

Farm to Fork: Reducing the Risk of Microbial Contamination through Farmers' Market Layouts

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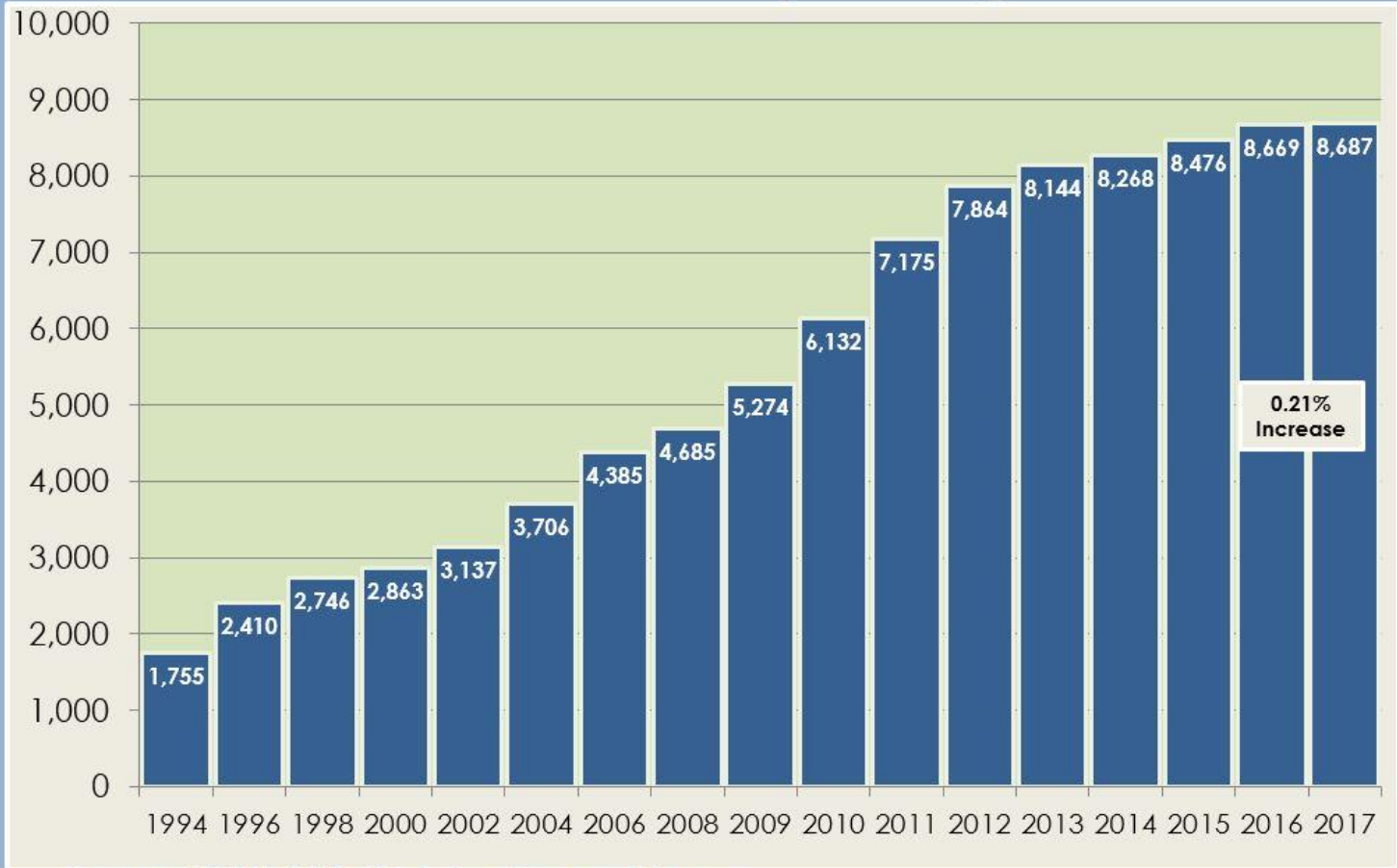
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National Count of Farmers Market Directory Listings



Source: USDA-AMS-Marketing Services Division

Farmers Market information is voluntary and self-reported to USDA-AMS-Marketing Services Division

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Farm-to-Fork trend:

- Enhances local economy
- Attracts consumers and hospitality owners that value social responsibility
- Opportunity for growers to sell products directly to consumers

→ Products capable of transmitting foodborne pathogens if not produced and handled properly

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Why is it such a risk now?

- Today's farmers markets are more complex than ever
 - Past: whole fruits and vegetables = primary items
 - Now: food is processed, cut open to be displayed, samples to entice purchases, actual products sold... etc.

- Increased complexity of product offerings = food safety has become a primary risk

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A few risks:

- Standardized rules for maintaining food safety
- Inspections
- **Environment**

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Environment

- Access to electricity
- Running water
 - Hand washing
 - Washing fresh produce
 - Dish washing (if needed)

Pathogens at farmers markets?

- The prevalence of **pathogens at farmers markets** has been documented and **thoroughly researched** (Bohaychuk et al., 2009; Li et al., 2017).
- Tested produce for thermotolerant *Campylobacter* and found that six different types of vegetables were **positive at farmers markets**, whereas those that were sampled at **grocery stores tested negative** (Park and Sanders, 1992)
- Tested samples of fresh herbs at farmers markets found that **24.1% tested positive** for generic *E. coli* (Levy et al., 2015)

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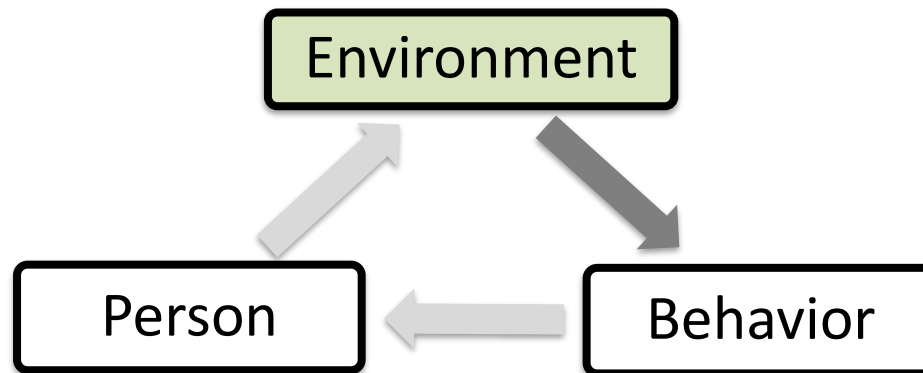
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Research model

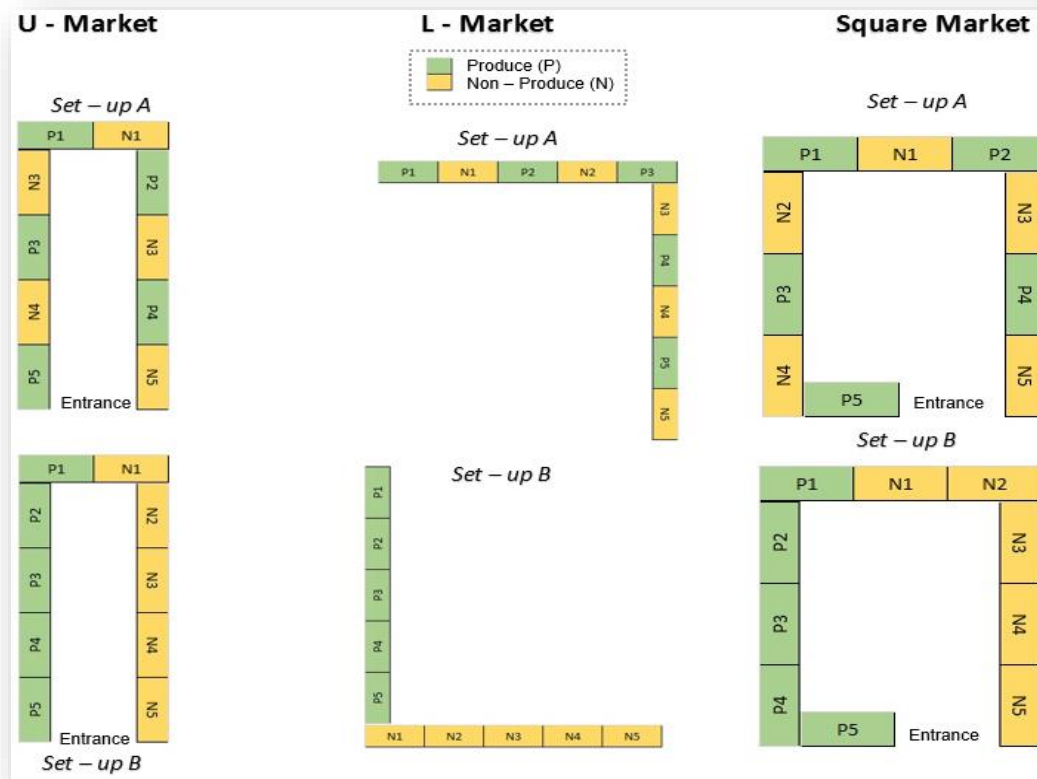
- Relationship between FM layouts and cross-contamination = not yet been explored
- Bandura's Social Cognitive Theory's Triadic Reciprocity Model (Bandura, 1978; 1986).



- **Research Question 1:** Can the environment influence consumers' behaviors in order to reduce the risk of potential cross-contamination?
- **Research Question 2:** What commonly used farmers market layout is the most effective at reducing the risk of potential cross-contamination?

Methodology

- 3*2 experimental between-subjects factorial design (factors were: vendor booth configurations and set-up)
- Participants (n=54, 9 per layout)
- One gram of florescent compound (FC; GloGerm™) lotion was spread on the hands of each participant



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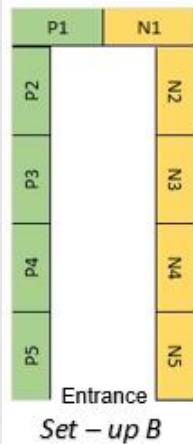
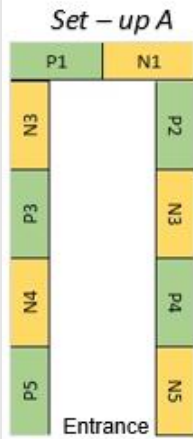


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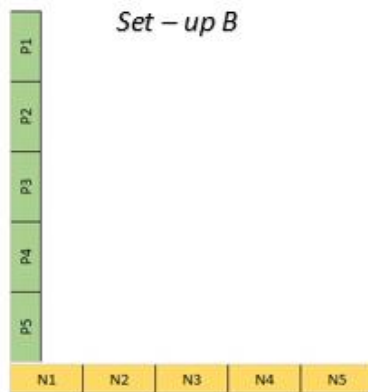
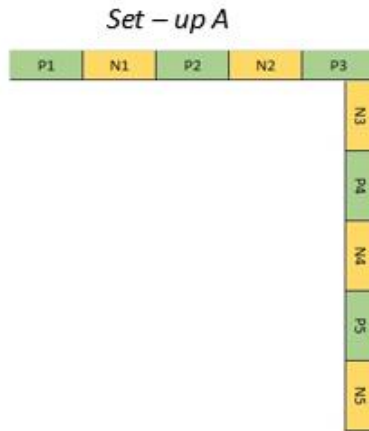
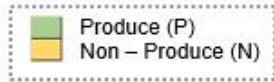
Methodology (continued)

- The most common vendor booth configurations (L-shaped [L-S], U-shaped [U-S], and S-shaped [S-S] layouts) were investigated (TDA, 2017).
- Each market was designed with 2 different setups (A and B) that differed in how produce (P) and non-produce (N) booths were scattered.
- A total of 475 swab samples (25 swabs per layout) were processed and recorded for absorbance levels. The absorbance at 370 nm was measured using a DU 640 spectrophotometer (Beckman Coulter, Inc., Brea, CA).

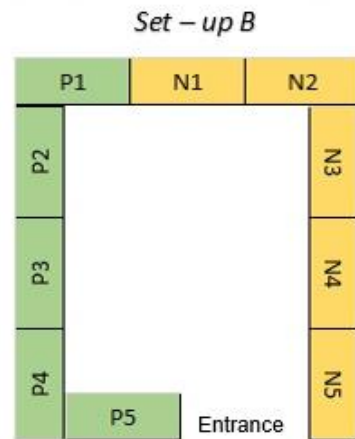
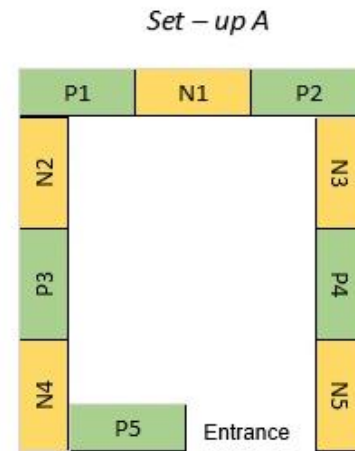
U - Market



L - Market



Square Market



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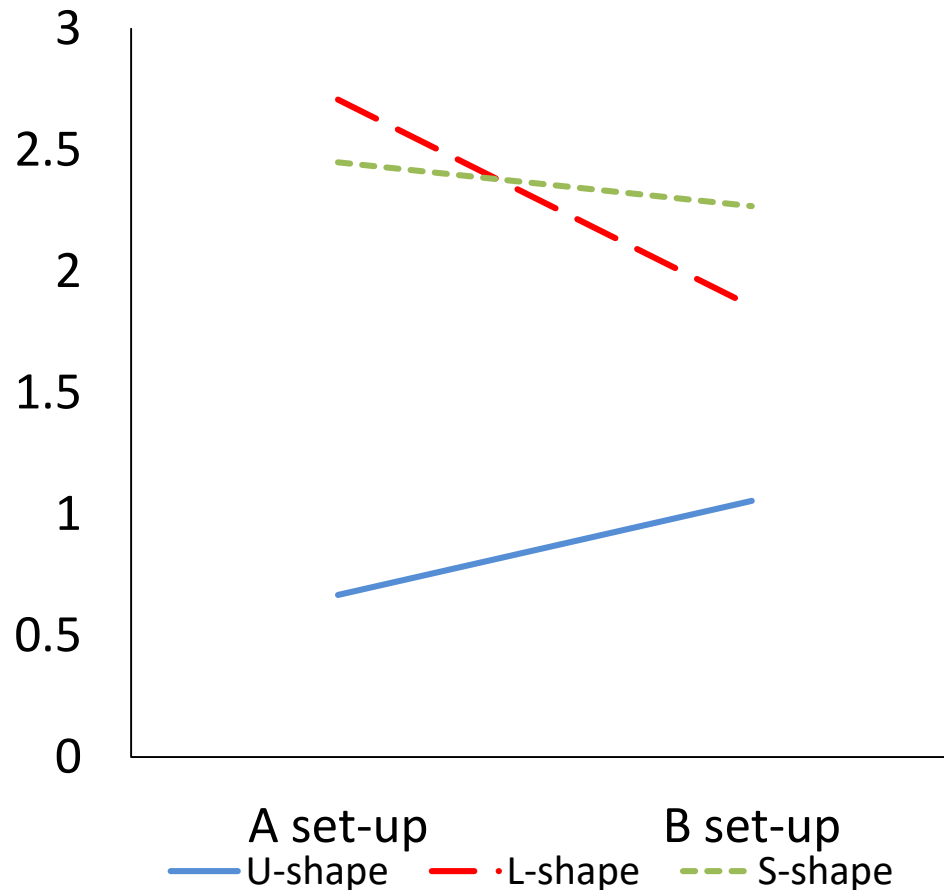
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Results

- Results showed that the simulated average level of CC of U-S market (0.874 g/mL) was significantly lower ($p < 0.001$) than L-S (2.321g/ml) and S-S market (2.372 g/ml).



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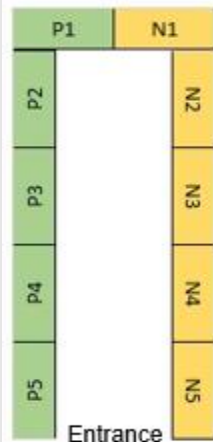
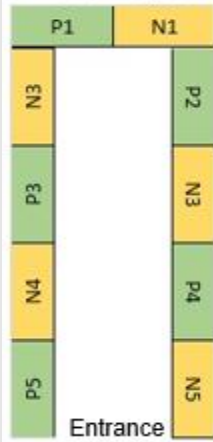
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U - Market

Set - up A

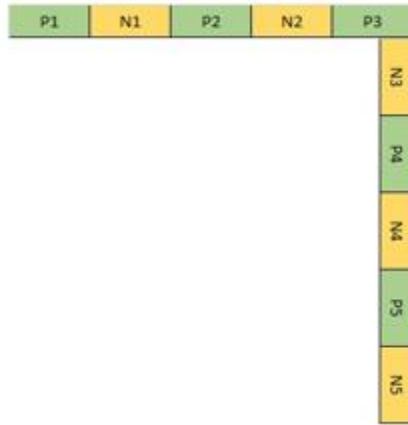


Set - up B

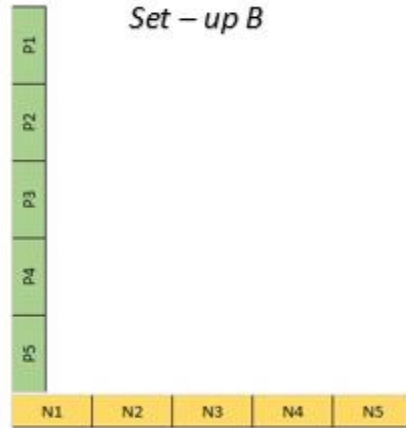
L - Market

Legend:
■ Produce (P)
■ Non - Produce (N)

Set - up A

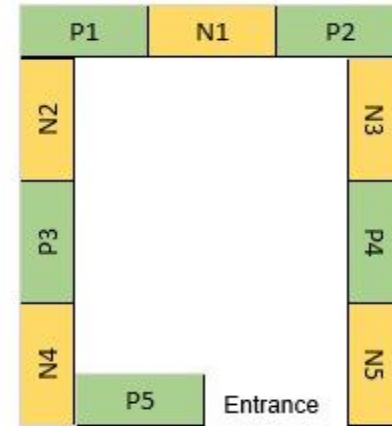


Set - up B

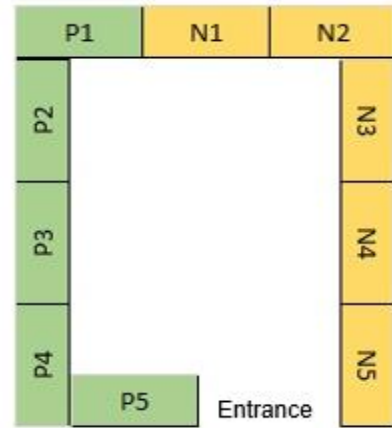


Square Market

Set - up A



Set - up B



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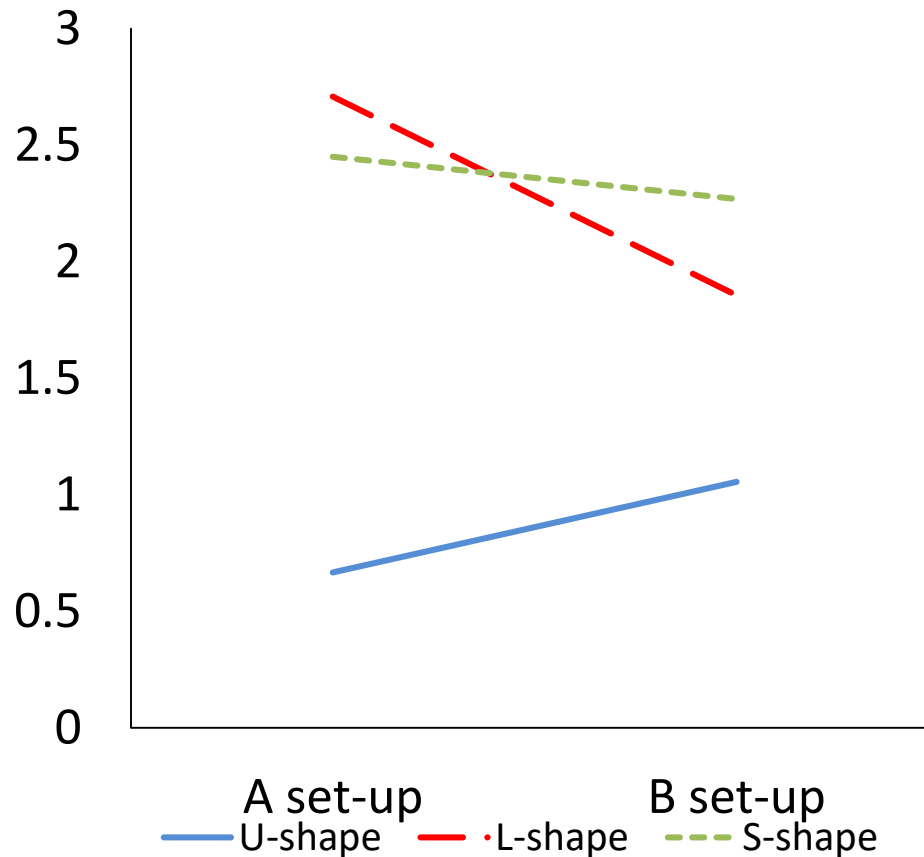
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Results

- The best market layout and setup based on the average levels of FC (0.667g/ml) was the U-S market with A setup where produce and non-produce booths were scattered.



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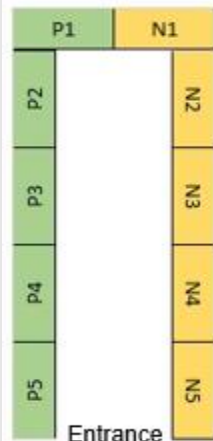
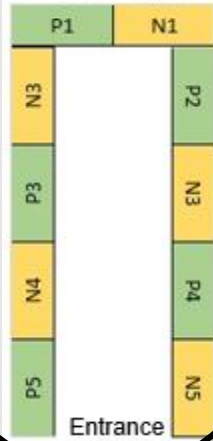
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U - Market

Set - up A

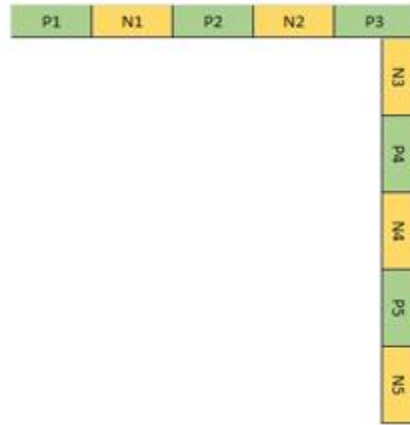


Set - up B

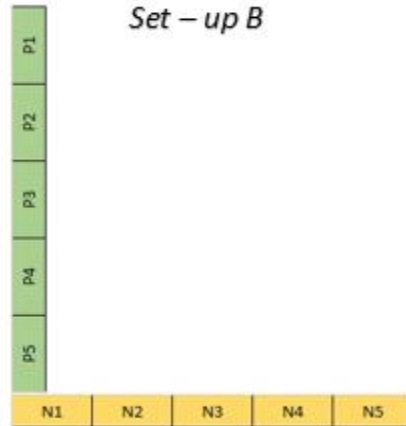
L - Market

Legend:
■ Produce (P)
■ Non - Produce (N)

Set - up A

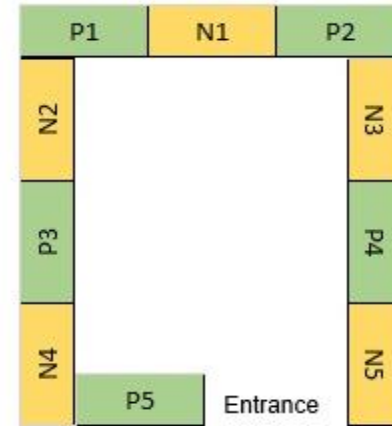


Set - up B

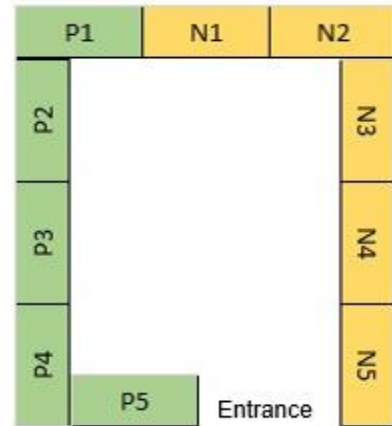


Square Market

Set - up A



Set - up B



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Recommendations/takeaways:

- If space allows, good to implement
- Note: Addition / extra precaution

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Future research:

- Investigate reasons that CC level varies in FM - different layouts and designs
- Researchers may also consider different points of initial contamination:
 - Vendor hand contacts, fresh produce items, containers, and other factors in FM

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- **Research Question 1:** Can the environment influence consumers' behaviors in order to reduce the risk of potential cross-contamination? **Yes!**
- **Research Question 2:** What commonly used farmers market layout is the most effective at reducing the risk of potential cross-contamination? **U-S A set-up**

Thank you!

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