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**Take home message** For plots with geographical constraints, double herds breeding systems with dairy and suckling herds allow a better grazed grass utilization rate, leading to good forage autonomy and good economic performances at farm scale.

**Introduction** Ruminant production is predominant in mountainous areas. In those areas, some plots of grasslands cannot be mechanized or are difficult to reach. Many mountain breeding systems combine in the same farm, a herd of dairy cows and a suckling cattle herd. We hypothesize that double herds allow a better grazed grass utilization rate than specialized herds for plots with constraints. The aim of this study was to characterise which herd distributions allow the best combination between grazed grass utilization, animal production and economical performances.

**Material & methods** We used the bio economic optimization model Orfee (Mosnier *et al.*, 2017a) and data from two farm-types with dairy and suckling herds in cruising condition from the INOSYS database (Charroin *et al.*, 2005). Farm_1 is a medium size system with a summer mountain pasture and Farm_2 is a large size system with a fragmented plot and cereal crops. These two farms are representative of the mountain double herd cattle farms. The model was adapted to take into account geographical constraints and the heterogeneity of grassland plots based on the French typology of permanent grasslands (Launay *et al.*, 2011). Simulations are based on the two different farms and five scenarios (described as the percentage of livestock units (LU) in the dairy (D) herd): 100D for a single dairy herd, 75D for a dominant dairy herd, 50D for balanced dairy and suckling herds, 25D for a dominant suckling herd and 0D for a single suckling herd.

Milk yield is fixed, and the use of grassland, facilities and machinery are optimized in the simulations. Biotechnical and economic indicators characterizing the feeding system, the animal and the system performances have been analysed for each scenario. This leads to evaluate simultaneously; operating profit per men work unit (MWU), grazed grass utilization rate (ratio of the amount of grazed grass to the amount of available pasture grass), animal production (milk and meat quantities), forage and concentrate consumption, related with the combination of dairy and suckling herds.

**Results & discussion** The annual cumulative consumption of forage is around 4 tons of dry matter (tDM) per LU in both farms for all the scenarios. Linked to the decrease of dairy LU in herds (Table 1), we observed a trend corresponding to an increase in the stocking rate and a decrease of concentrates intake per LU. Grazed grass utilization rate and operating profit per MWU reach their maximum for mixed herds systems (between 50D and 25D) as 60% of farms with double herds in the Massif Central (France). These systems that maximize grazed grass utilization also allow good economic performances.

**Table 1** Levels of main indicators related to different analysed criteria for scenarios corresponding to the farm-types.

| Farm-types | Farm_1 | | | | | Farm_2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Scenarios | 100D | 75D | 50D | 25D | 0D | 100D | 75D | 50D | 25D | 0D |
| Total livestock unit (LU) | 65 | 73 | 80 | 82 | 80 | 113 | 125 | 137 | 132 | 128 |
| Concentrates (tDM/LU/year) | 0.95 | 0.87 | 0.76 | 0.54 | 0.25 | .83 | 0.85 | 0.86 | 0.52 | 0.33 |
| Grazed grass utilization rate (%) | 58 | 72 | 85 | 82 | 85 | 72 | 84 | 89 | 100 | 90 |
| Stocking rate (LU/ha) | 0.93 | 1.04 | 1.14 | 1.18 | 1.15 | 1.05 | 1.17 | 1.28 | 1.24 | 1.20 |
| Milk sold per year (1000L/year) | 257 | 215 | 158 | 82 | 0 | 486 | 403 | 302 | 146 | 0 |
| Meat sold (1000kg/ year) | 9 | 12 | 15 | 17 | 19 | 18 | 26 | 34 | 40 | 45 |
| Operating profit (1000€)/MWU | 6.51 | 7.21 | 7.64 | 7.67 | 5.78 | 18.82 | 20.60 | 21.86 | 22.34 | 22.02 |

**Conclusion** This study shows that systems with double herds, particularly systems with 25 to 50% dairy cattle LU, maximize the grazed grass utilization rate in a context of mountain grasslands, with constraints of mechanisation and access to dairy cows. These systems that maximize grazed grass utilization also have good animal production and economic performances. However, the structure of the farm plot is essential to specify the optimal herd's distributions, which improve grazing and economic performances.

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