

**APTITUDE TO MACHINE MILKING OF MERINO BEIRA BAIXA EWES
II. PRODUCTIVE BEHAVIOUR FACE TO HAND MILKING
AND MACHINE MILKING**

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SUMMARY

In four groups of ewes, 4 series of measurements to characterize the morphology of the udder were performed, as well as, their milk production every 3 weeks from the beginning of milking (57±7 days after lambing). To each group of 8 animals that included ewes of the 1st., 2nd, 3rd and 4th lactation, were distributed the following treatments: group 1-handmilking; group 2-handmilking with "repassé"; group 3-machine milking; group 4-machine milking with "repassé". We observed relevant differences in milk production ($P<0.05$) between handmilking and machine milking. In the groups where "repassé" was done, the milk production was rather superior to the other groups ($P<0.05$). The average milk production of four measurements ($n=64$) was of: handmilking (group 1+ group 2) = 309.9 ± 138.7 ml; machine milking (group 3 + group 4) = 361.9 ± 130.3 ml; milking without "repassé" (group 1 + group 3) = 289.2 ± 122.1 ml; milking with "repassé" (group 2 + group 4) = 382.6 ± 146.8 ml. In handmilking the parameters that showed higher correlations with milking production were the volume of the udder ($r=0.66$), the width between the teats ($r=0.52$) and the depth of the udder ($r=0.44$). The results obtained with machine milking were: udder width ($r=0.49$), length of teats ($r=0.42$), teats volume ($r=0.40$) and teats inclination ($r=-0.29$).

1. INTRODUCTION

The increased importance on sheep production in Castelo Branco region, are motivating the study and characterization of Merino da Beira Baixa (MBB) sheep flocks, related to their productive and reproductive parameters. The MBB, are a small breed, on which adult females have an average live weight about 39 ± 1.03 Kg (PINTO DE ANDRADE et al., 1987). They are explored on their double ability (milk and meat), having the milk production a great importance on the manufacture of "Castelo Branco Cheese".

The average milk production is about 43.3 l per lactation of corrected 150 days. The milk is obtained by shepherd by handmilking, and today the farmers, cause to a lack of handiwork, are beginning to introduce machine milking.

The morphological characteristics of the udder and its relations to milk production was study by REBELLO DE ANDRADE et al. (1989). With the present work we have pretended to analyse the breed under the point of view of milk ability to machine milking. According to LABUSSIÈRE (1989), the most milking machines were designed to the Lacaune breed, so it is necessary to adapt that equipments to other breeds and also make a strict selection on the sheep flocks.

2. MATERIAL AND METHODS

2.1 Animals and Treatments

This work was performed in a flock of 300 MBB heads belonging to the Escola Superior Agrária de Castelo Branco, Portugal. The ewes were mated on April may, lambing on September october. The measurements were performed spaced by 3 weeks after the beginning of milking (57±7 days after lambing) until the 10th week. The animals were chosen by chance (32 animals) and grouped in the next four lots of 8 animals belonging, in equal number, to the 1st., 2nd, 3rd and 4th lactation:

- Group 1 - Handmilking without "repasse"
- Group 2 - Handmilking with "repasse"
- Group 3 - Machine milking without "repasse"
- Group 4 - Machine milking with "repasse"

2.2. Milking technics

Milking was done twice a day (in the morning at 8h 30m a.m., and in afternoon at 16h 30m p.m.). Two of the groups were hand milking and the others machine milking. In one of the groups of each type of milking technics was applied the repasse, i.e., the hand stripping a few minutes after the hand or machine milking. In machine milking teat cups were set without preparation of the udder.

Characteristics of the milking machine

- Milking machine.....Alfa-Laval
- Vacuum level.....35 KPa
- Vacuum pump.....VP 76 (900 l/min)
- Milk line.....down line
- Pulsation ratio.....50 p.100
- Pulsation speed.....90 p/min
- Collector.....transparent plastic
- Liners.....monobloc.Alfa-Laval on silicone[®]∅ 19 mm
- Teat Cups.....inox steel of Alfa-Laval

Characteristics of sheep contention system

- Italian type, mobile.....from Alfa-Laval
- Size.....room 2 x 24 with 24 milking units

2.3. Controls

Every measurements were made one hour before the first milking of the day, on the 1st, 4rd, 7th and 10th weeks of lactation, and always by the same operator during all controls. The methodology

used was described by LABUSSIÄRE et al.(1981) and PURROY et al.(1982), which is described:

2.3.1. Morphological characteristics of the udder

2.3.1.1. Teats position

In relation to a vertical plan, giving a value of 1 to 5. We consider: 1 when the teat shows a back hinder inclination; 2 when it is vertical; 3 when it shows a slightly inclination ahead; 4 if the inclination is more prominent and 5 when it's much prominent (fig.1).

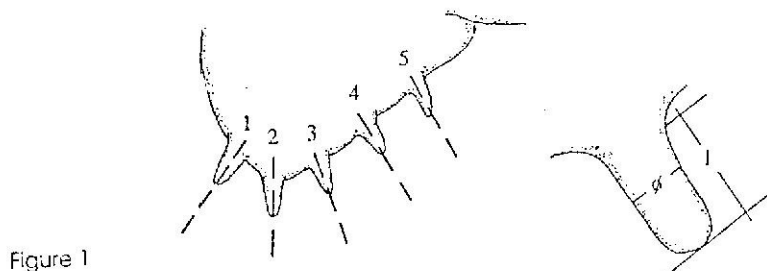


Figure 1

2.3.1.2. Length and diameter of the teats (cm)

The length was taken with a glass tube on which was marked the lower point of the teat and after measured. The diameter was taken with a standard measure type on the high/medium zone, of the teat avoiding its compression (fig.1).

2.3.1.3. Udder depth (cm)

The udder depth was obtained between the hinder zone (perineal zone and its abdominal insertion (Fig.2).

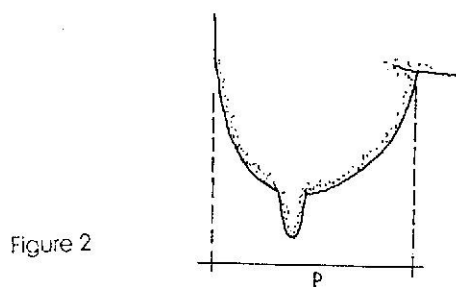


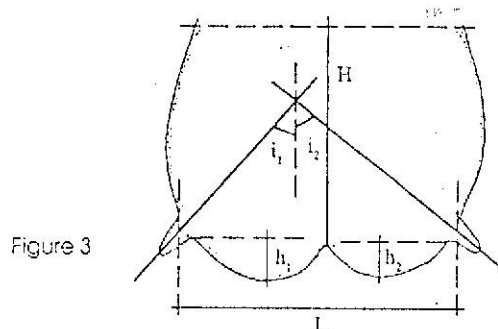
Figure 2

2.3.1.4. Udder volume (ml)

The udder volume was estimated after being sink in a plastic vessel with graduation, full of tepid water. The udder volume is obtained by difference to the initial volume of water.

2.3.1.5. Teats inclination (°)

With a transparency upon a acrylic transparent sheet applied under the posterior surface of the udder we have draw the udder shape including the level of teat implantation their inclination and also the shape of both cisterns. The measures were made on the table with a angle tranferor. We have also obtained other measures (cisterns height, udder height and udder width) by the same way (Fig.3).



2.3.2. Milk production (ml)

Milk production for machine milking was obtained through a graduate collector intersecting the milk line, and for handmilking and repasse were used a graduated provet. For each group the milk production was described as follow:

Group 1 - Hand milk (HM) ; Total production (TP) = HM

Group 2 - HM and repasse milk (RM); TP = HM + RM

Group 3 - Machine milk (MM) ; TP = ML

Group 4 - ML and RM ; TP = MM + LR

2.3.3. Milking time (s)

Milking time was recorded wuth a chronometer since the set of teat cups or first milk jact in handmilking, and stopping with the lack of milk ejection.

2.4. Statistical analyses

For the statistical analyses of averages values of measurements between milking technics for the all groups were established. The trial was delineated in a Randomized Complete Block (RCB)(GOMEZ et GOMEZ, (1983). All values were analysed by multiple regression and analyse of variance for the full regression.

3. RESULTS AND DISCUSSION

The average morphological characteristics of the udder of the ewes submitted to various treatments, their milk yields and milking times are presented in Table I:

3.1 Morphological characteristics

In relation to the parameters that characterize the udder morphology, related with the milking technique, we observe significant differences in the udder volume and its depth. The udder volume, in the groups submitted to machine milking, we verify an enlargement in udder volume (about 19.9 %), compared to the groups submitted to hand milking.

According to the aleataneous choice of the ewes in the beginning of the experiments, the milk yield measurements obtained, make us suggest that the udder volume variation results of the greater persistence shown by the machine milking groups during the experiments, maintaining a bigger activity of the mammary gland. This fact may be observed in Table II, showing a greater average daily milk yield in the groups submitted to machine milking (Group 3 - 302.6 ± 126.5 ml; Group 4 - 421.3 ± 129.9 ml) in relation to the groups submitted to hand milking (Group 1 - 275.8 ± 113.9 ml; Group 2 - 344.0 ± 159.1 ml).

TABLE II. Average total milk production, milking and repasse production showing de proportion of repasse to total milk production

Treatments	Groups	Milk yield (ml)			Total milk
		Morning milking + Afternoon milking			
		Milking milk (Am)	Repasse milk (Bm)	Bm/Am %	
Hand milking	1	275.8±113.9	---	--	275.8±113.9
Hand milking with repasse	2	283.6±109.6	60.7±14.5	21.4	344.0±159.1
Machine milking	3	302.6±126.5	---	--	302.6±126.5
Machine milking with repasse	4	331.1±93.7	90.2±22.5	27.2	421.3±129.9

In relation to the udder depth, height and width (width between teats), The differences are not so evident because these are linear measures and their algebrical product may define the volume. Therefore, we made before about the volume are equally faithful. On the other hand, these are measures that show a greater correlation, as we can verify in the values obtained by LABUSSIÈRE et al. (1981) in Lacaune ewes, PURROY y MARTIN (1982) in Churra ewes and REBELLO DE ANDRADE et al. (1989) in Merino Beira Baixa ewes.

Table I. Average morphological characteristics of the udder of ewes, their productions and milking times, in function of the milking technics used. The values with (*) respects only to the morning milking.

PARAMETERS		Hand milking		Machine milking		
		Without repasse	With repasse	Without repasse	With repasse	
T	Position	left	3.19±0.77	2.69±0.58	3.06±0.50	3.03±0.59
		right	3.34±0.69	2.91±0.68	3.06±0.61	2.69±0.58
E	Length	left	2.78±0.52	2.71±0.76	2.74±0.38	2.79±0.58
		right	2.61±0.36	2.68±0.64	2.93±0.50	2.85±0.61
A	Diameter	left	1.53±0.22	1.50±0.39	1.54±0.25	1.53±0.23
		right	1.45±0.16	1.47±0.37	1.58±0.23	1.50±0.27
S	Inclination	left	32.31±10.02	34.22±13.40	36.13±11.79	37.53±14.89
		right	39.72±8.77	41.63±10.32	36.25±11.16	39.63±13.69
	Width between teats		10.76±1.15	10.72±1.02	11.30±0.92	11.46±0.89
	Cisterns height	left	0.69±0.37	0.87±0.43	0.87±0.42	0.93±0.48
		right	0.87±0.38	0.85±0.36	0.85±0.38	1.06±0.48
U	Height		10.47±1.37	10.10±1.04	11.03±1.53	10.85±1.93
D	Volume		378.75±107.78	384.06±100.80	446.71±118.96	468.13±138.19
E		Depth		7.77±1.52	7.88±1.55	8.28±1.80
M I L K	Hand or machine (*)		169.38±78.34	201.22±114.14	195.38±77.93	230.31±88.90
	repasse (*)		---	38.38±12.84	---	55.31±38.00
	Total (*)		169.38±78.34	240.09±120.09	195.38±77.93	285.62±85.00
T I M E	Hand milk or machine milk (*)		22.9±9.0	18.53±4.22	86.91±26.08	99.67±33.09
	repasse (*)		---	10.28±2.91	---	21.09±15.98
	Total (*)		22.9±9.0	28.81±5.23	86.91±26.08	121.03±33.13

3.2 Milk yield

In Table III we compare the average values obtained in the milk yield in the a.m. milking, in the p.m. milking and the total daily yield, of each treatment. It is also clear the relation between the proportion of the milk obtained in the hand stripping ("repassé") related to the total milk yield, for the groups which were submitted to hand stripping.

TABLE III. Average milk production of morning milking and afternoon milking showing the proportion of hand stripping milk related to total milk yield for each treatment

Treatments	Groups	Milk production (ml)					
		Morning milking			Afternoon milking		
		Milking milk (Am)	Milk repasse (Bm)	Bm/Am %	Milking milk (At)	Milk repasse (Bt)	Bt/At %
Hand milking	1	169.4±78.3	---	--	99.2±46.8	---	--
Hand milking with repasse	2	201.2±114.1	38.9±12.8	19.3	82.4±36.9	21.8±16.2	26.5
Machine milking	3	195.4±77.9	---	--	106.9±57.	---	--
Machine milking with repasse	4	230.2±88.9	55.3±38.0	24.0	100.8±45.4	34.8±22.2	38.5

As far as the milk yield is concerned, we verify that, comparing hand milking with the machine milking, the daily average milk yield obtained was significantly superior in the last technique. This superiority is also observed in the groups submitted to hand stripping. Nevertheless, analysing the contribution of the morning milk, evening milk and stripping milk for the total daily amount, we verify that:

- The hand stripping contributes with 21.4 % and 27.2 % for the total milk yield, respectively in hand milking and machine milking. PURROY et al.(1984a) and PURROY et al.(1984b) also observed a contribution of 21.24 % and 21.87 % , in Churra ewes, of the stripping milk to the total yield.

- In the a.m. milking, the proportion of the stripping milk obtained in the group submitted to machine milking was 4.7 % higher comparing with the group submitted to hand milking. This difference was more evident (12 %) in the p.m. milking (TABLES II AND III).

These facts make us think that although machine milking seems to be more efficient for the cisternal milk, there still would be a

fraction of alveolar milk that would remain retained due to lack of oxytocin relief or due to lack of stimulation, "rendering stagnant" until hand stripping, made some minutes after the removal of teat cups, or until the next milking in those groups that were not submitted to manual stripping. LABUSSIÈRE (1988) refers that if one wishes to maintain a high level of milk secretion, the alveolar milk must be removed and that the suppression of hand stripping in ewes of 1 peak causes a decrease of production, sometimes, superior to 30 %. ABASCAL e MAESO (1985) refer, also for 1 peak ewes, that the milk ejection reflex during milking is partial made up for during the period between milkings, by some flow of milk from the glandular acines to the cistern.

In our experiment we can see this fact observing the amount of hand stripped milk in the evening milking and morning milking that, in general, present closer values than those observed in machine milking or hand milking. As the break between milkings is bigger before the morning milking, and the energetic requirements are superior during the day, it is hoped that during the quiet of the night, there will be more milk secretion that is being transferred from the acines to cisterns. This will be the milk that is quickly extracted by milking machine, more efficiently than by hand milking.

We also saw that the biggest part of milk was quickly extracted since we set the teat cups. From that moment onwards the ewes began to show signals of disturbance caused by sucking if teat cups were not removed. Although we could not have established a differentiation between 1 peak and 2 peak ewes, by lack of adequate equipment, and according to the observations of LABUSSIÈRE and RICORDEAU (1970), LABUSSIÈRE et al. (1981) and ABASCAL and MAESO (1985) referring BENMERDEL (1982), that in 1 peak ewes the volume of the first emission is bigger than the one of 2 peak ewes, the facts observed make us accept, even without confirmation, that Merino Beira Baixa ewes will be mostly 1 peak ewes.

TABLE IV. Analysis of Variance (RCB)

Source of variation	Sum of squares	D.F.	Mean square	F ratio	
Total (corr.)	2663526.9	127			
Controls	386278.9	3	128759.65	7.011	***
Error	2277247.9	124			

TABLE IV. Analyses of Variance (Split Plot)

Response variable : Milk production					
Source of variation	Sum of squares	D.F.	Mean square	F ratio	
Main effects	365927.41	2	182963.70	9.9626829	
Milking	86736.125	1	86736.125	4.7229286	*
Repasse	279191.28	1	279191.28	15.202437	**
Residual	2277247.9	124	18364.903		
Total (corr.)	2663526.9	127			

3.3 The most significant correlation analysis

In tables V, VI, VII and VIII are presented the most significant correlations ($P < 0.05$) among the parameters that influence the most the milk yield and the milking time for the different groups.

In Group 1 - Hand milking, the parameters that define the udder size present high correlations with the morning milk (udder volume = 0.66; udder width (width between teats) = 0.52)), being the milking time proportionate to the milk yield (0.60). The relationship between milking time and milk yield is not significant in group 3 - machine milking, whence the use of this technique becomes profitable related to the time needed for milking operations, above all if we deal with high production ewes.

TABLE V . Correlation matrix for Group 1 - Hand milking

	Width between teats	Udder depth	Udder height	Udder volume	Total milk
Total milk of the morning	0.52		0.41	0.66	
Milking time	0.45	0.36		0.59	0.60

In Group 2 - Hand milking with hand stripping ("repasse"), once again the parameters that define the udder size present high correlations with the milk yield (udder volume = 0.69 and udder height = 0.49). The milking time is proportionate to the udder volume (0.61), udder depth (0.59), morning milk (0.53) and total

milk yield (0.53). The stripping time is proportionate to the udder volume (0.48), rendering evident the provenance of the milk extracted in this operation, and it becomes lower when the width increases (-0.42).

TABLE VI . Correlation matrix for Group 2 - Hand milking with repasse

	Teats position	Teats inclination	Udder depth	Udder height	Udder volume	Milk of morning	Repassé milk of morning	Total milk of morning
Milk of the morning	0.47	0.36	0.37	0.49	0.65			
Milk repasse of morning					0.41	0.42		
Total milk of the morning	0.46	0.35	0.37	0.49		0.99	0.51	
Milking time	0.43		0.59		0.61	0.53		0.53
Repassé time			-0.42		0.48	0.39		
Total time								0.39

In Group 3 - Machine milking, the total morning milk presents high correlations with the width between teats (0.50) and the cisterns height (0.42). The average values of the cisterns height and width between teats, in all the groups, are 0.87 and 11.06 cm respectively.

TABLE VII . Correlation matrix for Group 3 - Machine milking

	Udder width	Teats position	Cisterns height
Total milk of the morning	0.50	-0.37	0.42

CASU and LABUSSIÈRE (1972), relate the ewes capacity to support large breaks between milkings with the milk storage capacity in cisterns. Comparing the cisterns height of Merino Beira Baixa ewes with those ones of Sarda ewes (3.19 cm) and Lacaune ewes (1.93 cm) characterized, according LABUSSIÈRE (1988), by small amounts and relative proportion of stripping milk and residual milk, we verify that, as a matter of fact, the small size of the cisterns, in the ewes in which we carried out our studies, will

be the principal reason for the proportion of the hand stripping milk related to the total milk yield.

Looking at Table II again, we can see that the milking yield differences found only in the evening milking are not very significant among all the groups, comparing only the milking milk. Related to total milk yield, hand stripping represents a relative proportion superior to that found in the morning milkings, the values may be considered too close. In this group we can still see that a more horizontal teats position becomes disadvantageous for the milk yield, having a negative repercussion ($r=-0.37$).

In Group 4 - Machine milking with hand stripping, we see that teats inclination is negatively correlated with the morning milk yield (-0.42), also with the total morning milk yield (-0.48) and positively with the hand stripping time (0.40). This characteristic becomes unfavourable not only for the machine milking but also for the hand stripping, increasing the time needed to do it. According to LABUSSIÈRE (1988), as far as the utilization of machine milking is concerned, the teats inclination must be avoided because it is, in part, responsible for:

- Frequent fall of the teat cups, disturbing an efficient work organization.
- Need of man's intervention to help the milk ejection to the teat cups.
- The teat cups weight may cause pain at the basis of the most horizontal teats, inhibiting the milk ejection reflex by inhibition of oxytocin releasing.

TABLE VIII. Correlation matrix for Group 4 - Machine milking with repasse

	Teats inclination	Teats diameter	Teats length	cisternal height	Udder depth	Udder volume	Milk morning	Repasse morning	Total milk morning	Milking time
Milk of the morning	-0.42		0.40							
Repasse of the morning					0.43	0.61				
Total milk of the morning	-0.48	0.46	0.52				0.91			
Milking time							0.44		0.35	
Repasse time	0.40			0.56	0.40	0.42		0.57		
Total time										0.83

We also found in this Group, as well as in Group 2, high correlations of stripping milk with udder volume (0.61) and udder depth (0.43) and of the stripping time with cisterns height (0.40). The total time is also highly correlated (0.88) with the milking time. Somehow, this relation will not be correct if we consider the time needed to machine milk the entire group of ewes and the time the time needed to hand strip the same number of animals.

In Table IX we present significant correlations ($P < 0.05$) common to all the groups of hand milking (hand milking + hand milking with hand stripping) and of machine milking (machine milking + machine milking with hand stripping).

TABLE IX. Correlation matrix for the Groups:

Hand milking (a) (Hand milking + Hand milking with repasse) and Machine milking (b) (Machine milking + Machine milking with repasse)

(a) Hand Milking		(b) Machine milking	
	Milk production		Milk production
Udder volume	0.66	Udder volume	0.40
Udder height	0.39	Udder height	0.31
Udder depth	0.44	Udder depth	0.32
Udder width	0.52	Udder width	0.49
Teats inclination	0.26	Teats inclination	- 0.29
Cisterns height	0.24	Teats position	- 0.28
		Teats length	0.42

Analysing together the groups above mentioned, we verify that the parameters with more influence in milk yield in the hand milking are: the udder volume (0.66), the udder depth (0.44) and the width between teats (0.49). In the machine milking, the higher positive correlations with the milk yield are: the width between teats (0.49) and the udder volume (0.40).

In both cases, quantitatively, it is evident the relation of these characteristics with the milk yield, depending, above all, of udder conformation aspects. But there are other characteristics like the teats length (0.42), inclination (-0.29) and position (-0.28), showing us that, in fact, there are some limitations, depending on the animal, that influence negatively

the milk yield when ewes are machine milked with a specific machine milking.

4. CONCLUSIONS

Although the main quality of a dairy animal is its production level, it is also essential to be able to give the most of its yield in response to stimulus of machine milking (SAGI and MORAG, 1974) allowing a rapid extraction of the milk retained in the udder with a minimum of manual intervention, in machine milking perspective. These characteristics are revealed in high production dairy cows, resulting from selection, genetic improvement and improvements in machine milking design. Nevertheless, in ewes, frequently explored in their double aptitude, such as Merino Beira Baixa ewes, suckling the lambs for 1 or 2 months before the ewes start being milked, the selection for milk production and aptitude to machine milking becomes difficult because they disguise the response to machine utilization. LABUSSIÈRE (1988), refers that if lambs are weaned only with 4 days of age, the percentage of 2 peak ewes is of is of 70 % ; but if the suckling period is increased to 42 days this percentage is reduced to 50 % , due to the development of a maternal behaviour between mother and lamb during the post weaning period. So, we must be cautious about the conclusions in this type of experiments because it is important to consider the husbandry system in the milk production context and in the perspective of an optimum use of machine milking.

In this way, according to functional characteristic of MBB ewes and considering the use of machine milk, aspects as teat size presenting high correlations with milk yield may suggest that selection must be done in a way to obtain ewes with increased teats size. We also may conclude that, according to the size of teat cups in the experiment, the ewes having larger teats were the best fitted and easiest to milk. In this case, to modify the teat cups in function of the most common teat size seems to be a better option than selecting ewes in function of this characteristic. As referred by LABUSSIÈRE (1989) it is easier to modify the machine than the animal. Another aspect related with the material is the weight of teat cups, collector and tubes conjoined, that in ewes presenting teats with an evident cranial projection may cause pain at the basis of the teat, inhibiting the milk ejection. The reduction of that weight would surely improve the aptitude to machine milking. Vacuum pressure is also another important question to study when dealing with MBB ewes. Sometimes, due to the small size, the udder itself was suckled into the teat cups, causing wrinkles through which big amounts of air was admitted, provoking damage pressure changes.

Although machine milking have evidenced good results in relation to hand milking, specially when ewes present higher yields, the suppression of hand stripping is not advisable. Although this

operation increases considerably the total milking time, it is justified the hand stripping because when not used there is a significant reduction in the total milk yield (almost 30 %) and mainly the fat content which is so important for the traditional manufacture of "Castelo Branco Cheese", that really is the main purpose of the MBB dairy sheep production.

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RESUMEN

Se han estudiado 4 tipos de ordeño: manual (grupo 1), manual con repaso (grupo 2), mecánico (grupo 3) y mecánico con repaso (grupo 4). En cada tratamiento se incluyeron hembras de 1ª, 2ª, 3ª y 4ª lactación, en un total de 8 animales por grupo. Después del inicio de ordeño (57±7 días post-partum) se hicieron mediciones de la morfología de las ubres y de la producción lechera, en cada 3 semanas. Para la cantidad de leche se han observado diferencias significativas ($P<0.05$) entre el ordeño manual y mecánico. En los grupos con repaso, se demostró ser significativamente superior ($P<0.05$). El promedio diario de las medidas ha sido, 309.9 ± 138.7 ml en el ordeño manual (grupo 1+grupo 2), 361.9 ± 130.3 ml en el ordeño mecánico (grupo 3+ grupo 4), 382.6 ± 146.8 ml en el ordeño con repaso (grupo 2+grupo 4) y 289.2 ± 122.1 ml sin repaso (grupo 1+grupo 3). Para el ordeño manual, las correlaciones mayores con la cantidad de leche han sido: volumen de la ubre ($r=0.66$), anchura entre los pezones ($r=0.52$) y profundidad de la ubre ($r=0.44$). Para el ordeño mecánico, las correlaciones mayores han sido: anchura entre los pezones ($r=0.49$), longitud de los pezones ($r=0.42$), volumen de la ubre ($r=0.40$) e inclinación de los pezones ($r=-0.29$).

RÉSUMÉ

On a effectué sur 4 groupes de brebis, 4 séries de mesures de la morphologie de la mamelle et de la production laitière, avec trois semaines d'intervalle, a partir du début de la traite (57±7 jours après la mise bas). Les groupes d'huit animaux, ont été constitué avec des brebis de 1ère, 2ème, 3ème et 4ème lactation, distribués: Groupe 1 - traite manuelle; Groupe 2 - traite manuelle avec "repasse"; Groupe 3 - traite mécanique; Groupe 4 - traite mécanique avec "repasse". On a observé des différences significatives dans la production laitière ($P<0.05$) entre la traite manuelle et la traite mécanique. Dans les groupes avec "repasse", la production de lait a été significativement supérieure ($P<0.05$). La production moyenne dans les 4 mensurations ($n=64$) a été: Traite manuelle (Groupe 1+ Groupe 2) = 309.9 ± 138.7 ml; Traite mécanique (Groupe 3+Groupe 4) = 361.9 ± 130.3 ml; Traite sans "repasse" (Groupe 1+ Groupe 3) = 289.2 ± 122.1 ml; Traite avec "repasse" (Groupe 2+Groupe 4) = 382.6 ± 146.8 ml. Dans la traite manuelle, les paramètres qui ont montré des corrélations plus élevées avec la production laitière ont été: le volume de la mamelle ($r=0.66$), largeur entre les trayons ($r=0.52$) et profondeur de la mamelle ($r=0.44$). Pour la traite mécanique on a obtenu: largeur entre trayons ($r=0.49$), longueur des trayons ($r=0.42$), volume de la mamelle ($r=0.40$) et inclinaison des trayons ($r=-0.29$).

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