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AVERAGE PASSAGE TIME AND VIABILITY OF FABACEAE SEEDS RECOVERED FROM SHEEP FECES

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ABSTRACT - Most of the forage plants in the Fabaceae family have a high percentage of hard seeds, so the endozoochoric dispersion of seeds can in theory accelerate their germination due to the natural scarification carried out during passage through the animals' digestive tract. However, damage caused by the chewing and digestion processes can kill the seeds, reducing the percentage of germination. The objective was to evaluate the passage time of seeds of butterfly pea, tropical kudzu and Campo Grande Stylosants through the digestive tract of sheep; as well as its viability after this process; and the potential of these animals as dispersing agents of these seeds in pastures. Seventy grams of seeds from each fabaceae were mixed with the concentrate and offered, in a single time, to nine castrated crossbred lambs with an average body weight of 40 kg. The animals were housed individually in metabolic cages, and their feces were collected at intervals of 6 h after ingesting the seeds (6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66 and 72 h). The recovered seeds are counted and evaluated for germination in the laboratory. The design used was completely randomized, in a factorial scheme: 3 fabaceous plants x 12 collection times, with three replications (animals). The recovery percentage of *Clitoria ternatea*, stylosants and kudzu seeds varied between 16 and 23%. Passage through the digestive tract positively affected the germination of kudzu seeds, which had the highest average (39%). *Clitoria ternatea* and stylosants seeds showed germination of 9% and 10%, respectively. The period of greatest seed recovery was 24 to 30 h for three species studied. Under these conditions, sheep can be considered legitimate agents that disperse these seeds in pastures.
Keywords: Dormancy, scarification, germination.

TEMPO MÉDIO DE PASSAGEM E VIABILIDADE DE SEMENTES DE FABÁCEAS RECUPERADAS NAS FEZES DE OVINOS

RESUMO - Grande parte das forrageiras da família Fabaceae apresenta alta porcentagem de sementes duras, assim a dispersão endozoocórica de sementes em tese pode acelerar a germinação destas devido à escarificação natural exercida durante a passagem pelo trato digestório dos animais. No entanto, os danos causados pelos processos de mastigação e digestão podem matar as sementes, reduzindo a porcentagem de germinação. Objetivou-se avaliar o tempo de passagem das sementes de *Clitoria ternatea*, kudzu tropical e estilosantes Campo Grande pelo trato digestório de ovinos; assim como sua viabilidade após esse processo; e o potencial destes animais como agentes dispersores destas sementes nas pastagens. Setenta gramas de sementes de cada fabácea foram misturados ao concentrado e oferecidos, em única vez, a nove cordeiros mestiços castrados com peso médio corporal de 40 kg. Os animais foram alojados individualmente em gaiolas metabólicas, e suas fezes foram coletadas em intervalos de seis horas após a ingestão das sementes (6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66 e 72 h). Sendo as sementes recuperadas contadas e avaliadas quanto à germinação, em laboratório. O delineamento utilizado foi o inteiramente casualizado, em esquema fatorial: 3 fabáceas x 12 tempos de coleta, com três repetições (animais). A porcentagem de recuperação das sementes de *Clitoria ternatea*, estilosantes e kudzu variou entre 16 e 23%. A passagem pelo trato digestório afetou positivamente a germinação das sementes de kudzu, que apresentaram a maior média (39%). As sementes de *Clitoria ternatea* e estilosantes apresentaram germinação de 9% e 10%, respectivamente. O período de maior recuperação de sementes foi de 24 a 30 h para três espécies estudadas. Nestas condições os ovinos podem ser considerados legítimos agentes dispersores destas sementes em pastagens.
Palavras-chave: Dormência, escarificação, germinação.

INTRODUCTION

In natural environments, the germination of forage plant seeds is shaped not only by physical factors like water, light, and temperature, but also by biotic influences. One key example is the role of herbivorous animals, which, through ingestion, serve as seed dispersers, facilitating endozoochoric dispersion and contributing to the spread and growth of these plants (PALMER and CATTERALL, 2021; MOLINA et al., 2023).

Dispersal is the transport of the seed away from the mother plant, contributing to the perpetuation of the species, in addition to occupying new environments (MILOTIĆ; HOFFMANN, 2016). Effective seed dispersal by animals on pasture involves a series of phases: (1) seed ingestion,

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(2) passage through the digestive tract (DT), (3) germination, (4) development, (5) establishment and survival of seedlings (ALVAREZ et al., 2017). Seed dispersing animals can influence the reproductive success of plants due to their legitimacy (effect on the germination capacity of dispersed seeds), efficiency (dispersion in areas desirable for grazing) and effectiveness (proportion of seedlings originating from dispersed seeds in relation to the total of established seedlings) (PARK, 2015).

After ingestion, seeds can be damaged during the processes of chewing and digestion. The extent of this damage depends on several factors, including the seed's size, shape, and hardness of the coating, the proportion of seeds in the animal's diet, the species of the animal, the overall quality of the diet, and the length of time the seeds remain in the digestive tract (TJELELE et al., 2015).

The passage of certain types of seeds through the digestive tract of ruminants enables chemical scarification, which promotes gas exchange and removes germination inhibitors found in the seed. This process also enhances water absorption and reactivates essential metabolic functions, aiding in seed germination. (LAMICHHANE et al., 2022). Machado et al. (1997) stated that passing through digestive tract (DT)can cause changes in its longevity and dormancy, as well as in the percentage and speed of germination, and initial growth of the seedling. Bolzan et al. (2019), studying the effects of simulated chewing, fermentation, in vitro acid-enzymatic digestion, and the dynamic effects of these processes on the physiological quality of seeds from four *Brachiaria* spp. cultivars (cv. Marandu, cv. MG5-Xaraés, cv. Basilisk, and cv. Ruziziensis), observed that treatments simulating the passage of *Brachiaria* spp. seeds through the bovine digestive tract in vitro caused a reduction in seed germination.

Considering the endozoochoric dispersion that occurs naturally in pastures, this work aimed to evaluate the potential of sheep as seed dispersers of three tropical Fabaceae forages: *Clitoria ternatea*, Campo Grande Stylosants and tropical kudzu; as well as evaluating the viability of seeds recovered in sheep feces, and the average dispersion time of these seeds after ingestion.

MATERIAL AND METHODS

The present work was carried out in the sheep farming sector of the Animal Husbandry Research Support Unit (UAPZ) and the germination analyzes were carried out in the Seed Technology Sector of the Pyrotechnics' Laboratory (LFIT), both belonging to the Darcy Ribeiro Northern Rio de Janeiro State University, in Campos dos Goytacazes county, RJ. Seeds of *Clitorea ternatea*, Campo Grande Stylosants (*Stylosanthes capitata* vog. and *Stylosanthes macrocephala* M. B. FERR. et S. COSTA) and tropical kudzu (*Pueraria phaseoloides*) were used, the batches of which underwent initial germination tests, according to Brasil (2009), to determine the germination and initial vigor of the seeds.

For the study, nine crossbred lambs (Santa Inês x Dorper), castrated, weighing an average of 40 kg were used. The animals were housed individually in metabolic cages composed of trays at the bottom, which allowed the accumulation of feces. Feeding was carried out individually, following a forage: concentrate ratio of 60:40, with 700 g day^{-1} of concentrate based on corn and soybean bran and 4 kg day^{-1} of chopped elephant grass (quantities divided into two treatments). daily) and water ad libitum. The diet was balanced according to NRC (2007) for a gain of 150 g per day.

There was an adaptation period of seven days for both accommodation and food. The animals were randomly divided into three groups of three animals. Each group received seeds from a species of fabaceae. 70 g of seeds from each fabaceae were mixed in the 350 g of concentrate provided in the morning, to facilitate ingestion. This quantity corresponds to approximately 1,400 seeds of *Clitoria ternatea*, 24,500 of stylosants and 6,790 of tropical kudzu, all *in natura* (without scarification) (BRASIL, 2009). A sample of the seeds evaluated in this trial was measured using a digital caliper, obtaining an average size. The seeds of *Clitoria ternatea* (largest seed evaluated) are on average 6.62 mm long, 4.62 mm wide and 2.80 mm thick. Kudzu is an average size of 2.66 mm long, 2.46 mm wide and 2.19 mm thick. The stylosants (smallest seed evaluated) has seeds averaging 2.50 mm long, 1.71 mm wide and 0.99 mm thick.

Seeds of all species were provided only on the first day of the experiment at 06:00. At 12 pm on the same day (6 h after offering the seeds), feces from these animals began to be collected at intervals of 6 h, with collection extending up to 72 h after ingesting the seeds.

Collections were made over periods of 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66 and 72 h. At each collection, the feces containing the seeds were softened in water, in a 5 L bucket, and then washed using procedure gloves and tweezers, in running water at low flow, over fine mesh sieves. The recovered seeds were taken to the Seed Technology Sector, where they were counted. After counting, germination tests were carried out with intact seeds, constituting the control (time 0 h) and seeds recovered at each collection time. Germination tests were based on the recommendation of the Rules for Seed Analysis (RAS) (BRAZIL, 2009) with four replications of 50 seeds, when the number of seeds recovered was sufficient, in a photoperiod of 8/16 h light/dark.

The stylosants and kudzu tests were mounted on Germitest paper in a gerbox and placed in germination chambers at 20-35ºC and 25ºC, respectively, with the first count being carried out at 4 days and the final count on the 10th day, for both species. The tests with *Clitoria ternatea* seeds were mounted on a Germitest paper roll and placed in germination chambers with an alternating temperature of 20-300ºC. The first and last counts were carried out at 7 and 14 days. Only those that gave rise to normal seedlings were considered viable seeds, according to the RAS (BRASIL, 2009).

A completely randomized experimental design was used, in a 3x12 factorial scheme (fabaceae x collection times), with 3 replications (animals). The results were

subjected to SAS (2009) analysis of variance. The Scott-Knott test was used to group the means, at 5% significance, using the GENES program (CRUZ, 2006).

RESULTS AND DISCUSSION

The analysis of variance of the percentage of seed recovery indicated significance only for the collection times ($P<0.01$) (Table 1). No seeds were found in the waste 6 h after ingestion. It is believed that hours were not enough for the beginning of the expulsion of seeds in the sheep's feces, for the three species evaluated.

Therefore, the results from this period were excluded from statistical analyses. To carry out this study, there was no availability of many animals, limiting the number of repetitions, but the homogeneity of the group (age, weight, sex and management) was maintained. Despite this, seed recovery in sheep feces showed great variation between animals, probably due to differences in everyone's metabolism. This behavior was also observed by Lisboa et al. (2009) and Acherkouk et al. (2017). Therefore, studies involving the planned dispersal of seeds through animal feces must consider the greatest homogeneity of the batch, as well as the greatest number of repetitions possible to reduce the variation in results due to the nature of the animals. However, in practice, this variation in results will not be an obstacle to the use of this dispersion technique.

TABLE 1 - The possible number of normal plants originating from kudzu, butterfly pea, and stylosanthes seeds recovered from sheep feces, based on the total germination percentage (GP%) and the total germination percentage after additional scarification (GPA%) at each passage time (h).

Dispersion periods (h)	Normal plants					
	Kudzu		Clitorea		Stylosanthes	
	GP	GPA	GP	GPA	GP	GPA
0	1313	1313	616	616	7023	7023
12	1	1	0	0	6	6
18	31	31	1	22	35	35
24	178	225	7	49	132	132
30	338	384	17	45	89	89
36	113	133	3	16	16	16
42	32	55	0	4	12	31
48	39	58	2	12	6	24
54	24	27	0	0	4	4
60	13	14	0	2	0	0
66	1	1	0	0	3	10
72	4	4	0	0	2	2
Total	774	932	30	150	306	351
Total (%)	59	71	5	25	4	5

Regarding the number of seeds recovered in sheep feces, there was a significant difference between the fabaceae in the period 18 to 42 h after ingestion of the seeds. Therefore, sheep must remain in the paddocks where the introduction of fabaceae is intended for at least 42 h after consuming the seeds. Among the passage times, the greatest recovery of kudzu seeds occurred 30 h after ingestion. For stylosants seeds, the greatest recovery was 24 and 30 h after ingestion. For *Clitoria ternatea* seeds there was no significant difference between dispersal times, however seed recovery at times 24 and 30 h had a higher average than at other times (Figure 1).

Silva et al. (2019), studying the viability of butterfly pea, Campo Grande stylosanthes, kudzu, and macrotyloma seeds after passing through the gastrointestinal tract (GIT) of goats, as well as the role of these animals as dispersal agents, found that the seed recovery percentage ranged from 16.9% for butterfly pea to 70.9% for macrotyloma. Passage through the GIT positively affected the germination of kudzu seeds, which showed the highest average germination rate (45%) compared to the other species, while it negatively affected the seeds of stylosanthes and butterfly pea, with germination rates of 15% and 13%, respectively. The highest seed dispersal occurred between 24 and 42 h, with a peak at 36 h.

Seed recovery increased gradually with increasing time after ingestion, up to 30 h. After 36 h, the number of seeds recovered reduced over time. This response was also observed by Gökbulak (2006), in which the recovery of seeds in cattle feces reduced when the time was increased from one to four days after ingestion. Regarding the recovery percentage, there was a total percentage of 16, 19 and 23% for *Clitoria ternatea*, stylosants and kudzu, respectively. Milotić and Hoffmann (2016) studied seed germination after simulating herbivore digestion in a standardized laboratory environment. Ruminants (cattle) and hindgut fermenters (horses) were used as model organisms in this simulation experiment. Three major digestive processes were studied through mechanical, thermal, and chemical treatments of the seeds, simulating mastication, body temperature, and digestive fluids, respectively.

Congeneric groups of annuals and perennials were tested with 15 species belonging to the plant families Cistaceae, Cyperaceae, Fabaceae, Poaceae, and Urticaceae. No differences were found in the impact of the simulated herbivore digestive environments (cattle and horses), but

significant differences were observed in the germination behavior among plant species. For most of the tested species, treatments had a decelerating and inhibitory effect on germination compared to untreated seeds. However, species from the Cistaceae and Fabaceae families benefited from mechanical treatments. Species of Cyperaceae and Poaceae were minimally affected by any of the treatments and even germinated better after chemical treatments. Thermal treatments, which simulated body temperature, inhibited germination in most cases. The germination success of *Urtica urens* was significantly higher after all treatments, suggesting that its seeds are particularly well adapted to gut passage and, therefore, to endozoochorous dispersal.

The greater recovery, in percentage, of kudzu seeds may be related to the hardness, shape and size of these seeds (JONES and SIMÃO NETO, 1987). These results indicate that kudzu seeds are less susceptible to damage caused by chewing and passage through the DT of sheep than stylosants and *Clitoria ternatea* seeds. According to Simão Neto et al. (1987) shorter seeds are less damaged when passing through the animal DT, just as spherical seeds with a smooth seed coat make damage during chewing more difficult.

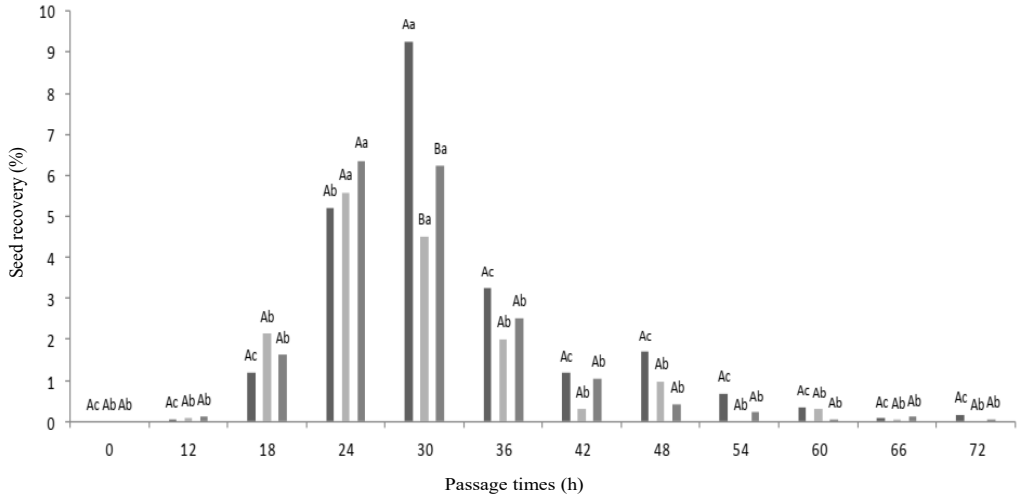

FIGURE 1 - Percentage of kudzu, butterfly pea, and stylosanthes seed recovery from sheep feces, based on passage time through the digestive tract (h).

Clitoria ternatea seeds were recovered in a smaller proportion, probably due to their larger size, which induces greater chewing intensity by sheep. In corroboration, Simão Neto et al. (1987) stated that large seeds are more prone to damage caused by chewing, since a small crack in the seed coat is enough to expose them to attack by rumen microorganisms and the other effects of digestion. Deminicis et al (2020) obtained 57% recovery of *Clitoria ternatea* seeds in bovine feces, a value higher than that found in this study (16%). In a study on the chewing efficiency of herbivores, Fritz et al. (2009) reported that the size of the particle to be ingested must be proportional to the animal's body mass, thus, sheep have a greater chewing intensity when compared to cattle.

Considering that approximately 24,500 stylosants seeds were offered to the animals and that 4,588 (19%) were recovered, it can be said that the difference was degraded by the chewing and digestion processes (JONES and SIMÃO NETO, 1987). The degradation of these seeds can be proven by the high percentage of dead seeds in germination tests (average of 79%).

Disagreeing with what was exposed by Simão Neto et al. (1987) who reported that small seeds are more resistant to damage caused by chewing and digestion, due to the lower chewing intensity and higher rate of passage through the animals' DT. These authors also stated that the viability of seeds recovered in feces is proportional to their hardness, as seeds with a hard seed coat are better able to resist damage caused by tooth pressure during chewing. Based on this information, the results of the present study suggest that stylosants seeds have a lower degree of integumentary hardness.

The analysis of variance of germination in the first count of recovered seeds indicated significance only in the interaction fabaceae x collection times ($P<0.01$), whereas for total germination and total additional germination all variables were significant ($P<0.01$) (Table 1). For kudzu seeds, the greatest germination occurred within 60 h after ingestion. For *Clitoria ternatea* seeds, the greatest germination occurred at times 0 and 30 h after ingestion. For stylosants seeds there was no significant difference between dispersal times (Figure 2).

When observing the germination of the seeds after passing through the sheep DT, it is possible to verify a greater hardness of the kudzu seeds, since the highest germination, in the first count, occurred 60 h after ingestion of the seeds. Therefore, these seeds needed 60 h of residence in the DT of sheep to significantly break dormancy. This fact may explain the greater recovery of seeds from this species. The germination results in the first count also showed that the stylosants seeds have lower integumentary hardness, since the germination in the first count of the

seeds that passed through the sheep DT was statistically equal to the germination of seeds without any type of treatment to break dormancy (control). Passage through DT negatively affected the germination of *Clitoria ternatea* seeds, except for the 30-h collection, which was statistically equal to the control.

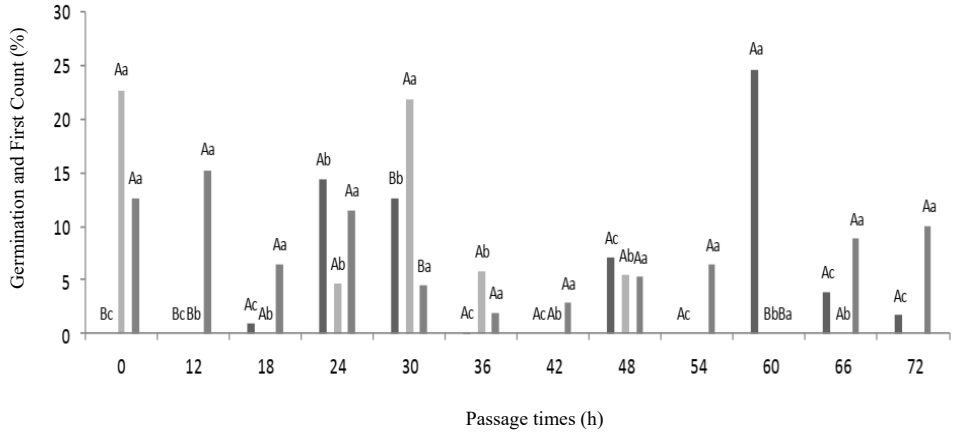

FIGURE 2 - Germination, at the first count, of kudzu, butterfly pea, and stylosanthes seeds recovered from sheep feces, based on the passage time through the digestive tract (h).

Regarding total germination, there was a significant difference between the fabaceous plants at all passage times, except for 66 h, with the highest percentages of germination presented by kudzu seeds. The stylosants seeds showed no difference in the percentage of germination between the passage periods. The greatest germination of *Clitoria ternatea* seeds occurred at times 0 and 30 h after ingestion of the seeds. The kudzu seeds showed greater germination at times 24, 30, 36, 42, 54 and 60 h after ingesting the seeds (Figure 3).

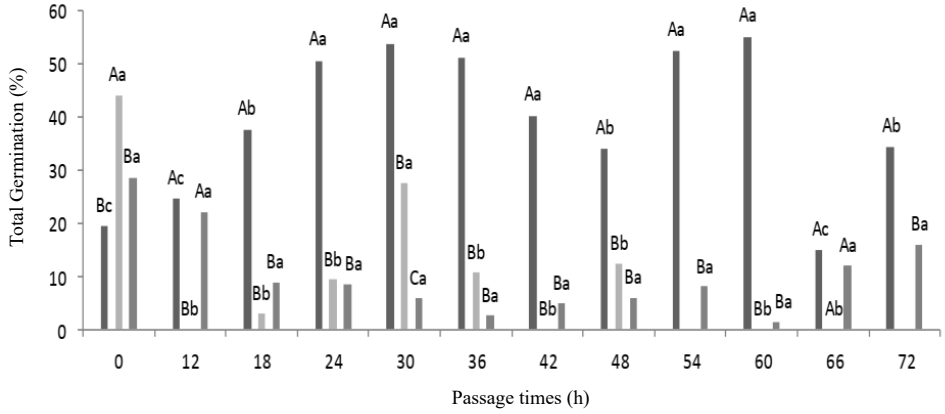

FIGURE 3 - Total germination of kudzu, butterfly pea, and stylosanthes seeds recovered from sheep feces, based on the passage time through the digestive tract (h).

Regarding total germination, kudzu seeds were positively affected by passage through the sheep DT. For these seeds, germination during passage times was always higher than in the control treatment (19%). These results suggest that digestive processes promoted scarification in these seeds. The idea that dormancy is broken when seeds pass through animal DT is widely accepted, however there are contradictory results in the literature (BUISSON et al., 2021).

Due to the great variation between animals regarding the degradation of ingested seeds, passing through the sheep's DT had no effect, statistically, on the germination of stylosants seeds. However, it is possible to see that the germination of these seeds reduced after passing through the DT, with germination at 36 h being eleven times lower than in the control. These results are not in agreement with Simão Neto et al. (1987) who stated that small seeds are more resistant to this damage mainly due to the lower chewing intensity and higher rate of passage through the animals' TD.

The passage through the sheep TD negatively affected the germination of *Clitoria ternatea* seeds, always being lower than the germination in the control test, except for the time of 30 h, which was statistically equal (Figure 3). This reduction in germination can be explained by the degradation of seeds with a more permeable seed coat

caused by the chewing and digestion processes, with only seeds with an impermeable seed coat surviving. In a study of the germination of *Clitoria ternatea* seeds recovered from cattle feces, Deminicis et al (2020) obtained 94% germination for these seeds. These results highlight the differences between animal species, mainly in the size of the oral apparatus, which results in different levels of damage during chewing.

Gomes et al. (2017), evaluating the influence of diets containing castor bean cake on ingestive behavior, intake, and performance in sheep, observed that there was no difference in total chewing time, as it results from the sum of feeding and rumination times, and these individually did not show any differences between treatments. Oveisi et al. (2021), evaluating the fate of seeds from various weed species (*Convolvulus arvensis, Cuscuta campestris, Rumex crispus, Hordeum spontaneum*, and *Sorghum halepense*) after passing through the digestive tract of sheep and goats, observed that a greater proportion of seeds disappeared after passing through the sheep's digestive tract compared to the goats'. In goats, a higher proportion of seeds were dead after passage, but the number of seeds collected from the feces was also higher. A very large number of viable seeds can be found in the feces of both goats and sheep, so the use of rotted manure is highly recommended to avoid the transport of viable seeds through manure-based fertilizers. However, when comparing the two studies, germination after additional scarification was identical for both species (54%) (Figure 4).

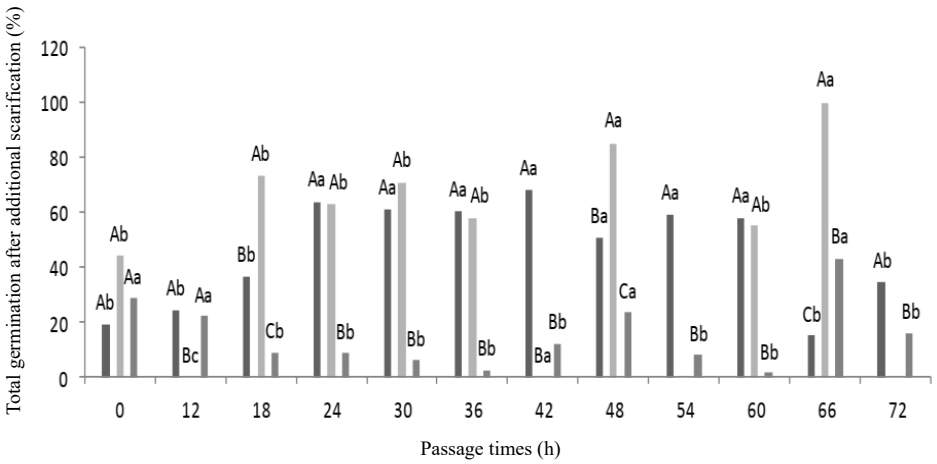

FIGURE 4 - Total germination, after additional scarification, of kudzu, butterfly pea, and stylosanthes seeds recovered from sheep feces, based on the passage time through the digestive tract (h).

Despite the scarification exerted on the seeds during passage through the sheep DT, the presence of hard seeds was still verified at the end of some germination tests, mainly of *Clitoria ternatea* seeds. This shows that the viability of the recovered seeds is higher than the germination obtained from the test results. Then, to ensure the viability of these seeds, additional scarification (mechanical) was carried out, with 100 grit sandpaper, only on the seeds that were still hard. The results regarding total germination, after additional scarification, can be seen in graph 4. As a result, the average germination of kudzu seeds increased from 39 to 46%; of *Clitoria ternatea* seeds from 9 to 54%; and stylosants seeds from 10 to 15%. Nóbrega et al. (2023), evaluating the passage of *M. tenuiflora* seeds through the digestive system of goats and sheep at different ingestion periods, observed that seed recovery occurred up to 120 h for goats and 96 h for sheep after ingestion, with the highest number of seeds recovered at 48 h. Seeds collected after 120 h from goats and after 24 and 96 h from sheep showed improved germination and breaking of seed dormancy. Anatomical analysis demonstrated that the passage through the animals' digestive systems promoted scarification of the seed coat.

Only 16% of the total ingested *Clitoria ternatea* seeds were recovered in the sheep's feces. These seeds probably had a more impermeable seed coat, as the germination tests showed a high percentage of hard seeds (average of 74%), even after passing through the DT of sheep. This data suggests that seeds with a more permeable seed coat were degraded by the digestive processes and the more intense chewing of sheep. However, these seeds did not germinate due to their seed coat hardness, but remained viable, germinating after additional scarification with sandpaper. In corroboration, Machado et al. (1997) observed that there was an increase in the fraction of hard *Trifolium vesiculosum* seeds when these seeds were passed through the TD of sheep, possibly due to the degradation of seeds that did not have hardness in the seed coat. Thus, there was a reduction in germination, without changing the percentage of viable seeds.

For kudzu seeds, additional scarification did not make much difference, as there were few hard seeds at the end of the germination tests. Furthermore, the germination of kudzu seeds immediately after passing through the sheep DT was already high, in relation to other species. Contrary to what occurred with *Clitoria ternatea* seeds, in which germination after additional scarification was much more significant, due to the high percentage of hard seeds recovered in the feces.

The average germination rate of stylosants seeds did not increase significantly after additional scarification, probably due to the large percentage of dead seeds at the end of the germination tests (average of 79%). However, at 42, 48 and 66 h after ingesting the seeds, germination increased considerably. Suggesting that only seeds with an impermeable seed coat survived these periods, and germinated after additional scarification.

Therefore, these periods of seed permanence in the sheep's DT were sufficient to degrade seeds with more permeable seed coats, but not to break the dormancy of seeds with impermeable seed coats. Thus, germination immediately after passing through DT was low, as hard but viable seeds remained in the tests. Therefore, with additional scarification on seeds with seed coat hardness, the germination percentage increased. Percentage of recovery *versus* percentage of germination for the species *Clitoria ternatea* and stylosants, the highest percentage of seed recovery was concentrated in the period 24 to 30 h after ingestion (10 and 12%, respectively). During this period there was germination of 37% and 14%, respectively for *Clitoria ternatea* and stylosants. For kudzu, the greatest seed recovery occurred within 30 h, corresponding to 9% of the total recovered. During this period, the seeds showed 54% germination.

Based on the results of seed recovery and germination percentage, a possible number of normal plants generated by seeds dispersed in sheep feces was calculated in each passage period. To do this, the number of seeds recovered was multiplied by the percentage of germination obtained in the tests, at each collection time. In this study, the number of possible kudzu seedlings corresponded to 11% of the total number of seeds ingested by the animal. According to Jolaosho et al. (2006), the number of seedlings obtained will rarely exceed 20% of the number of seeds ingested by the animals, due to losses in the chewing and digestion processes.

The results of this study regarding seed recovery and germination indicate kudzu as the most suitable species for this dispersal technique. It is considered a relevant result, since this forage is a great option for intercropping with poaceae, mainly *Urochloa brizantha* (LIMA et al, 2015). in addition to presenting good palatability and a high percentage of crude protein (23.24% in leaf %) (MUKHERJEE and HEDAYETULLAHA, 2018).

The possible number of normal plants even increased after additional scarification of the still hard seeds. As a result, the number of kudzu plants increased from 774 to 932 of *Clitoria ternatea* from 30 to 150, and of stylosants from 306 to 351. Thus, under natural field conditions, when sheep disperse the seeds on the soil, some of them will germinate readily, and some will remain dormant in the feces. This is a way of maintaining a bank of fabaceous seeds of interest for animal production on the pasture. The dormancy of these seeds is slowly broken; either through time, through the fermentation of feces, or through the action of insects or fungi present in the fecal cake and soil, enabling new germination in the next period of favorable water, light and temperature conditions.

The technique of introducing fabaceae into intercropped pastures using sheep as seed dispersers is viable, but this is a long-term procedure. Considering the great loss in seed dispersion, due to degradation by chewing and digestion processes, it is necessary to offer a greater quantity of seeds to animals or more frequently.

CONCLUSIONS

The periods of 24 and 30 h are those that allowed greater seed recovery.

Kudzu showed higher percentages of seed recovery and germination, being the species most suitable for the endozoochoric dispersal technique, making it possible to use sheep to disperse the seeds in pastures.

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