

# Quality improvement of Orthodox Rotorvane type of tea through optimization of degree of wither

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# Background

- Tea – Non alcoholic healthy beverage
- Quality and price of high grown tea – determined by Liquor Color, Strength, brightness of Infused leaf and the blackness of made tea
- Price and quality of tea – assessed by the tasters' evaluation
- Quality of tea also can be assessed by chemically (estimation of TF & TR contents) except in flavor season
- Black tea processing – withering is very important unit operation as far as quality & cost factors are concerned



# Background

- Most upcountry and certain Uva factories – Orthodox & RV mix type of manufacture and the trend was to produce 30 – 40% BOP.
- Now produce higher % of small grades - several RV passes and also due to severe rolling of the RV machine – generate more heat as well.
- Therefore factories have deviated from the recommended degree of wither 45% to softer wither.
- Study was carried out to determine the most suitable degree of wither for the present style of Orthodox & RV manufacture.



# Objectives

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1. To study quality characteristics of tea with respect to appearance and liquoring properties of tea at different degrees of wither
2. To determine the most suitable degree of wither having the best quality character



# Materials & Methods (Miniature scale)

- Study was conducted - two different scales
  1. Miniature
  2. Commercial
- 5kg of green leaves with average about 68% good leaf standard were plucked from St. Coombs estate.
- Bulk was divided into five fractions. Each fraction was withered using Environment controlling chamber up to following degrees of wither.



# Materials & Methods (Miniature scale) *contd.*

## Withering

➤ Fraction	D/wither (%)
F1	36
F2	40
F3	43
F4	45
F5	47

$$\text{Degree of wither} = \frac{\text{MT}}{\text{WL}} \times 100$$



# Materials & Methods (Miniature scale) *contd.*



Rolling



Hand sieve  
(2.5 mm)



Dhool extraction



ECM chamber

Fermentation

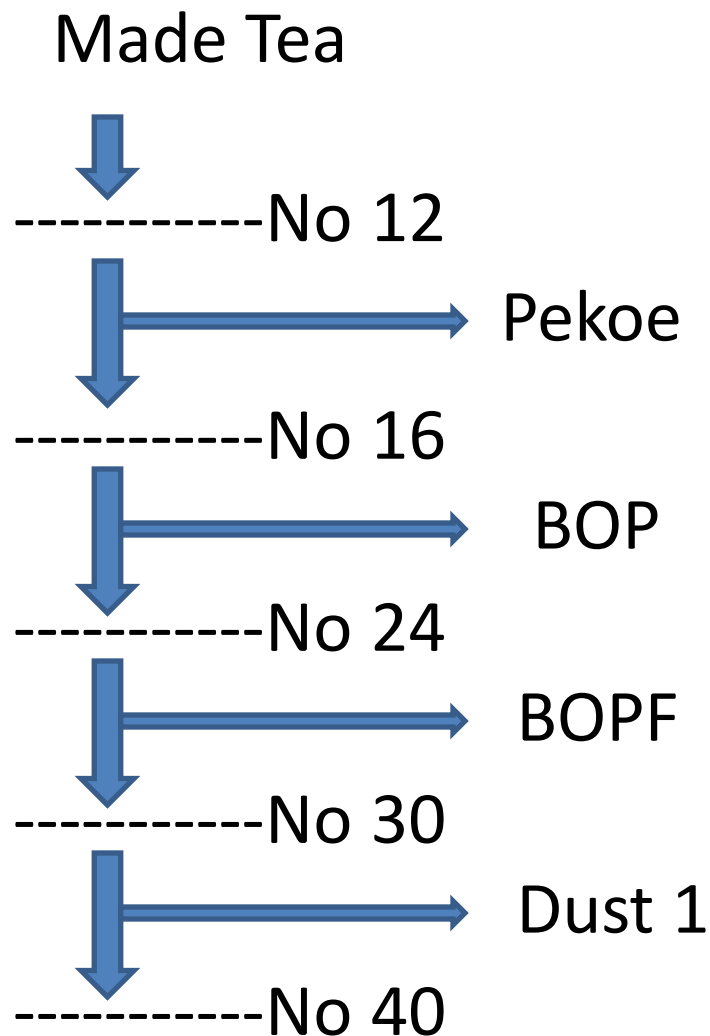
Fermented dhool

Firing



# Materials & Methods (Miniature scale) *contd.*

## Grading & Packing



# Materials & Methods (Miniature scale) *contd.*

- Graded tea samples produced at five different degrees of wither were analyzed for chemical quality parameters and organoleptic assessment.
- Five replicates were conducted.
- Data were statistically analyzed.



# Results – Miniature Experiment

Characteristics	Grade	Degree of wither (%)					LSD (p = 0.05)
		36	40	43	45	47	
Blackness of graded tea	BOP	3.66 $a$	3.92 $a$	3.72 $a$	3.85 $a$	3.68 $a$	ns
	BOPF	3.73 $a$	4.43 $a$	3.67 $a$	4.02 $a$	3.73 $a$	ns
	Dust 1	3.72 $ab$	4.33 $a$	3.55 $ab$	3.95 $ab$	3.42 $b$	0.1768
Liquor color	BOP	3.00 $b$	3.20 $ab$	3.30 $ab$	3.40 $ab$	3.60 $a$	0.1971
	BOPF	3.10 $a$	3.40 $a$	3.50 $a$	3.60 $a$	3.50 $a$	ns
	Dust 1	3.10 $a$	3.20 $a$	3.50 $a$	3.30 $a$	3.40 $a$	ns
Liquor strength	BOP	3.30 $a$	3.60 $a$	3.50 $a$	3.60 $a$	3.80 $a$	ns
	BOPF	3.50 $b$	3.80 $ab$	4.10 $ab$	4.20 $a$	4.10 $ab$	0.1599
	Dust 1	3.90 $a$	4.50 $a$	4.30 $a$	4.50 $a$	4.60 $a$	ns

**Note: Results were calculated based on tasters' score data**

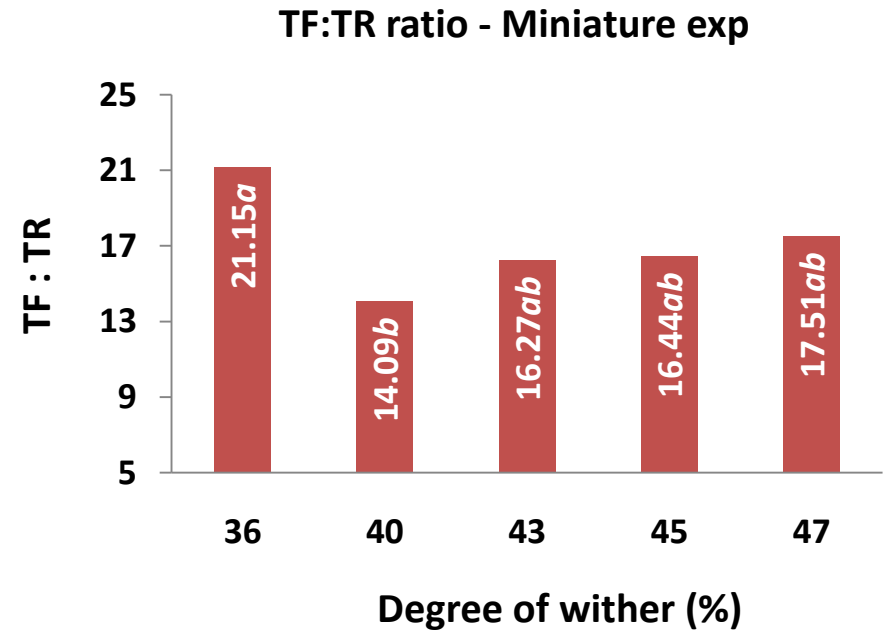
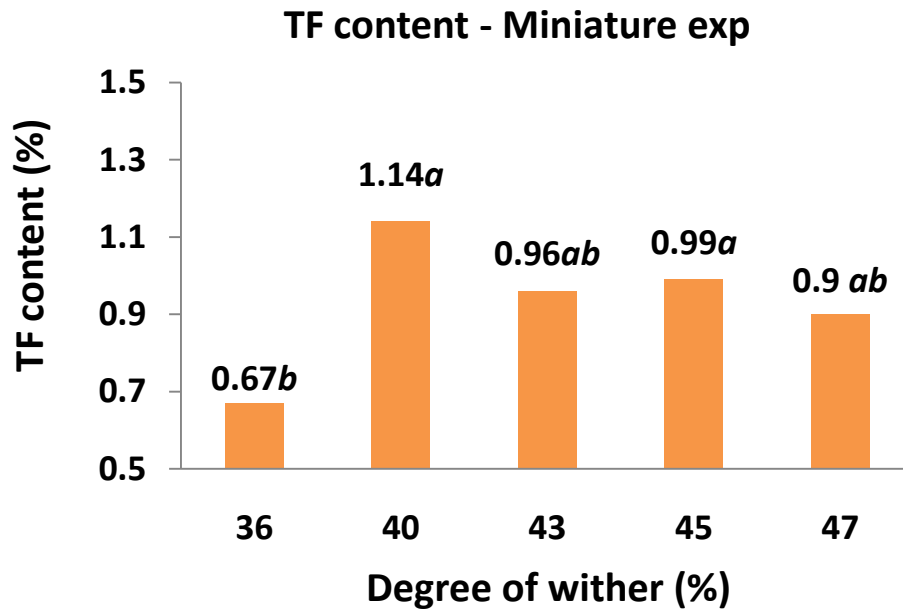


# Results – Miniature Experiment *contd.*

Tea Character	Grade	Degree of wither (%)					LSD (p = 0.05)
		36	40	43	45	47	
Liquor quality	BOP	4.50 $a$	5.10 $a$	4.80 $a$	5.10 $a$	4.70 $a$	ns
	BOPF	4.40 $a$	5.00 $a$	4.70 $a$	4.90 $a$	5.10 $a$	ns
	Dust 1	4.60 $b$	5.40 $a$	4.90 $ab$	5.00 $ab$	4.80 $ab$	0.1693
Overall quality	BOP	18.07 $a$	19.52 $a$	18.98 $a$	19.45 $a$	19.22 $a$	ns
	BOPF	18.47 $b$	20.37 $a$	19.63 $ab$	20.32 $a$	19.87 $ab$	0.0492
	Dust 1	19.05 $c$	21.03 $a$	20.22 $ab$	20.55 $ab$	19.85 $bc$	0.0120

Note: Results were calculated based on tasters' score data

# Results – Miniature Experiment *contd.*



# Results – Miniature Experiment *contd.*

**Table 1: Percentages of three main grades**

Grade	Degree of wither (%)				
	36	40	43	45	47
<b>BOP</b>	21	21	23	20	23
<b>BOPF</b>	40	42	39	39	38
<b>Dust 1</b>	30	25	27	25	26

- No considerable variation of grade % for five different degrees of wither



# Conclusion – Miniature experiment

- Based on the above results it can be concluded that tea produced at 36% and 47% degrees of wither were in poor quality for three different grades.
- Therefore commercial scale experiment was designed by omitting these two extreme degrees of wither.



# Commercial experiment



# Materials & Methods

- Three withering troughs (58' x 6') were selected to study the commercial scale experiment.
- 800kg GL were loaded to each trough. For different trials leaf standard was varied 55 – 60%.
- Each trough was withered to achieve the following degrees of wither by intermittent checking of moisture using MW – oven.  
T1 = 40%;      T2 = 43%;      T3 = 45%
- First batch of each trough was manufactured according to Orthodox & RV mix type of processing.





Dhool extract  
through mesh  
No 7, 7, 8



1<sup>st</sup> Dhool

2<sup>nd</sup> Dhool

3<sup>rd</sup> Dhool



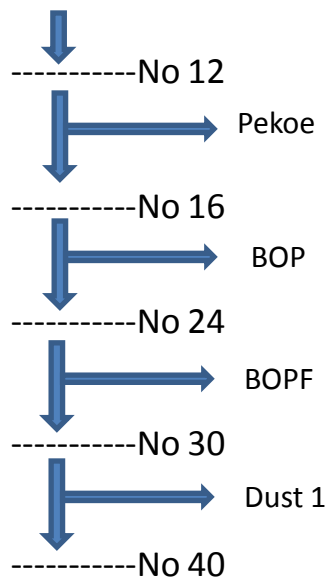


Fermentation

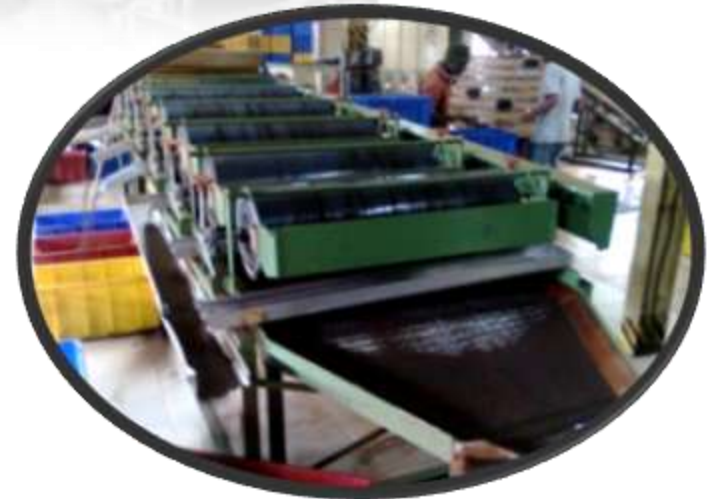


Drying

Made Tea



Grading



# Materials & Methods (commercial scale)

- Graded tea samples were packed & coded and sent for tasters' evaluation.
- Graded tea samples were analyzed chemically to determine TF & TR contents.
- Three replicates were conducted.
- Data were analyzed statistically.



# Results – Wet dhool

Table 2. Wet Dhool % for three different degrees of wither

Degree of wither (%)	Wet dhool %				
	1 <sup>st</sup> dhool	2 <sup>nd</sup> dhool	3 <sup>rd</sup> dhool	4 <sup>th</sup> dhool	BB
40	9	11	23	39	18
43	12	9	31	30	18
45	22	29	26	9	14

- 1<sup>st</sup> and 2<sup>nd</sup> dhool % have increased from 40% to 45% degree of wither.
- 4<sup>th</sup> dhool % has decreased from 40% to 45% degree of wither.

# Results – Main grades

Table 3. Main grades & off grades % for three different degrees of wither

Degree of wither (%)	Graded tea %				
	BOP	BOPF	Dust 1	Pekoe	Off grade
40	7	34	43	1	15
43	7	36	42	1	14
45	10	30	44	1	15

➤ No substantial variation of grade %



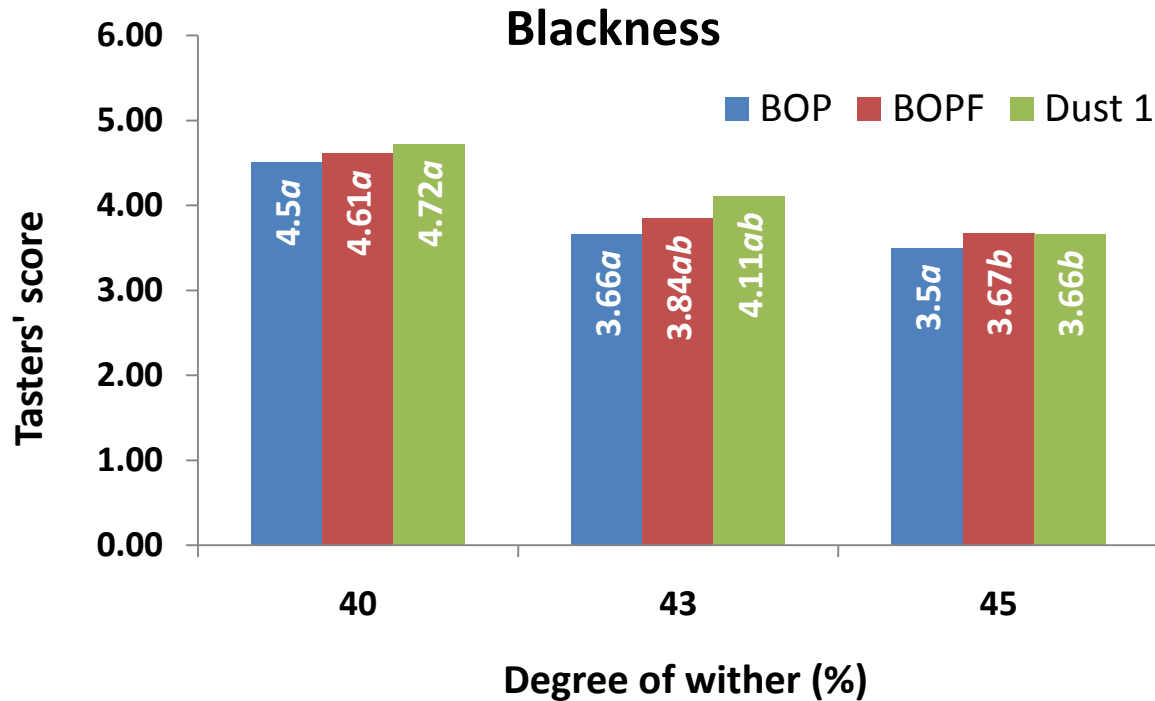
# Results – Prices

Table 4. Prices of main grades for three different degrees of wither

Degree of wither (%)	Price (Rs. /kg)			
	BOP	BOPF	Dust 1	NSA
40	326.70	326.70	398.30	363.50
43	315.00	320.00	385.00	351.70
45	307.50	317.50	376.70	347.00



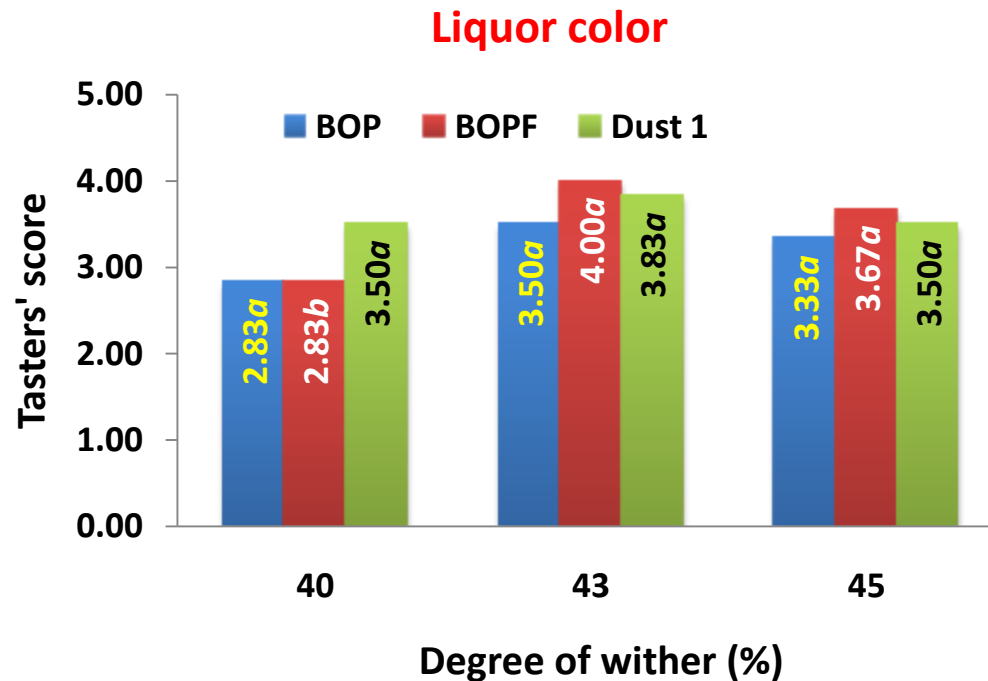
# Results – Blackness



**Fig 1.** Blackness of three grades for three different degrees of wither

- Significantly higher blackness was achieved for BOPF and Dust 1 when the degree of wither is 40%.

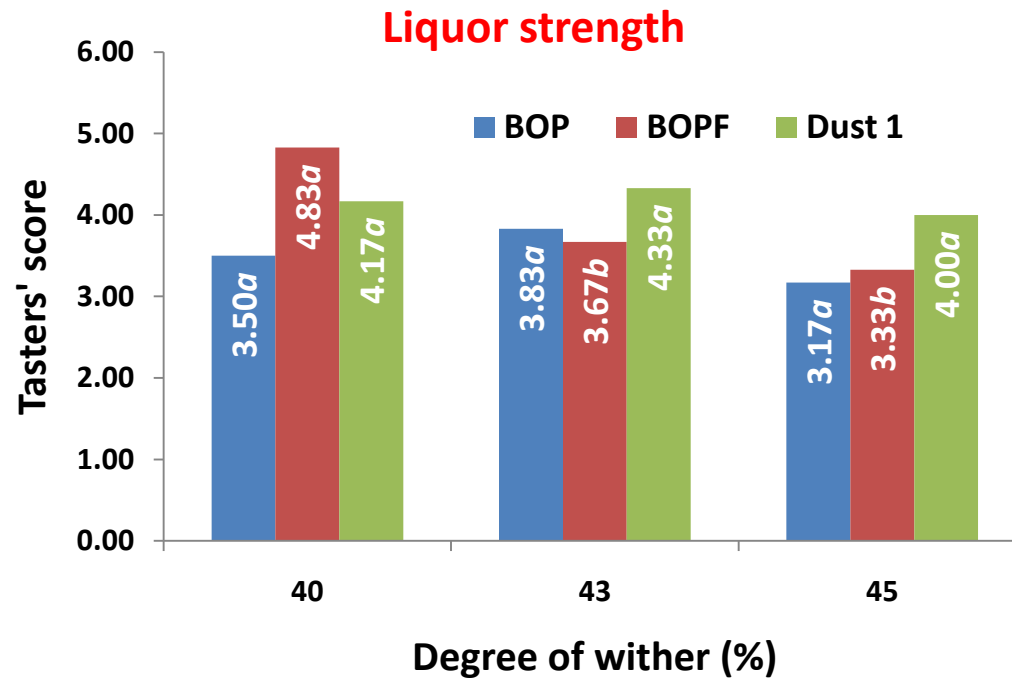
# Results – Liquor color



**Fig 2.** Liquor color of three main grades for three different degrees of wither

- Significantly higher liquor color was achieved for BOPF when the degree of wither were 43 and 45%.

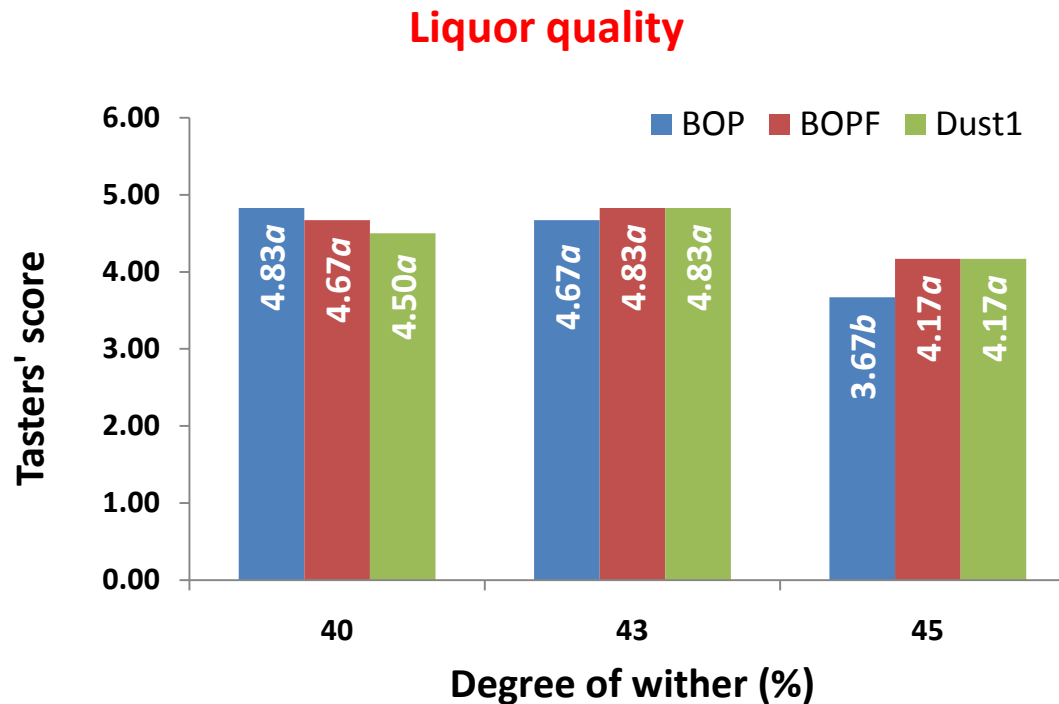
# Results – Liquor strength



**Fig 3.** Liquor strength of three different degrees of wither

- Significantly higher liquor strength was achieved for BOPF when the degree of wither is 40%.

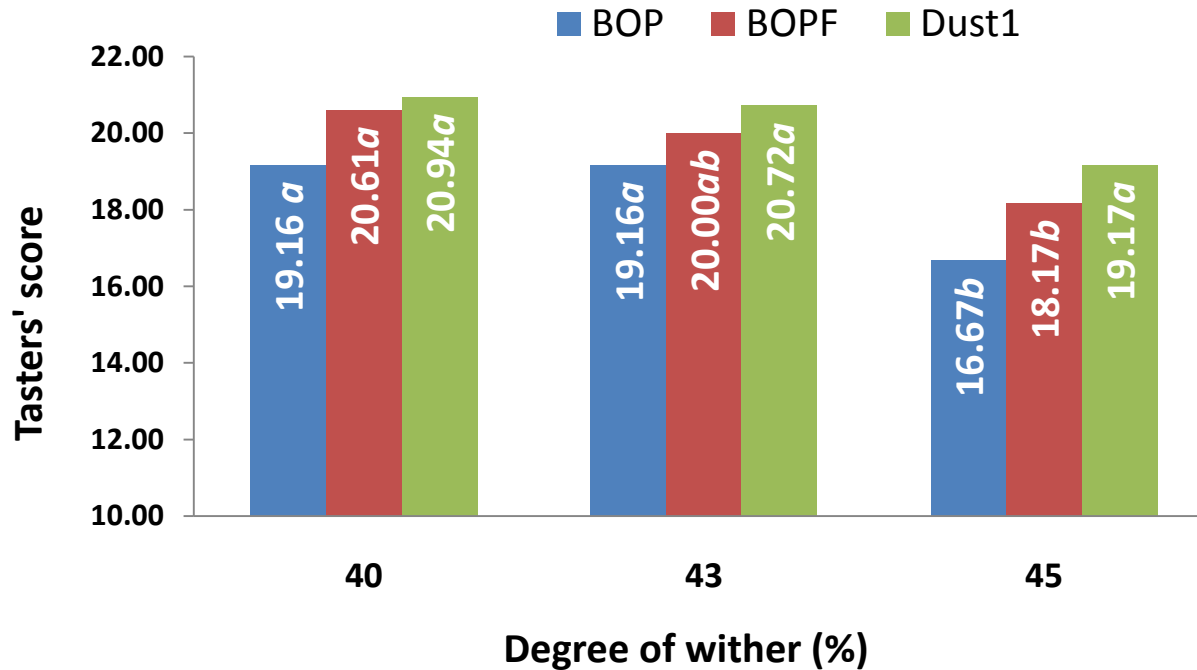
# Results – Liquor quality



**Fig 4.** Liquor quality of three different degrees of wither

- Significantly higher liquor quality was achieved for BOP when the degree of wither is 40 and 43%.

# Results – Total quality



**Fig 5.** Total quality of three main grades for three different degrees of wither

- Significantly higher total quality was achieved for BOPF when the degree of wither is 40 %.

# Results – TF content and TF:TR

Table 5. Theaflavins content and TF : TR of graded tea

Degree of wither (%)	Tea grade					
	BOP		BOPF		Dust 1	
	TF	TF:TR	TF	TF:TR	TF	TF:TR
40	1.12 $a$	1:12 $a$	1.10 $a$	1:14 $a$	1.17 $a$	1:15 $a$
43	1.06 $a$	1:15 $a$	1.08 $a$	1:15 $a$	1.08 $ab$	1:17 $ab$
45	1.02 $a$	1:16 $a$	1.04 $a$	1:16 $a$	1.00 $b$	1:18 $b$

- Significantly higher TF content was achieved for BOPF and Dust 1 when the degree of wither was 40%.
- Significantly lower TF : TR was achieved for Dust 1 when the degree 40%



# Conclusions

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Therefore controlling degree of wither between 40 – 43% would be more beneficial to produce better quality orthodox + RV type of tea.



**Thank you**



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