



Millet Malt Magic

Ghostfish Brewery
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Who are we?





What do we do?

“We are a group of plant breeders, researchers and graduate students set on a path to **bring diversity to our agroecological landscapes** through innovative plant breeding and agronomic practices. Local farmers inspire our research projects and our supporters and funders fuel our pursuit of **adapting novel crops to our regions and developing new, functional traits for our staple grains**. In the lab, we study our crops down to the molecular level. In the field, we partner with farmers throughout the Pacific Northwest to conduct variety, agronomic and breeding trials on their land. In our work, we emphasize the value of engaging farmers throughout the breeding process. The strength of our breeding program comes from the melding of farmer and researcher knowledge.”

Millet in PNW/WA

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MILLET IN THE GREAT PLAINS

- Primarily produced in CO, NE, WY, ND, SD
- 400,000 - 600,000 acres annually
- 15-20% export to over 70 countries
- **Cash grain bids**
 - \$11.00-\$12.75 CWT
- **Grower contracts**
- Breeding programs (NE, KS)

Photo Credit
Cody Holland



MILLET IN THE GREAT PLAINS

- Wheat, corn, soy, sunflower systems
- Planted after wheat
 - Controls weeds and conserves soil moisture
- “Catch crop”
- Dryland/rainfed conditions
 - Shallow root system



Photo Credit
Cody Holland

MILLET IN PNW/WA: CHALLENGES

- Soil temperature
- Growing degree days
- Summer precipitation
- Frost dates
- Birds
- Soil pH

Photo Credit
Cody Holland



MILLET PROJECTS AT WSU

1

2

3

4

Phenotypic responses
of twenty diverse proso
millet (*Panicum
miliaceum*) accessions
to irrigation. (2012-
2014)

Effect three levels of
fertilizer on: greenness
index, plant height,
heading date, seed
maturity, and yield.
(2015-2016)

Extrusion
Characteristics of
Whole Grain Proso
Millet (*Panicum
miliaceum*) Var.
Huntsman (2015)

Variety trials of 15
varieties of millet in
Rwanda (2016-Present)



Small Grain Breeding: Emphasis on Field Evaluations of Diverse Millet Species

Cody Holland¹, Cedric Habiyaremye¹, Kevin Murphy¹

Department of Crop & Soil Sciences, Washington State University



MILLET IN PNW/WA: CHALLENGES

- Soil temperature
 - Growing degree days
 - Summer precipitation
 - Frost dates
 - Birds
 - Soil pH
-
- **Market – who's going to buy it?**
 - End-use suitability

Photo Credit
Cody Holland



MILLET IN PNW/WA



The Seattle Times

Pacific NW Magazine

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Millet is getting some serious attention from cooks, brewers and researchers as it makes its way from the bird feeder to the menu (and the beer mug)

“The current challenge for farmers, Bunch says, would be, ‘Millet might be a great rotation crop, but where am I going to sell it?’ They can’t just take it to the local grain elevator.” Part of his work is helping find other options.”

Millet Projects at WSU: Western SARE

Diversifying Northwestern fields and palates by
**developing high quality malt and nutritious
food markets for quinoa, millet, and buckwheat**



THEMES

- Diversifying farmscapes by adding value to crop rotation species
- Improving farm profitability by expanding markets of underutilized grain crops
- Bolstering resiliency of farming communities through health and profits



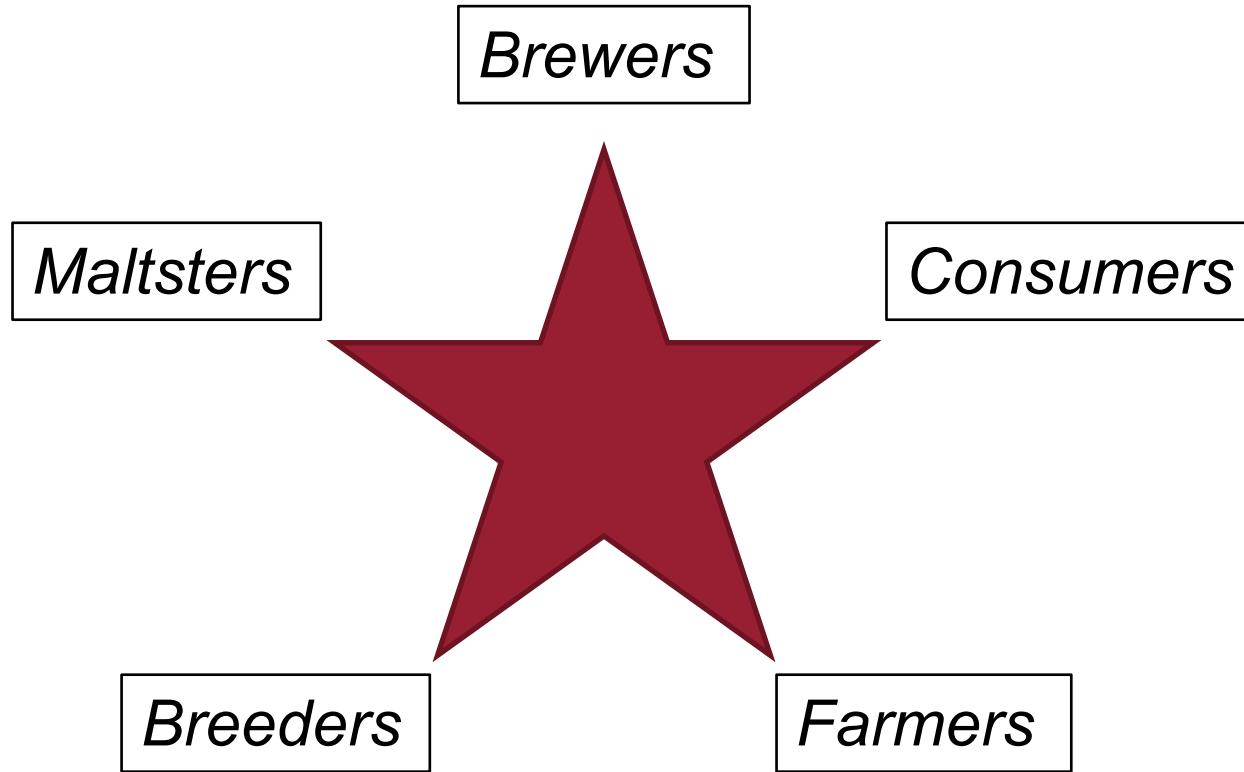
OBJECTIVES

1. Variety Trials
2. Characterize varieties for nutrition and flavor, malt quality
3. Quantify potential human nutrition and health impacts
4. Develop a participatory, sensory-based outreach program





BREEDING FOR MALT QUALITY



Thank you for attending the sensory panel.
PLEASE PRESS THE BLUE SIGNAL LIGHT TO LET THE EXPERIMENTER KNOW YOU ARE HERE.

Can you keep a secret?

We value experimenter's individual opinions - so please don't discuss or comment on your evaluation of the samples with other panel members (either in the building or in the hallway). Thank you.



Sample: includes citrus, dry fruits, dried nuts, herbs, green plants, green tea, and

Grain: includes oats, rice, barley, and cracked rice

Fluffy: includes cream, velvet, satin, plush, and softness

Bumpy: includes rough, coarse, bumpy, grainy, textured, scrubbed, scrubby, fuzzy, and bumpy

Smooth: smooth, soft, and sleek

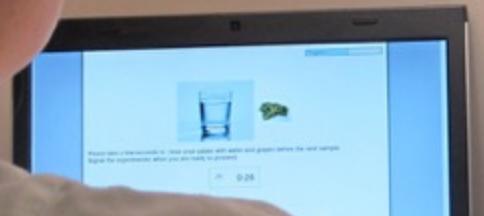
Round: includes round, apple, rounded, and button

Elliptical: includes elongated, oval, ribbed, and rounded

Rectangular: the opposite shape of round

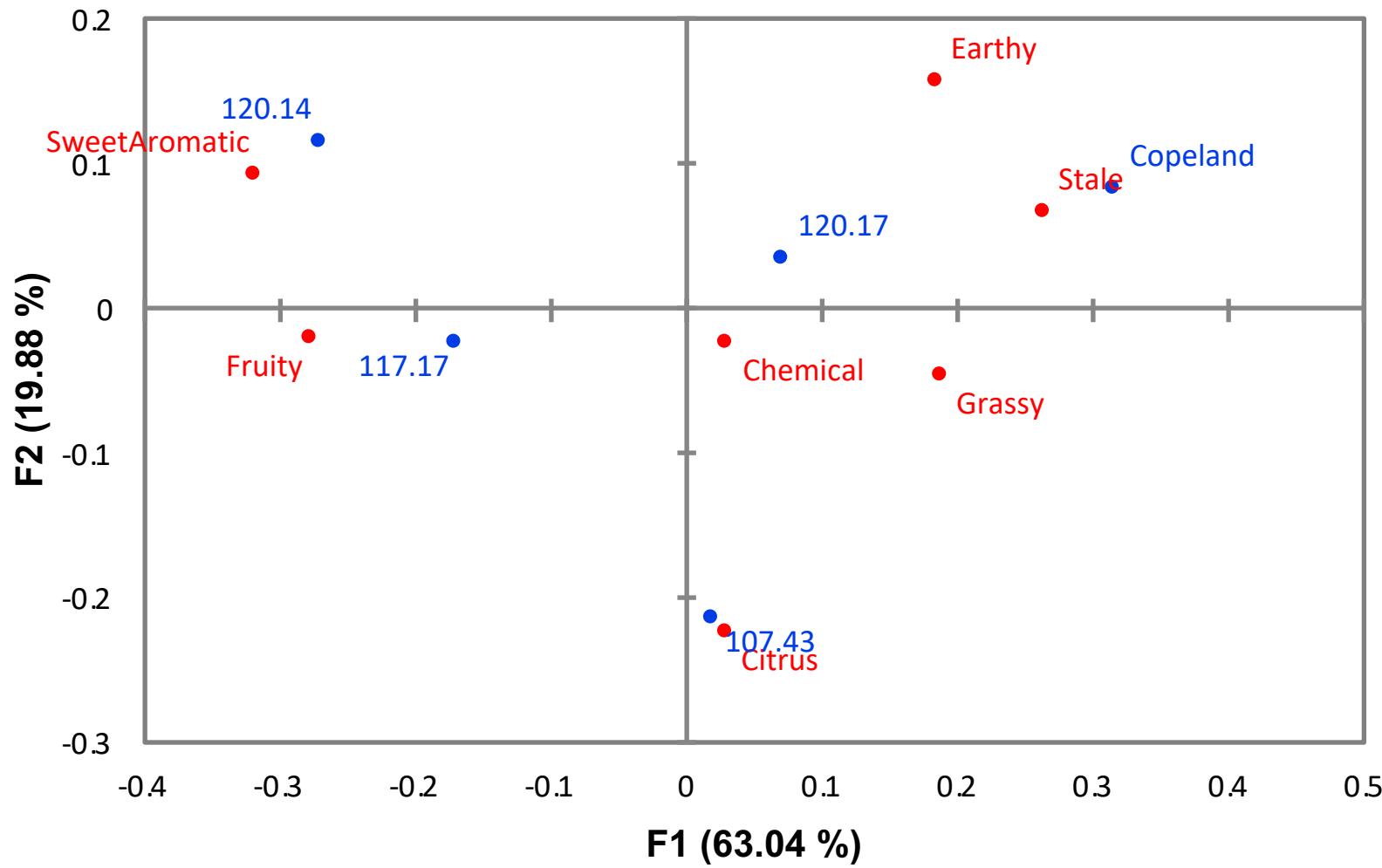
Angular: includes sharp, dry, stony, mineral, and sand stones

Solid: includes solid, crusty, paper, cardboard, and wood



BEER: CORRESPONDENCE ANALYSIS

(axes F1 and F2: 82.91 %)



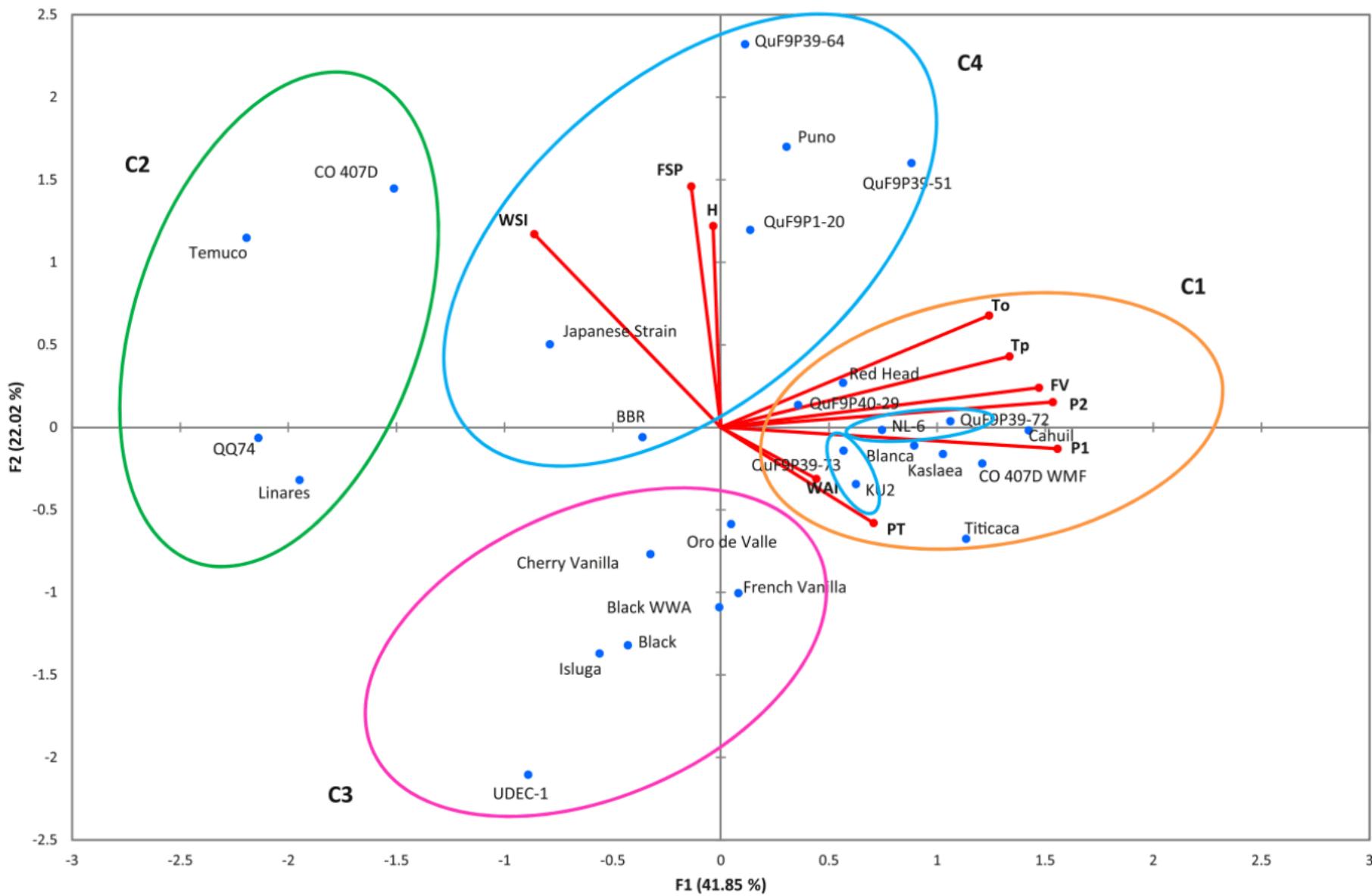
● Attributes ● Products

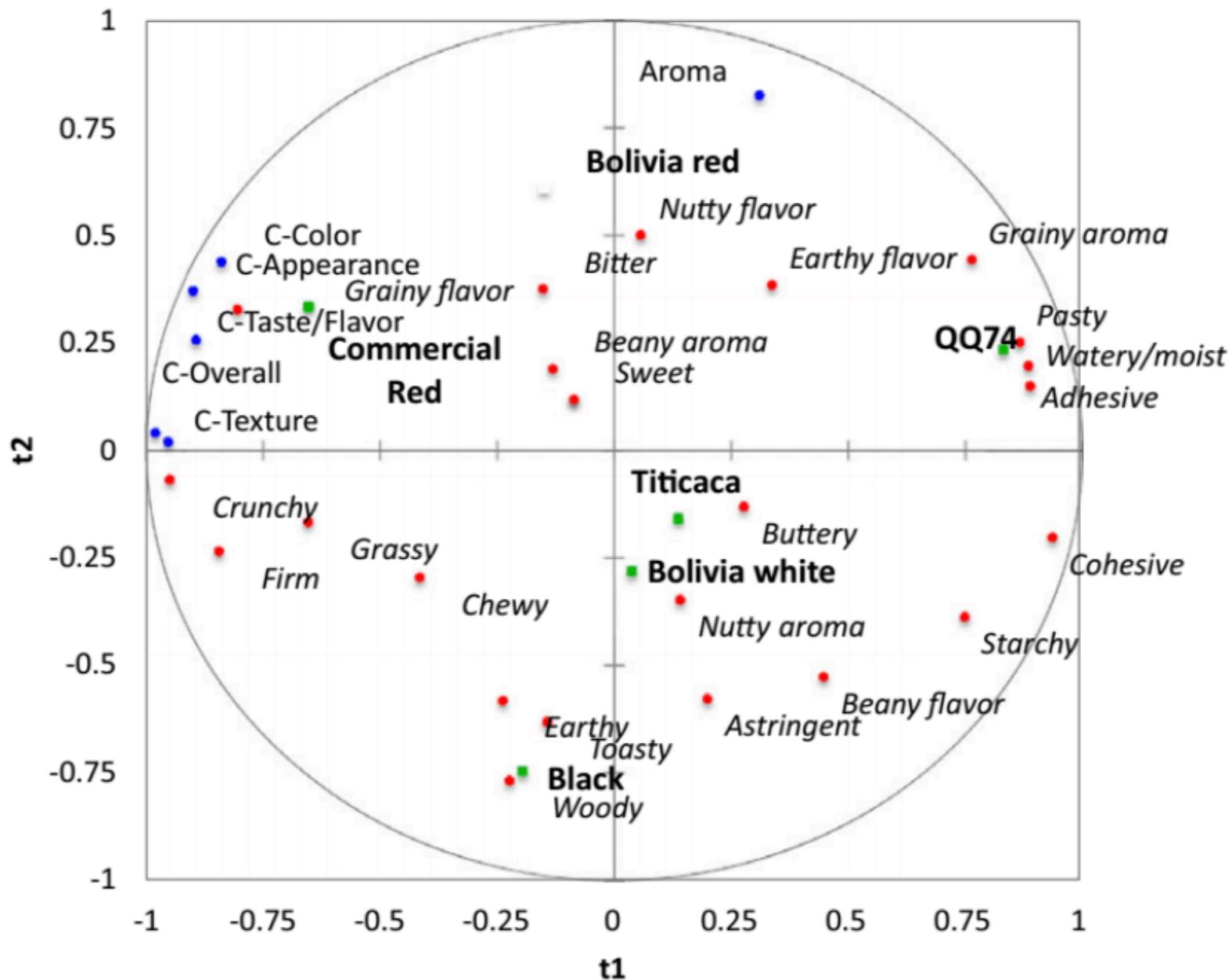
WILLINGNESS TO PAY FOR A SIX PACK

Price	Copeland	120.17	120.14	<u>107.43</u>	117.17
\$7.99	34%	34%	25%	40%	32%
\$9.99	19%	18%	27%	20%	24%
\$11.99	6%	8%	11%	5%	6%
\$13.99	1%	3%	3%	3%	0%
I would not buy this beer	40%	37%	34%	32%	38%



Biplot (axes F1 and F2: 63.87 %)







Thank you!



Images by Evan Craine