

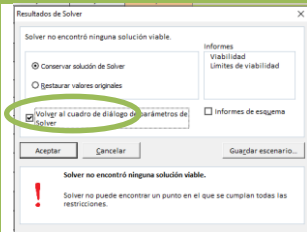
8. RESOLUCIÓ (SOLVER)

El plantejament, a diferència dels anteriors, conté moltes restriccions nutritives, i la formulació de la ració és dinàmica (varien la dMO, *EfPDI* i la CI). No es troba una solució amb facilitat. No obstant, es pot anar cap a aproximacions satisfactòries.

| Exemple: Vaca de 650 kg | 2 setmana lactació | Ingredients (marge entrada) |
|---|--------------------|---|
| Producció de llet estàndard l/ dia | 38,41 | Ensitjat blat de moro, pastós-vidriós (EBM) (0 a 100) |
| Capacitat ingestió (UE) | 16,31 | Fenc d'alfals, botons florals (FA) (0 a 10) |
| Energia (UFL) | 18,84 | Fenc de civada inici espigat (FC) (0 a 10) |
| Proteïna (g PDI) | 2.284,58 | Palla (0 a 4) |
| Ca, g | 170,40 | Concentrats i minerals |
| P, g | 83,98 | |

Quan formulem una ració, els farratges, en general, són els de l'explotació o comprats, algun d'ells, i no els podem canviar fàcilment. Els concentrats sí, per açò n'hi fem entrar molts per tal de saber quins comprar.

De moment, posem a tots els ingredients 0,01 €/kg, ja que ens interessa veure el funcionament de les restriccions. En general, comencem per la resolució amb *Solver*.¹

| Procediment de resoldre | Paràmetres de les restriccions | Resultat ració | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------|--------------|-------|-------|--------------|------|--------|-------|-----------|------|--------|-------|-----|-------|-------|-------|-----|-------|-------|-------|-----|----------|----------|----------|-----|-------|------|------|----|------|------|------|----|--------|--------|--------|---|-------|-------|-------|--|-------------|--|----------|-------|--------------------------------------|--|--------|------|----------------------------|--|-------|------|---------------------------|--|-------|------|------------|--|-------|------|------------------|--|-------|------|------------------------------|--|-------|------|----------|--|-------|------|---------------------------|--|-------|------|--|--|-------|------|--------------|--|-------|------|-----------------|--|-------|------|--------------|--|---------------|--------------|--|--|------|-------|--|--|------|-------|
|  <p>Quan diu per primera i successives vegades que No té solució, podem tornar a resoldre fins que digui que té solució o no; Si no té solució, quan els principals paràmetres (UFL, UFL; PDI; BPR, Ca i P) ja no canvien en aquests passos ho donem per bo i ho examinem.</p> | <table border="1"> <thead> <tr> <th>Paràmetres</th> <th>Mínim</th> <th>Máxim</th> <th>Valor</th> </tr> </thead> <tbody> <tr> <td>MSI (kg/dia)</td> <td>0,00</td> <td>999,00</td> <td>22,60</td> </tr> <tr> <td>%MS ració</td> <td>0,00</td> <td>999,00</td> <td>54,97</td> </tr> <tr> <td>UFL</td> <td>15,36</td> <td>16,97</td> <td>16,97</td> </tr> <tr> <td>UFL</td> <td>21,20</td> <td>21,20</td> <td>21,20</td> </tr> <tr> <td>PDI</td> <td>2.051,36</td> <td>2.637,47</td> <td>2.051,36</td> </tr> <tr> <td>BPR</td> <td>-8,00</td> <td>0,00</td> <td>0,00</td> </tr> <tr> <td>Ni</td> <td>1,80</td> <td>1,80</td> <td>3,48</td> </tr> <tr> <td>Ca</td> <td>149,13</td> <td>191,74</td> <td>149,13</td> </tr> <tr> <td>P</td> <td>73,51</td> <td>94,52</td> <td>94,52</td> </tr> </tbody> </table> <p>Els paràmetres (Valor) ja no canvien, hem acceptat. UEL, UFL, PDI, BPR pràcticament dins els límits, diferències imperceptibles. Ca i P dins límits.</p> | Paràmetres | Mínim | Máxim | Valor | MSI (kg/dia) | 0,00 | 999,00 | 22,60 | %MS ració | 0,00 | 999,00 | 54,97 | UFL | 15,36 | 16,97 | 16,97 | UFL | 21,20 | 21,20 | 21,20 | PDI | 2.051,36 | 2.637,47 | 2.051,36 | BPR | -8,00 | 0,00 | 0,00 | Ni | 1,80 | 1,80 | 3,48 | Ca | 149,13 | 191,74 | 149,13 | P | 73,51 | 94,52 | 94,52 | <table border="1"> <thead> <tr> <th colspan="2">INGREDIENTS</th> <th>kg fresc</th> <th>kg MS</th> </tr> </thead> <tbody> <tr> <td>ENSITJAT Blat de moro Pastós-vidriós</td> <td></td> <td>24,713</td> <td>2,91</td> </tr> <tr> <td>FENC Alfals Botons florals</td> <td></td> <td>0,267</td> <td>0,23</td> </tr> <tr> <td>FENC Civada Inici espigat</td> <td></td> <td>6,883</td> <td>6,19</td> </tr> <tr> <td>PALLA Ordi</td> <td></td> <td>0,188</td> <td>0,17</td> </tr> <tr> <td>Blat de moro gra</td> <td></td> <td>2,942</td> <td>2,53</td> </tr> <tr> <td>Soja tortó 48 curtit "tanne"</td> <td></td> <td>1,066</td> <td>0,95</td> </tr> <tr> <td>Mandioca</td> <td></td> <td>0,248</td> <td>0,21</td> </tr> <tr> <td>Ordi Bagàs cerveseria sec</td> <td></td> <td>4,721</td> <td>4,34</td> </tr> <tr> <td>Grassa vegetal, mantega de porc (tots els tipus)</td> <td></td> <td>0,002</td> <td>0,00</td> </tr> <tr> <td>Fosfat sòdic</td> <td></td> <td>0,004</td> <td>0,00</td> </tr> <tr> <td>Carbonat càlcic</td> <td></td> <td>0,072</td> <td>0,07</td> </tr> <tr> <td>TOTAL</td> <td></td> <td>41,105</td> <td>22,60</td> </tr> <tr> <td></td> <td></td> <td>Fa %</td> <td>64,15</td> </tr> <tr> <td></td> <td></td> <td>Co %</td> <td>35,85</td> </tr> </tbody> </table> <p>La ració podria ser aquesta, a partir d'aquí venen els ajustaments del nutricionista</p> | INGREDIENTS | | kg fresc | kg MS | ENSITJAT Blat de moro Pastós-vidriós | | 24,713 | 2,91 | FENC Alfals Botons florals | | 0,267 | 0,23 | FENC Civada Inici espigat | | 6,883 | 6,19 | PALLA Ordi | | 0,188 | 0,17 | Blat de moro gra | | 2,942 | 2,53 | Soja tortó 48 curtit "tanne" | | 1,066 | 0,95 | Mandioca | | 0,248 | 0,21 | Ordi Bagàs cerveseria sec | | 4,721 | 4,34 | Grassa vegetal, mantega de porc (tots els tipus) | | 0,002 | 0,00 | Fosfat sòdic | | 0,004 | 0,00 | Carbonat càlcic | | 0,072 | 0,07 | TOTAL | | 41,105 | 22,60 | | | Fa % | 64,15 | | | Co % | 35,85 |
| Paràmetres | Mínim | Máxim | Valor | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MSI (kg/dia) | 0,00 | 999,00 | 22,60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| %MS ració | 0,00 | 999,00 | 54,97 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| UFL | 15,36 | 16,97 | 16,97 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| UFL | 21,20 | 21,20 | 21,20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PDI | 2.051,36 | 2.637,47 | 2.051,36 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BPR | -8,00 | 0,00 | 0,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ni | 1,80 | 1,80 | 3,48 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ca | 149,13 | 191,74 | 149,13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| P | 73,51 | 94,52 | 94,52 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INGREDIENTS | | kg fresc | kg MS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ENSITJAT Blat de moro Pastós-vidriós | | 24,713 | 2,91 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FENC Alfals Botons florals | | 0,267 | 0,23 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FENC Civada Inici espigat | | 6,883 | 6,19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PALLA Ordi | | 0,188 | 0,17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blat de moro gra | | 2,942 | 2,53 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Soja tortó 48 curtit "tanne" | | 1,066 | 0,95 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mandioca | | 0,248 | 0,21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ordi Bagàs cerveseria sec | | 4,721 | 4,34 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Grassa vegetal, mantega de porc (tots els tipus) | | 0,002 | 0,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fosfat sòdic | | 0,004 | 0,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Carbonat càlcic | | 0,072 | 0,07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TOTAL | | 41,105 | 22,60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Fa % | 64,15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Co % | 35,85 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

- 1) Si no troba una solució viable, no desesperar, cal buscar l'aproximació
- 2) No perdre de vista l'estat fisiològic de la vaca ni els valors nutritius dels farratges
- 3) **Primer formular, després ajustar, no a l'inrevés**

¹ Tots el mètodes: precisió restriccions 0,0001, escala automàtica, temps màxim 100 segons, 200 iteracions màximes, i el que emprem GRG *nonlinear*: precisió convergència 0,0001, derivats avançat i no entrada múltiple