Romaine Knife and Waterjet Cutting Test #1

UC Davis and Fresh Express

June 2013

UC Davis results included here

Summary Test#1 June 2013

- Romaine lettuce was cut with used and new knives on a Translicer in a pilot processing line or by fuzzy and sharp nozzles on KMT pilot waterjet system.

- The romaine lettuce was of very high quality and no notable differences were observed among cutting treatments until after 12 days storage in air at 2.5C.

- At 18 days, the sharp nozzle was the superior cutting treatment and the fuzzy nozzle was the worst cutting treatment.

- A 2nd test with Fresh Express is planned for August 6.

Materials & Methods

Romaine lettuce

Variety: Green Forest

Growing Region: Salinas Valley, CA

Harvest Date: June 5, 2013 harvested as conventional Romaine (whole head); lettuce and process water send to UC Davis on June 5 where it was held overnight at 2.5C. All treatments processed on June 6.   Product held on ice until stored or packaged.

Cutting (2"x2" cut size):

Treatments T1, T2 at the Fresh Express Pilot Line,

Treatments T3 and T4 at the Mann Lab, UC Davis

Treatments:

T1 - Dull knife 3 x sharpened + end of last day of use (2 x 8 h) (end of knife life)

T2 - Sharp knife 0 x sharpened + beginning of 1st day (new knife)

T3 - Fuzzy nozzle Waterjet at 35000 psi at speed of 50 fpm

T4 - Sharp nozzle Waterjet at 55000 psi at speed of 25 fpm

Packaging & Storage conditions:

Set 1: Packaged under MAP following 10 oz HOR specs and stored at 40°F (4.4°C) for 12 days (Fresh Express R&D); Total product weight 283.5 g x 18 bags per treatment

Set 2: Packaged in air and stored at 36.5°F (2.5°C) for 18 days (UC Davis) Total product amount 50 pieces x 4 replicates per treatment

Visual quality scoring of salad cut romaine lettuce. Intermediate numbers are used when appropriate. Shelf-life was defined as the days to reach a score of 6.

Visual quality score	Descriptor	Attributes
9	Excellent	Fresh appearance, no defects; tissues firm, with green color characteristic of the variety and part
7	Good	Some loss of fresh appearance and texture; pieces remain green with little discoloration but there may be notable whitening; no decay
5	Fair	Pieces lack fresh appearance and typical texture, but is salable and green with moderate defects such as discoloration and whitening
3	Poor	Product not salable but pieces are usable with selection; product has notable defects including discoloration and whitening; there may be incipient decay
1	Unusable	Unusable due to substantial development of defects including discoloration and decay

Discoloration Rating Scale for Romaine
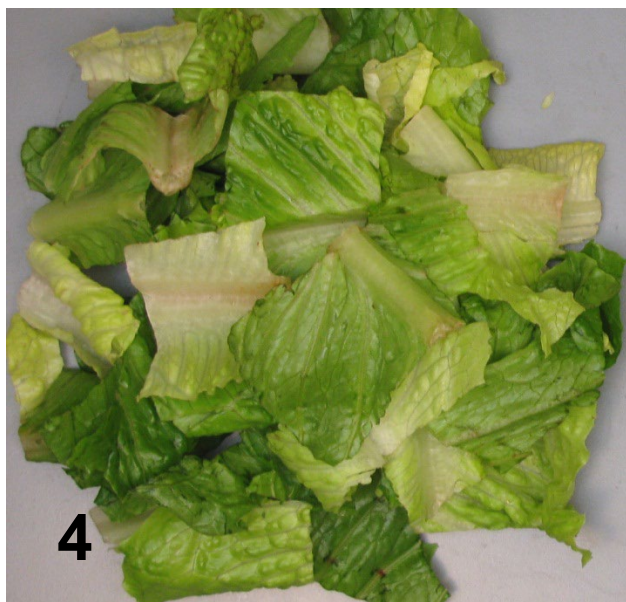
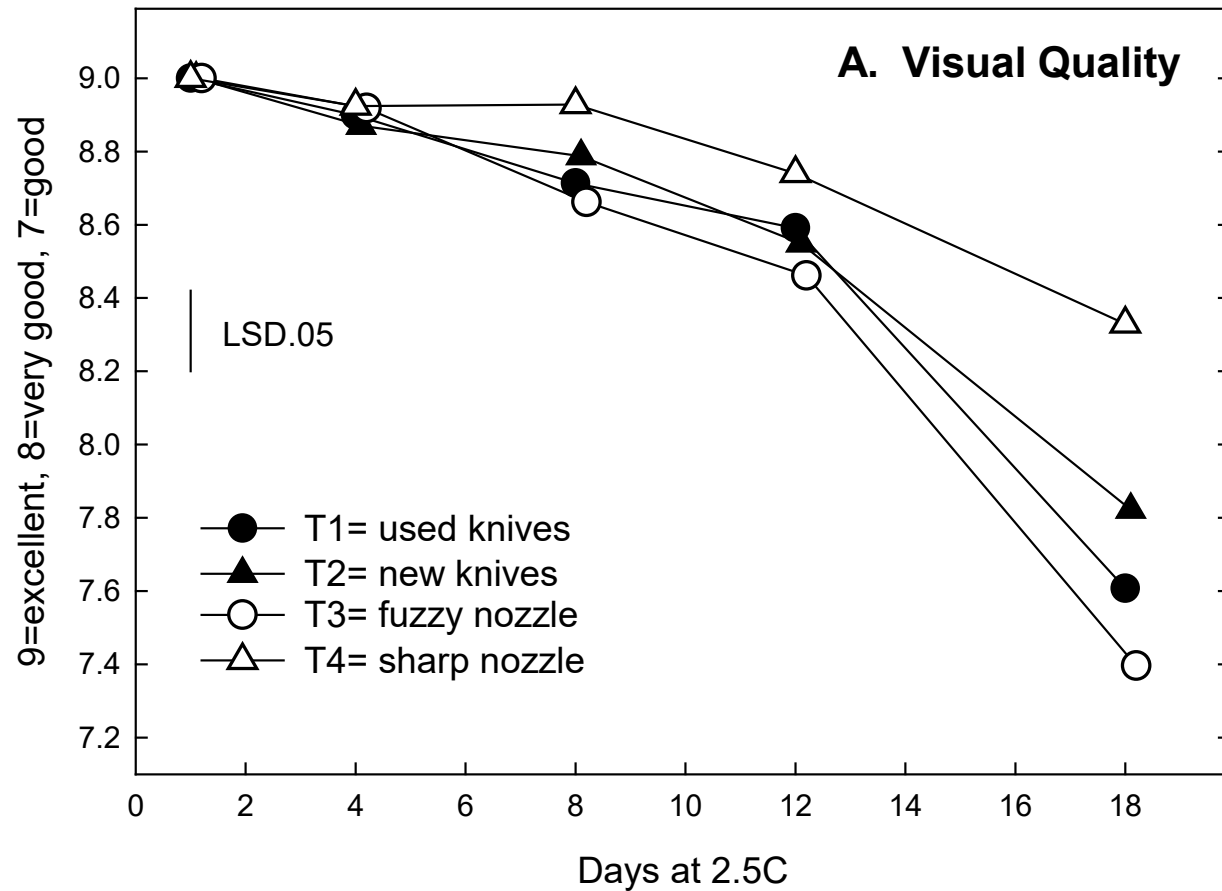# Whitening Rating Scale for Cut Edges of Romaine Lettuce
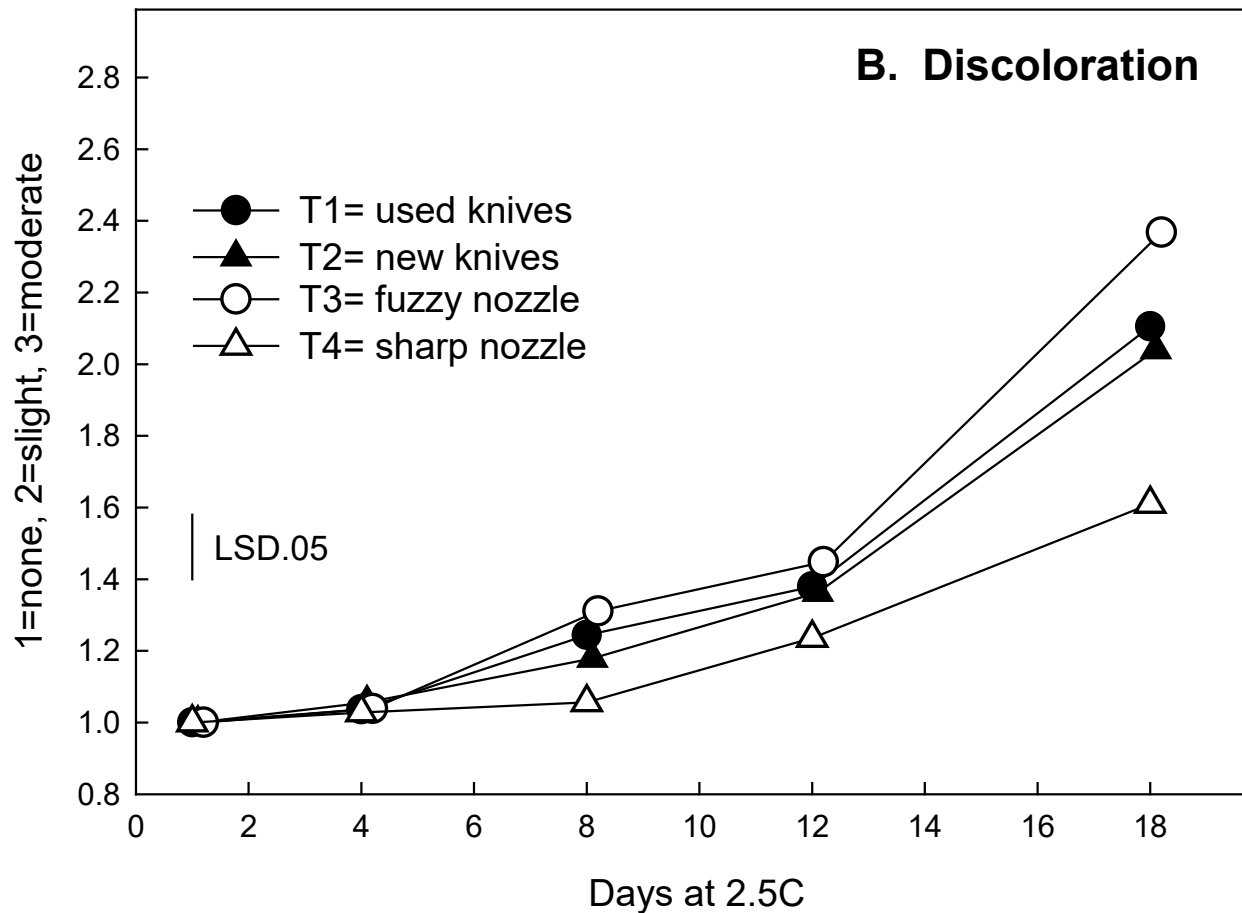
| 1 | 2 | 3 | 4 | 5 |

1=<10% white appearance
2=15-25
3=30-55
4=60-85
5=>90

A. Visual Quality

T1= used knives
T2= new knives
T3= fuzzy nozzle
T4= sharp nozzle

Data average of 50 pieces per rep per evaluation per treatment, evaluating at both cut ends; 4 reps.
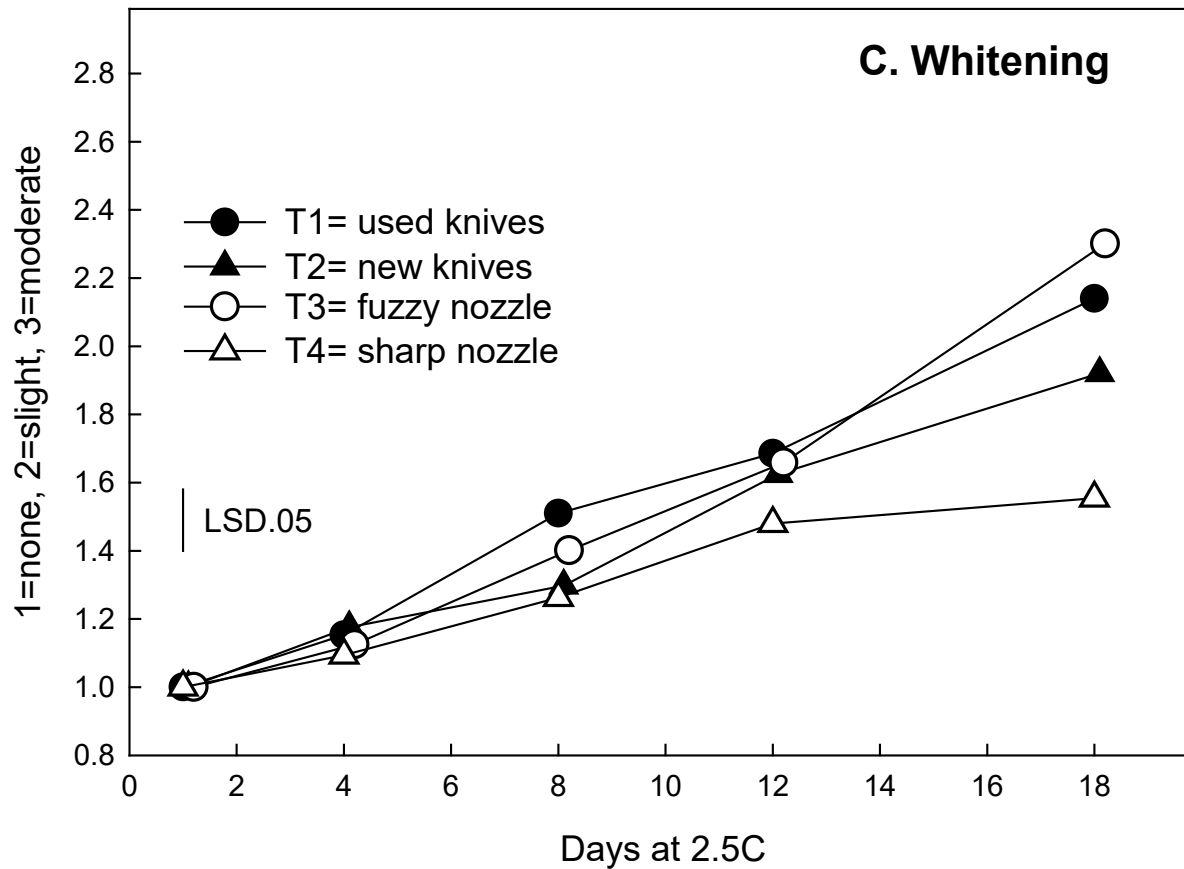
B. Discoloration

Data average of 50 pieces per rep per evaluation per
treatment, evaluating at both cut ends; 4 reps.

C. Whitening

Data average of 50 pieces per rep per evaluation per treatment, evaluating at both cut ends; 4 reps.

PHOTOS
Romaine Lettuce Salad Cutting
June 2013

Cut pieces stored in plastic bags in air at 2.5C
Pictures of 2 of 4 reps of each treatment

UC Davis and Fresh Express Test

Day 1: Treatment 1 (dull knife)

Day 1: Treatment 3 (fuzzy nozzle)

Day 1: Treatment 2 (sharp knife)

Day 1: Treatment 4 (sharp nozzle)

Day 1: Treatment 1 (dull knife)

Day 1: Treatment 3 (fuzzy nozzle)

Day 1: Treatment 2 (sharp knife)

Day 1: Treatment 4 (sharp nozzle)

Day 12: Treatment 1 (dull knife)

Day 12: Treatment 3 (fuzzy nozzle)

Day 12: Treatment 2 (sharp knife)

Day 12: Treatment 4 (sharp nozzle)

Day 12: Treatment 1 (dull knife)

Day 12: Treatment 3 (fuzzy nozzle)

Day 12: Treatment 2 (sharp knife)

Day 12: Treatment 4 (sharp nozzle)

June 24, 18 days in air at 2.5C
Treatment 1 = used or Dull blade

Pictures of 3 replicates. Focus on browning on the cut midrib; selected pieces of similar maturity

June 24, 18 days in air at 2.5C
Treatment 2 = New or sharp blade

June 24, 18 days in air at 2.5C
Treatment 3 = Fuzzy Nozzle

June 24, 18 days in air at 2.5C
Treatment 4 = Sharp nozzle

Total bacteria count (APC) Romaine salad-cut lettuce

	Log CFU/gram					
Treatment	Day 1	SD	Day 8	SD	Day 12	SD
1	3.76	±0.18	6.74	±0.02	5.13	0.10
2	3.99	±0.25	6.55	±0.32	5.25	0.13
3	3.11	±0.52	6.50	±0.07	4.93	0.29
4	2.41	±0.36	6.46	±0.05	4.36	0.27

1= used knives
2= new knives
3= fuzzy nozzle
4 = sharp nozzle

Total plate count
Lettuce
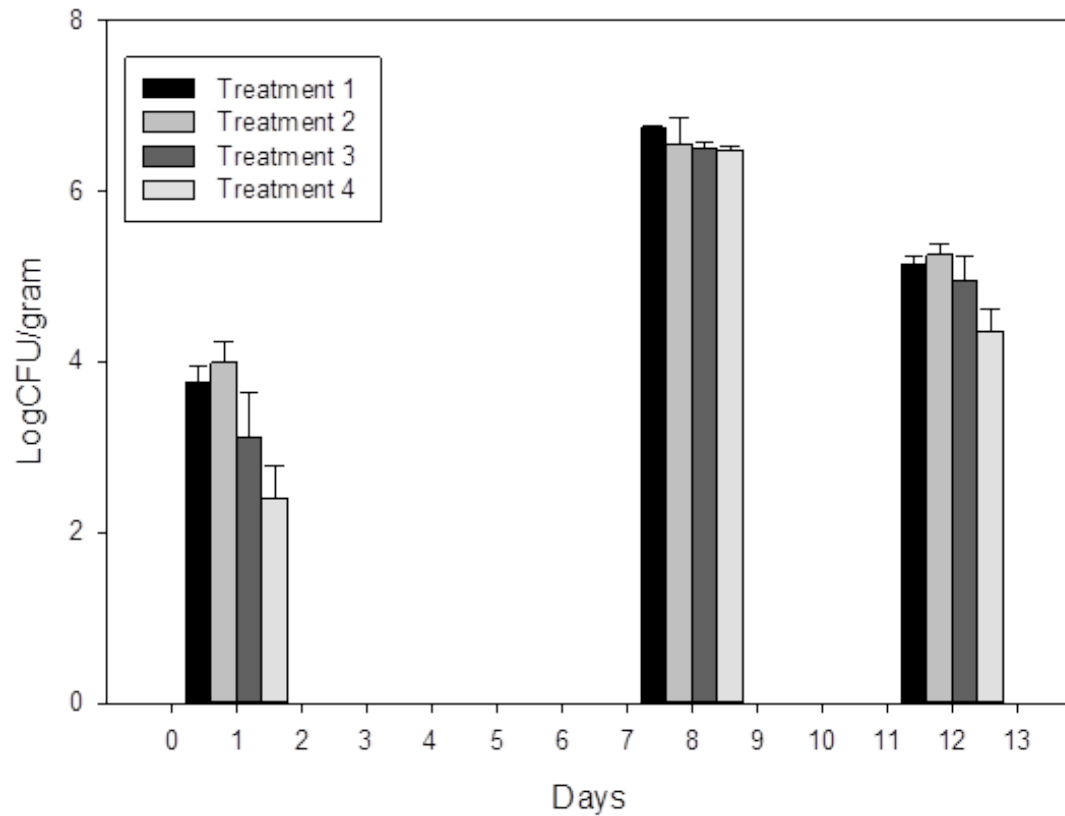
1= used knives
2= new knives
3= fuzzy nozzle
4 = sharp nozzle

Romaine Knife and Waterjet Cutting Test #2

UC Davis and Fresh Express

Augusto 2013

UC Davis results included here

Summary August 2013 Test

- Romaine lettuce was cut with used and new knives on a Translicer or by sharp nozzles on KMT pilot waterjet system at 2 conditions.

- The romaine lettuce showed quality changes faster than in Test#1; by 12 days in air at 2.5C, there were significant differences among cutting treatments.

- At 12 days, the waterjet sharp nozzle cutting was clearly superior to knife blade cutting treatments.

Materials & Methods

Romaine lettuce

Variety: Sun Valley

Growing Region: Salinas Valley, CA

Harvest Date: August 3, 2013 harvested as conventional Romaine (whole head); lettuce and process water send to UC Davis on August 5 where it was held overnight at 2.5C. All treatments processed on August 6.

Cutting (2"x2" cut size):

Treatments T1, T2 at the Fresh Express Pilot Line,

Treatments T3 and T4 at the Mann Lab, UC Davis

Treatments:

T1 - Dull knife 3 x sharpened + end of last day of use (2 x 8 h) (end of knife life)

T2 - Sharp knife 0 x sharpened + beginning of 1st day (new knife)

T3 - Sharp nozzle Waterjet at 35000 psi at speed of 50 fpm

T4 - Sharp nozzle Waterjet at 55000 psi at speed of 25 fpm

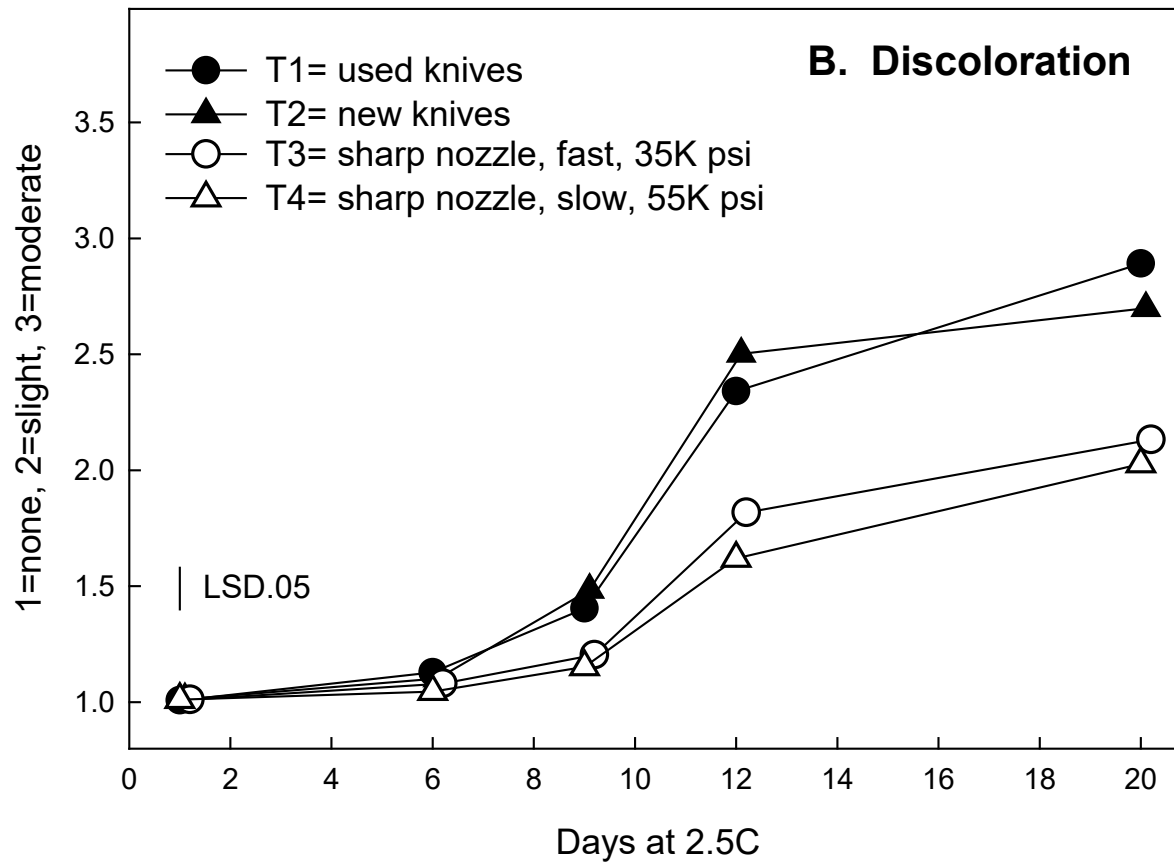## Packaging & Storage conditions:

Set 1: Packaged under MAP following 10 oz HOR specs and stored at 40°F (4.4°C)
for 15 days (Fresh Express R&D);

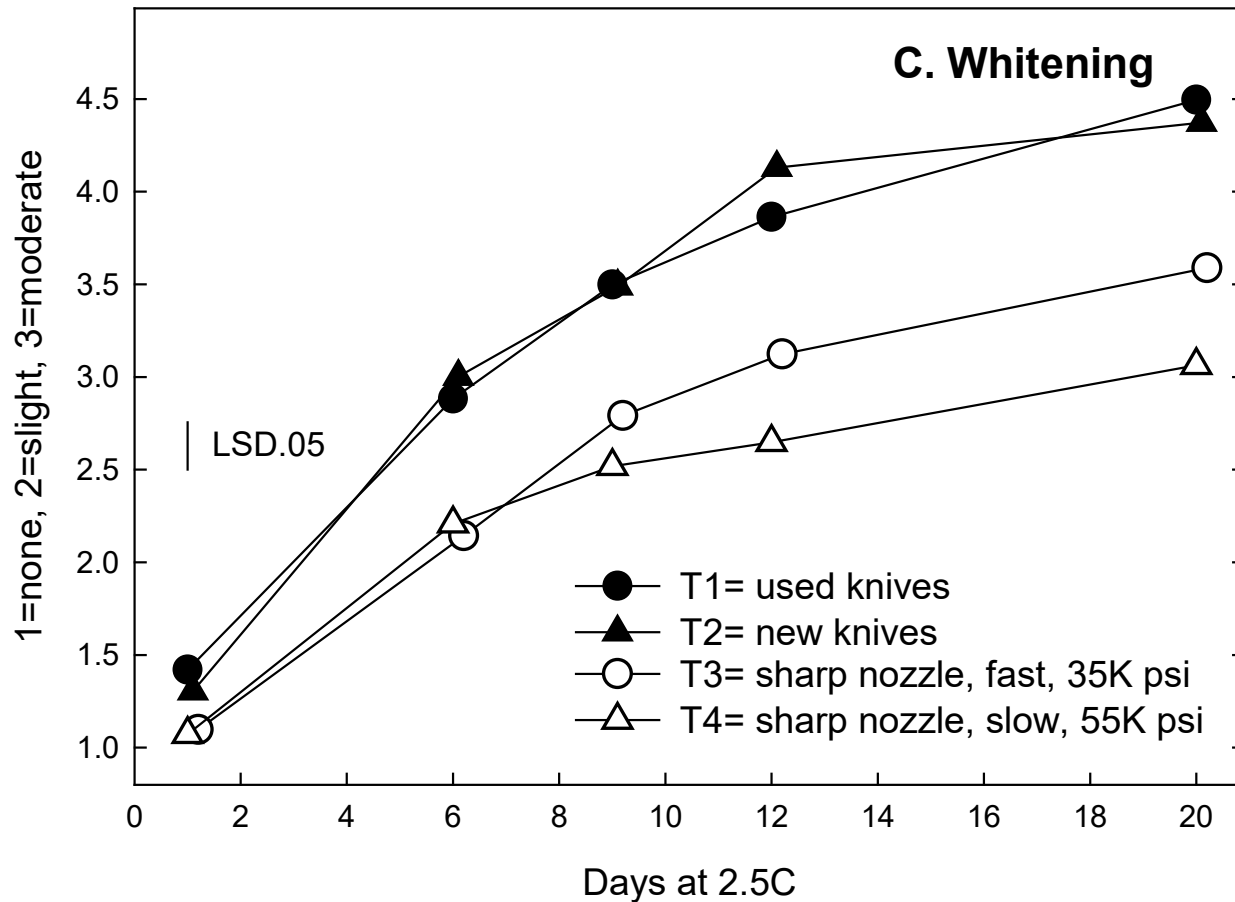Set 2: Packaged in air and stored at 36.5°F (2.5°C) up to 20 days (UC Davis)
Total product amount 35 pieces x 4 replicates (bag) per treatment per evaluation
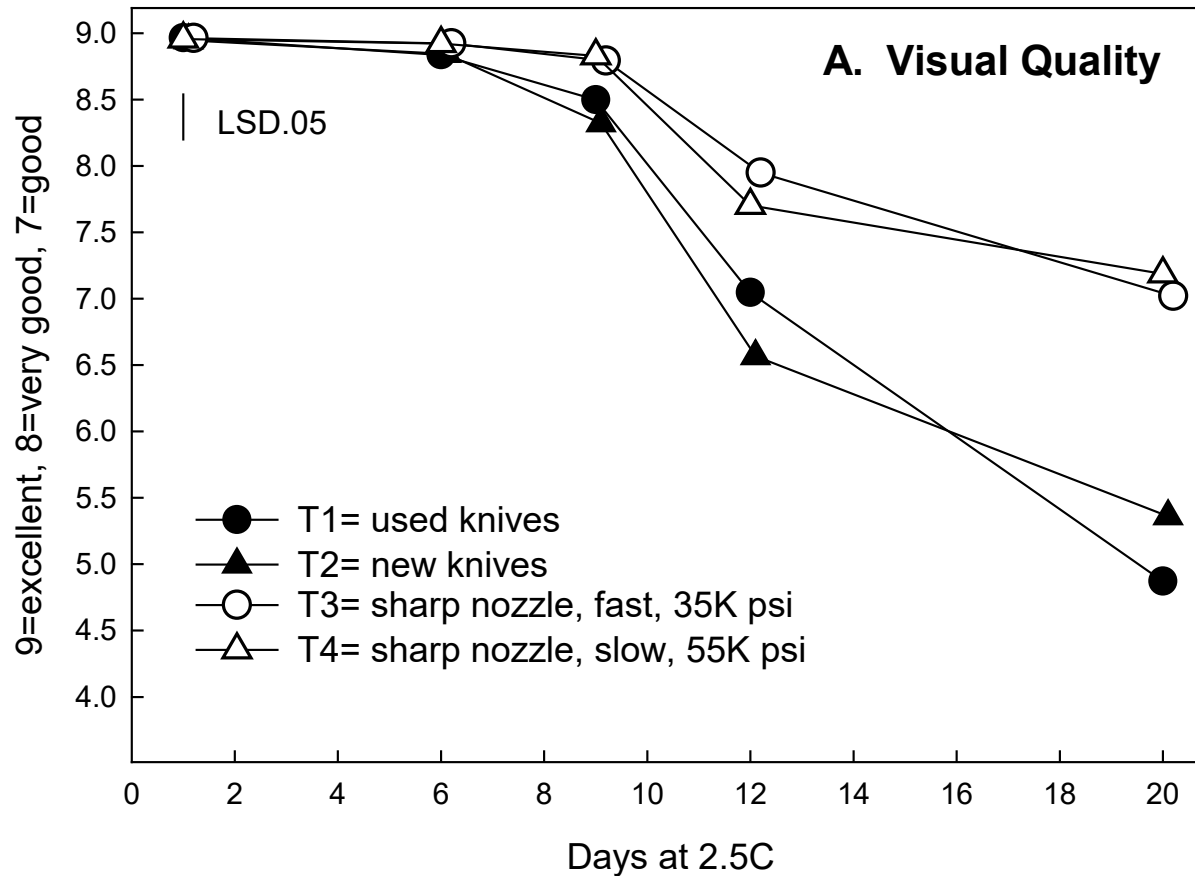
Data average of 35 pieces per rep per evaluation per treatment, evaluating at both cut ends; 4 reps.

Data average of 35 pieces per rep per evaluation per treatment, evaluating at both cut ends; 4 reps.

C. Whitening

1=none, 2=slight, 3=moderate

LSD.05

T1= used knives
T2= new knives
T3= sharp nozzle, fast, 35K psi
T4= sharp nozzle, slow, 55K psi

Days at 2.5C

Data average of 35 pieces per rep per evaluation per treatment, evaluating at both cut ends; 4 reps.

PHOTOS
Romaine Lettuce Salad Cuts
August 2013

Cut pieces stored in plastic bags in air at 2.5C

Pictures of 2 of 4 reps of each treatment

UC Davis and Fresh Express Test#2

Day 1: Treatment 1 (used or dull knife)

Day 1: Treatment 3 (sharp nozzle, fast 35K psi)

Day 1: Treatment 2 (new or sharp knife)

Day 1: Treatment 4 (sharp nozzle, slow 55K psi)

Day 1: Treatment 1 (used or dull knife)

Day 1: Treatment 3 (sharp nozzle, fast 35K psi)

Day 1: Treatment 2 (new or sharp knife)

Day 1: Treatment 4 (sharp nozzle, slow 55K psi)

Day 12: Treatment 1 (used or dull knife)
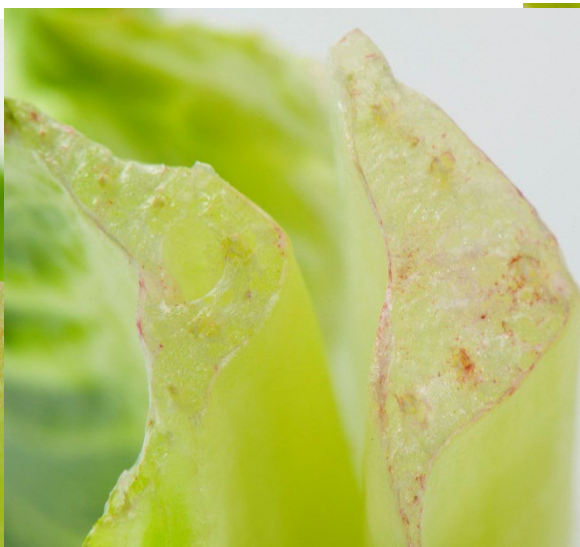
Day 12: Treatment 3 (sharp nozzle, fast 35K psi)

Day 12: Treatment 2 (new or sharp knife)

Day 12: Treatment 4 (sharp nozzle, slow 55K psi)

Day 12: Treatment 1 (used or dull knife)

Day 12: Treatment 3 (sharp nozzle, fast 35K psi)

Day 12: Treatment 2 (new or sharp knife)

Day 12: Treatment 4 (sharp nozzle, slow 55K psi)

Dull Knives (Used and reconditioned)

8 days at 2.5C in air
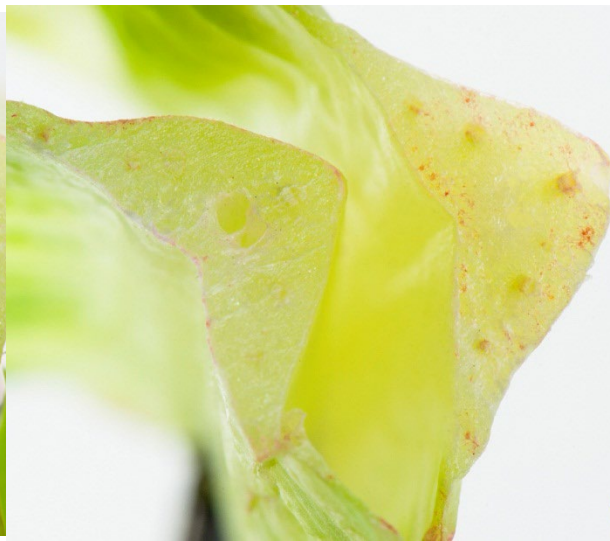
Sharp Knives (new knives)

8 days at 2.5C in air

Waterjet Sharp Nozzle (fast, 35,00psi)

8 days at 2.5C in air
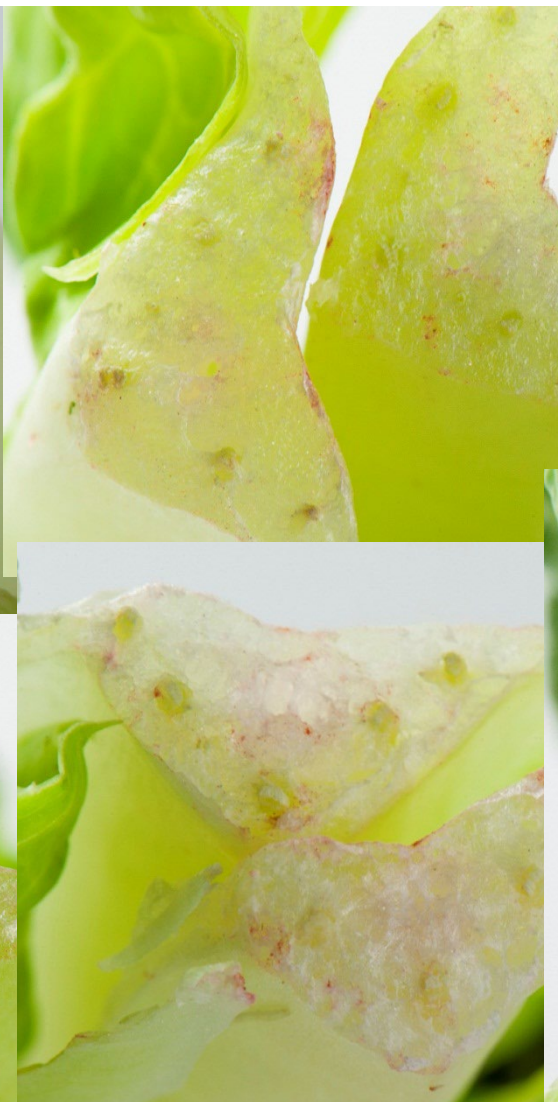
Watejet Sharp nozzle (slow, 55,000psi)
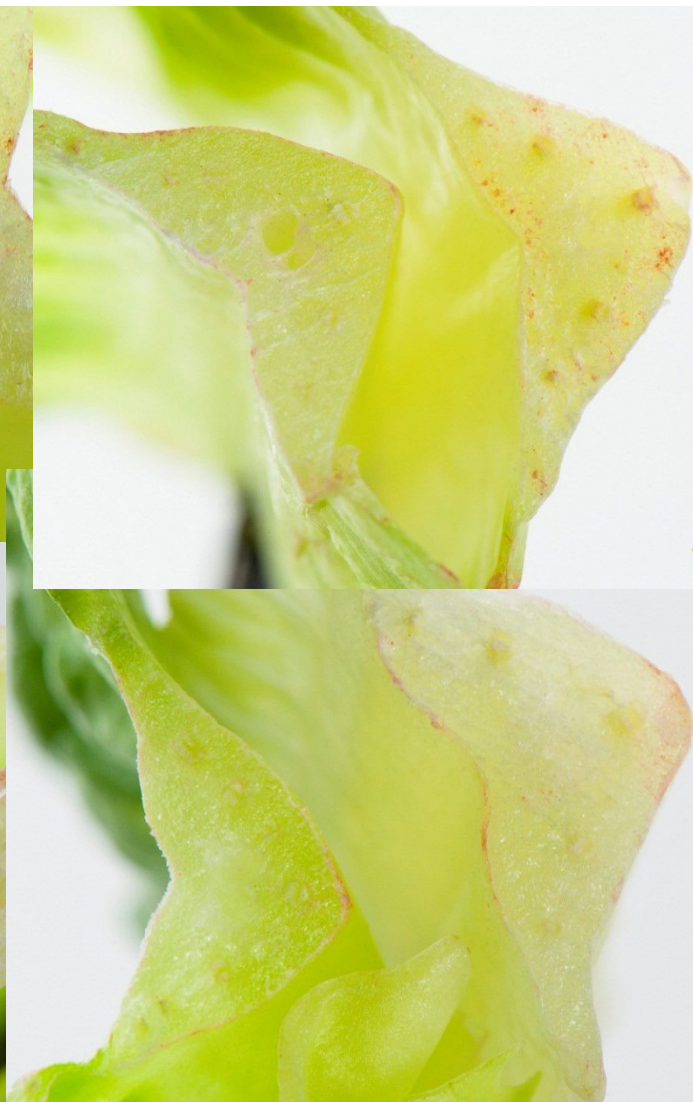
8 days at 2.5C in air

Used blades

Sharp new blades

Sharp nozzle
(slow speed, high pressure)

Package, no MA; 8 days at 2.5C in air

Test #2 FrEx 2013

Total bacteria count (APC) Romaine salad-cut lettuce Test#2

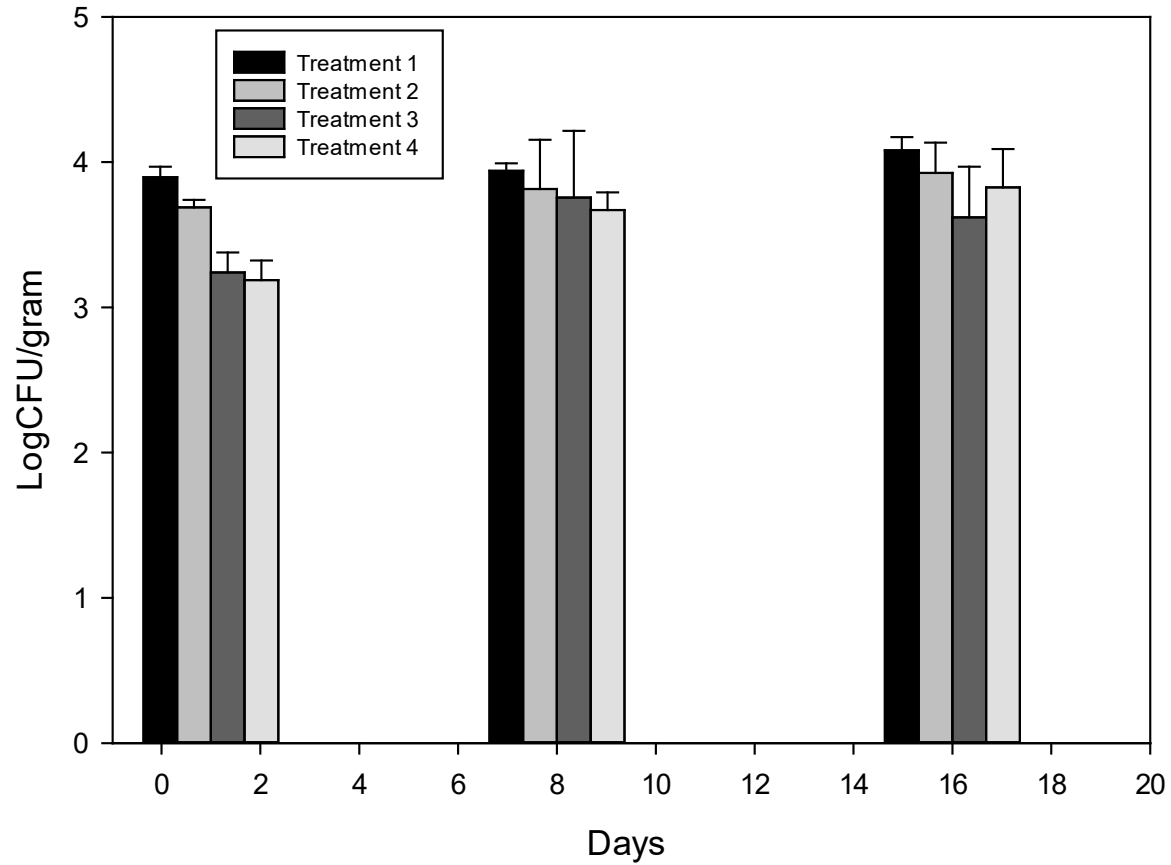|	Log CFU/gram					
Treatment	Day 1	SD	Day 8	SD	Day 16	SD
1	3.90	±0.07	3.94	±0.05	4.08	±0.09
2	3.69	±0.05	3.81	±0.34	3.93	±0.21
3	3.24	±0.14	3.76	±0.46	3.62	±0.35
4	3.19	±0.13	3.67	±0.12	3.83	±0.26

1= used knives
2= new knives
3= sharp nozzle, fast, 35K psi
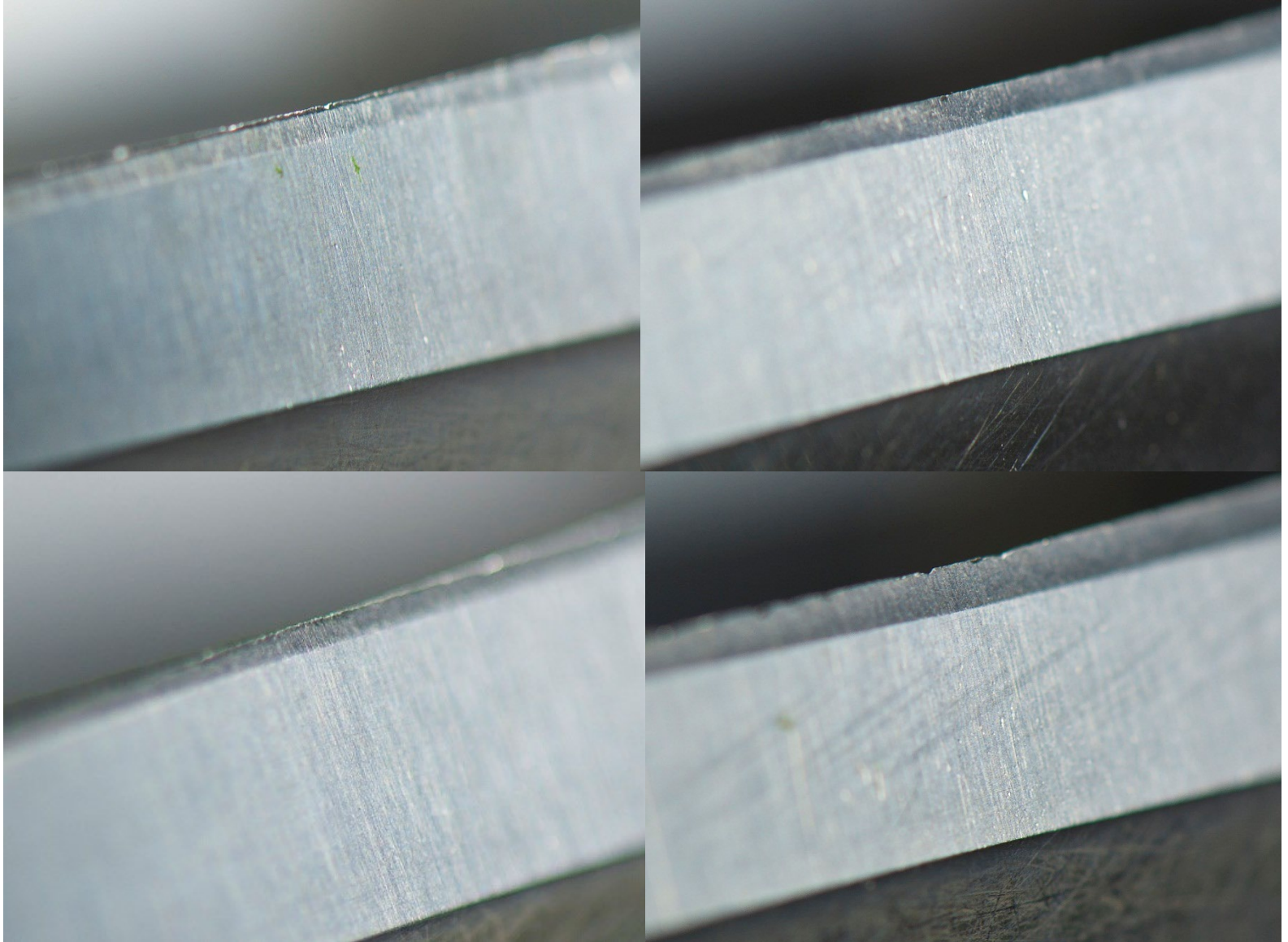4 = sharp nozzle, slow 55K psi

Total plate count
Lettuce

1= used knives

2= new knives

3= sharp nozzle, fast, 35K psi

4 = sharp nozzle, slow 55K psi

Dull knives (photo of top knife on each of 4 sets)

Sharp knives (photo of top knife on each of 4 sets)