The Banana Differential Balloting Station
A Project of the Future Democracies Laboratory at San José State University
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Project Overview and Goals

The Banana Differential Balloting Station is a simple apparatus for enfranchising plants in political systems by including their policy preferences in decision-making processes. Facilitating ubiquitous polling of flora by enlisting simple materials for rudimentary hormone measurement, the balloting station has the potential to avoid the limitations of expensive laboratory equipment and encourage participation in the botanical polling process by a broad range of humans globally.

The operating principle of banana differential balloting is that fruit ripens more quickly as the concentration of the phytohormone ethylene increases, so a pair of bananas can potentially be used as a readymade phytohormone monitor by comparing the ripening of a banana exposed to the ethylene emitted by a plant to the ripening of an isolated banana. The basic principle for determining the political preferences of a plant is to observe change in stress level over time, as indicated by change in ethylene emission, in order to find out whether the plant is growing more or less satisfied with the political status quo and therefore supports or opposes policies of incumbent politicians. ("*Are you better off now than you were four years ago...?*") Observation of results may inform decisions made by human voters, and ultimately may become the basis for plants to directly participate in elections or governance.

The Banana Differential Balloting Station is still at an early experimental stage. The scientific literature includes documentation of farmers using cut leaves to accelerate the banana ripening process based on the ethylene generated by the leaves, which is preliminary evidence that bananas are sufficiently sensitive to the ethylene in foliage, and therefore should ripen faster in plants emitting more ethylene due to higher stress caused by unfavorable living conditions. However there are no examples in the literature of fruit being used to monitor ethylene in lieu of methods such as gas chromatography, and there may be challenges such as feedback loops between the plant-generated ethylene and banana-generated ethylene. Therefore experimentation is needed to validate and refine the process.

The following protocol is intended as a starting point for experimentation. Some suggested variations follow the basic protocol. Experimenters are encouraged to be creative in the design of their experiments, but also rigorous in execution and documentation of results.

Questions, comments, and results should be sent to jonathonkeats@gmail.com

Banana Differential Balloting Experimental Protocol

Materials:
1) A potted plant
2) Two small unripe bananas (i.e., equally green)
3) Two large jars (e.g., mason jars)
4) A can of Coke (or equivalent)
5) An indelible marker
6) A watch or clock
7) A camera or smartphone
8) A computer with photo editing software

Method:
1) Using your marker, write 'Polling Unit' on one banana and 'Control Unit' on the other banana. Write 'Calibration Unit' and the current date and time on the can of Coke. Write 'Voter' and the location on the plant pot. Also inscribe a voter number on the pot if more than one plant is to be polled.
2) Photograph the Polling and Control Units next to the Calibration Unit for color calibration. Take your photos in good light.
3) Place the Polling Unit and the Voter under one jar. Place the Control Unit under the other jar. Both jars should be set in a place where there is adequate sunlight.
4) At the end of four days, remove the Polling and Control Units and photograph them with the Calibration Unit.
5) Return the Voter to its ordinary place indoors or outdoors.
6) Repeat the above protocol monthly, polling the same Voter for as many months as possible.
Note: More plants can be polled using a single control unit and calibration unit.

How to analyze the results:
1) Use the color of the Calibration Unit to match the color of the photographs.
2) Compare the ripeness of the Polling Unit to the ripeness of the Control Unit on Day 4. Compare the first-month results to results from later months.
3) Count a vote for the status quo if the difference in ripeness between the Polling Unit and the Control Unit decreases or stays the same from month to month. Count a vote for change if the difference in ripeness between the Polling Unit and the Control Unit increases from month to month.

Some additional factors to monitor and document (if possible):
- light level
- temperature
- humidity

Variations on the Standard Protocol

Potential variations to materials:
- Size and species of plant.
- Size and ripeness of bananas.
- Size and type of container.
- Type of fruit.

Potential variations to method:
- Increase or decrease the duration of exposure to the plant.
- Add a ripening period following exposure to the plant.
- Artificially stress the plant before testing, increasing the level of stress over a series of tests. Plants may be stressed by under-watering them. Many plants also respond adversely to saltwater, and to physical contact.

Potential variations to analysis:
- Difference in quantifiable optical qualities (e.g., reflectance).
- Difference in ripening pattern (e.g., spotting).
- Difference in fruit sweetness or flavor.
- Difference in texture.
- Difference in smell or strength of aroma.
- Difference in capacitance.

References

Basic setup for polling:
https://drive.google.com/file/d/1orw7IsyDd93tNjKnprB1ExySoC6d7FIT/view?usp=sharing

Basic setup for documentation:
https://drive.google.com/file/d/1TU6Tpij22osYhi6PKRxKpXyV5C1oXNL9/view?usp=sharing

Standard banana ripeness chart:
https://drive.google.com/file/d/1P8-AwNbvT_AlDZ7pbUu2Zumok8Xt3TxB/view?usp=sharing

Scientific literature on ethylene:
https://www.frontiersin.org/articles/10.3389/fpls.2017.00475/full
https://www.frontiersin.org/research-topics/4499/ethylene-a-key-regulatory-molecule-in-plants#articles

Scientific literature on banana ripening induced by leaves:
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6401149/
http://www.bioline.org.br/pdf?ja14034

Scientific literature on capacitance to monitor banana ripeness:
http://www.cropj.com/soltani_4_6_2010_443_447.pdf

Information about the Future Democracies Laboratory:
https://projects.cadre.sjsu.edu/democracyproject/index.html

Information about the Phytodemocracy Initiative:
https://drive.google.com/file/d/1o4zuuZouXV2JJrql4fhNNCZdFUln7LqY/view

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