# Factors associated with the risk of dystocia in the Romanian Spotted cows

**Radu Ionel Neamt[1*], Ludovic Toma Cziszter[1,2], Florin Cristian Neciu[1], Gheorghe Saplacan[1], Ciprian Valentin Mihali[1], Alexandru Eugeniu Mizeranschi[1,3], Silviu Ilie Saplacan[4], Andreea Stefania Anton[1] and Daniela Elena Ilie[1]**

[1] *Research Department, Research and Development Station for Bovine, 310059 Arad, Romania*
[2] *Department of Animal Production Engineering, University of Life Sciences "King Michael I of Romania" from Timisoara, 300645 Timisoara, Romania*
[3] *Institute for Advanced Environmental Research, West University of Timişoara, Timişoara, Romania*
[4] *Aurel Vlaicu University of Arad, Faculty of Economic Science, 310130 Arad, Romania*
*Corresponding author:* neamtr@yahoo.com

## Abstract

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The current study aimed to identify and quantify the detrimental impact that farm efficiency strategies, continuously used, exert on dystocia risk in Romanian Spotted dual purpose herds. In this respect, data aimed calving ease, twinning and calves body weight at birth were recorded between January 2020 and November 2022. The average incidence of twinning (T) was 6.28%, based on an upward trend in the subsequent study years (from 5.22% to 6.53%, $p \leq 0.05$). The same tendency was recorder related to the calves' body weight at birth (CBW), with average values of

38.12 kg, 40.6 and 41.14 kg respectively for the study years ($p \leq 0.05$). Analysing the incidence of dystocia (D) over time, suggested an increasing trend, as reflected by average thresholds of 5.97%, 6.34%, and 6.54% respectively, within the three years of the study. The mitigation of the intensity in increasing in T and CBW, resulted in a decreased incidence of D in herds, demonstrating the strong correlation between these three parameters included in the study. In conclusion, the economic efficiency of the farm by increasing T or CBW, leads to an increase in D, with its negative effects at the productive, reproduction, welfare and animals health status.

*Keywords:* dual purpose breed; dystocia risk; influential factors; welfare

## Introduction

The increasing demand for food products has led to attempts, often taken to extremes, by farmers, to cope with it. Often, especially in small or large farms, with a high degree of technology and intensive or super-intensive rearing systems, these extreme measures exert an opposite, negative effect, both on the financial and on the animals well-being state. This circumstance is conceptually known as "the enemy of the good is the best".

Obtaining an increased amount of weaned calves per dam in line with the shortening of the lactation period, along with a higher calf's average daily gain (ADG), established two trends for farm efficiency, namely increase in twinning and the increasing of calves' body weights at birth (CBW).

The results obtained over time have led to various findings about their effectiveness. Many factors impacting this parameter were identified (breed, parity, BCS, feed amount, season, and others), which contributed to the discrepancy in the conclusions.

Increasing the twinning incidence, in order to obtain more weaned calves per dam was found to be possible in conjunction with improved farm management (especially feeding). The improved feed quality allowed the cows to achieve the metabolic balance required for twinning, while increased milk production facilitated twinning.

Higher milk production was associated with reduced progesterone (Sawa et al., 2015). The decrease in progesterone levels was due to accelerated hepatic metabolism, based on increased blood flow based on high nutrient intake (Sangsritavong et al., 2002). This fact generates an increase in the concentration of FSH and LH and stimulation of ovulation (Stevenson et al., 2007). The incidence of twinning worldwide was 10–25% (Lopez *et al.*, 2017) while Kinsel et al., (1998) calculated a growth rate of about 0.1% per year over the period 1983–1993 (Kinsel et al., 1998). The negative effects of twinning on calving ease involves a loss between 59 USD and 225 USD/lactation (Andras et al., 2018; Mur Novales et al., 2018; István et al., 2019).

Twinning represent an important issue, especially in dairy farms (Caraviello et al., 2006) due the infertility, higher incidence of morbidity and mortality in calves, lower performances in reproduction caused by the dystocia and placenta retained, and decreased of both gestation length and lactation, issues that should be avoided in dairy farms (Mostafa, 2009; Özden, 2010). Furthermore, reducing the nursing period (expensive) and including the vegetal forages (chip) with positive effects on ADG was able to be supplemented with large body weights. This action has contradictory consequences in farm practice. Obtaining large calves increased the incidence of dystocia due to fetal-maternal disproportion (Johanson & Berger, 2003; Steinbock et al., 2003; Hohnholz et al., 2019), despite its dilation by 10-15% at the time of parturition (Meijering, 1984). More over, the cow's efforts to expel the massive calf decreases viability and survivability. The negative impact felt by the cow, leads to a drop in milk ejection, colostrum quality, and the vigor of the dam-calf couple (Christine et al., 2015).

In such circumstances, the risk of dystocia increases. It is necessary to investigate the correlations between influencing factors and the effects induced. The current study aimed to identify and quantify the detrimental impact that farm efficiency strategies, continuously used, exert on dystocia risk in the Romanian Spotted dual purpose breed.

## Materials and Methods

Use of animals and the procedures performed in this study were performed in accordance with the European Union's Directive for animal experimentation (Directive 2010/63/EU).

Location: The study was carried out in a semi-intensive farm located in the Western Plain of Romania (location: 46° 10′ 36″ N, 21° 18′ 4″ E, 107 m altitude, 582 mm annual average rainfall 21°C / -1°C average of temperature corresponding seasons summer / winter).

The confinement system: The confinement system applied in farm characterized by moderate gains rate for the categories of youth (500–700 g/day) and moderate productive values for dairy cows (5400–6300 kg/lactation). Newborn calves are separated from their dams within first hour after birth and kept in individual pens located in space intended of maternity up to 3 days of age. Between 4–48 days, calves are kept in individual hutch on straw bed with free access to the resting area (2 m²/head) and moving area (2.3 m²/head). The administration of dairy diet is made with maternal colostrum for the first 3 days and the next 4 days with raw milk from his own dam. From the eighth day, raw milk is administered from collector tank. The dairy diet is made in 3 daily portions, every 8 h (8 am, 14 pm and 22 pm). In parallel, starting from the 4th day of life, calves receive water and concentrated forage administered ad libitum until day 48 of age. Data regarding the calves' body weight were collected within first hour of age.

All cows were included in the Official Performance and Recording Scheme. Cows were milked twice per day (starting at 5:00 and 17:00) in a "herringbone" milking parlour (2 by 14 units). The milking parlour was equipped with AfiMilk 3.076 A-DU software (Afikim, Israel). Furthermore, all cows were fitted with AfiTag pedometers (Afikim, Israel) for production traits, oestrous and specific diseases detection.

Dams included in the current study were managed under a loose system with no grazing and were between 1st and 6th lactation. Cows were fed twice per day and had a feeding space allowance of 70–75 cm/head. They received a daily feed ration made of 15 kg of fresh cut alfalfa, 15 kg of green fodder, 12 kg corn silage, 6 kg of alfalfa hay and 4 kg of concentrates starting from spring until late autumn, and a ration made of 15 kg alfalfa, 25 kg of corn silages, 6 kg of alfalfa hay and 5 kg of concentrates during winter.

## Data recording

A data set of 1290 recording from 430 lactations collected between year of 2020 and year of 2022, was analysed for

estimation of the twinning and calves body weight at birth on incidence of dystocia. Statistical processing and data interpretation process aimed: a) identifying and assessing the effect of twinning on calving ease; b) assessing the impact of calves body weight at birth on calving ease; c) calculating the phenotypic correlations between influential factors. The incidence of dystocia was investigated according to a) year, b) incidence of twinning and c) calves' birth weight.

Incidence of dystocia were recorded according to influential factors included, in order to set up an "alarm" thresholds for optimal prediction of dystocia occurrence risk protocol. All the statistical inferences were carried out using the software package Statistica (StatSoft Inc., Tulsa, OK USA). The proportion of different dystocia incidence in respect with year, type of calving and calves body weight at birth was investigated using chi square test. Gravimetric measurements of calves were expressed as least squares means (±standard error) used the one-way ANOVA protocol. Differences were assessed using Tukey test. Decisions about the acceptance or ejection of statistical hypothesis have been made at the 0.05 level of significance.

## Results and Discussion

The data synthetically exposed in Table 1 highlight an upward trend associated with twin births, the calves' birth weight and the incidence of dystocia births. The concomitant evolution of the study's components, as well as their consistency throughout time, are critical to this research. These links should set off severe alarms threshold for the farmers directly involved.

The dynamics of twinning became visible in the study years subsequence, as an upward curve. The herd's average twinning incidence rate was 4.21%. This value is comparable with that recorded by Shaileen in the year of 2021 (Shaileen et al., 2021).

Although, dairy breeds have an increased incidence of twinning according to a study performed by Victor & Fricke (2021), we observe some similarity within dual purpose breed, a similarity favoured mainly by the increasing milk production programs implemented, and also correlated with

an improvement in the structure and nutritional value of the fodder ration (Victor & Fricke, 2021). The upward tendency of twinning is practically evident, recording significant differences ($p \leq 0.05$) over the studied years. Similarly results were recorded by Kinsel in 1998 or Victor in 2021 (Kinsel et al., 1998; Victor & Fricke, 2021).

Continuously feature of this tendency was highlighted by Fricke (2001) and Silva del Rio et al., (2007). This dynamic represents a significant challenge for farmers, who have to prepare for the unfavourable consequences. Losses caused by twinning emerge at multiple levels. Economic losses are extremely difficult to quantify. A financial loss of 100–250 dollars for lactation is recognized as possible (Beerepoot et al., 1992). Moreover, twinning is able to significant decrease the reproductive patterns, as retained placenta, dystocia, metritis as well as metabolic disorders, displaced abomasum or ketosis with negative impacts on the productive life of the cows and implicitly at the financial level of farm. A detrimental influence was additionally observed in calves, decreasing the colostrum IG absorption capacity or degrading calves vigour shortly after birth, with more or less long-term consequences (Komisarek & Zbigniew, 2002; Bart et al., 2012).

An important dystocia risk factor is represented by the cows' parity. Silva del Rio et al., (2007) records an upward tendency in this respect, 1.4% per year for multiparous and 1.2% per year for primiparous, respectively (Silva del Río et al., 2007). The semi-intensive system, as well as the involvement of a dual purpose breed in the present study, limited this growth rates. Comparatively, a total increase of twinning by 0.94% was registered with an annual average of 0.47%. The studies carried out in order to establish the repeatability of twinning highlighted an average value of 0.28 (Moioli et al., 2017) or 0.34 according to Wolc in a study performed in 2006 (Wolc et al., 2006). This coefficient could, over time, lead to the perpetuation of twinning, either by adding new generations of inbreeded cows or by the higher parity of existing ones, which are known to have a higher incidence of twinning.

In parallel with increasing twinning in the herd, certain technologically programs aimed to reducing the period from

**Table 1 Incidence of twinning, dystocia and least square means (±standard error) for calves' birth weight**

| Year | n | Twinning (%) | Calves body weight at birth (kg) | Dystocia (%) |
|---|---|---|---|---|
| Cohort | | 4.21 | 39.95±2.67 | 6.28 |
| 2020 | 134 | 3.73[a] | 38.12±1.47[a] | 5.97[a] |
| 2021 | 189 | 4.23[b] | 40.6±3.11[b] | 6.34[b] |
| 2022 | 107 | 4.67[b] | 41.14±2.8[b] | 6.54[b] |

[a,b] Column means with different superscripts differ significantly at $p \leq 0.05$

weaning to slaughter through obtaining massive calves at birth in addition to a higher average daily gain. Since it is a dual purpose breed, increasing the milk production whilst increasing twinning and achieving significant growth rates, appeared to be the key to success. The average calves body weight at birth was 39.95±2.67 kg, gender differences being evident (37.14±1.26 vs. 42.34±2.9 for heifers calves and male calves respectively, p ≤ 0.05), These results were confirmed by previous studies (Dhakal et al., 2013; Kwanghyun et al., 2021) Significant differences (p ≤ 0.05) suggest an upward trend in this sense throughout consecutive research years. The values associated with calves' body weights at birth recorded in the current study were validated by previous investigations (Yanar et al., 1993; Kertz et al., 1997). Previous values recorder in Romania by Muresan (1979) – 40.3 kg, Bulgaria by Ivanov (1982) – 34 kg or Sweden by Husdjursskotsel (1988) – 46 kg or Bulgaria by Ivanov (1982) – 34 kg, validate our results (Muresan, 1979; Ivanov1982; Husdjursskötsel, 1988). Breed significant influences the calves' body weights at birth. The weights associated with dairy breeds proved to be significantly reduced compared to dual purpose one, included in the current research (Dhakal et al., 2013).

The total gain of calves' body weights at birth in the sequence of the study years was 3.02 kg with an annual average of 1.51 kg. The importance of the growth rate of calves' birth weight resides in the impact that excess weight exerts on the calving ease. Starting from an average birth weight associated with a eutocya calving, numerous previous studies aimed to establish the level of impact in calving ease of each extra body weight kg. In this respect, Nix (1998) found an increased risk of dystocia (+0.23%) for each 1 extra body weight kg at the birth moment (Nix et al., 1998). Higher incidence of dystocia (+13% for 1 BWB kg) was recorded by Johanson & Berger (2003) (Johanson & Berger, 2003). Berry (2007) records a progressive increase in the risk of dystocia between 1 and 15% for a calf's birth weight between 20 and 50 kg (Berry et al., 2007). We can conclude that there is a strong but indirect relationship between calves birth weight and calving ease. More precisely, we also observed a strong and directly correlation between calves' birth weight and the dams surface of the pelvic area, also as previously recorded by Gaafar et al., (2011). The calves' birth weight seem to be the limiting factor related to calves, while width at ischia seem to be the limiting factor related to dams.

In general, ample studies has been conducted on dairy cows, where the deleterious impact of dystocia is felt more acutely and at multiple levels, with a greater impact on productive and reproductive indices. The sizes of dairy cows are smaller compared to meat or dual purpose cows. Based on the morphological differentiation of the breeds, we can conclude that one of the reasons for the low frequency of dystocia in respect to calves' birth weight is the calve-dam biometrically relationship, including calves' birth weight and dams' pelvic aria surface (Nix et al., 1998). The total increase in dystocia incidence was 0.57% associated with a total calf birth weight of 3.02 kg. In this respect, the current study recorded a 0.19% increase in dystocia incidence for each extra 1 kg of birth weight.

The analyses aimed the incidence of dystocia assessed both the impact of influential factors (year, calves body weight at birth and twinning) and the correlations established between these parameters and the risk of dystocia.

The average dystocia incidence was calculated as 6.28%. This percentage included only severe (1st degree of severity) and medium (2nd and 3rd degrees of severity) dystocia, that required immediate veterinary intervention. The reported incidence is consistent with that found by Mee (2011), who calculates a threshold of 5–9% for severe dystocia (Mee et al., 2011). Dystocia (with 1 to 5 degrees of severity) is far more prevalent, accounting for 20–40% of the total births or even 50% according to a study conducted by Abera (2017) (Abera, 2017). In beef breeds has been recordead a lower incidence of dystocia, range between 2–6% (De Amicis et al., 2018; Hohnholz et al., 2019). The average dystocia incidence calculated in the current research proved to be consistent with the average of dual purpose breeds.

The presence of beef genes limits the incidence of dystocia, despite the fact that this incidence shows no evidence of decreasing in time, mainly due to the ongoing improvement of milk production. Dystocia incidence recorded an upward tendency in the studies years. A total increase of 0.57% was recorded in time, with an average value of 0.28%/year. Consisted results were recorded by Gaafar (2011), but the values proved to be higher in the Holstein breed (6.9%) (Gaafar et al., 2011). Bahrami (2022) also reported variations in the incidence of dystocia over time, 3.5% overall with an annual average of 0.58% (Bahrami et al., 2022).

A strong correlation was calculated between calves body weight at birt hand dystocia (R = 0.47). Similar correlations were also previous calculated by Meyer (2001) and Steinbock (2003) (Meyer et al., 2001; Steinbock et al., 2003). The twinning proved to be a significant influential factor on risk of dystocia, being responsible for about 12–15% of deaths in new-born calves. Twinning associated with fetus abnormal presentations, is responsible for 37% of dystocia, while single births account for only 5%. The present study found a connection of 0.36 between mixed twinning, abnormal presentation, and dystocia.

## Conclusions

The current study confirm the detrimental effects of aggressive improvement programs, as well as the one-way character of technology designed for high and immediate monetary benefits. The study found that dystocia increased by 0.28% every year, while twinning increased by 0.47% per year. At the same time, each additional birth weight kg recorded during the study period resulted in a 0.19% annual increase in dystocia. Even while these gains are slightly compared to dairy breeds, their consistent upward trend over time should serve as a wake-up alarm for farmers.

## Implications

The dynamics of dystocia are consistent with the worldwide rising trend. This is mostly due to extensive and often unidirectional improvement programs aimed at qualitatively accelerating producing processes in order to achieve beneficial economic results.

Reducing the incidence of dystocia is a complex and difficult task. Good results were obtained only by acting on multiple levels. Thus, at the farm level, semi-intensive improvement programs for milk production, calves' body weight at birth and farmer education have given good results. Farm management, with emphasis on youth animals rearing and growth, and veterinary assistance have led to the reduction of dystocia or the losses caused by them. Further studies are needed to determine the levels of influence of the various influential factors and the existing relationships between them. At the same time, the inability to completely cancel out the effects of all of these factors requires their identification, quantification, and classification to prioritize the attention given. Last but not least, the development of easy and affordable manners to decrease the risk of dystocia is critical. This includes the establishment of criteria for evaluating the risk of dystocia based on both, dams and calves.

*Conflict of Interest Statement*
The authors declare that the current research was performed without any special interest (commercial or financial).

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