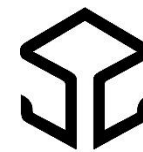


Nutritional value of seaweed for ruminants



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Background

- **Seaweed is a large biomass source**
- **Use of seaweeds in animal feeding is not new**
- **Knowledge on feed value is very limited**

Aim

- **Study feed value for ruminants of seaweed, and variation between seaweed species and seasons in chemical composition and in vitro digestibility**

Samples

- **8 seaweed species**
- **2 seasons 2014, spring and autumn**



Legumes and seaweeds as alternative protein for sheep (AltPro)



Bodø: 67°19'00" N, 14°28'60" E

Sample collection

- **Hand picked**
- **2 baths with sea water**
 - eliminate sand, animals and fouling organisms
- **1 quick bath with 30% sea water**
 - eliminate salt
- **1 quick bath on pure fresh water**
 - eliminate more salt

Red seaweeds Rhodophyta



Mastocarpus stellatus



Porphyra sp.



Palmaria palmata

Photo: M. Novoa-Garrido

Brown seaweeds Ochrophyta



Pelvetia canaliculata



Alaria esculenta



Laminaria digitata

Photo: M. Novoa-Garrido, M.Y. Roleda

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Green seaweeds Clorophyta



Acrosiphonia sp.



Ulva sp.

Photo: M. Novoa-Garrido,

Analysis

- **Samples freeze dried**
- **Ash (525 °C)**
- **Acid insoluble ash as measure for sand pollution (spring samples)**
- **N (Dumas) to estimate crude protein (x 6.25)**
- **Neutral Detergent Fibre (NDF) in Fibertech including sodium sulphite and residual ash correction**
- **In vitro organic matter digestibility (Tilley & Terry), rumen fluid from 3 dry rumen fistulated cows fed standard ration at maintenance (hay, straw and concentrate)**

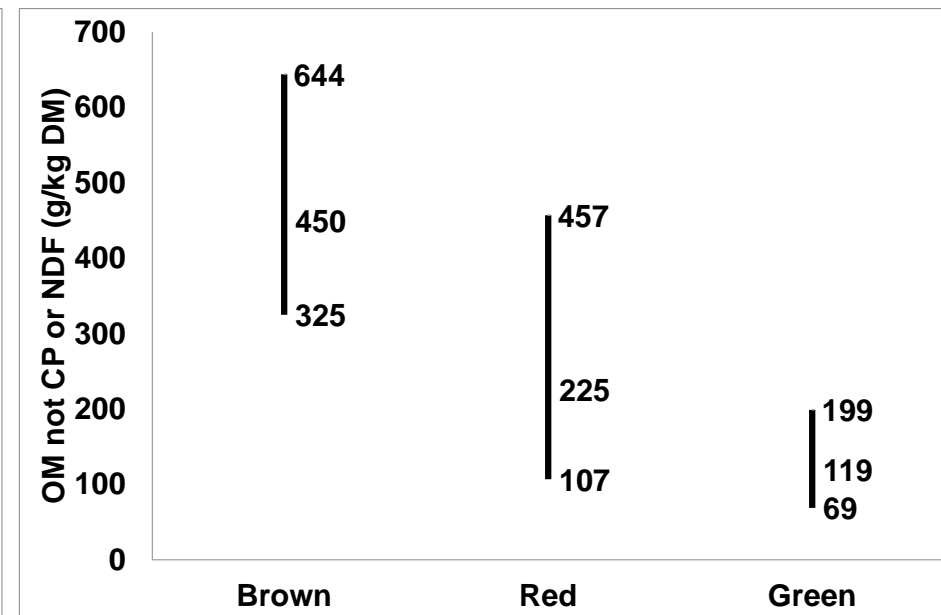
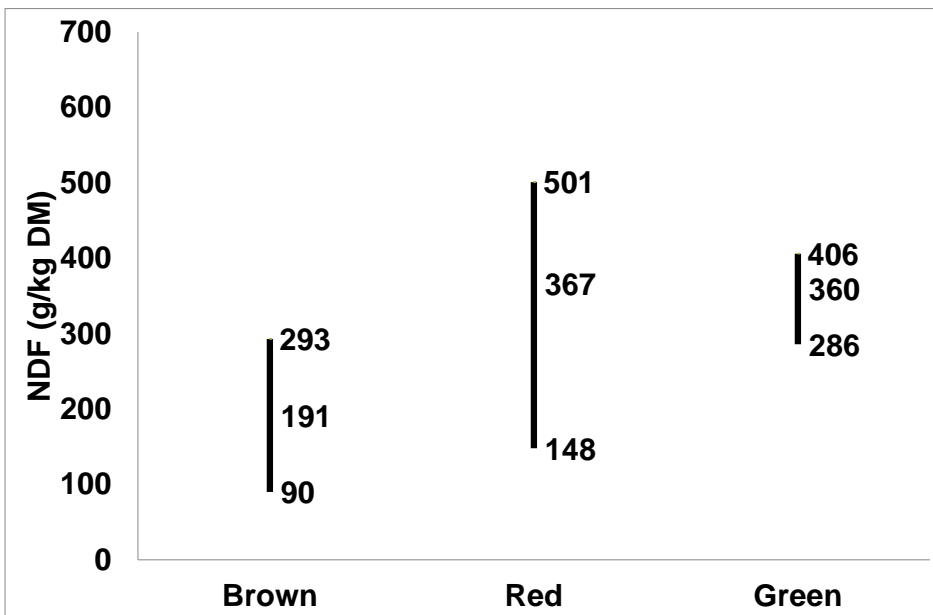
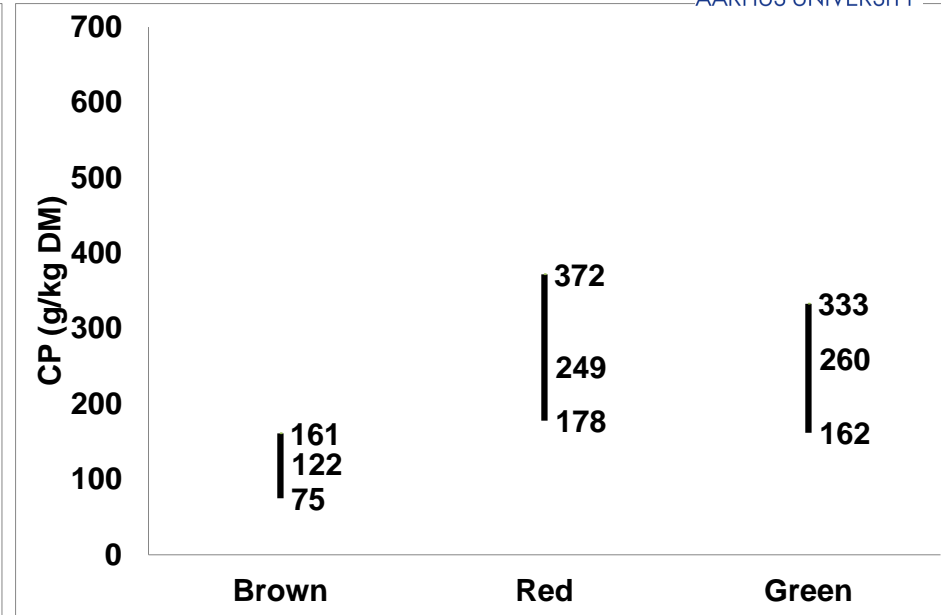
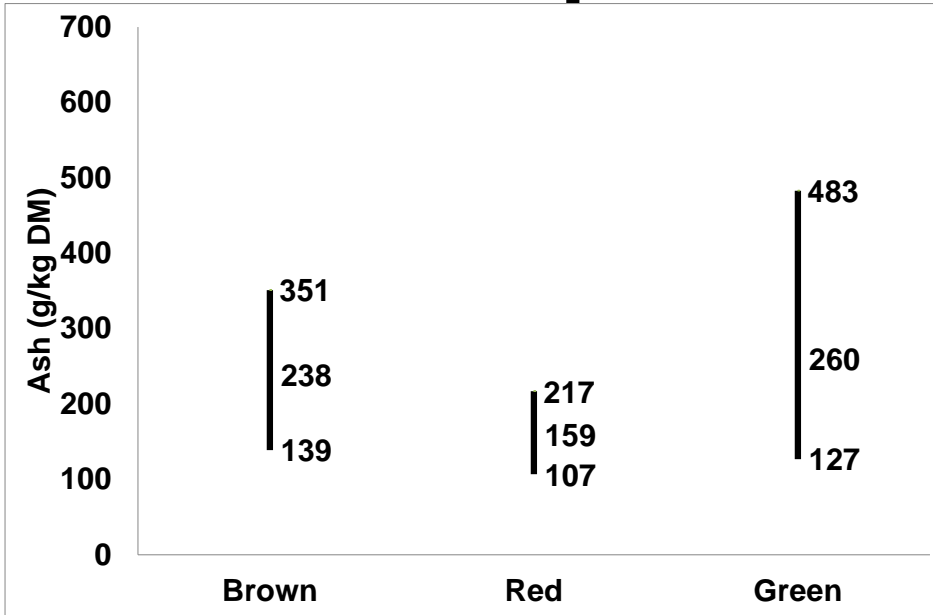
Composition of seaweeds

Acid insoluble ash only analysed in spring samples, however concentrations were low or below detection level

→ No sand pollution

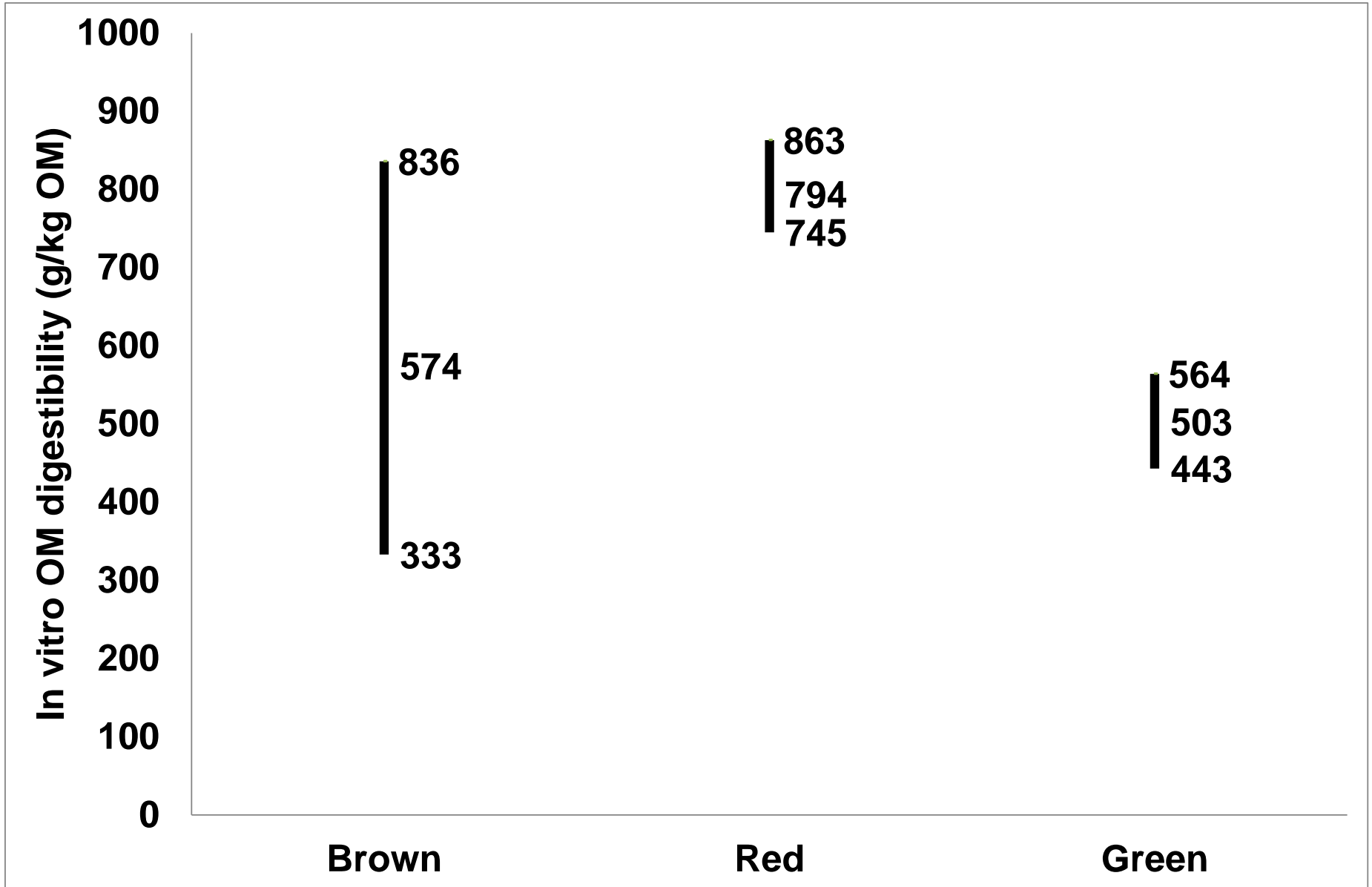
Composition of seaweeds

| Specie | Season | DM | Ash | CP | NDF | OM _{other} | In vitro dig. |
|-----------------------|---------------|------|---------|---------|-------|---------------------|---------------|
| | | g/kg | g/kg DM | | | | g/kg OM |
| Brown seaweeds | | | | | | | |
| <i>Alaria</i> | Spring | 132 | 278 | 158 | 117 | 447 | 590 |
| | Autumn | 237 | 139 | 127 | 90 | 644 | 529 |
| <i>Laminaria</i> | Spring | 128 | 351 | 161 | 163 | 325 | 792 |
| | Autumn | 173 | 233 | 103 | 201 | 463 | 852 |
| <i>Pelvetia</i> | Spring | 229 | 219 | 105 | 293 | 383 | 359 |
| | Autumn | 244 | 210 | 75 | 280 | 435 | 333 |
| Red seaweeds | | | | | | | |
| <i>Mastocarpus</i> | Spring | 283 | 217 | 178 | 148 | 457 | 746 |
| | Autumn | 254 | 208 | 178 | 351 | 264 | 760 |
| <i>Palmaria</i> | Spring | 160 | 165 | 257 | 421 | 157 | 839 |
| | Autumn | 200 | 108 | 188 | 501 | 203 | 863 |
| <i>Porphyra</i> | Spring | 148 | 149 | 372 | 371 | 107 | 778 |
| | Autumn | 105 | 107 | 321 | 408 | 164 | 780 |
| Green seaweeds | | | | | | | |
| <i>Acrosiphonia</i> | Spring | 226 | 171 | 333 | 406 | 90 | 444 |
| | Autumn | 194 | 127 | 286 | 388 | 199 | 502 |
| <i>Ulva</i> | Autumn | 143 | 483 | 162 | 286 | 69 | 564 |
| P value | Species (n=8) | 0.09 | <0.01 | <0.0001 | <0.01 | <0.0001 | <0.0001 |
| | Season (n=2) | 0.17 | 0.02 | <0.01 | 0.21 | <0.0001 | 0.7 |





Digestibility of seaweeds



Sampling and work continued in 2015

Preliminary spring data confirm 2014 effects and variation

Further work has been performed on protein degradability and digestibility, and on indigestible NDF



Conclusions

- **Dry matter concentrations as high as for land grown forages**
- **Very high and variable ash (not sand)**
- **Low to very high protein concentration, higher in spring than in autumn**
- **Very low to very high organic matter digestibility**
- **Non NDF non protein organic matter high in brown seaweed**
- **Some seaweed species could be highly interesting as energy (some red and brown) and protein (some red and green) feed for ruminants**

Thank you for your attention

In situ measures of protein availability in dairy cows

