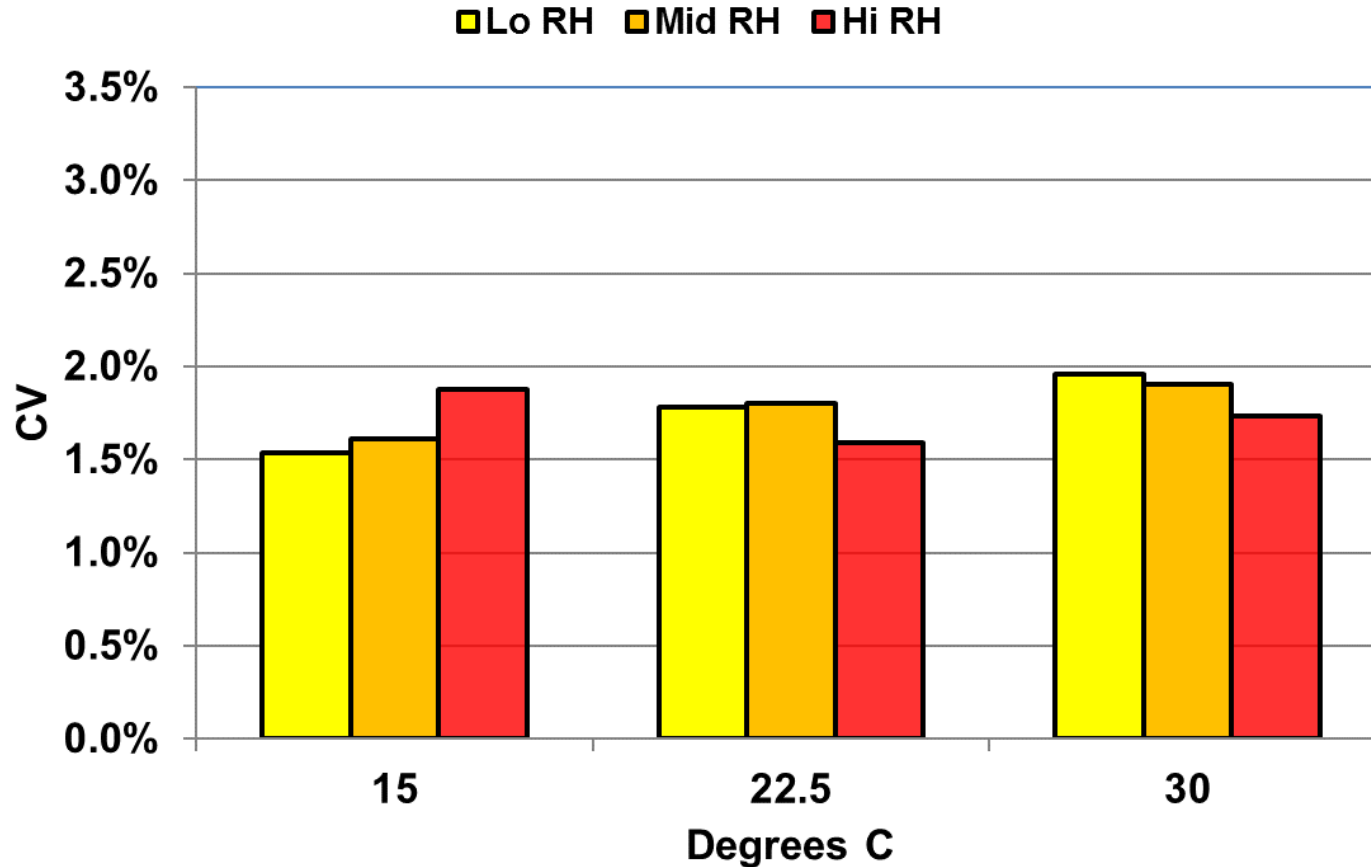
## 200 $\mu\text{L}$ tips delivering 100 $\mu\text{L}$



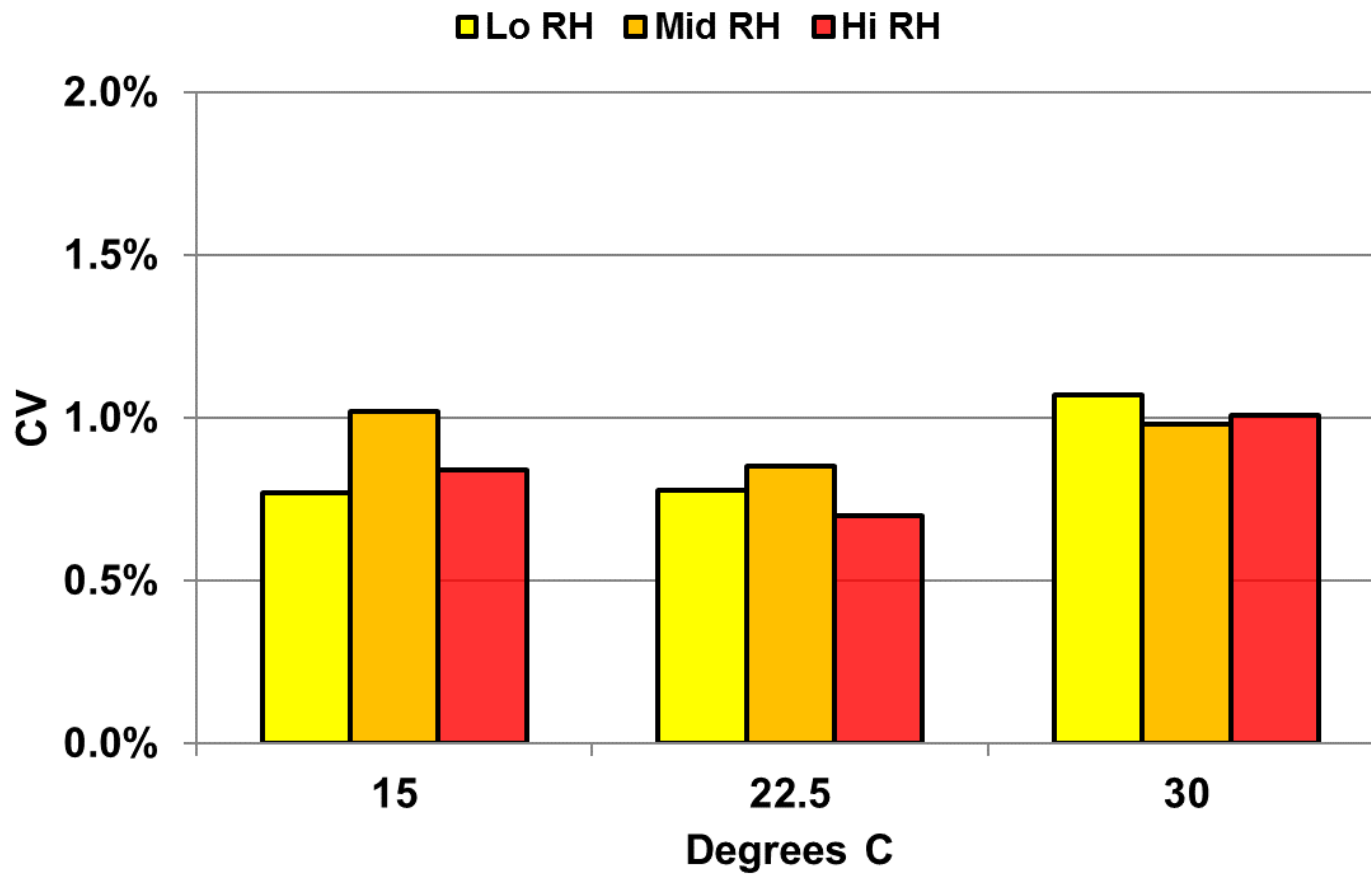
## 200 $\mu$ L tips delivering 25 $\mu$ L



## 200 $\mu$ L tips delivering 10 $\mu$ L

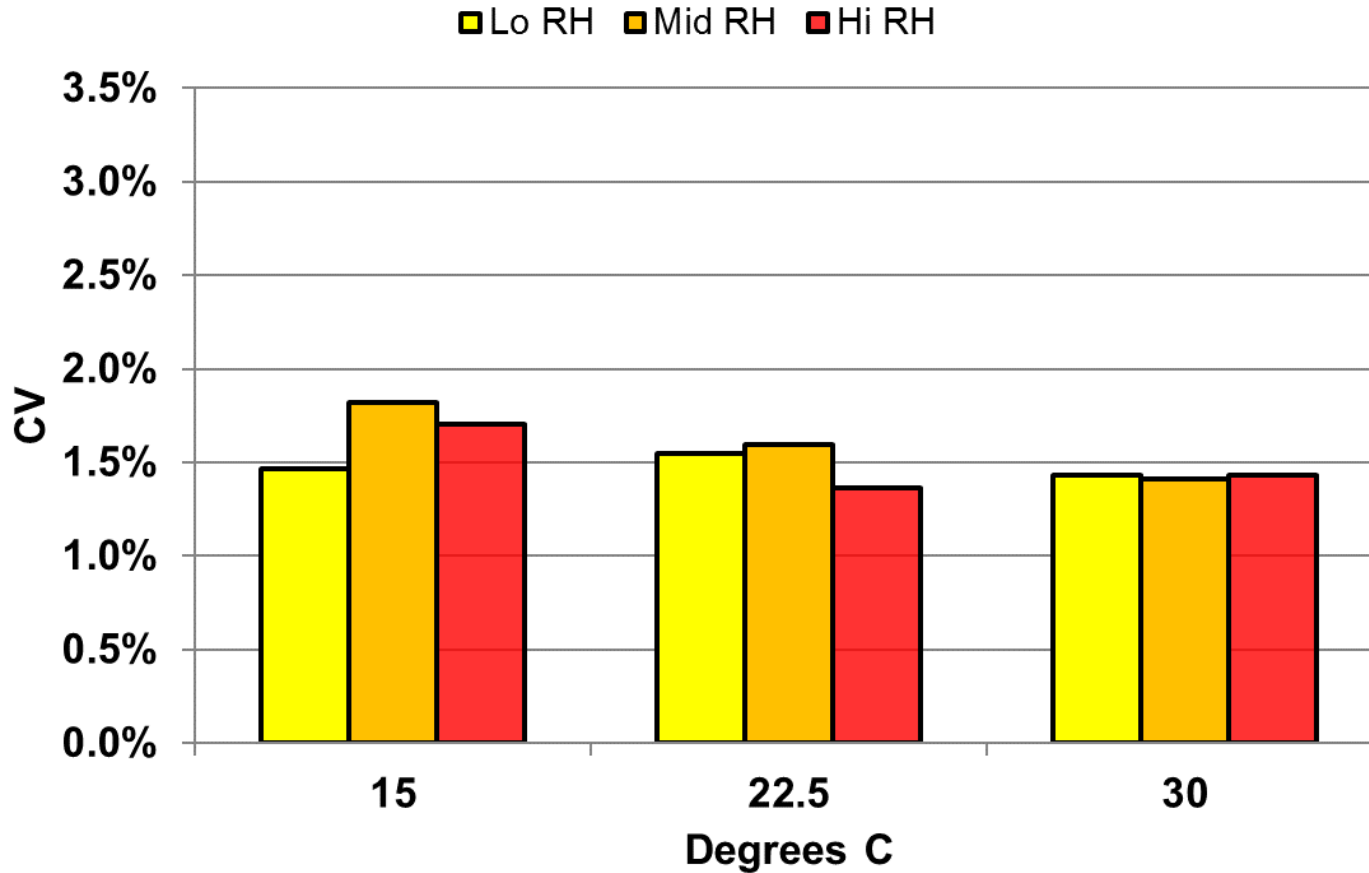


## 50 $\mu\text{L}$ tips delivering 25 $\mu\text{L}$



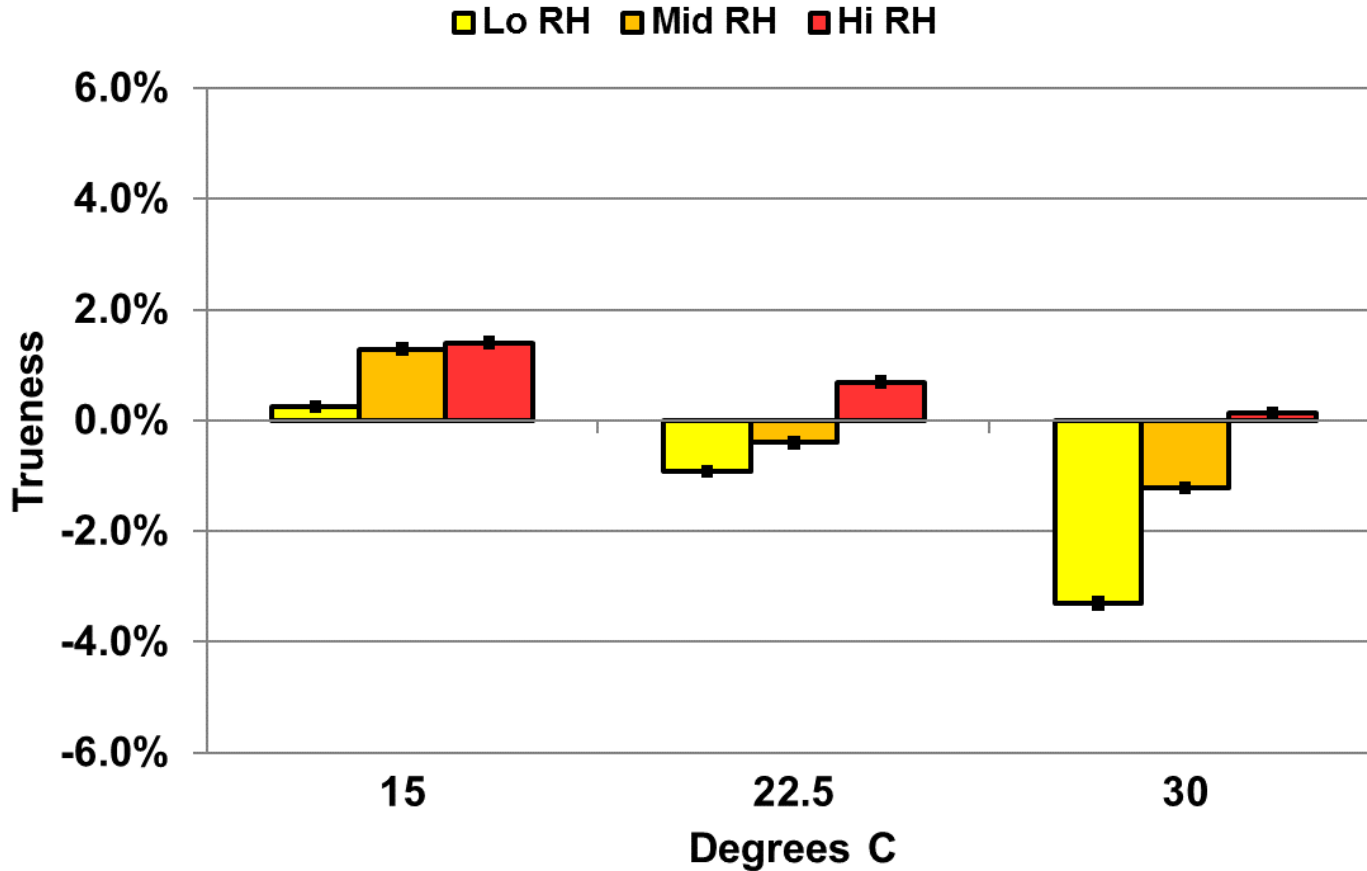


# 50 $\mu\text{L}$ tips delivering 10 $\mu\text{L}$

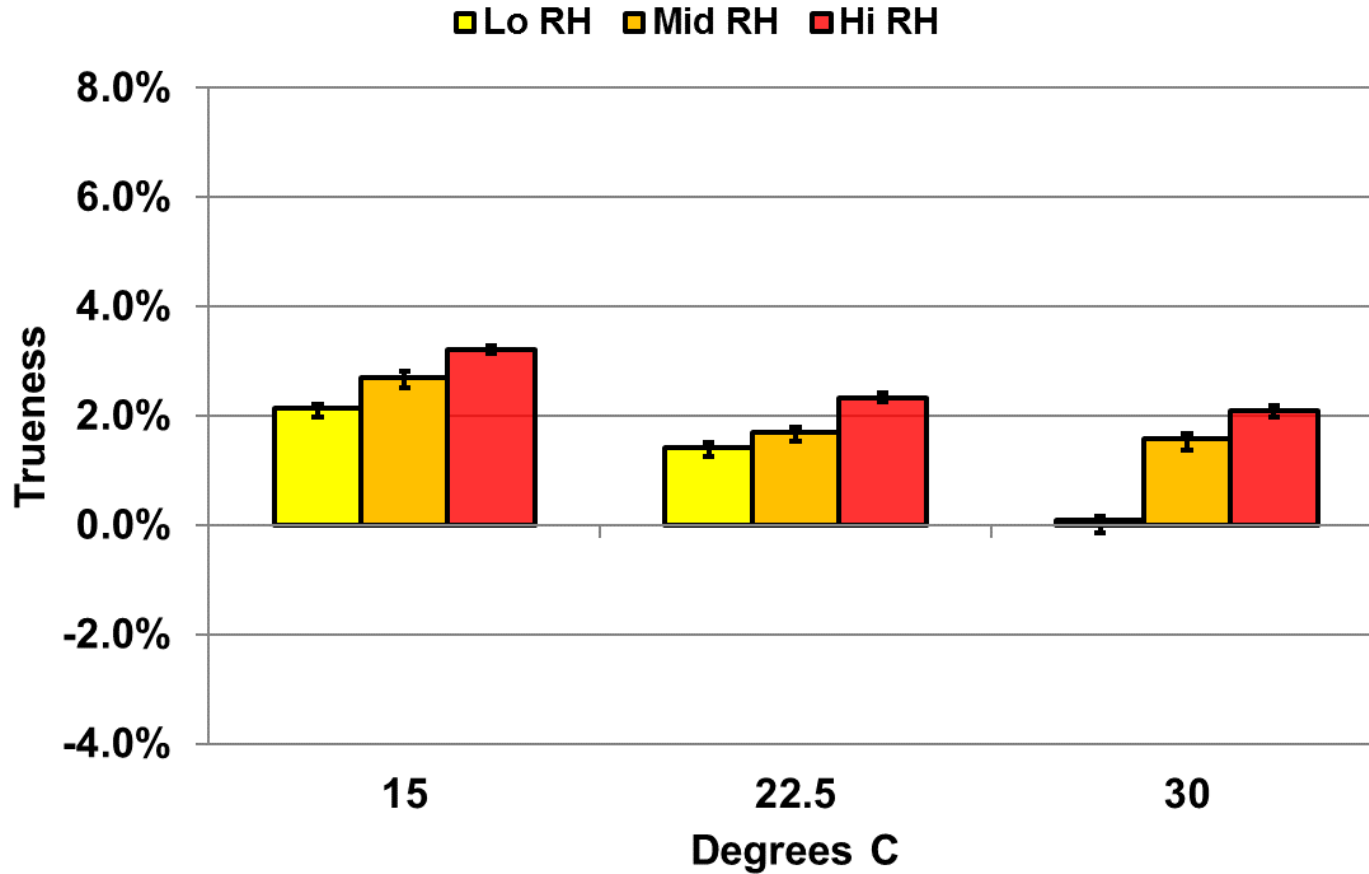


**Trueness**

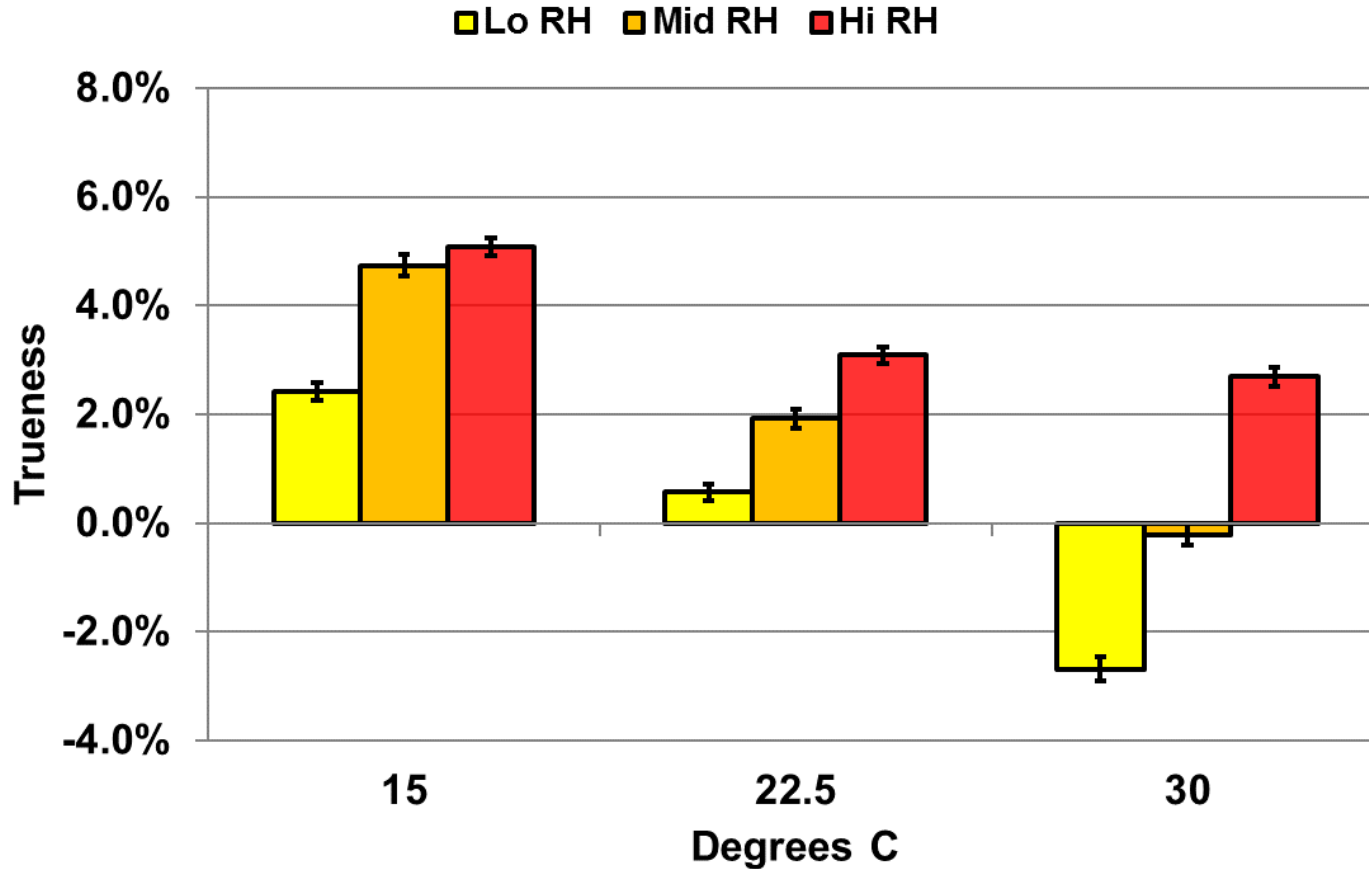
# 1000 $\mu\text{L}$ tips delivering 200 $\mu\text{L}$



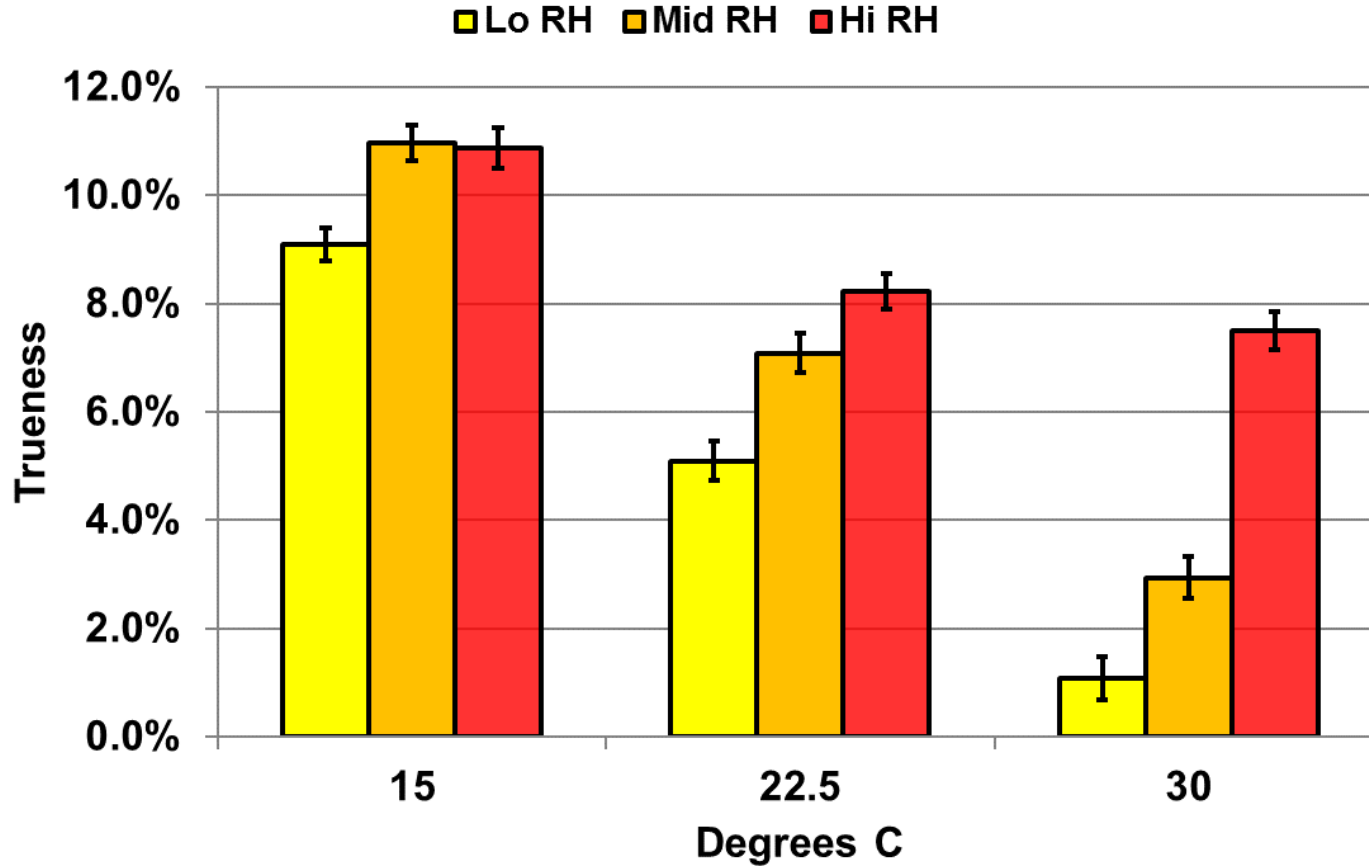
## 200 $\mu\text{L}$ tips delivering 100 $\mu\text{L}$



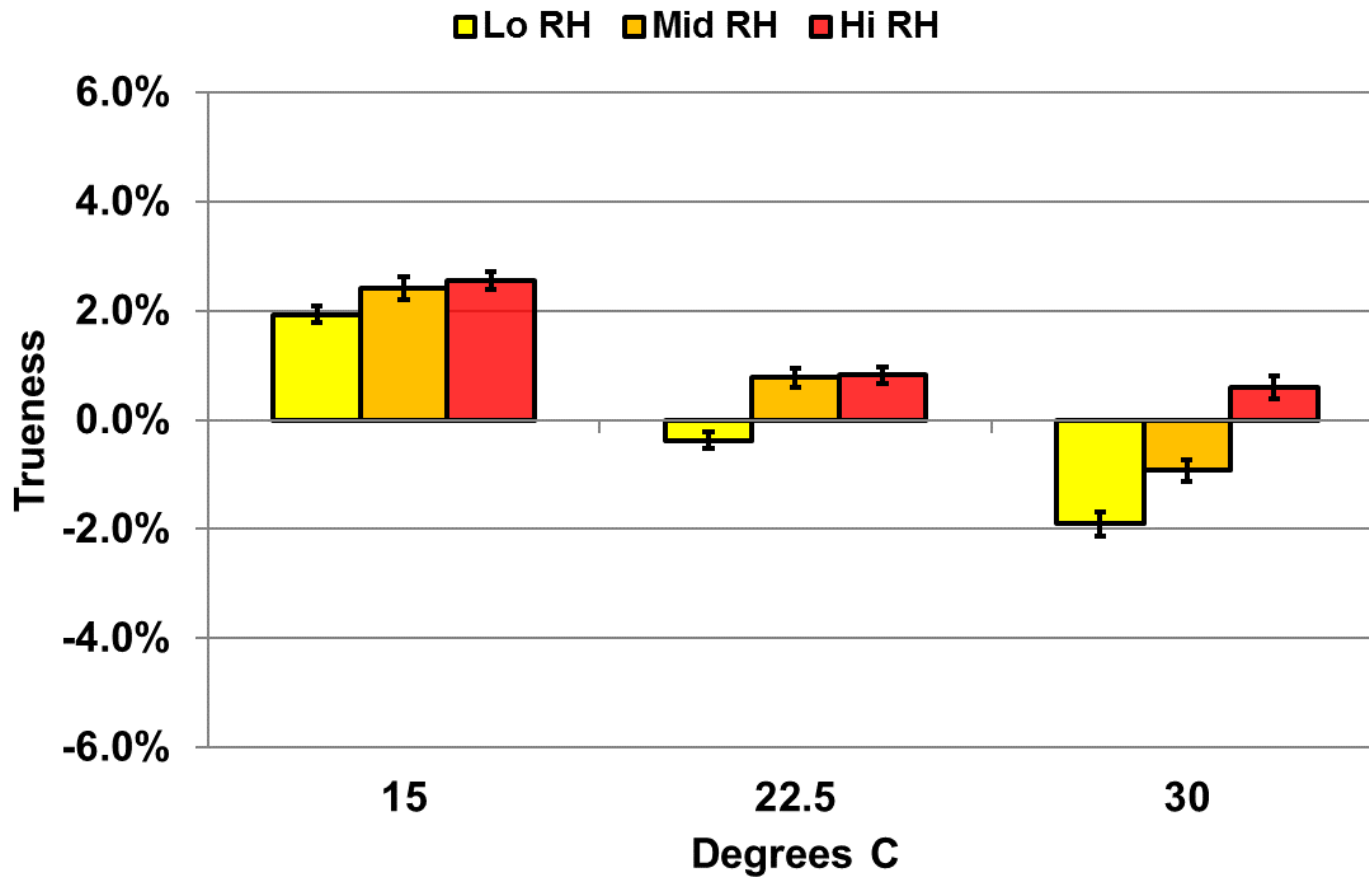
## 200 $\mu$ L tips delivering 25 $\mu$ L



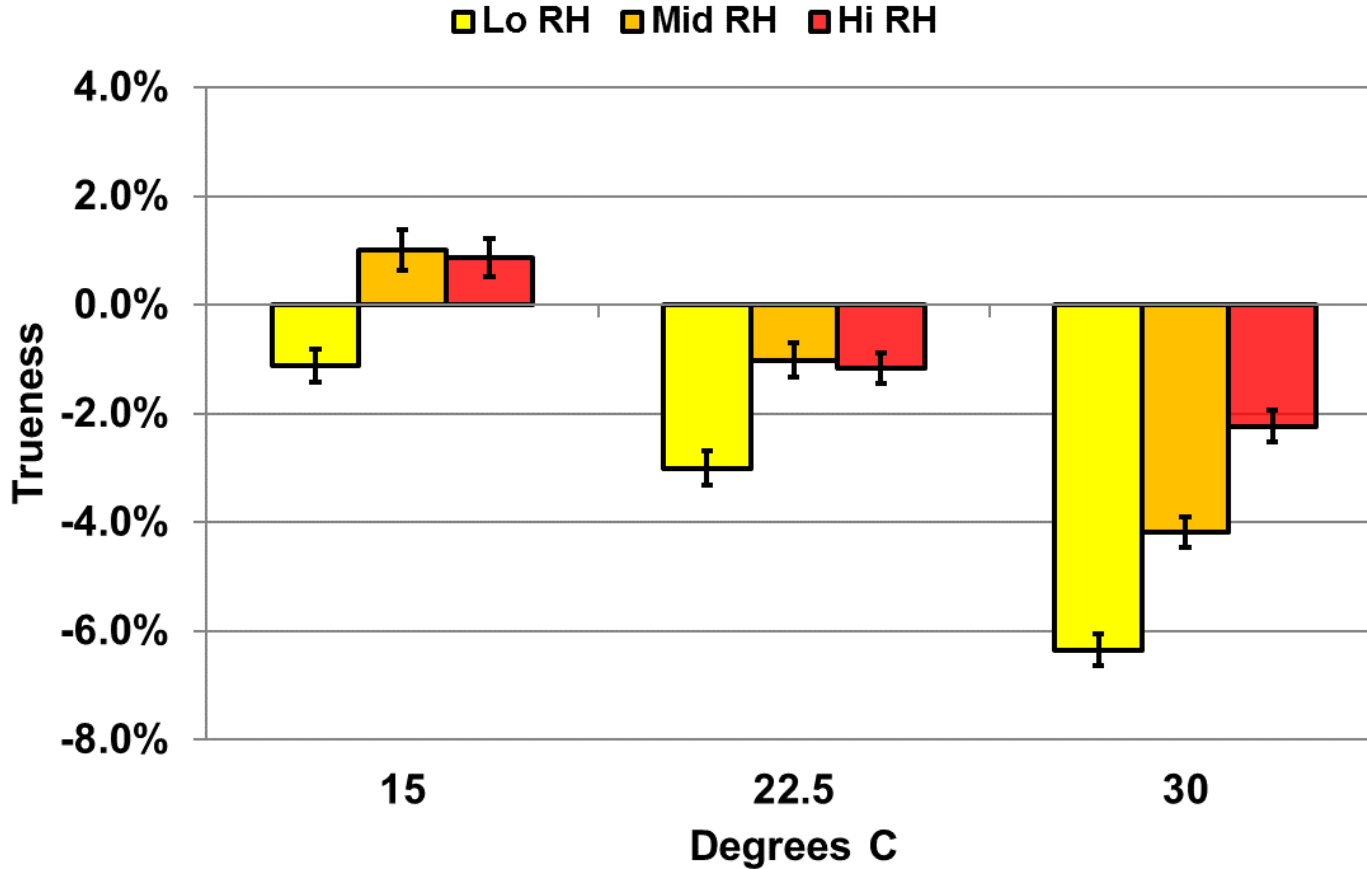
## 200 $\mu$ L tips delivering 10 $\mu$ L



## 50 $\mu$ L tips delivering 25 $\mu$ L



# 50 $\mu\text{L}$ tips delivering 10 $\mu\text{L}$





# Conclusions

Precision was not greatly impacted by temperature and humidity

Trueness changes with temperature and humidity

High Temperature → Less Volume

Low Humidity → Less Volume

Trueness should be optimization under the local environmental conditions

# Thank You

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