

# Urine Metabolomics Analysis Associated with Feed Efficiency on Crossbred Steers during the Growing and Finishing Period on Forage- and Concentrate- Based Diets.



## Finishing Period on Forage- and Concentrate- Based Diets.

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### Introduction

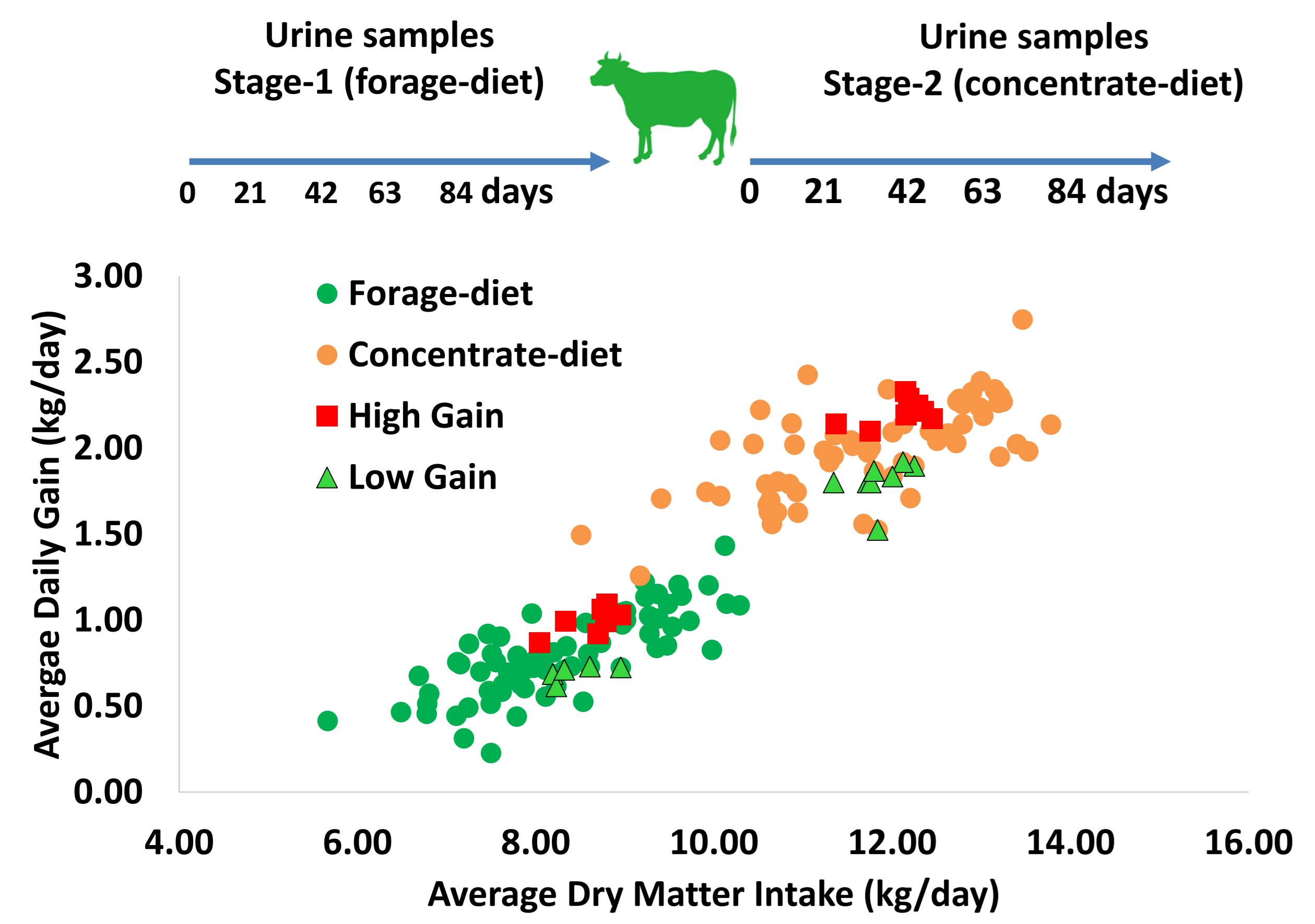
Improving **production efficiency** by increasing beef produced per amount of feed offered would reduce operating cost and waste from beef cattle production.

### Objective

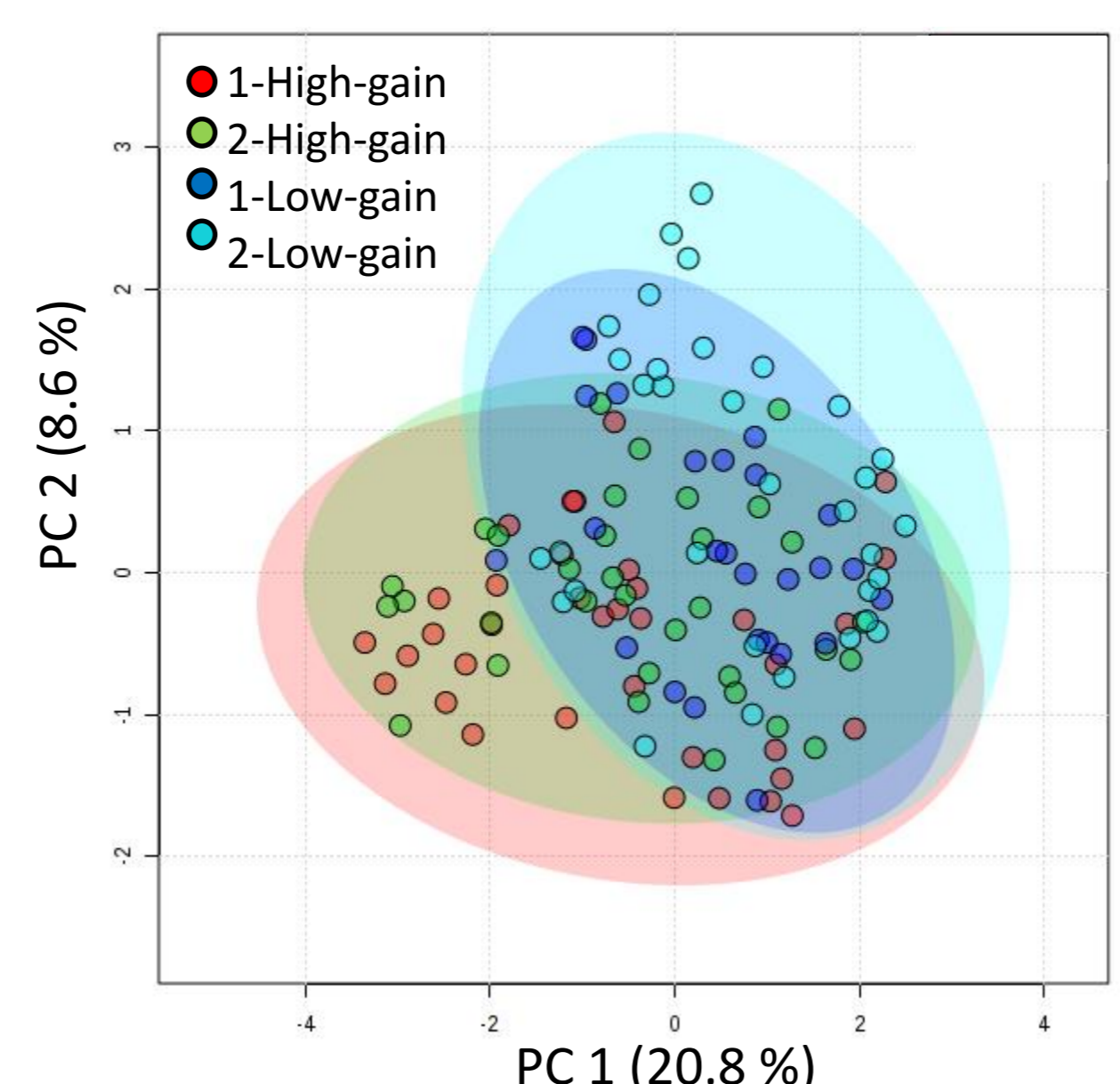
Identify **non-invasive biomarkers** that can detect subtle metabolic discrepancies for cattle feed efficiency using **untargeted and targeted urine metabolomics** by ultra-performance liquid chromatography-mass spectrometry.

### Methods

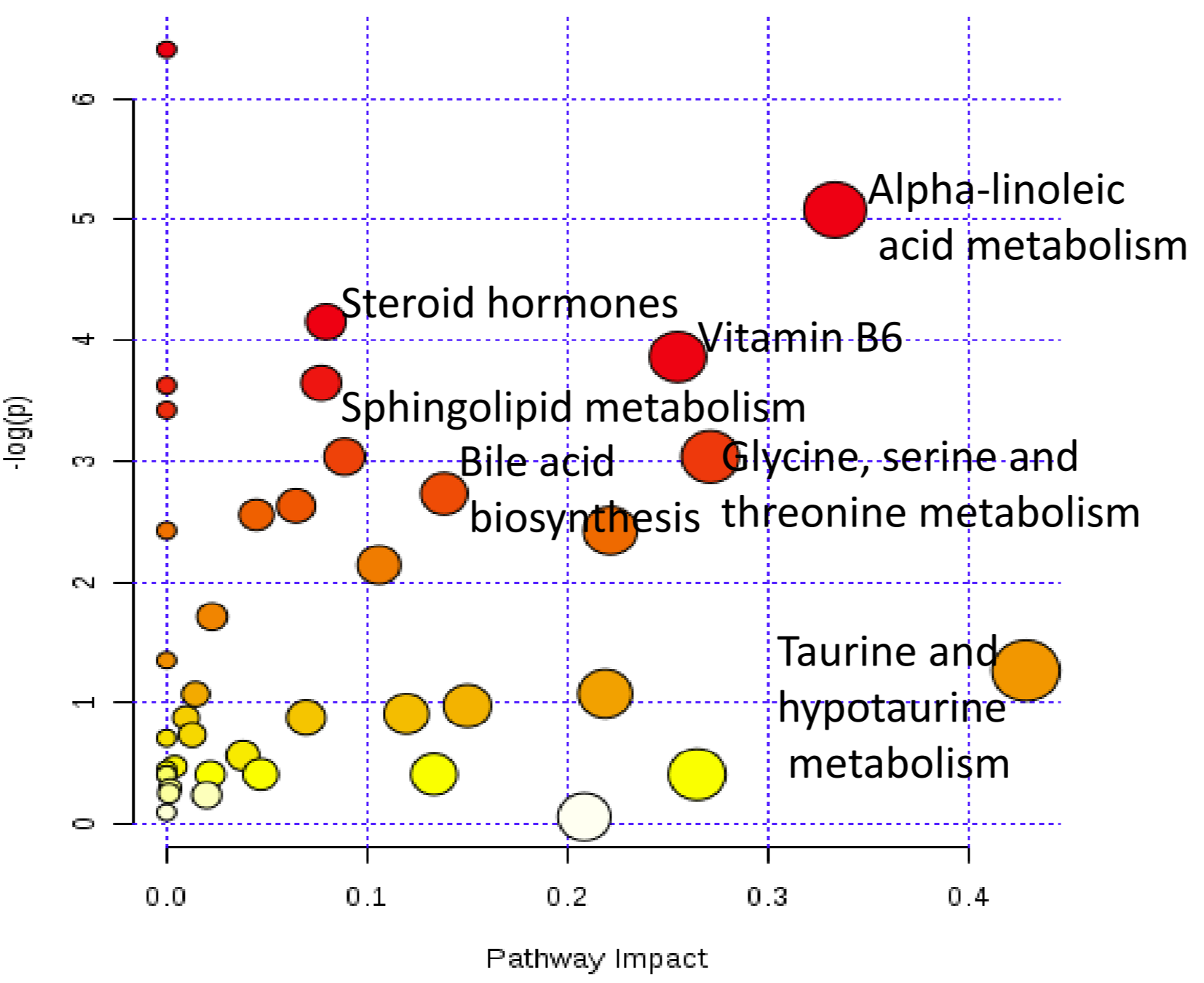
Individual feed intake and body-weight was measured on 76 steers during 105 d on a **forage-based growing ration (stage-1)** followed by a **high-concentrate finishing ration (stage-2)**. Steers (n=28) were selected according to differences in Average Daily Weight Gain (ADG) ( $P = 0.01$ ) within 0.32 SD of the mean of dry-matter-intake (DMI).



A **principal component analysis (PCA)** of the identified untargeted metabolites (n =199;  $P < 0.05$ ), fully segregated the highest-ADG and lowest-ADG animals, with overlap across diets (both stages).

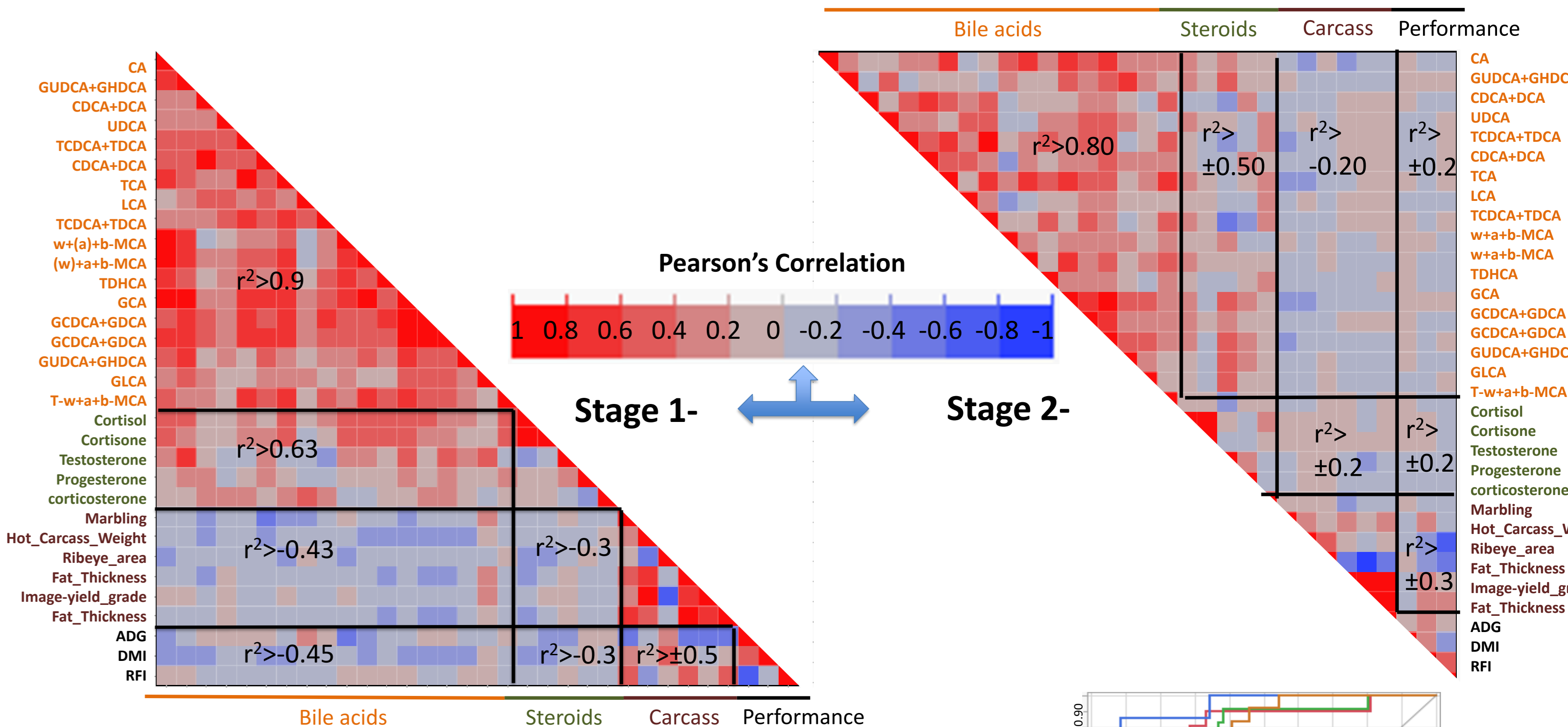


**Pathway analysis** impact was calculated from all matched identified metabolites with the *Bos taurus* KEGG pathway database. Their node color (redness) was based on their  $P$ -value ( $< 0.05$ ).

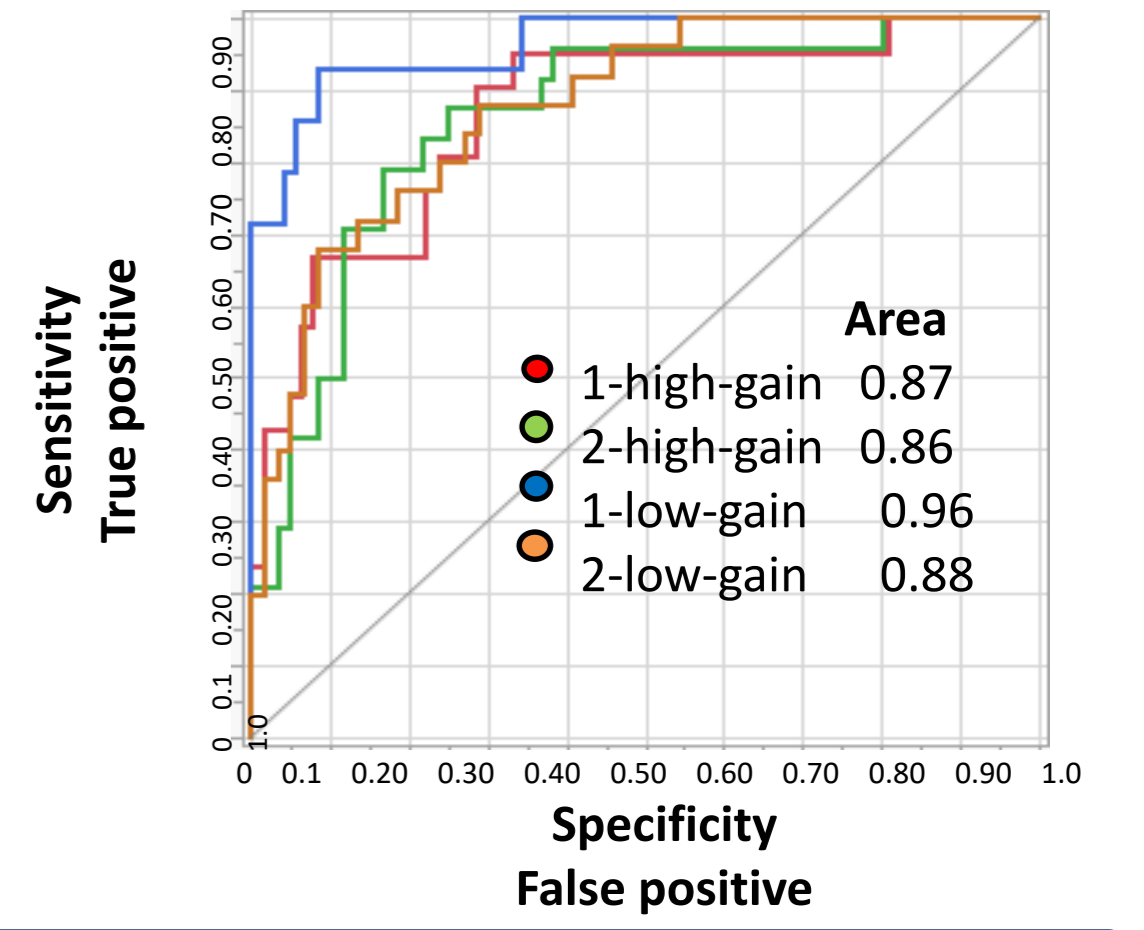


### Results

**Urine concentrations of bile acids and steroids** were moderately associated ( $P < 0.05$ ) with animal performance and carcass traits in stage-1. The association decreased at stage-2.



**Receiver operating characteristic curve analysis** showed urine bile acids and steroids to be excellent predictors of 1-low-gain group (AUC=0.96) and good predictors of 1-high-gain and 2-low/high-gain groups (AUC>0.8;  $P < 0.05$ ).



### Conclusions & Implications

- Urine bile acids and steroids are potential biomarkers of differences in animal performance.
  - Urine ALA metabolism, as well as ALA in other tissues (previously reported), may relate to hepatic lipid metabolism (i.e., synthesis/catabolism of cholesterol) which influence bile acids/steroids concentrations.
  - Metabolomics provides new insight into the physiological mechanisms and identified potential biomarkers of cattle feed efficiency.
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