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Infrared thermography as a suitable technique to evaluate the quality of corn silage after the fermentation process

S. Miotello[1], C. Stelletta[2], A. Simonetto[1], R. Cecchinato[3], F. Tagliapietra[1] and L. Bailoni[1]

[1]Animal Science Department, University of Padova, Italy
[2]Veterinary Clinical Science, University of Padova, Italy
[3]KWS Italia Spa, Italy

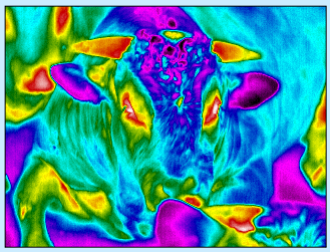
Infrared thermography (IRT)

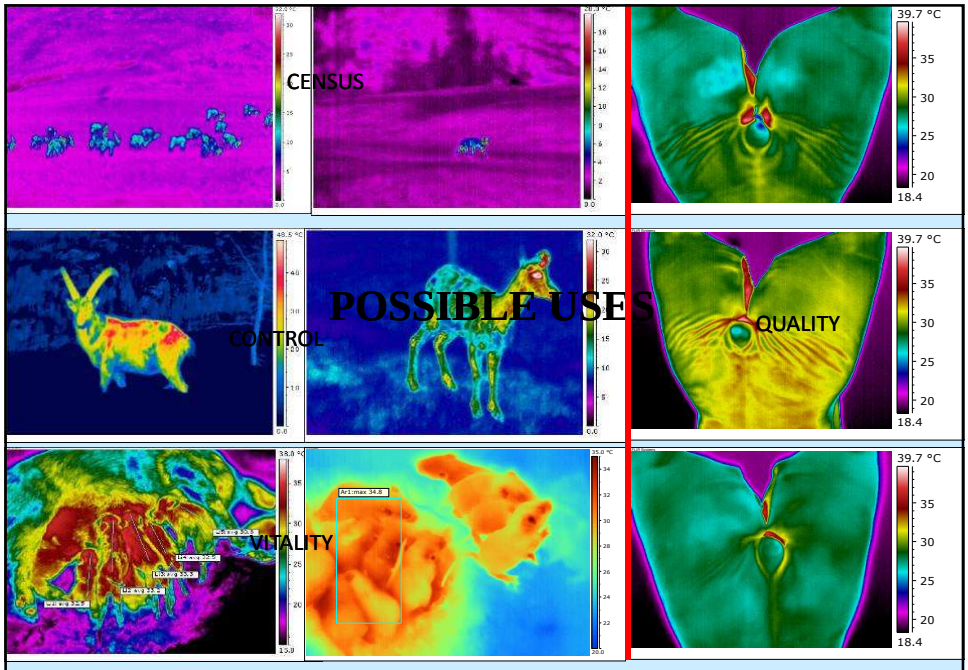
Innovative technique that detects infrared radiation and generates images based on the amount of heat emitted by any subject.

It is a non-invasive technique, relatively cheap, rapid and easily obtained

APPLICATIONS:

- ✓ Surveillance in security and defence
- ✓ Night vision
- ✓ Condition monitoring
- ✓ Volcanology
- ✓ Process control
- ✓ Chemical imaging
- ✓ Nondestructive testing
- ✓ Medical imaging
- ✓ Infrared Mammography
- ✓ Research
- ✓ **Veterinary medicine**



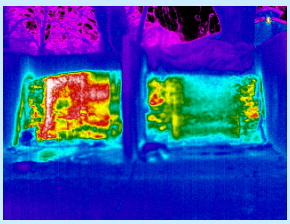


Few researches report its utilization in feed evaluation

Aim

To verify the suitability of the Infrared Thermography to assess the quality of the corn silage after the fermentation process





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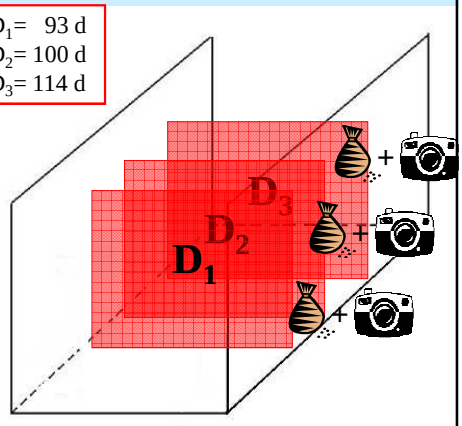
Material and Methods/1

Six different hybrids of corn were ensiled into mini-silos (3 x 2.5 x 6.2 m)

Use of the buried bag technique *(Woolford, 1984)* at three different depthes ($D_1 \rightarrow D_3$)

D_1= 93 d
D_2= 100 d
D_3= 114 d



During feedout:

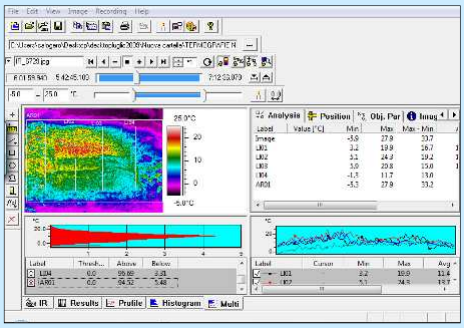
✓Bags buried were recovered and analyzed for chemical composition (gross composition, fiber fraction, pH value, ammonia nitrogen, buffer capacity, VFA, starch, sugars and alcohols; *AOAC, 2000*) and DM and NDF degradability *(DAISY^{II})*

✓ Nutritional value of different silage were assessed *(*TDN, EN_L, UFC, UFL; *NRC, 2001)*

✓IRT measurements of each silo were taken

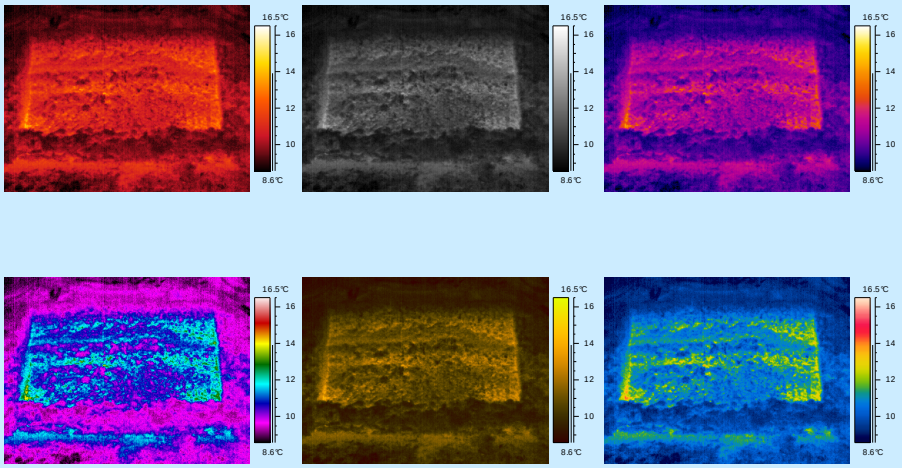
Material and Methods/2

- ✓ Hand-held portable infrared camera *(ThermaCam P25, Flir System)*
- ✓ Calibrated to environmental temperature, humidity and absorptive condition
- ✓ Distance was fixed at 4 m
- ✓ The images were elaborated by a specific software *(ThermaCam Researcher basic 2.08)*
- ✓ Data were reported as average temperature



Material and Methods/3

Different color palettes available for highlight a temperature gradient



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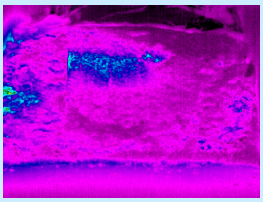
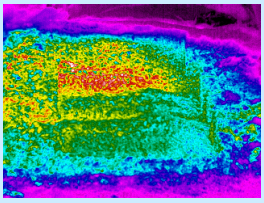
Material and Methods/4



Before silage removing

Passage of Mixer-wagon



After silage removing

All data were subjected to statistical analysis

Results/1

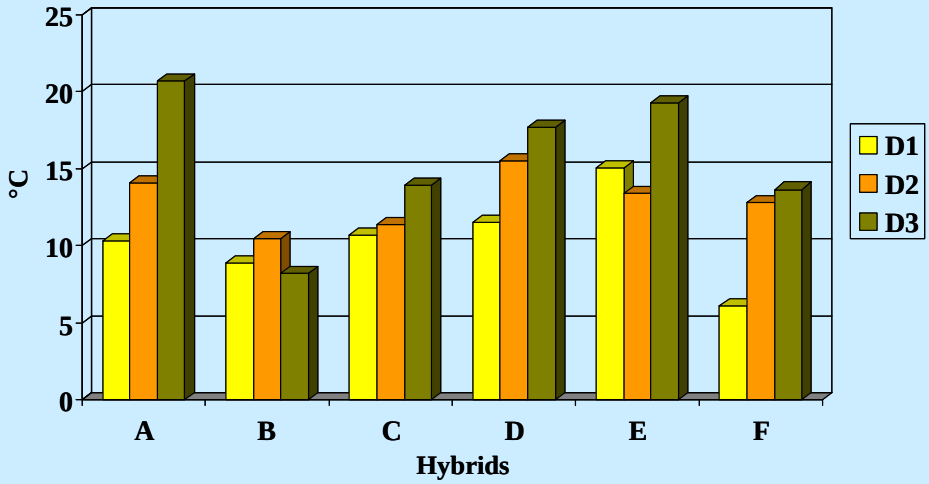
ANOVA of hybrid and depth effects on post removing silage temperature (R^2=0.98)

Effect	*D.F.*	***Temperature***
Hybrid *(H)*	5	***
Depth *(D)*	2	***
H x D	10	***
Error	36	0.52

****=P<0.001*

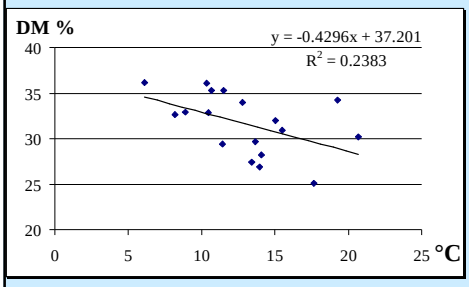
Results/2

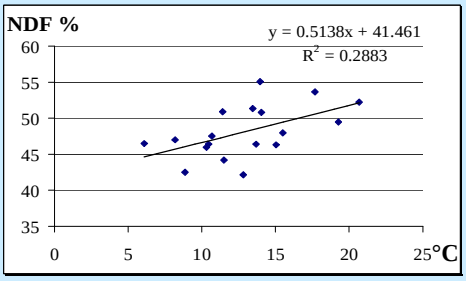
Effect of hybrids x depth interaction on temperature post removing silage



Results/3

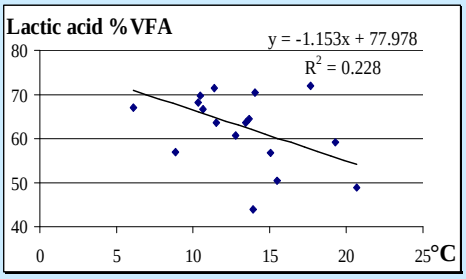
Correlations between T values and <u>chemical</u> characteristics of the silage

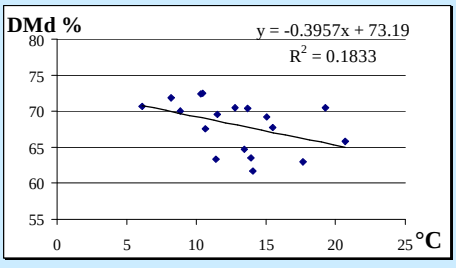




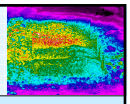
Results/4

Correlations between T values and <u>fermentation products</u> and <u>nutritional</u> characteristics of the silage





Conclusions



✓These preliminary results show that IRT can be useful to evaluate the quality of silage after the fermentation process because good correlations were found between temperature and some chemical and nutritional characteristics of silage

✓Great potential of IRT in forage evaluation (i.e. evaluation of silage quality without chemical analyses; monitoring the trend of fermentation processes; identify area with anomalous fermentations)

✓Image elaboration could supply other information (i.e. temperature classes distribution; hot/cold spots; thermal variability) to better evaluate the quality of forages

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