Science Trial Report – Apples – Kashmir 2023

Time

- March-November 2023.

Locations

The trial was conducted in the following orchards in Kashmir, India:

1. Anantnag..... elevation 4874 ft (1486 m)
2. Shopian..... elevation 6749 ft (2057 m)
3. Pulwama ..... elevation 5350 ft (1631 m)
4. Ganderbal ..... elevation 5312 ft (1619 m)
5. Kangan ..... elevation 5940 ft (1811 m)
6. Shalimar..... elevation 4679 ft (1426 m)
7. Kreeri ..... elevation 3680 ft (1122 m)
8. Bandipora..... elevation 6892 ft (2101 m)
9. Hajin ..... elevation 7123 ft (2171 m)
10. Control ..... elevation 5378 ft (1639 m)

Crop

- Organic apples.

Species

- Apples native to the Jammu & Kashmir union territory.

Irrigation Type

- Drip irrigation
- Single emitter per tree stem.

Goal of Trial

The trial was aimed to test, verify and measure the effects of Kyminasi Plants – Crop Booster (KPCB) on organic apple trees.

Setup

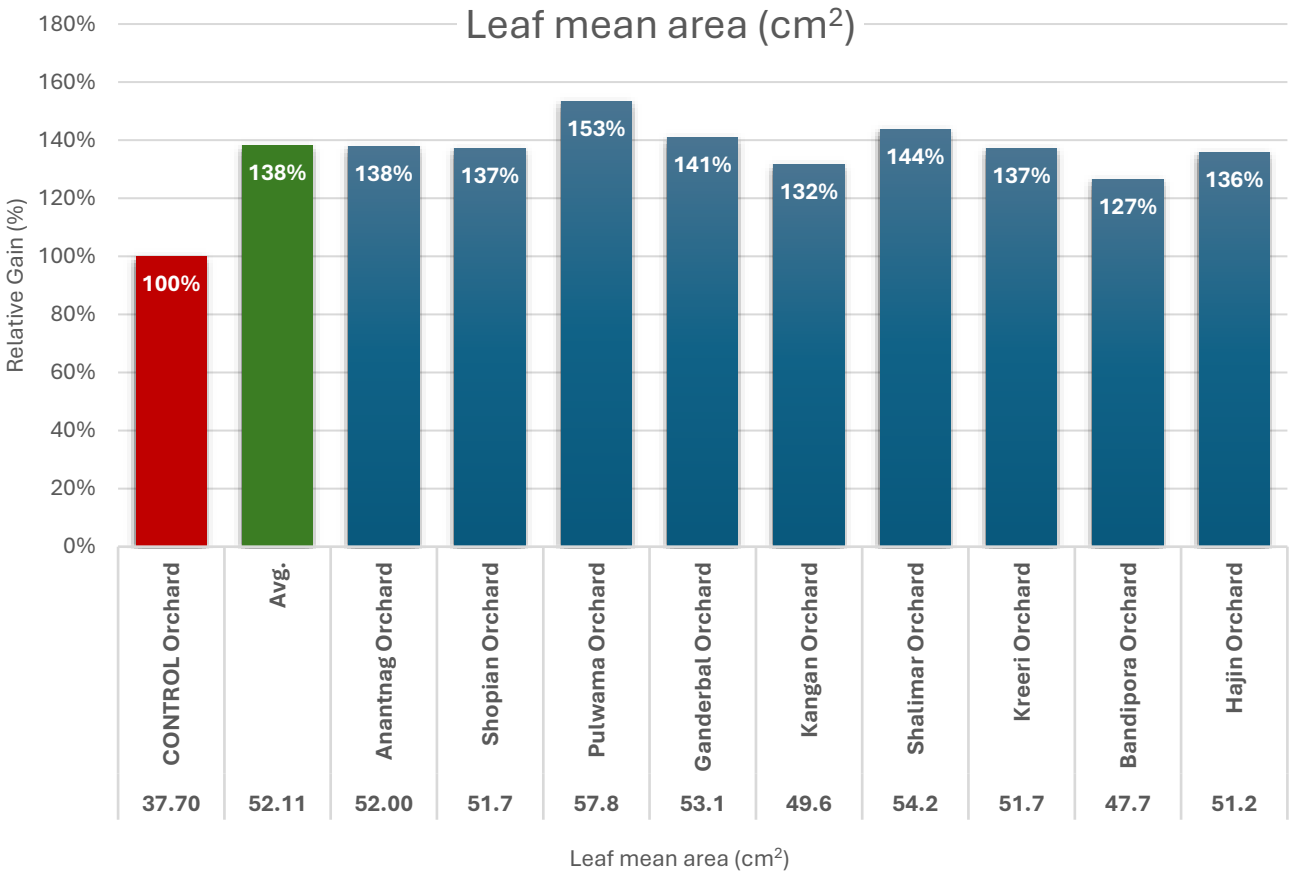
This area of Kashmir utilizes **high-density apple orchards,** a type of growing setup inspired by Italian apple orchards that has enabled higher apple production on smaller plots of land.

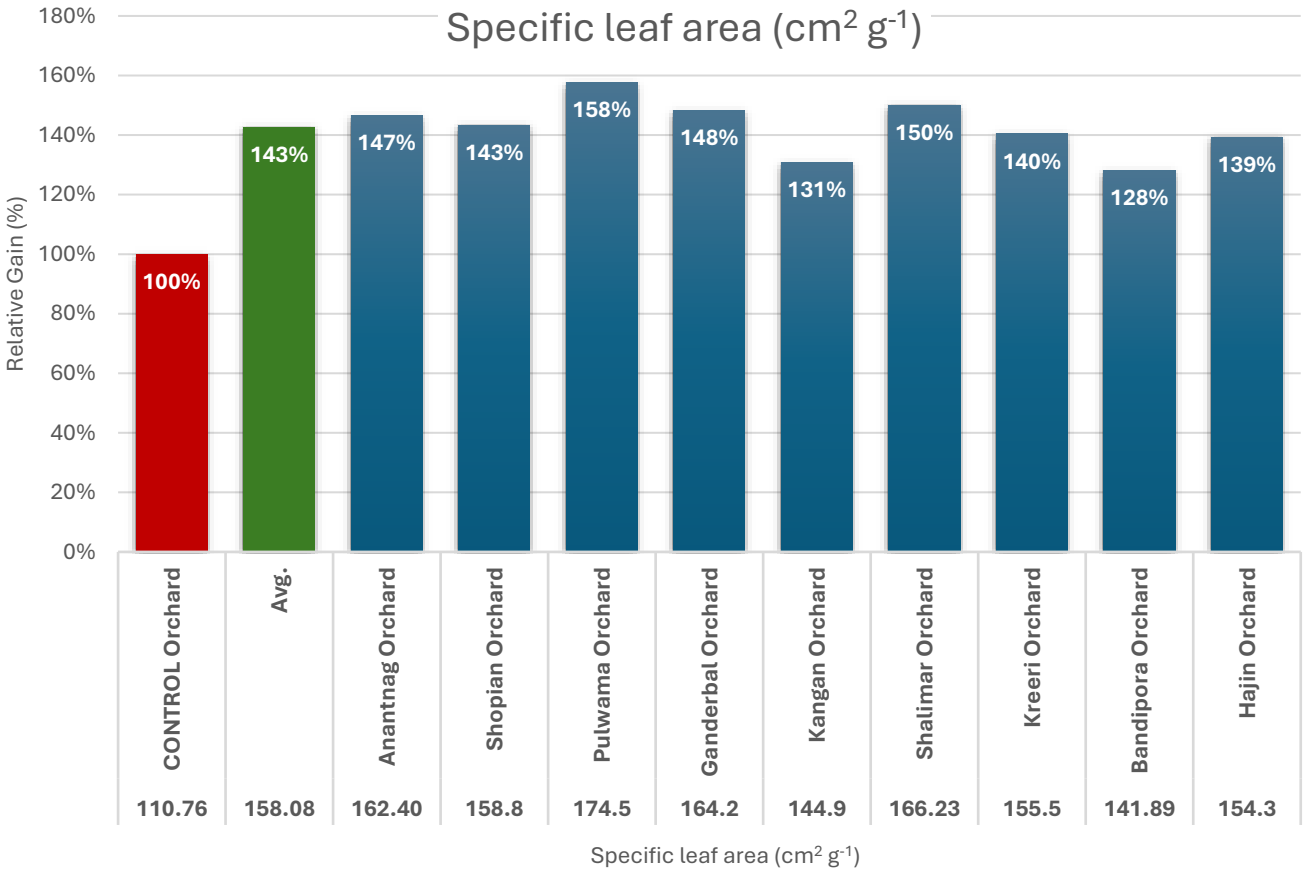
The trial was set up in ten neighboring orchards in Kashmir. Nine apple orchards with KPCB, and the tenth orchard used as a common Control plot. All these orchards are chemical-free.

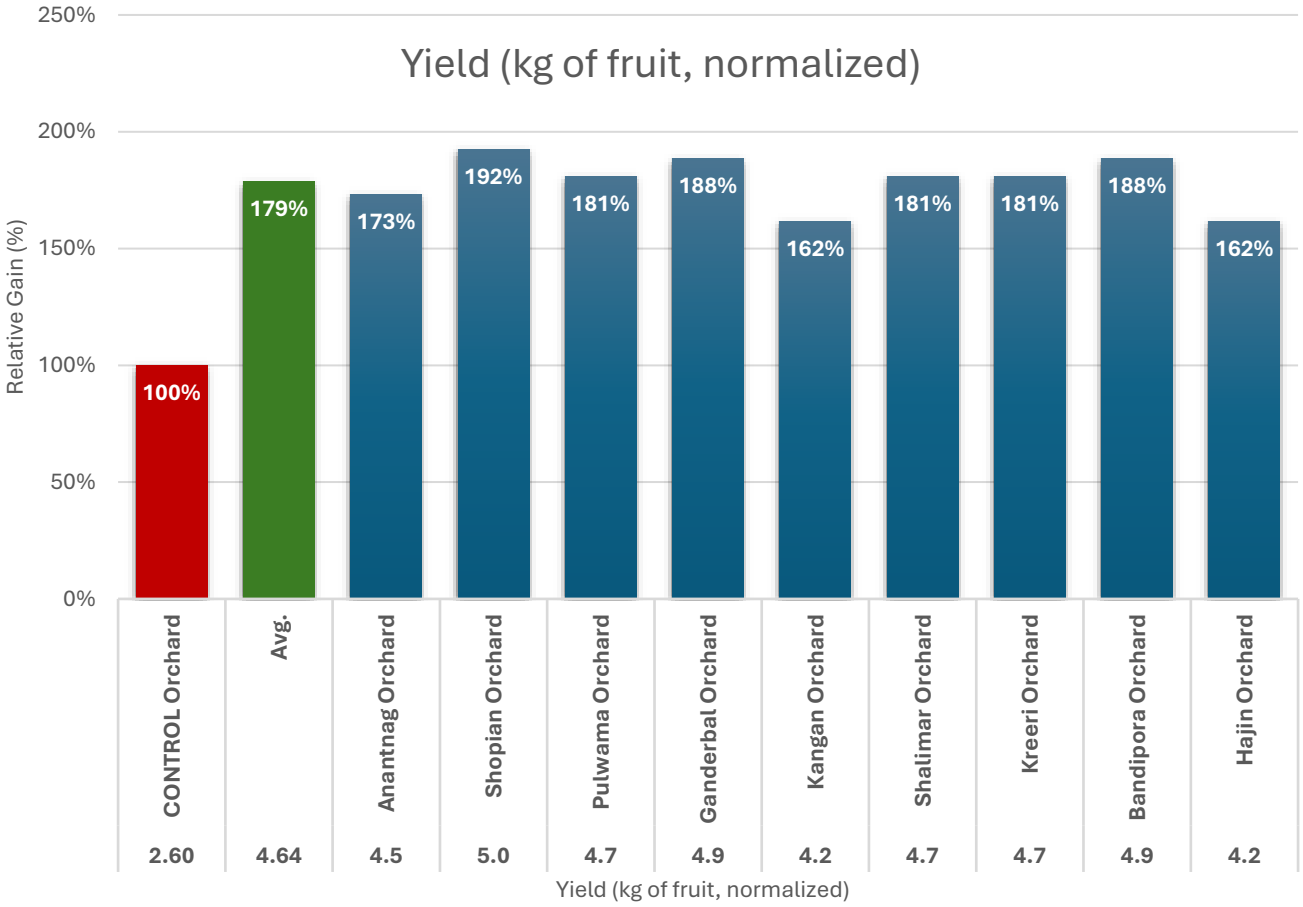
Results

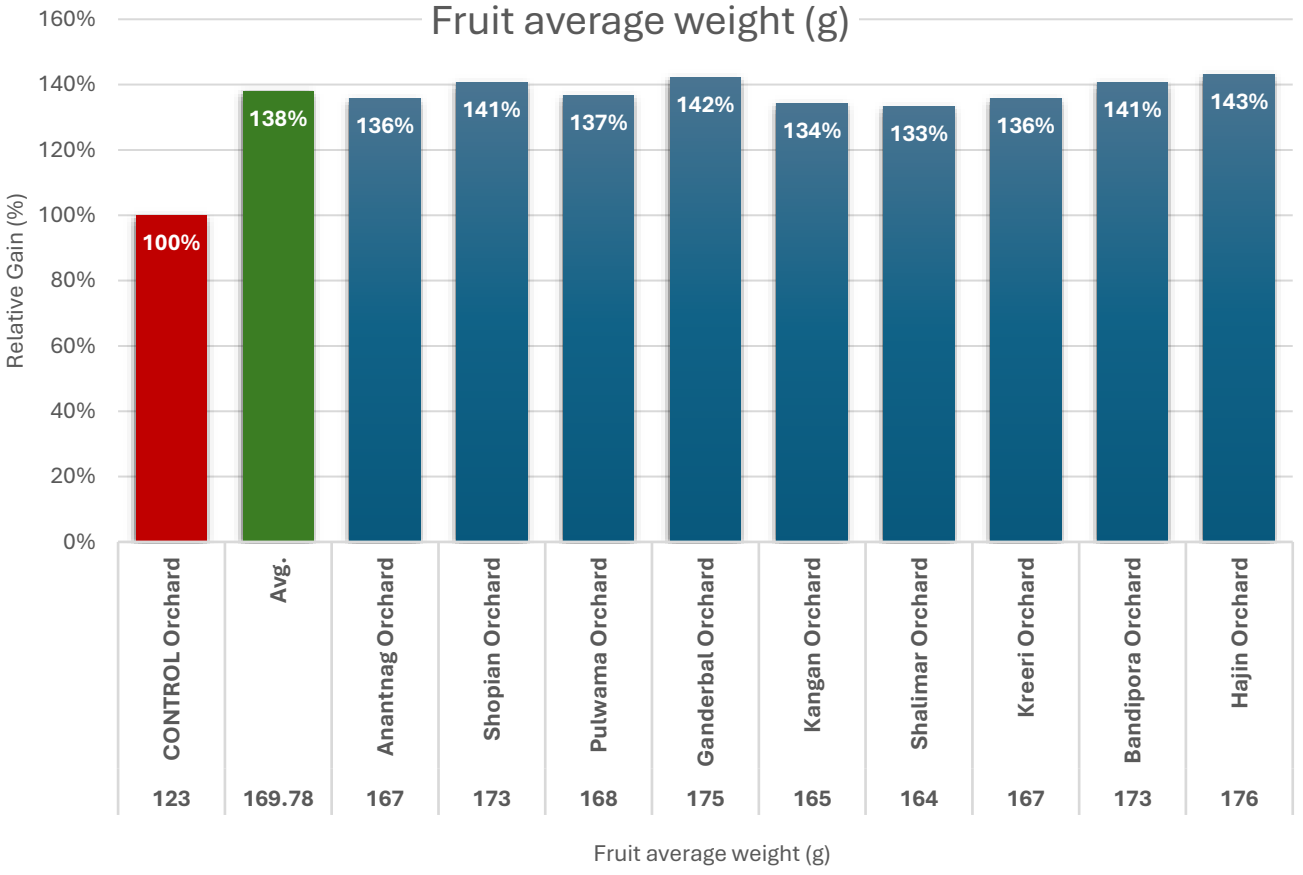
The graphs below represent the results taken in ten orchards:

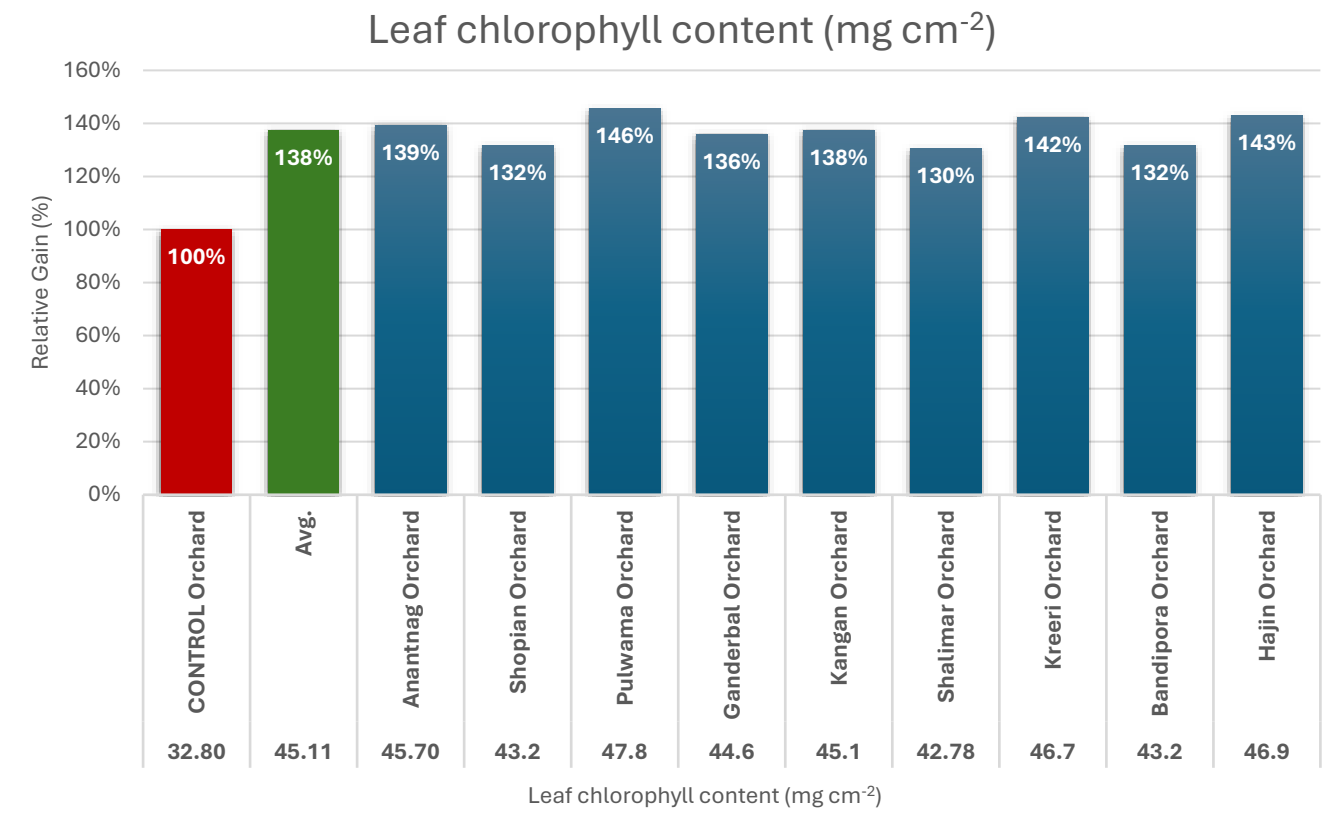
- Blue bars: measurements from nine apple orchards with KPCB,
- Green bar: average of all orchards,
- Red bar: measurement from a common Control plot.

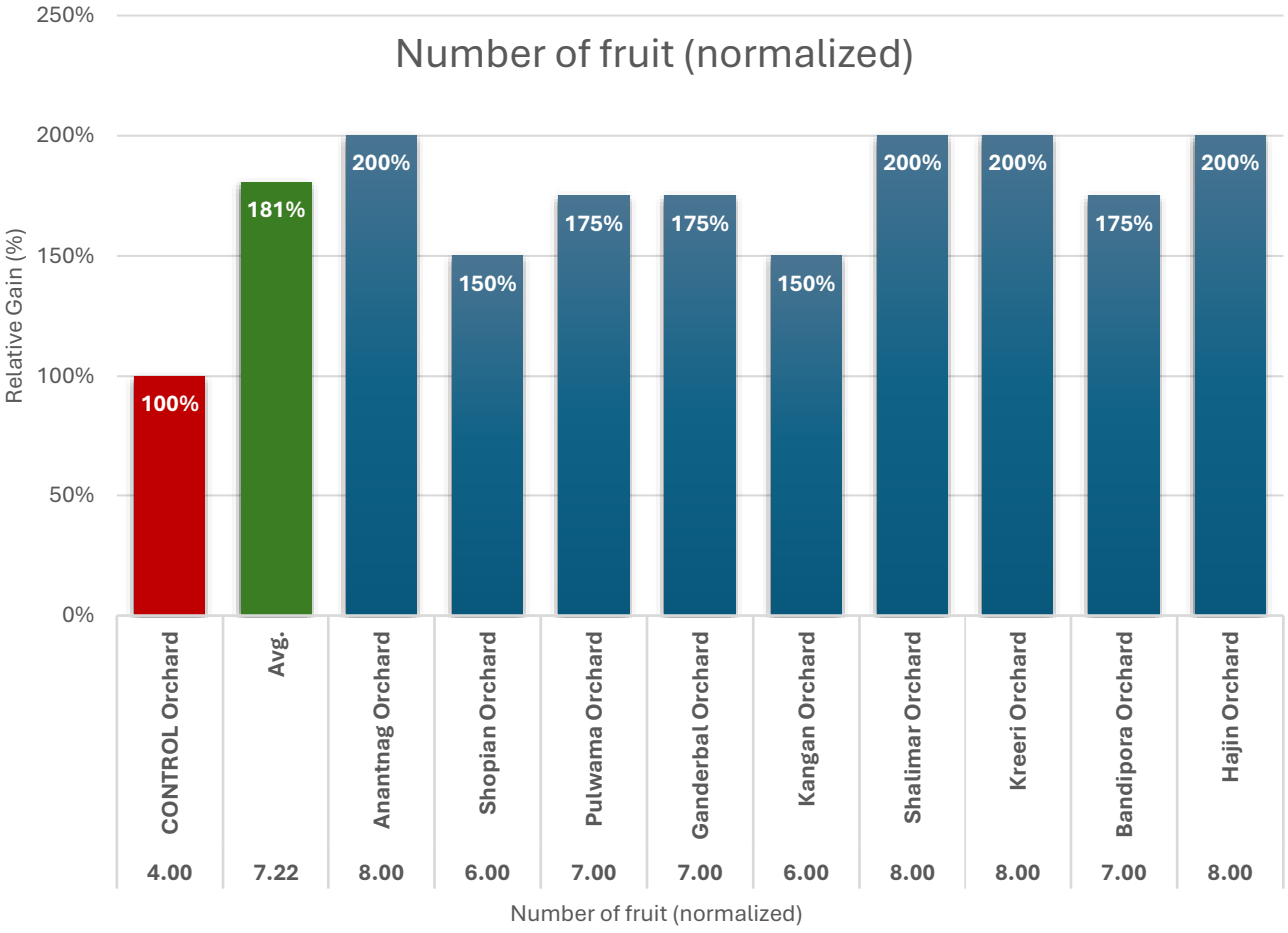

Leaf mean area (cm²)
Relative Gain (%)
180%
160%
140%
120%
100%
80%
60%
40%
20%
0%
100%
138%
138%
137%
153%
141%
132%
144%
137%
127%
136%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
37.70
52.11
52.00
51.7
57.8
53.1
49.6
54.2
51.7
47.7
51.2
Leaf mean area (cm²)

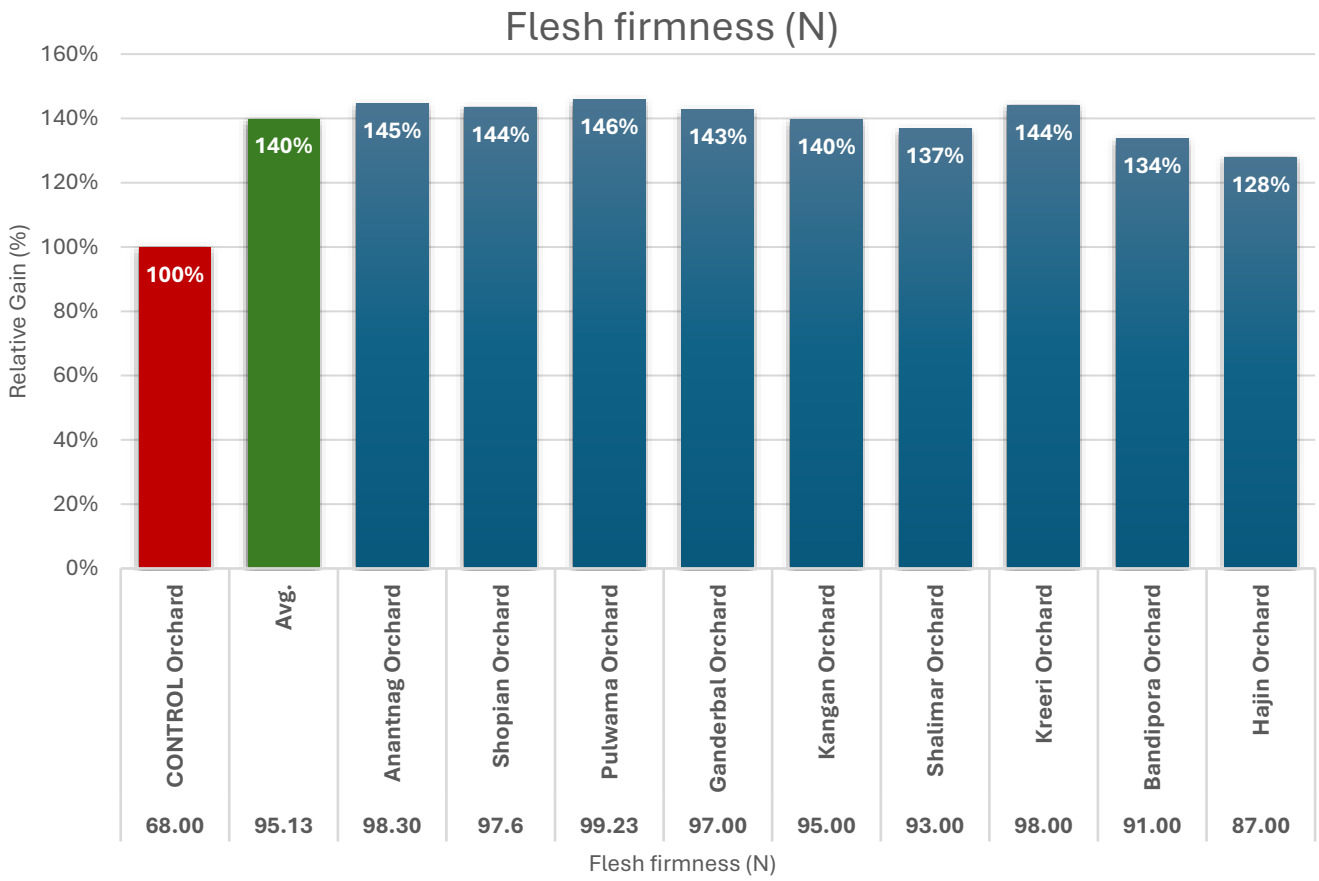

Specific leaf area (cm² g⁻¹)
Relative Gain (%)
180%
160%
140%
120%
100%
80%
60%
40%
20%
0%
100%
143%
147%
143%
158%
148%
131%
150%
140%
128%
139%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
110.76
158.08
162.40
158.8
174.5
164.2
144.9
166.23
155.5
141.89
154.3
Specific leaf area (cm² g⁻¹)

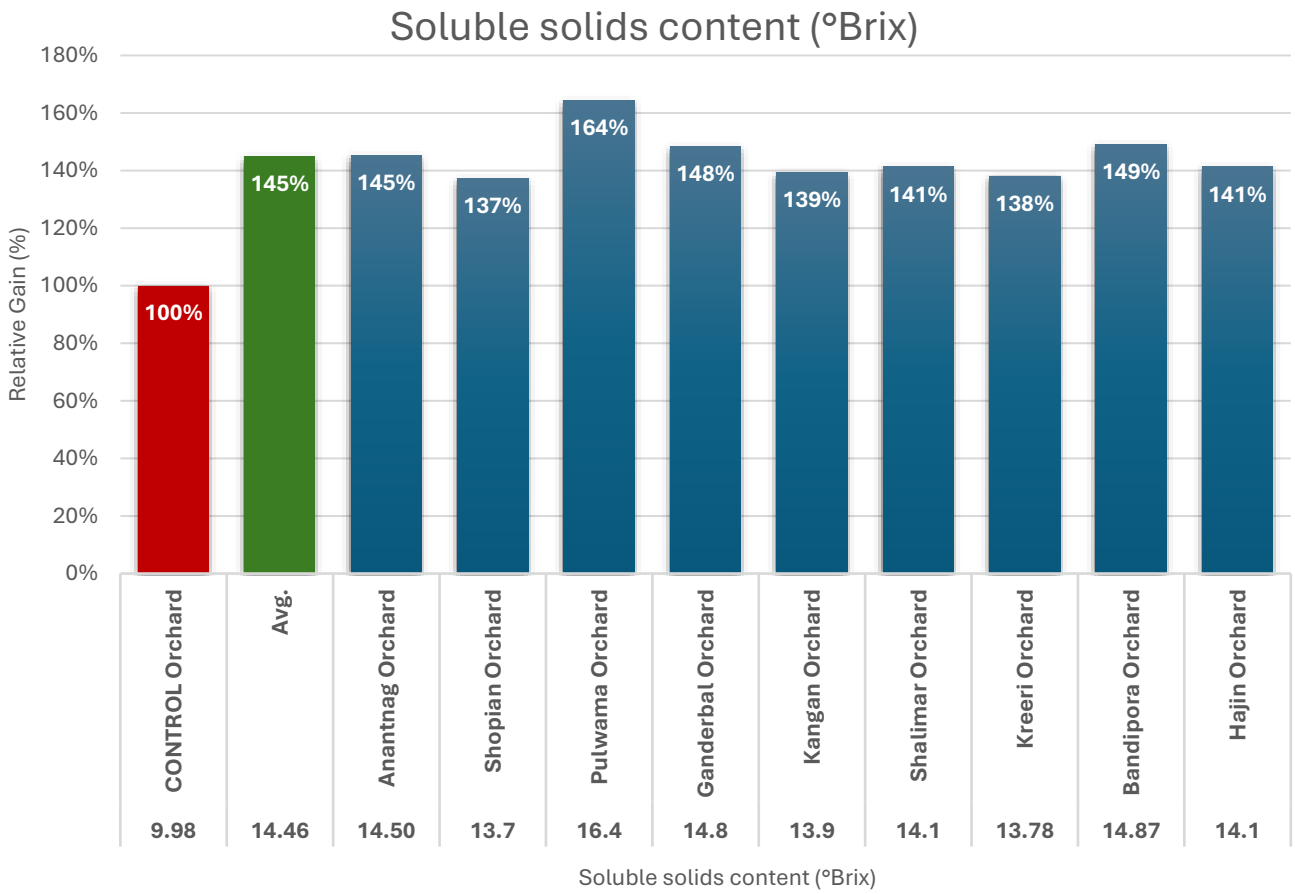

Yield (kg of fruit, normalized)
Relative Gain (%)
250%
200%
150%
100%
50%
0%
100%
179%
173%
192%
181%
188%
162%
181%
181%
188%
162%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
2.60
4.64
4.5
5.0
4.7
4.9
4.2
4.7
4.7
4.9
4.2
Yield (kg of fruit, normalized)

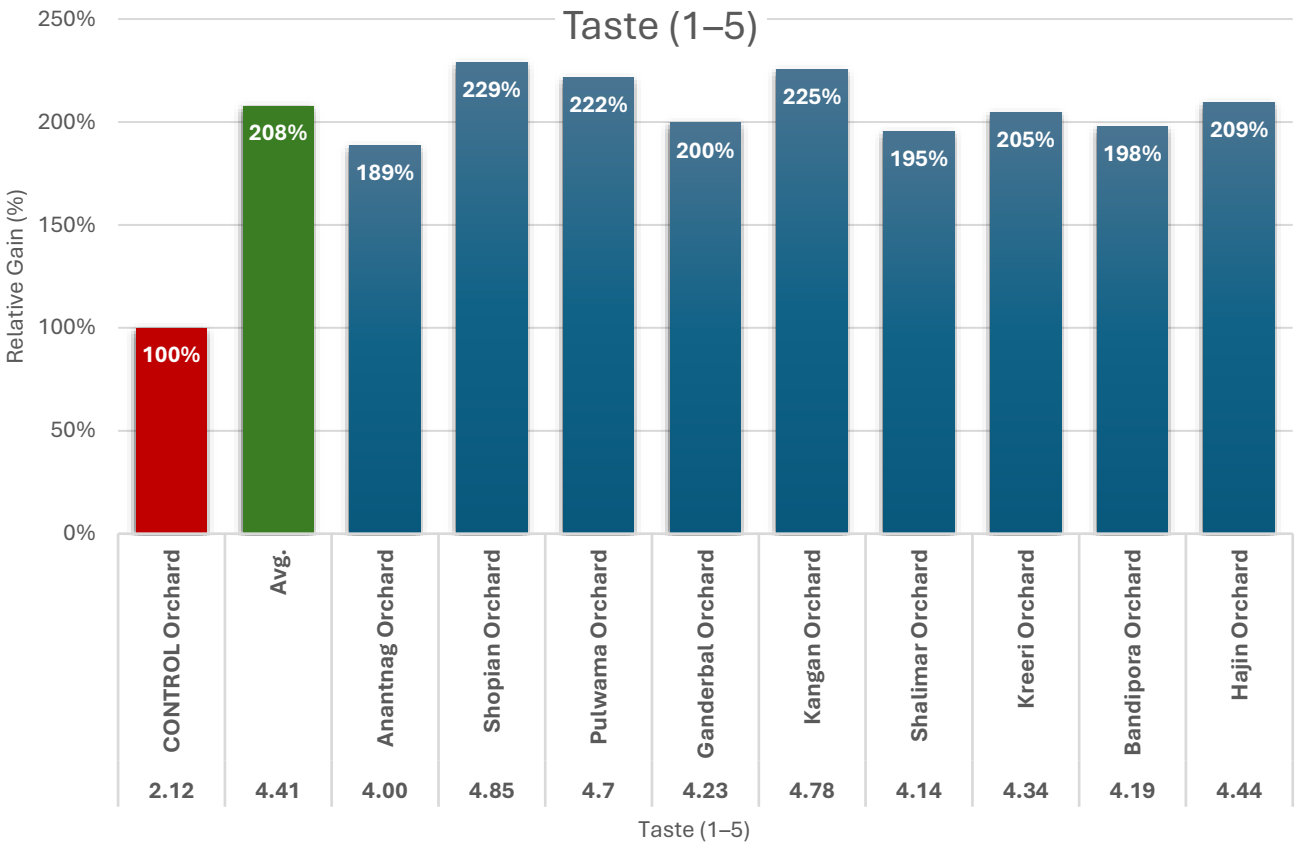

Fruit average weight (g)
Relative Gain (%)
160%
140%
120%
100%
80%
60%
40%
20%
0%
100%
138%
136%
141%
137%
142%
134%
133%
136%
141%
143%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
123
169.78
167
173
168
175
165
164
167
173
176
Fruit average weight (g)

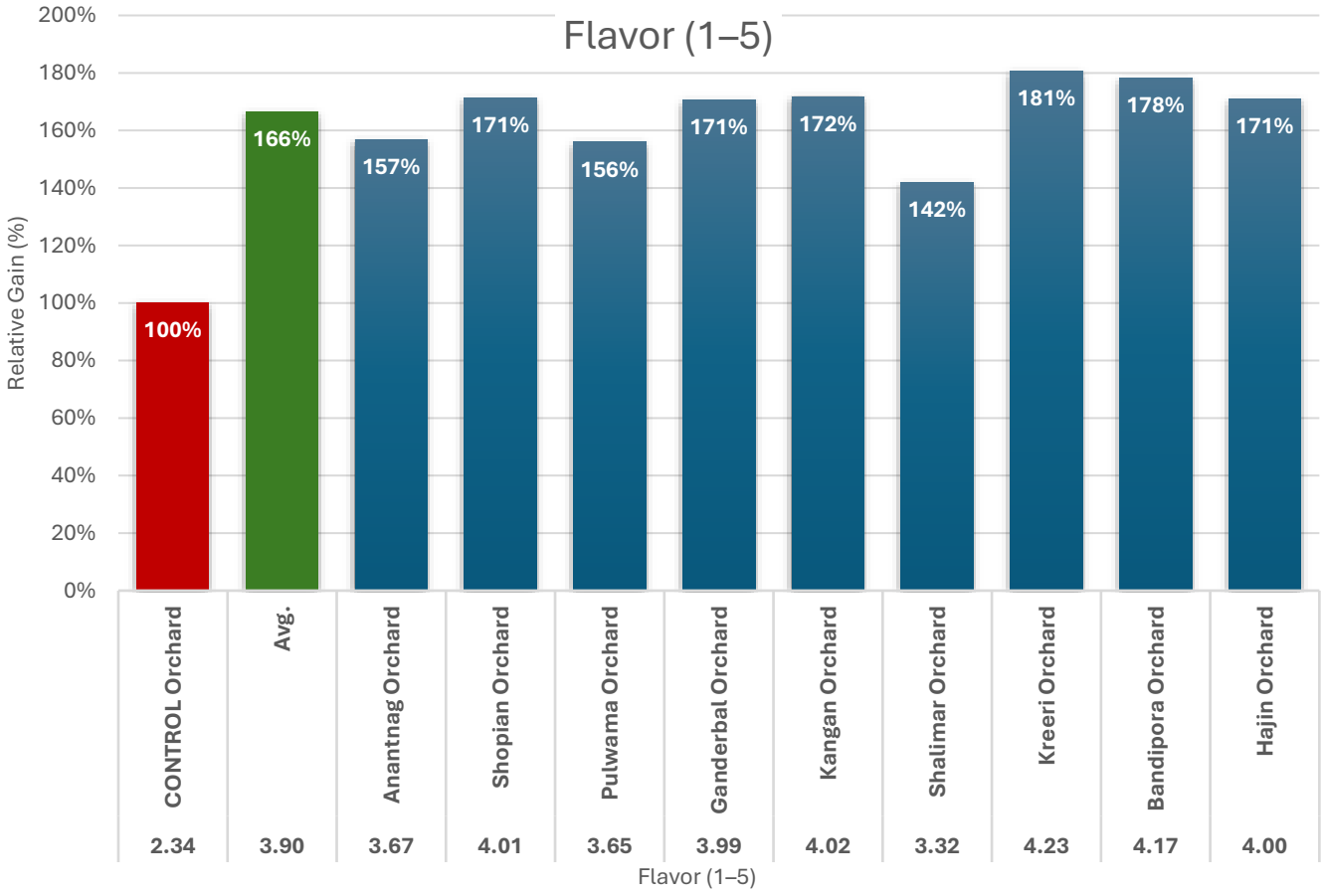

Leaf chlorophyll content (mg cm-2)
Relative Gain (%)
160%
140%
120%
100%
80%
60%
40%
20%
0%
100%
138%
139%
132%
146%
136%
138%
130%
142%
132%
143%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
32.80
45.11
45.70
43.2
47.8
44.6
45.1
42.78
46.7
43.2
46.9
Leaf chlorophyll content (mg cm-2)

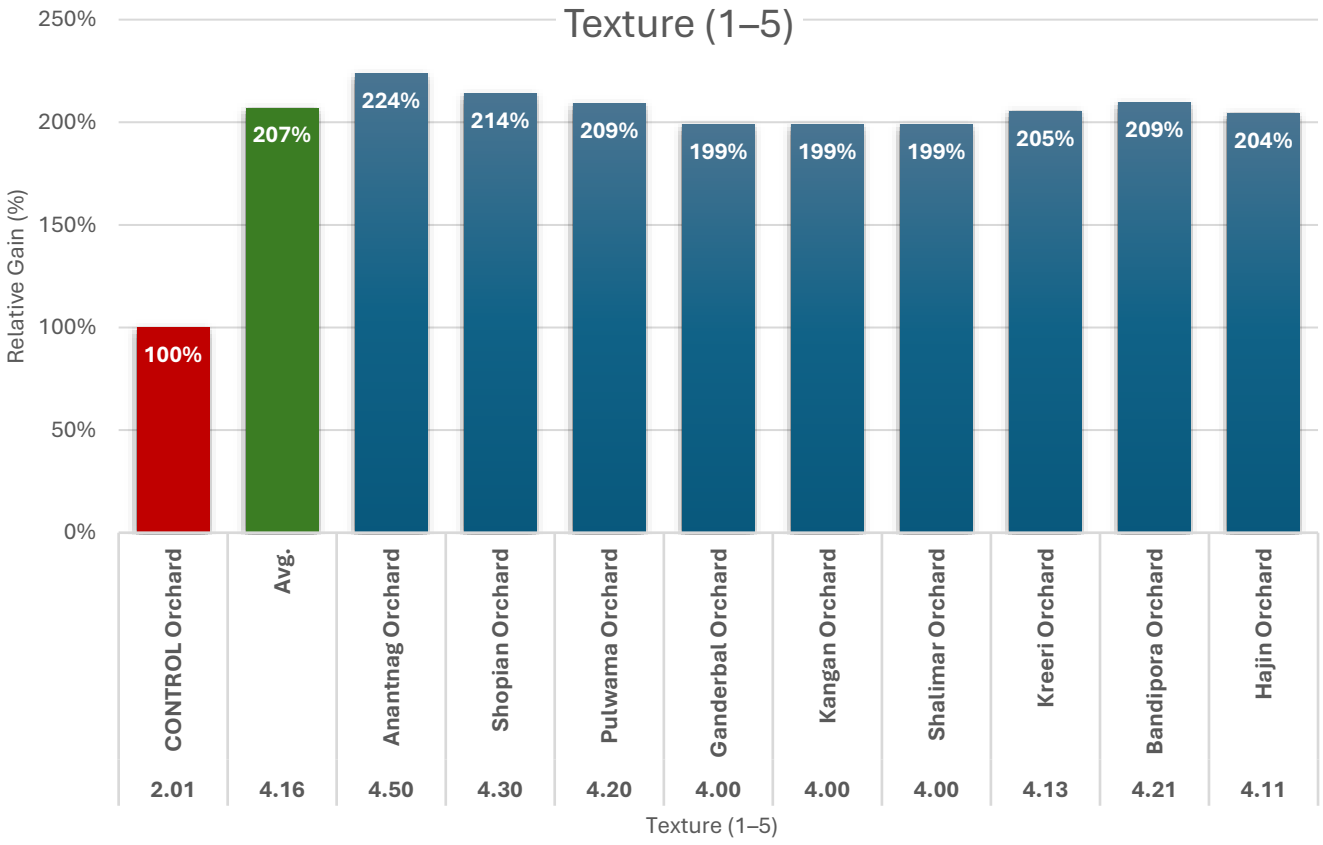

Number of fruit (normalized)
Relative Gain (%)
250%
200%
150%
100%
50%
0%
100%
181%
200%
150%
175%
175%
150%
200%
200%
175%
200%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
4.00
7.22
8.00
6.00
7.00
7.00
6.00
8.00
8.00
7.00
8.00
Number of fruit (normalized)

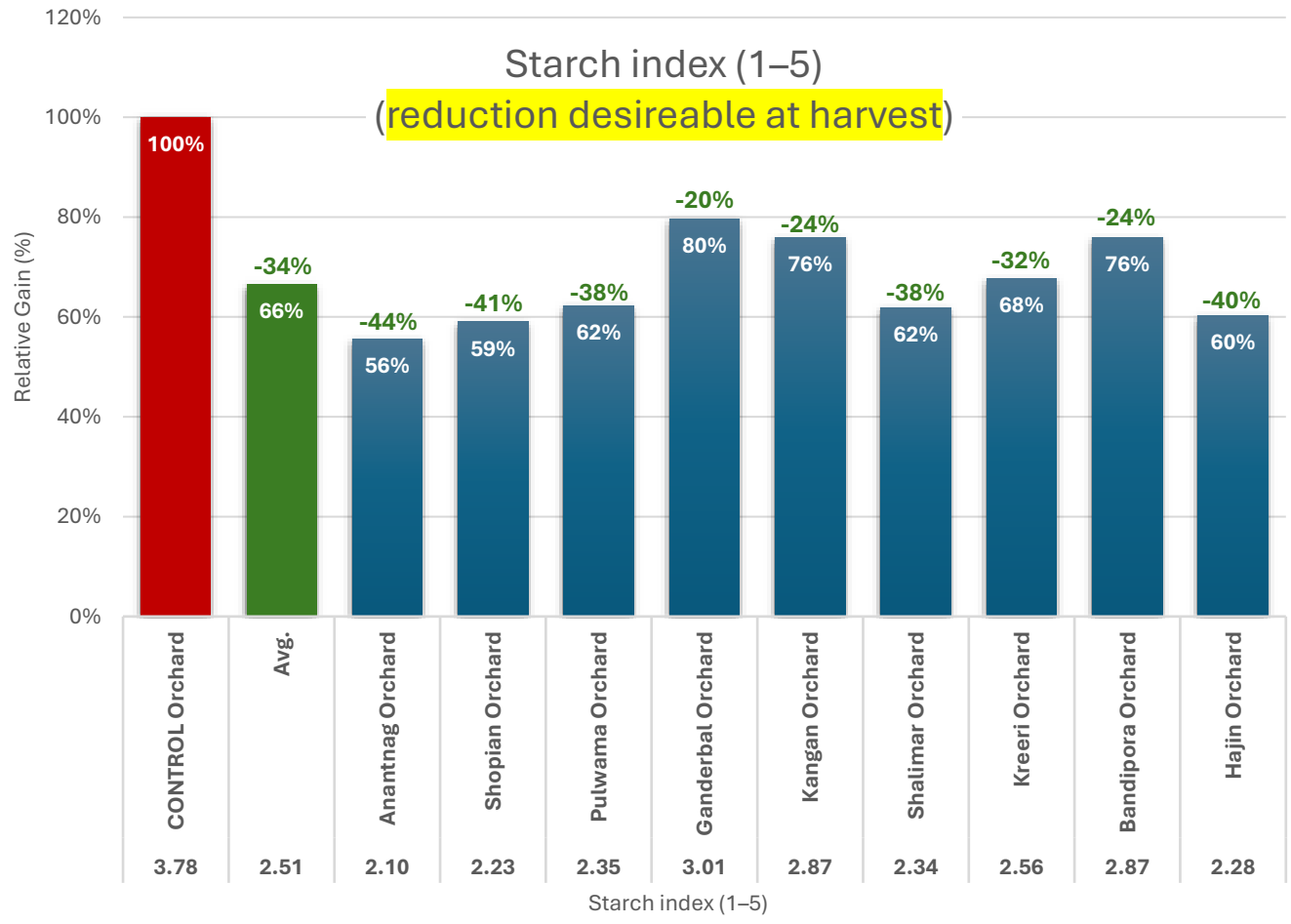

Flesh firmness (N)
Relative Gain (%)
160%
140%
120%
100%
80%
60%
40%
20%
0%
100%
140%
145%
144%
146%
143%
140%
137%
144%
134%
128%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
68.00
95.13
98.30
97.6
99.23
97.00
95.00
93.00
98.00
91.00
87.00
Flesh firmness (N)

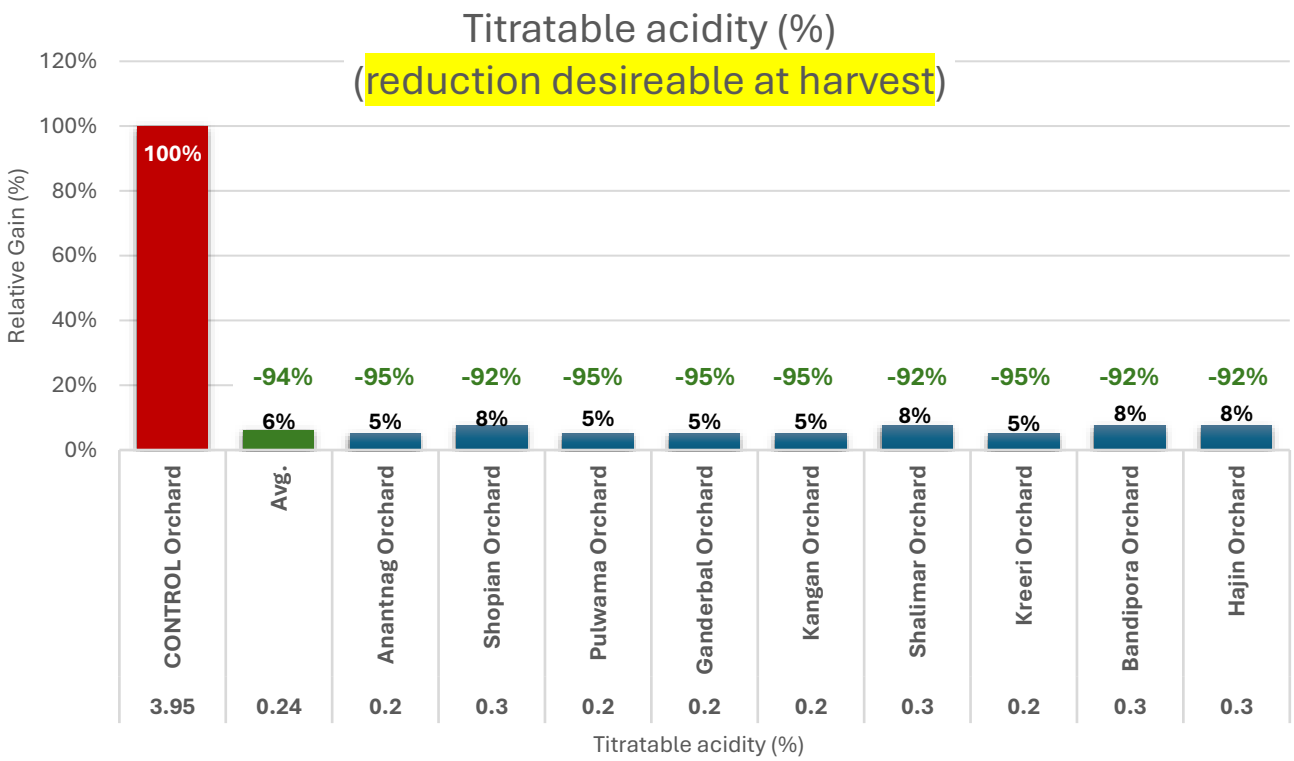

Soluble solids content (°Brix)
Relative Gain (%)
180%
160%
140%
120%
100%
80%
60%
40%
20%
0%
100%
145%
145%
137%
164%
148%
139%
141%
138%
149%
141%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
9.98
14.46
14.50
13.7
16.4
14.8
13.9
14.1
13.78
14.87
14.1
Soluble solids content (°Brix)

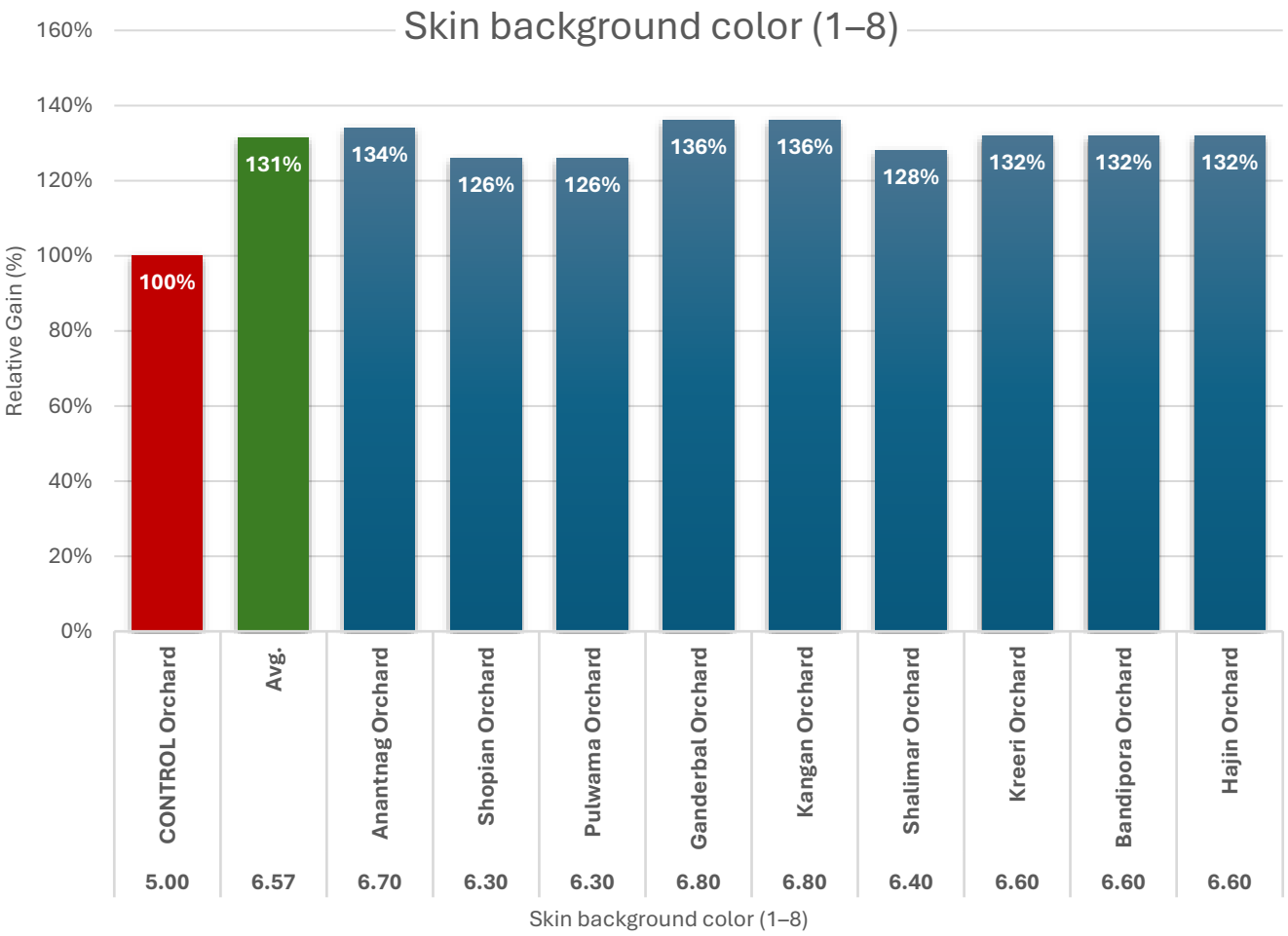

Taste (1–5)
Relative Gain (%)
250%
200%
150%
100%
50%
0%
100%
208%
189%
229%
222%
200%
225%
195%
205%
198%
209%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
2.12
4.41
4.00
4.85
4.7
4.23
4.78
4.14
4.34
4.19
4.44
Taste (1–5)

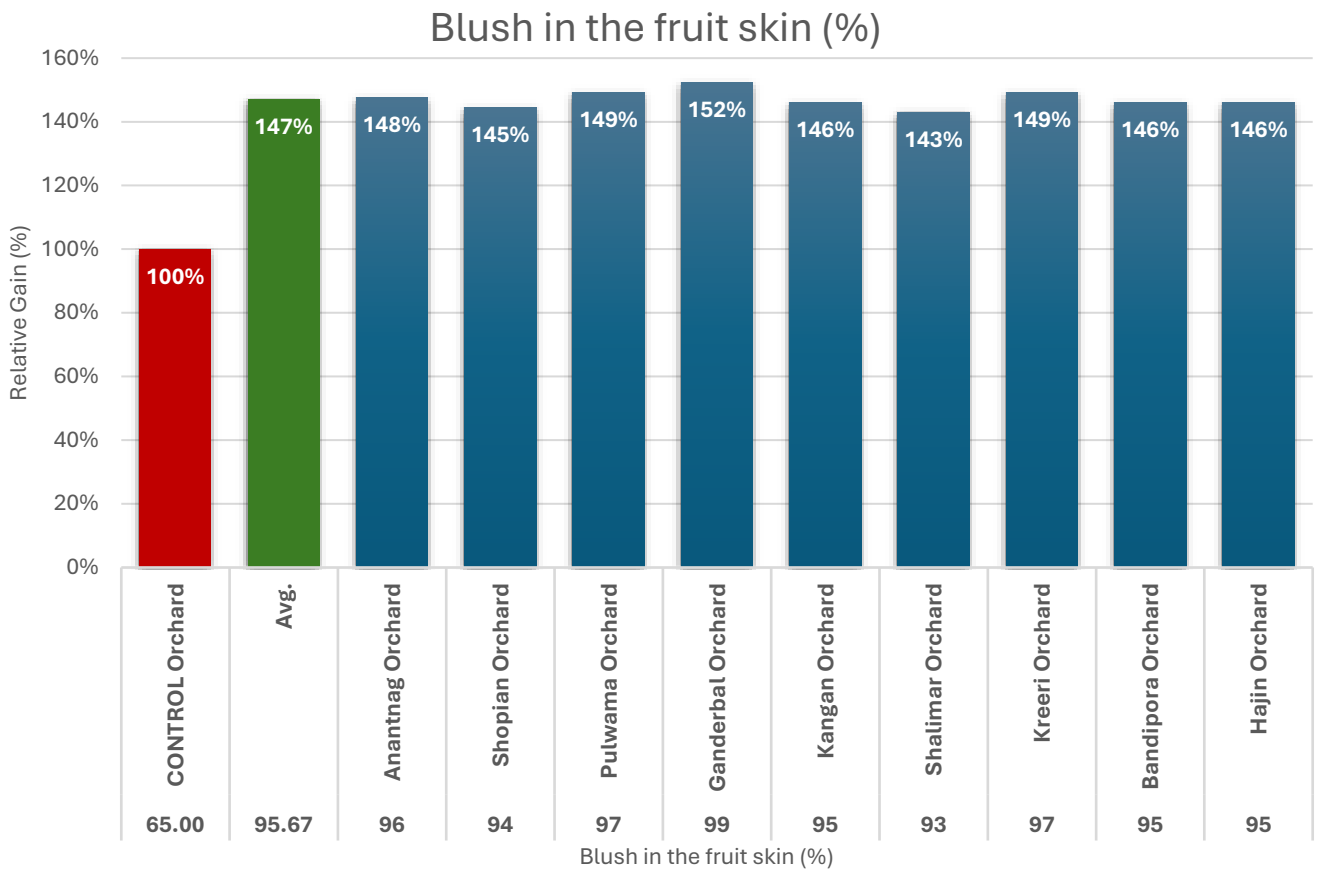

Flavor (1–5)
Relative Gain (%)
200%
180%
160%
140%
120%
100%
80%
60%
40%
20%
0%
100%
166%
157%
171%
156%
171%
172%
142%
181%
178%
171%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
2.34
3.90
3.67
4.01
3.65
3.99
4.02
3.32
4.23
4.17
4.00
Flavor (1–5)

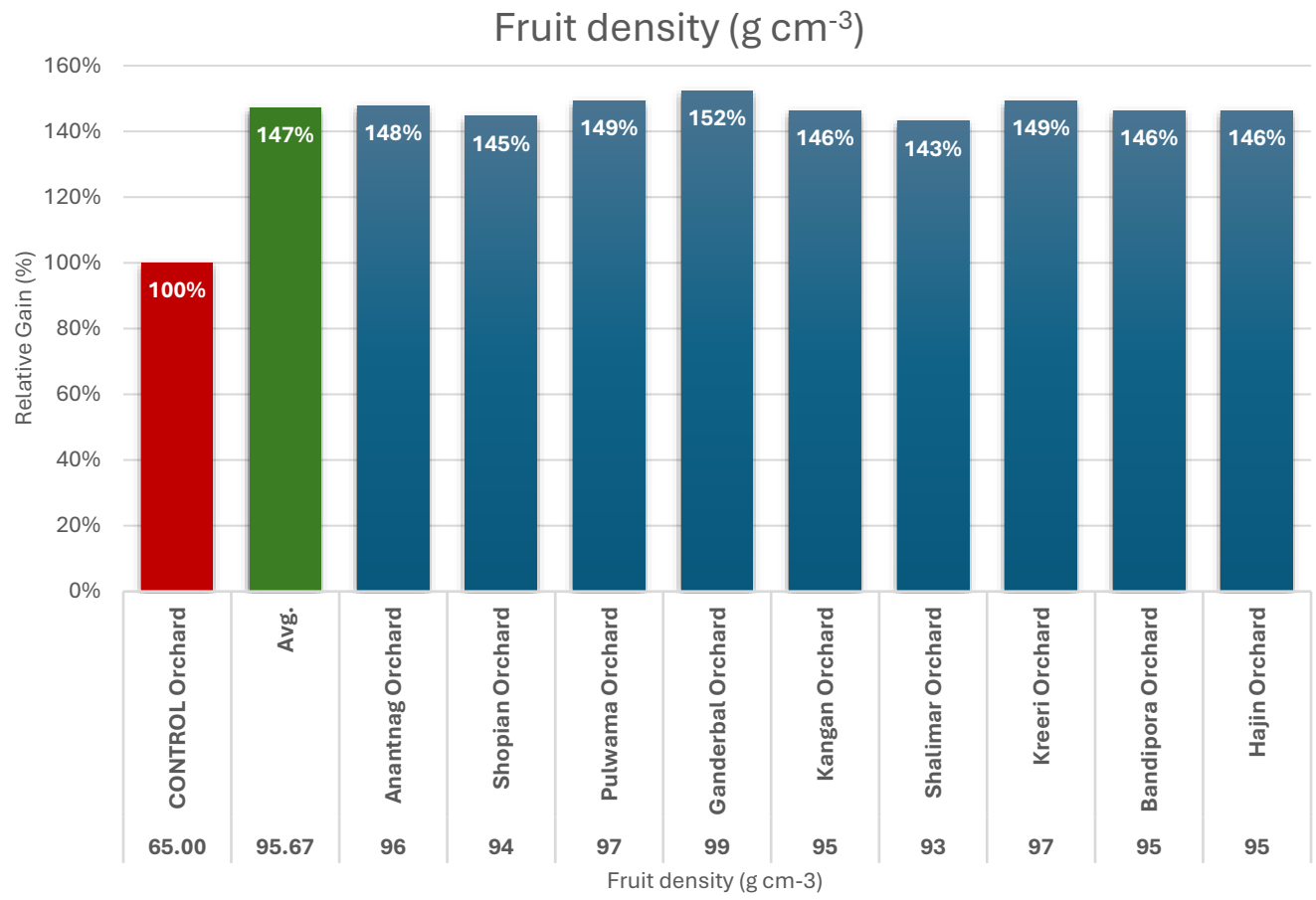

Texture (1–5)
Relative Gain (%)
250%
200%
150%
100%
50%
0%
100%
207%
224%
214%
209%
199%
199%
199%
205%
209%
204%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
2.01
4.16
4.50
4.30
4.20
4.00
4.00
4.00
4.13
4.21
4.11
Texture (1–5)


Starch index (1–5)
(reduction desireable at harvest)
Relative Gain (%)
120%
100%
80%
60%
40%
20%
0%
100%
-34%
66%
-44%
56%
-41%
59%
-38%
62%
-20%
80%
-24%
76%
-38%
62%
-32%
68%
-24%
76%
-40%
60%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
3.78
2.51
2.10
2.23
2.35
3.01
2.87
2.34
2.56
2.87
2.28
Starch index (1–5)


Titratable acidity (%)
(reduction desireable at harvest)
Relative Gain (%)
120%
100%
80%
60%
40%
20%
0%
100%
-94%
-95%
-92%
-95%
-95%
-95%
-92%
-95%
-92%
-92%
6%
5%
8%
5%
5%
5%
8%
5%
8%
8%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
3.95
0.24
0.2
0.3
0.2
0.2
0.2
0.3
0.2
0.3
0.3
Titratable acidity (%)


Skin background color (1–8)
Relative Gain (%)
160%
140%
120%
100%
80%
60%
40%
20%
0%
100%
131%
134%
126%
126%
136%
136%
128%
132%
132%
132%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
5.00
6.57
6.70
6.30
6.30
6.80
6.80
6.40
6.60
6.60
6.60
Skin background color (1–8)


Blush in the fruit skin (%)
160%
140%
120%
100%
80%
60%
40%
20%
0%
Relative Gain (%)
100%
147%
148%
145%
149%
152%
146%
143%
149%
146%
146%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
65.00
95.67
96
94
97
99
95
93
97
95
95
Blush in the fruit skin (%)


Fruit density (g cm-3)
160%
140%
120%
100%
80%
60%
40%
20%
0%
Relative Gain (%)
100%
147%
148%
145%
149%
152%
146%
143%
149%
146%
146%
CONTROL Orchard
Avg.
Anantnag Orchard
Shopian Orchard
Pulwama Orchard
Ganderbal Orchard
Kangan Orchard
Shalimar Orchard
Kreeri Orchard
Bandipora Orchard
Hajin Orchard
65.00
95.67
96
94
97
99
95
93
97
95
95
Fruit density (g cm-3)

Conclusions

In this trial, apple trees irrigated with KPCB-treated water produced 81% more fruits and 79% higher yield. Growth parameters were 51% higher on the average. The results also show 59% higher average in quality parameters, especially in taste and appearance.

The table below summarizes the average results from all orchards that participated in this trial, alongside our evaluation of extra benefits for sustainability and carbon sequestration.

		SUSTAINABILITY FACTORS		
MEASUREMENT	AVG. NET GAIN	GROWTH PARAMETERS	QUALITY PARAMETERS	CARBON SEQUESTRATION RELATED
Leaf mean area (cm^2)	38%	✓		✓
Specific leaf area ($cm^2\ g^{-1}$)	43%	✓		✓
Yield (kg of fruit, normalized)	**79%**	✓		✓
Fruit average weight (g)	**38%**	✓	✓	
Leaf chlorophyll content ($mg\ cm^{-2}$)	38%	✓		✓
Number of fruit (normalized)	**81%**	✓		
Flesh firmness (N)	40%		✓	
Soluble solids content (°Brix)	45%		✓	✓
Taste (1–5)	108%		✓	
Flavor (1–5)	66%		✓	
Texture (1–5)	107%		✓	
Starch index (1–5)	34% down		✓	
Titratable acidity (%)	95% down		✓	
Skin background color (1–8)	31%		✓	
Blush in the fruit skin (%)	47%		✓	
Fruit density ($g\ cm^{-3}$)	37%	✓	✓	✓
Overall Average Benefits:	**45%**	**51%**	**59%**	

Originating Scientist

- Study devised and conducted by: Dr. Owais Bashir
- Affiliated with: SKUAST-Kashmir, University of Agricultural Sciences and Technology
- Study sponsored by: Dr. Owais Bashir.

Dr. Owais Bashir – Profile

(Source: LinkedIn.com)

- Research scientist in pedometrics[1]
- Department of Soil Science (PG)
- Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K)
- Founder and CEO of Smart Pedotek, (From Earth to Innovation), Soil Research Scientist, Pedologist, Agriculture scientist, and Climate Change researcher. Having expertise in Python, remote sensing, spectroscopy, artificial intelligence, and machine learning.
- LinkedIn profile: https://linkedin.com/in/owais-bashir-395585195
- ResearchGate profile: https://www.researchgate.net/profile/Owais-Bashir

Areas of Expertise

“I am a soil scientist with a deep interest and expertise in a range of disciplines related to soil science and the environment. My work experience includes a focus on artificial intelligence and machine learning, as well as remote sensing and GIS [Geographic Information System] technologies. I am particularly knowledgeable in pedology and pedometrics, and have developed a unique machine, Pedotek, that applies these concepts to soil analysis. I am the founder and CEO of smart Pedotek. I have also worked on climate change modeling, indicating a commitment to using your skills and expertise to address pressing global environmental challenges. My personality is characterized by a strong sense of curiosity, a passion for innovation, and a desire to use your knowledge and skills to make a positive impact in your field and beyond.”

Activity

“I am reaching out to invite you to contribute a chapter to our forthcoming book, "Modern Technologies for Sustainable and Climate-Smart Agriculture," to be published by Apple Academic Press in collaboration with Taylor and Francis. Your expertise is crucial in shaping this comprehensive volume, which aims to highlight innovative solutions for sustainable agricultural practices amidst climate challenges. Importantly, there will be no publication fee charged, as we prioritize fostering collaboration and knowledge exchange within the global agricultural community. Your valuable insights will greatly enrich our collective understanding and contribute to the advancement of agricultural sustainability worldwide.”

[1] Applying mathematical and statistical methods, including mapping and geo-statistics, to the study of soil conditions.