

# Carcase Inkjet Printing

Meat Carcass Ink-Jet Fluid Development

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## 1.0 Executive Summary

The research project aimed to develop a food grade ink capable of printing lines / dots directly onto a range of lamb and beef carcasses. Matthews International conducted extensive research into suitable ingredients that would likely meet the FDA food grade criteria and Matthews Australasia conducted inhouse and onsite trials to explore the suitability based on the stated criteria of print quality, contrast, adhesion and dry time. Whilst the outcome offered positive results some limitations require further investigation before commercialising this into a solution with relevant certification (E.g., FDA approval). Specifically, the additionally requested halal certified formulation would require further refinement.

## 2.0 Introduction

The project aims to develop a custom food grade ink for use in Matthews Drop on Demand (DOD) inkjet printers capable of printing directly onto lamb and beef carcasses. This ink will need to be adequately visible, adhere and dry on a range of varying meat, fat, and muscle tissue, resistant to moisture from the substrate and environment.

## 3.0 Project Objectives

The objective of the project was to develop and evaluate a custom ink capable to print onto meats through inhouse and onsite trial and based on the below success criteria:

- Print Contrast (Prominence)
- Print Quality
- Ink Adhesion
- Ink Dry Time

The printed message included the following:

- Lines / dots
- Alphanumeric - human readable text



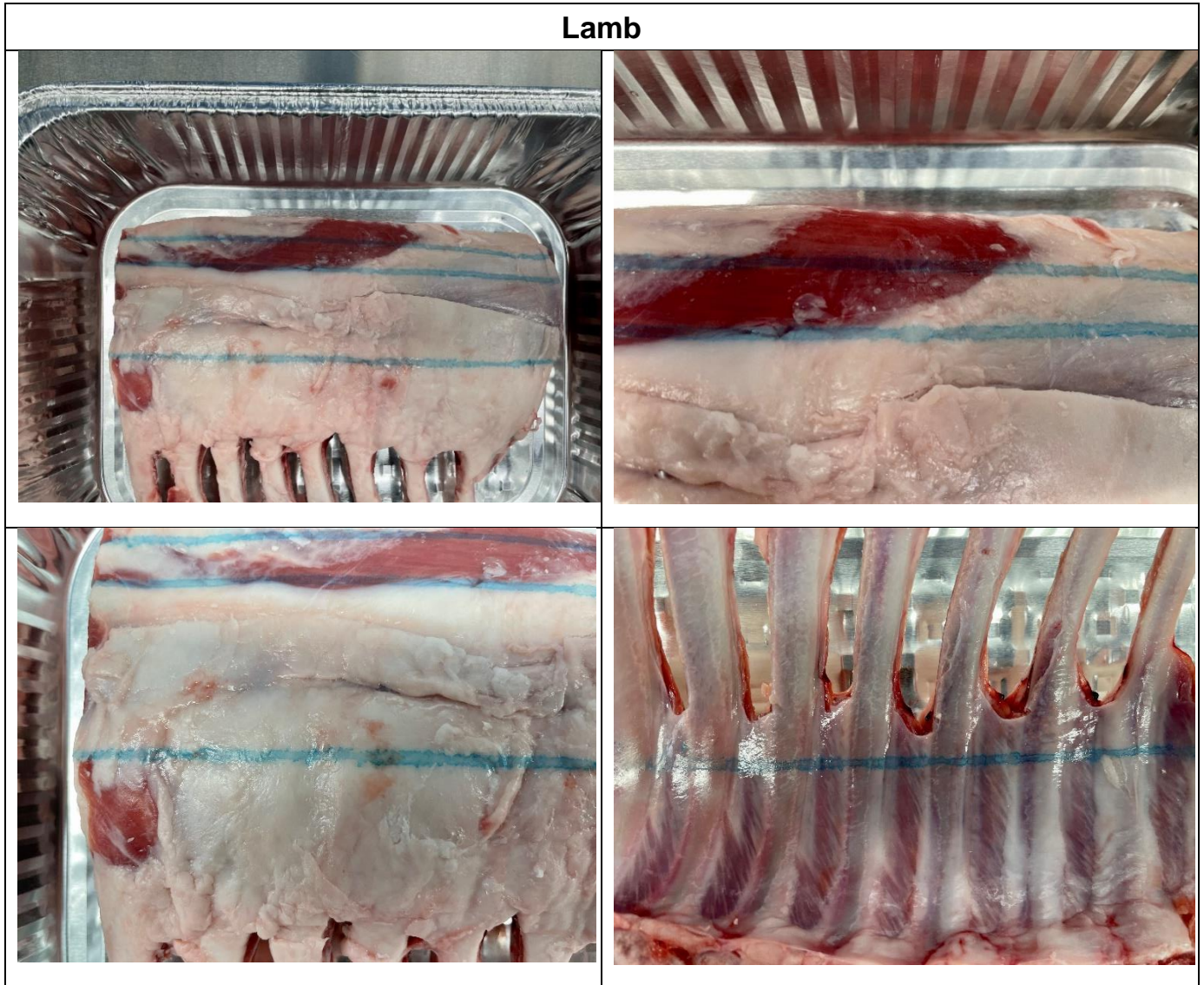
## 4.0 Methodology

1. Milestone 1
  - a. Evaluate raw materials for suitability including direct FDA Food Contact.
  - b. Evaluate formulation for performance on substrates.
  - c. Evaluate formulation for performance in DOD printers (laboratory environment).
    - i. Before Printing the Meat was chilled to 5°C and then rinsed and pat dry (Some moisture remained).
  - d. Conduct laboratory testing to provide confidence of next milestone (2) onsite alpha trials<sup>1</sup>.
2. Milestone 2
  - a. Onsite printing trial (Appendix 1) to evaluate ink adhesion, quality, dry time and print contrast on a range of beef and lamb cuts.
    - i. Location- Not conducted 'in situ' due to compliance requirements.
    - ii. Equipment- 7D Mperia Controller, 32v Maxi 8000+ Printhead, HP ISU
    - iii. Ink - Blue Custom (1L) Ink
    - iv. Print downwards ~15mm print height.
    - v. Ink-printhead condition, configuration mounting setup (Matthews Australasia)
  - b. Analysis and review of data and full report to all key stakeholders.

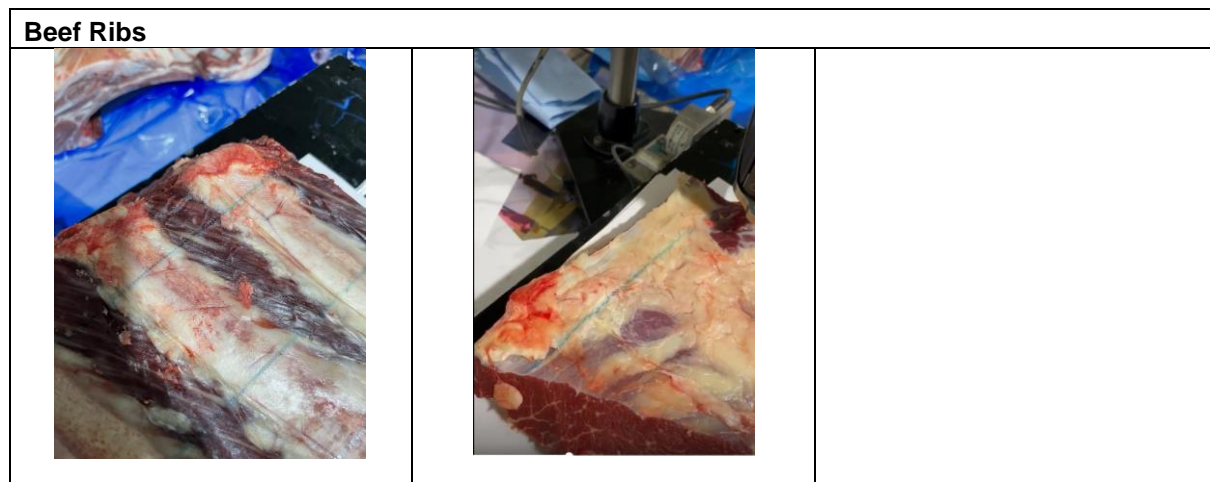
## 5.0 Project Outcomes

### 5.1 Milestone 1: Lab Results

Samples shown below provide contrast on all three types of carcass tissue and display excellent adhesion to substrate:

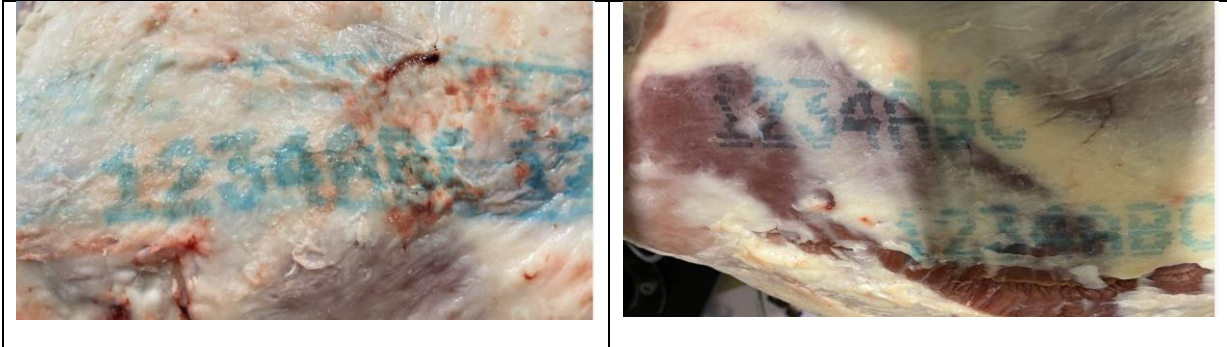


## 5.2 Milestone 2: Onsite Results



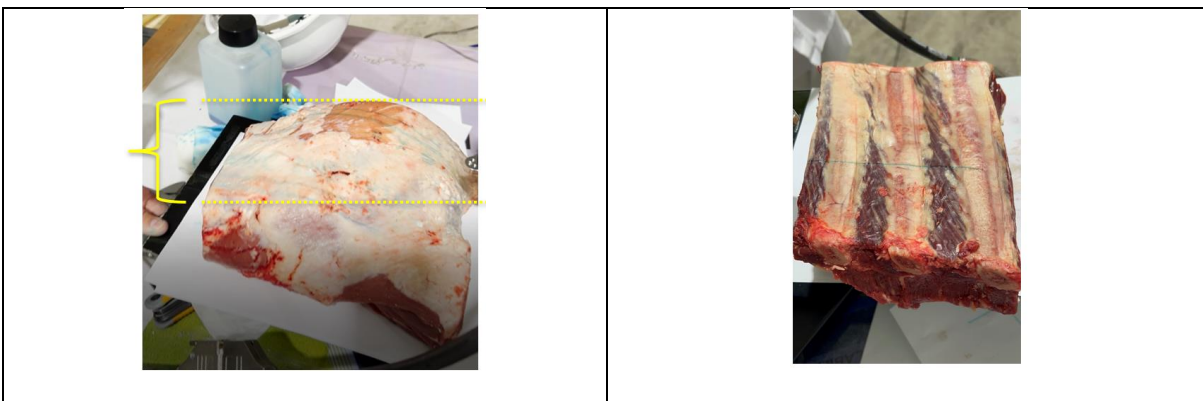
### 5.3 Moisture Analysis

- Moisture plays a significant role in print quality / integrity.
- Print conditions were in a general warehouse (rather than inside a cold room), which may have impacted on-meat moisture - Perhaps this is different in cold room environment – this was unable to be confirmed.



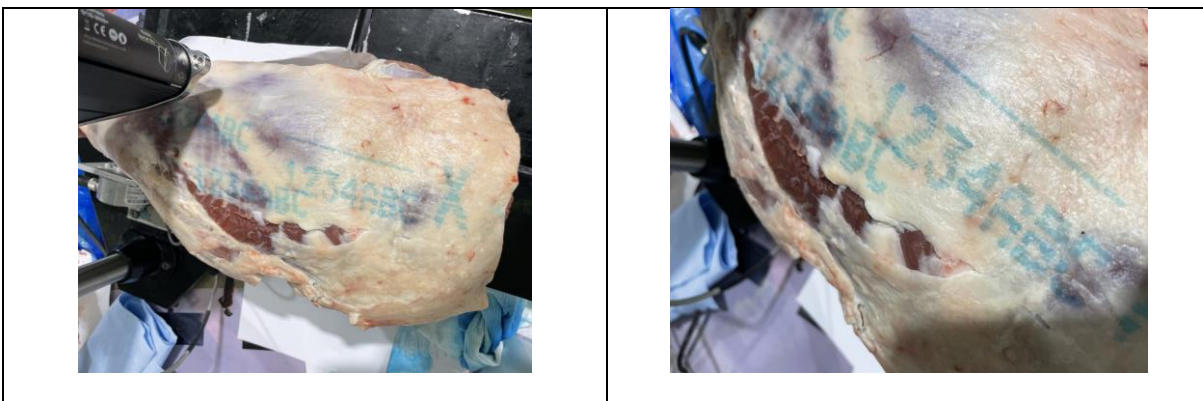
### 5.4 Throw Distance

- Initial prints were inconsistent in throw distance, this was controlled in later test prints
- Throw distance was a more noticeable impact for text vs printed lines/dots



### 5.5 Dry Time

- Difficult to assess dry time due to moisture on meat, however, once ink dried, print integrity was maintained.
- Printing onto the fat, print quality can be easily disrupted by moving the fat itself.
- Need to clarify ink dry time expectations from end user's if moisture cannot be minimised.



## 6.0 Discussion

The results suggest that the custom DOD ink developed showed promising success onto the select meats tested with performance varying depending on the level of substrate moisture. Key success criteria for contrast, adhesion and quality appeared acceptable within the stated limitations and confines of the onsite trial. Dry times was challenging to assess and would require further investigation as would any varying results if the trial was conducted in a cold room environment to provide further confidence.

Materials handling was also identified as scope for future consideration and refinement as consistent meat placement and print throw distance were important factors impacting print quality. Combined Ink and DOD Inkjet printing systems was internally assessed as:

Key Criteria	Result	Notes
Print Contrast	Good	Good across all meat cuts reviewed, better on lighter parts
Print Quality	Good	Good on as long as the substrate is dry
Ink Adhesion	Good	Good on as long as the substrate is dry
Ink Dry Time	TBD	Hard to assess within the trial scope and environment <sup>1</sup>

Finally, the end user provided feedback that a Halal certified formulation would be preferable, this which was outside the original scope of this custom ink formulation and would require further development if this was deemed critical.

## 7.0 Conclusions / Recommendations

The ink development and onsite trial offered encouraging potential for printing directly onto meat. Further confirmation from end users regarding precise dry times required in live production environments as well as criticality of halal and level of moisture on the meat surface would require new investigation. A Halal approved ink would require further research and development and should incorporate the key insights uncovered through this Research and Development Project. Preliminary feedback indicates this is of interest to all parties involved and should be explored further.



## 8.0 Appendices

### 8.1 Appendix 1: Onsite Setup



### 8.2 Appendix 2: Disclaimer

This report in no way provides license or permission to utilise practices herein in a production environment.