

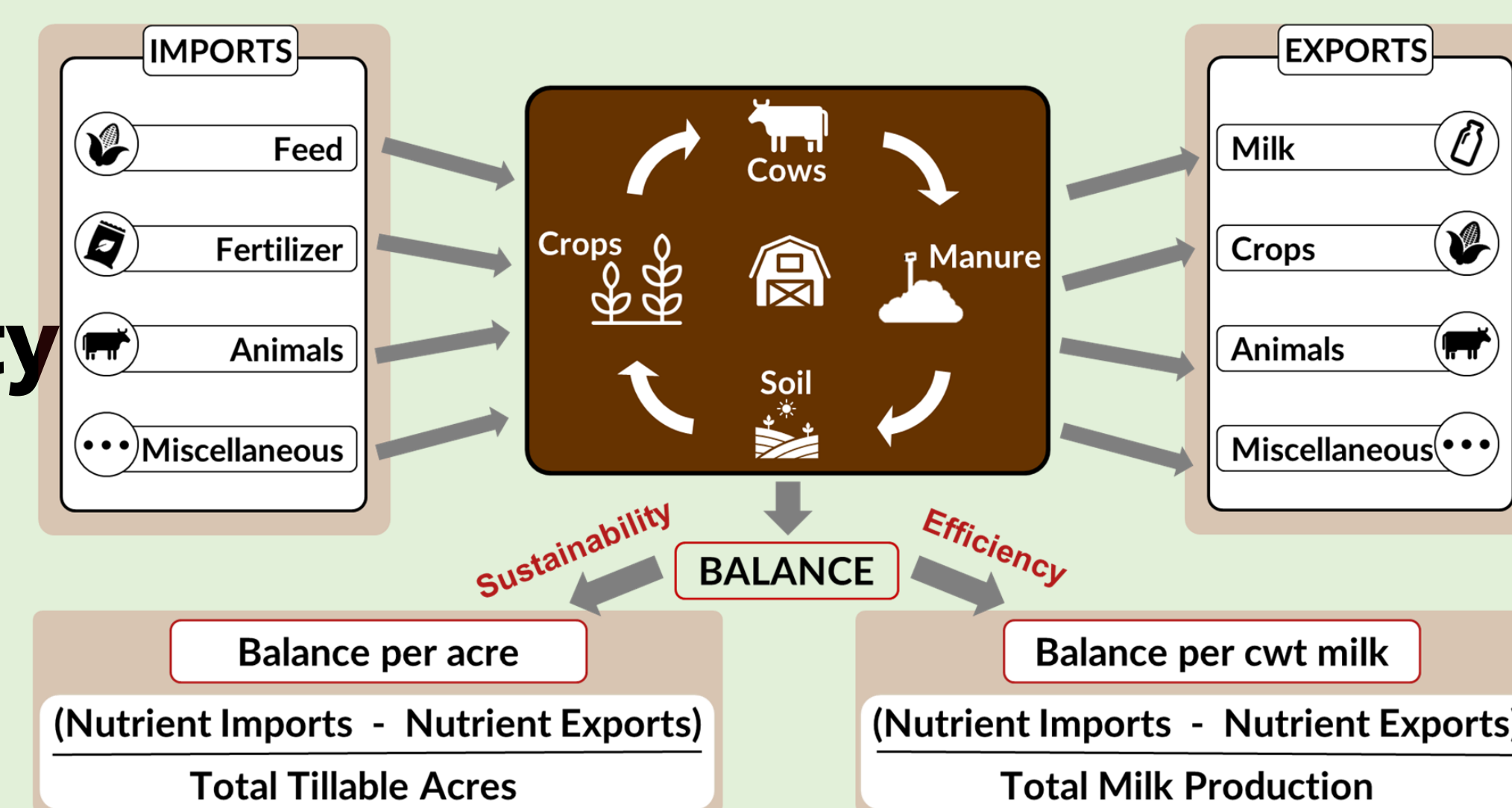
Whole-farm nutrient mass balances: A tool for advancing dairy sustainability

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What is the nutrient mass balance tool?

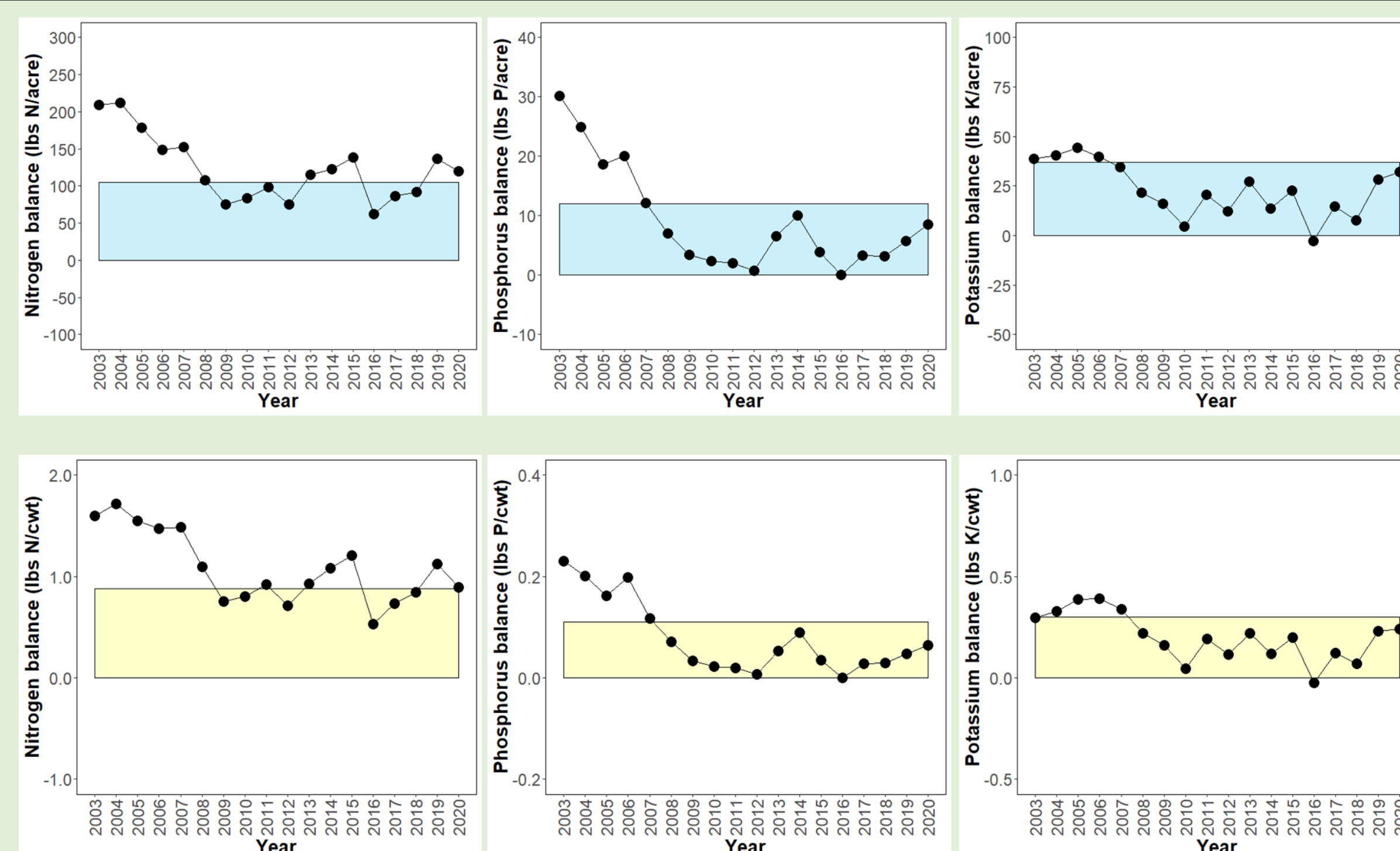
Whole-farm nutrient evaluation tool that aids in the management and monitoring of **nutrient status and nutrient use efficiency** on dairy farms over time

- Helps farms **optimally allocate nutrients** and **increase profitability**
- Focus on **N, P and K** for now
- Developed with **NYS Dairy**



What do we gain from this tool?

- Potential economic and environmental opportunities
- Increased productivity
- Decreased cost of production



What we provide to the farmers:

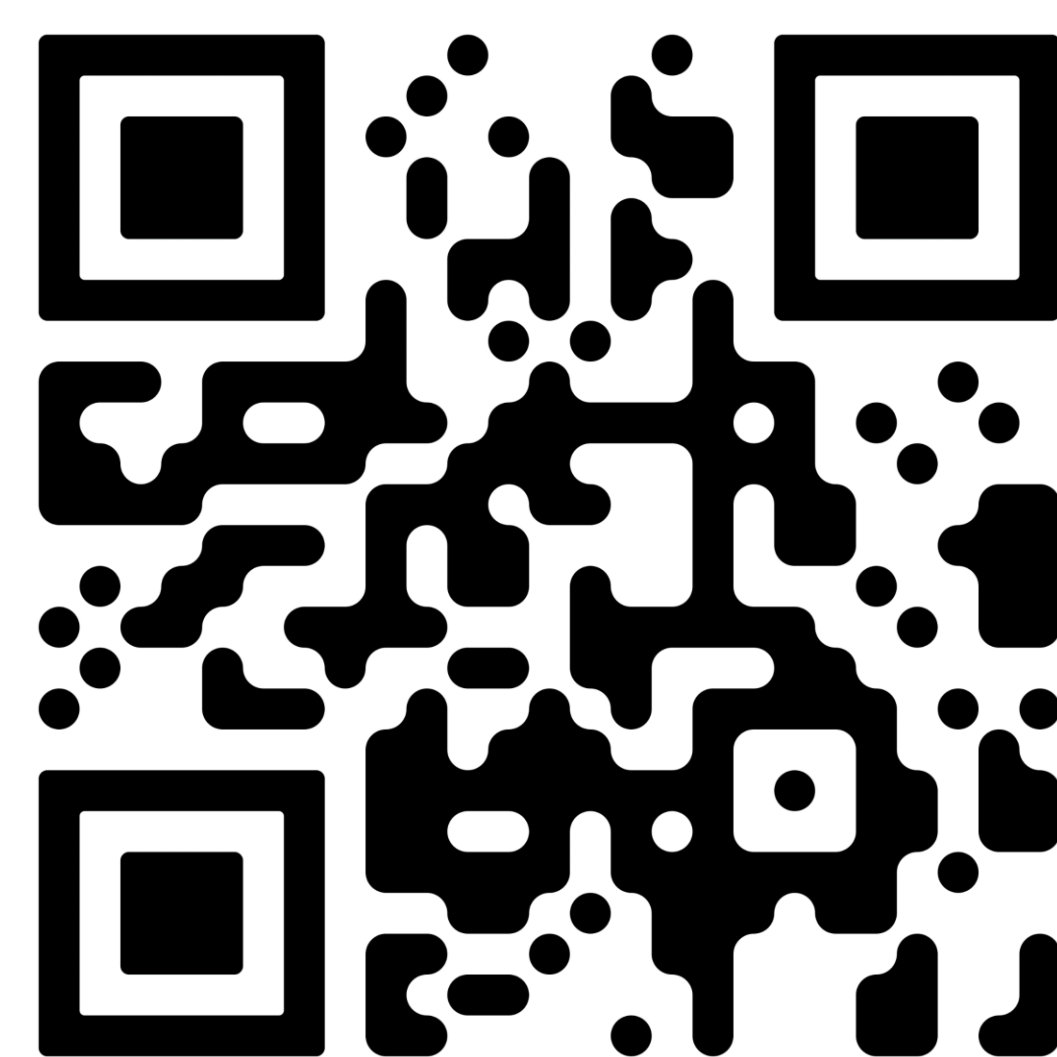
- An **“opportunity table”** that shows farm key performance indicators (KPIs) and **“thresholds”**
- Used to identify opportunities for **continuous improvement**
- Benchmarks for farmers to compare their balance to **feasible limits and peers**
- Data to show consumers that they are **dedicated to sustainable practices**

Table 2. Indicators to predict high risk of exceeding feasible balances.

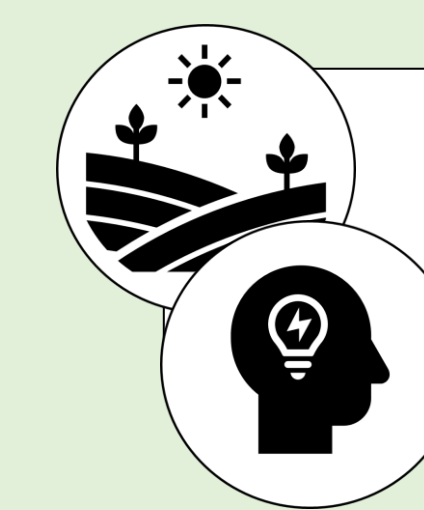
| Indicator to predict likelihood of exceeding feasible balances | Example Farm 2020 | | | High risk of exceeding the feasible balances if | | |
|--|-------------------|--------|------|---|------------|--------|
| | N | P | K | N | P | K |
| 1 Balance per acre (lbs/acre) | 120 | 9 | 32 | > 105 | > 12 | > 37 |
| 2 Balance per cwt milk (lbs/hundredweight milk) | 0.90 | 0.06 | 0.24 | > 0.88 | > 0.11 | > 0.30 |
| 3 Milk per cow (lbs/cow/year) | | 26,607 | | - | < 20,000* | - |
| 4 Animal density (animal units/acre) | | 1.04 | | - | > 1.00 | - |
| 5 Whole-farm nutrient use efficiency (%) | 43 | 63 | 47 | < 44 | < 51 | < 39 |
| 6 Purchased feed (lbs/acre) | 174 | 22 | 57 | > 121 | > 20 | > 38 |
| 7 Feed (tons dry matter/animal unit) | | 6.9 | | - | 3.5 to 7.5 | - |
| 8 Feed use efficiency (milk, %) | 21 | 25 | 12 | < 20 | < 25 | < 11 |
| 9 Homegrown feed (% dry matter) | | 69 | | - | < 65 | - |
| 10 Homegrown forage (%) | | 69 | | - | - | - |
| 11 Homegrown grain (%) | | 0 | | - | - | - |
| 12 Homegrown nutrients (% dry matter) | 48 | 55 | 68 | < 50 | < 50 | - |
| 13 Crude protein (CP) and P in all feed (%) | 15 | 0.34 | 1.26 | > 17 | > 0.40 | - |
| 14 CP and P in purchased feed (%) | 25 | 0.49 | 1.30 | > 30 | > 0.60 | - |
| 15 CP in homegrown feed (%) | 10.2 | | | < 11.8 | - | - |
| 16 Fertilizer (lbs/acre) | 32 | 1 | 3 | > 39 | > 6 | > 38 |
| 17 Crop exports (lbs/acre) | 1 | 0 | 1 | 0 | 0 | 0 |
| 18 Manure exports (lbs/acre) | 11 | 1 | 5 | 0 | 0 | 0 |
| 19 Overall crop yield (tons dry matter/acre) | | 5.0 | | | | |
| 20 Acres receiving manure (%) | | 82 | | | | |

* Based on Holstein cows

For more information on this topic and graphs



Key lessons learned:



No one size fits all solution!



Feed and **fertilizer** imports are the biggest drivers of balances

Animal density is a key driver



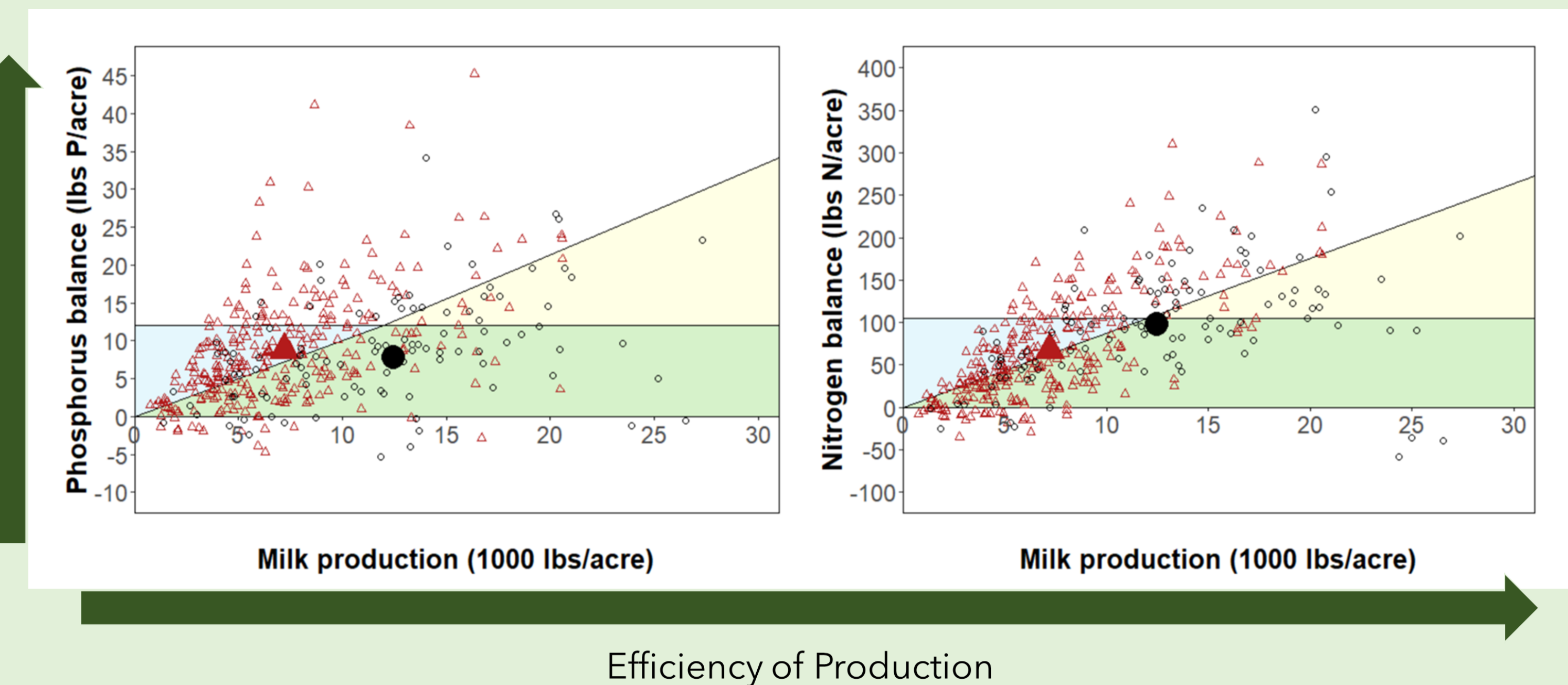
Manure exports have big potential

Progress made in New York!

Dairy farms participating in these assessments between 2005 and 2019:

- Produced **over 50% more milk per acre**
- 36% improvement in **P use efficiency**
- Fed diets with an **improved N efficiency**
- Actively engaged** in identifying more opportunities for improvement
- Of the feed fed to the animals on the farms, almost **70% was homegrown** feed → Reduces feed imports → avoid the carbon footprint of transportation
- Improved soil health, crop production and climate resiliency** with use of manure, and reduce fertilizer use
- Implemented practices that **promote biodiversity** on the farm-base through crop rotation and field management
- Creating a **circular economy!**

Environmental impact of production



Questions?

- Can the same thresholds be implemented across the US?
- Should some be permitted to lose more nutrients to the environment than others?
- How can we market these data to consumers to increase confidence in the dairy industry?

Acknowledgements

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