765 Evaluation of nonprotein nitrogen-based protein supplements to enhance low-quality forage utilization by cattle. C. C. Stefan*, J. E. Sawyer, and T. A. Wickersham, *Texas A&M University, College Station.*

Efficacy of 4 NPN-based protein supplements for stimulating intake and digestion in cattle consuming low-quality forage (6.8% CP) was evaluated. Five ruminally cannulated steers (238 kg ± 9.1 kg) were used in a 5 × 5 Latin square consisting of 4 supplements and a negative control (CON). Supplements were infused directly into the rumen, before feeding and included a 40% CP mineral mix (40MM; 100% of CP from biuret), 60% CP mineral mix (60MM; 100% of CP from biuret), 25% CP liquid (25L; 61% of CP from slow-release N source; RumaPro, Anipro/Xtraformance Feeds), or 35% CP liquid (35L; 74% of CP from RumaPro). Mineral mixes were provided at 114 g/d and liquids at 310 g/d. Periods were 14 d; 8 d adaptation to treatment and 6 d sample collection. Forage OM intake tended to be greater for 25L (5.56 kg/d; $P = 0.06$) and 35L (5.53 kg/d; $P = 0.08$) than CON (5.20 kg/d), but was similar to CON for 40MM (5.34 kg/d; $P = 0.44$) and 60MM (5.13 kg/d; $P = 0.71$). Total OM intake was greater ($P < 0.01$) for both liquid supplements (5.81 and 5.79 kg/d; 25L and 35L, respectively) than CON (5.20 kg/d) but 40MM (5.38 kg/d; $P = 0.33$) and 60MM (5.18 kg/d; $P = 0.92$) were comparable to CON. There were no differences ($P \geq 0.11$) between supplements and CON for total tract OM digestion, which ranged from 56.0 – 58.6%. Total digestible OM intake was greater ($P < 0.01$) for 25L (3.4 kg/d) and 35L (3.36 kg/d) compared with CON (2.94 kg/d), but not for 40MM (3.03 kg/d; $P = 0.43$) or 60MM (3.06 kg/d; $P = 0.27$). Average ruminal NH_3 concentrations were greater ($P < 0.01$) with supplementation, 0.33 m*M* (CON) versus 1.06, 1.96, 1.71, and 2.09 m*M*, for 40MM, 60MM, 25L, and 35L; respectively. Ruminal VFA concentrations were greater (84.7 vs 98.7 m*M*) with supplementation ($P < 0.06$). These data suggest a potential benefit to providing readily fermentable OM when delivering supplemental NPN to cattle consuming forage near a 7% CP threshold, below which protein supplementation typically stimulates forage utilization.

Key Words: cattle, nonprotein nitrogen, supplementation

766 The effect of Mediterranean saltbush (*Atriplex halimus*) treated with exogenous enzymes on feed intake, nutrient digestibility and ruminal fermentation in sheep. H. N. Alsersy[1], A. Z. M. Salem*[1,2], H. Gado[3], B. E. Borhami[1,3], M. M. El Adawy[1], and M. H. Yacuot[4], *[1]Faculty of Agriculture, Alexandria University, Egypt, [2]Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Estado de Mexico, Mexico, [3]Animal Production Department, Faculty of Agriculture, Ain Shams University, Qalubia, Egypt, [4]Animal Production Institute, Ministry of Agriculture, Dokki, Cairo, Egypt.*

This research was conducted to assess the effects of Mediterranean saltbush (*Atriplex halimus*) treated with exogenous enzymes on feed intake, nutrient digestibility and ruminal fermentation in sheep. Three Barki rams were used in consecutive digestibility trials while 3 ewes fitted with permanent rumen fistula were used as the source of inoculum for in vitro rumen fermentation trials. The treatments comprised: (1) D1, *A. halimus* (leaves and stems) plus barley grain (300 g/head/day), (2) D2, *A. halimus* treated with 2 L of ZAD per ton and 5% molasses ensiled for 30 d plus barley grain (300 g/head/day), (3) D3, *A. halimus* plus barley grain (300 g/head/day) containing ZADO (4 g/head/day) and (4) D4, *A. halimus* treated with 2 L of ZAD per ton with 5% molasses ensiled for 30 d plus barley grain (300 g/head/day) containing ZADO (4 g/head/day). Enzyme product of ZADO (powder) or ZAD (liquid) is commercially available multi-enzyme feed additive in a powder form produced from *Ruminococcus flavefaciens* and manufactured by the Academy of Scientific Research and Technology in Cairo, Egypt. The *A. halimus* was offered ad libitum to animals twice daily at 0900 and 1600 h, while barley grain was given once daily at 1000 h. Results showed that total DM intake of D2 and D4 were lower ($P < 0.05$) than D1 and D3; while ZADO was minor increase ($P < 0.05$) the feed DM intake. D4 recorded highest ($P < 0.05$) value of DM, OM, CP and EE digestibilities than D2, D3 and D1, except nitrogen free extract. Addition of ZAD or ZADO increased ($P < 0.05$) N balance, ruminal fermentation such as total VFA and NH_3-N, microbial protein production, as well as rumen DM digestibility and rumen volume, while decreased ($P < 0.05$) N intake and rumen outflow rate. It could be concluded that addition of ZAD or ZADO to sheep diets can improve the efficiency of roughage digestibility and alter ruminal fermentation.

Key Words: *Atriplex halimus*, digestibility, exogenous enzymes

767 Volatile profile of Hyblean cultivated and native pasture detected by gas chromatography/mass spectrometry/olfactometry. T. Rapisarda*[1], C. Pasta[1], G. Licitra[1,2], and S. Carpino[1], *[1]CoRFiLaC, Ragusa, Italy, [2]DISPA, Catania University, Catania, Italy.*

The Hyblean area is the major dairy producer of southeastern Sicily. Cattle farms producing cheese are based on semi-extensive systems, implying animals to graze pasture. Previous studies (Licitra et al., 1997; Carpino et al., 2003; Carpino et al., 2004a) reported that Hyblean pastures show a great variety of plants that influence milk and cheese quality. This work was a further investigation on the aroma active compounds to detect differences in flavor profile of 2 Hyblean pasture types: cultivated vs. spontaneous. Forage samples were gathered twice, at the beginning (I Period) and at the end of April (II Period). Detection and identification of odor-active compounds (OACs) were performed by gas chromatography/mass spectrometry/olfactometry (GC/MS/O) analysis. The extraction of OACs was carried out using the steam distillation technique. Then, OACs were detected and chemically identified in 7 classes: alcohol, aldehyde, ester, ketone, pyrazine, sulfur and terpene. Not identified compounds were also included in a "Not Identified" (NI) class. Data from GC/MS/O were subsequently subjected to statistical analysis performed with JMP 8.2 (SAS Institute Inc., Cary, NC) software by applying Chi-squared test at a significant level of $\alpha = 0.05$. Overall, spontaneous pasture showed a significant higher number of OACs compared to cultivated pasture ($P < 0.01$). Reflecting the natural forages growing trend, OACs were higher in Period I compared with Period II in each pasture type but only significantly higher in the spontaneous one ($P < 0.05$). In both pasture types, chemical classes were significantly different ($P < 0.0001$): alcohol, aldehyde, ketone and terpene classes presented a higher number of OACs compared to pyrazine, sulfur, and NI classes, but similar to esters. In conclusion, spontaneous pasture showed richer odor profile than cultivated pasture, confirming that this type of forage is an important marker tied to the production area that might influence the aroma properties of milk and dairy products. Further studies are needed to investigate the pasture season effect on milk flavor.

Key Words: odor active compounds, pasture, forbs

768 Effects of cutting height, time of day, and nitrogen fertilization on nutrient content of Bermudagrass (*Cynodon dactylon*). B. McIntosh*, D. McIntosh, J. Beeler, and G. Bates, *University of Tennessee, Knoxville.*

Bermudagrass (*Cynodon dactylon*) is a warm-season grass commonly used for pasture and hay for horses in the southeastern United States. The objective of this study was to determine the effects of cutting height, time of day at harvest, and nitrogen fertilization on the nutrient content of Bermudagrass (Vaughn's No.1, Hybrid). A randomized complete block design with 4 replications on 48 test plots (9.3 m^2) was performed at 2 locations over 2 growing seasons. Nitrogen was applied at 0 (NONE), 33.4 (MED) and 67.2 (HIGH) kg/ha. Harvest was conducted at 0700 (a.m.) and 1900 (p.m.) with cutting heights of 38.1 (SHORT) and 50.8 (TALL) cm. All plots were harvested using a flail small-plot harvester to capture total forage plant material in June, July, and August. Forage samples (n = 312) were oven-dried at 60°C in a forced air oven for 72 h to determine dry matter (DM) and analyzed for CP, ADF, NDF, Ca, P, K, Mg, WSC and sugar using a Foss 6500 near-infrared spectrometer. Data were analyzed using the mixed model method for randomized complete block design with repeated measures (SAS V. 9.3, SAS Institute 2012). Data are reported as LS Means ± SEM as a percent of DM. Cutting height, time of day, and nitrogen rate affected CP, ADF, NDF, Ca, P, K, Mg, WSC and sugar content ($P < 0.05$). However, the magnitude of the differences between treatments was slight and insignificant to the nutritional management of horses. Notable differences include the effect of the SHORT vs. TALL cutting height on CP (9.8 ± 0.3 vs. 8.5 ± 0.2), ADF (33.9 ± 0.2 vs. 35.0 ± 0.2), NDF (65.6 ± 0.1 vs. 67.6 ± 0.1), Ca (0.22 ± vs. 0.16 ± 0.0), and sugars (6.3 ± 0.2 vs. 5.7 ± 0.2). Lower concentrations of sugars and WSC were observed in samples collected during a.m. (5.5 ± 0.2; 7.6 ± 0.2, respectively) when compared with p.m. (6.5 ± 0.2; 8.9 ± 0.2). The HIGH nitrogen application also resulted in increased sugar and WSC (6.3 ± 0.3 and 8.7 ± 0.3, respectively) compared with NONE (5.5 ± 0.3 and 7.7 ± 0.3, respectively). Production strategies can alter the nutrient content of Bermudagrass and should be considered when managing forages for horses.

Key Words: horse, forage, nutrition

769 Effect of bale feeder, forage, and monensin on hay waste, disappearance, and cow performance. W. A. Moore* and W. J. Sexten, *University of Missouri, Columbia.*

Forty-eight spring-calving crossbred cows, 124 ± 8 d in gestation were used in a 3X2 factorial arrangement within a Latin square design to evaluate the effect of 3 bale feeders and 2 forages on hay waste. Cows were stratified by age (4 ± 2.5 years), weight (517 ± 68.8 kg) and 12th rib ultrasound measured fat thickness (0.4 ± 0.16 cm) into 6 replicate pens with 8 cows per pen. Supplemental treatments were 1 $kg \cdot hd^{-1} \cdot d^{-1}$ supplement with 182 g/ 909 kg monensin (Mon) or without monensin (Con). Bale feeders evaluated were open bottom with 17 slanted feeding stations (Open) (2.4 m diam., 1.2 m height), sheeted bottom with 15 slanted feeding stations and tapering sides (Taper) (2.1 m diam. top, 2.4 m diam. bottom, 1.2 m height, 0.5 m sheeting), and sheeted bottom and top with 16 straight feeding stations and chain cone (Cone) (2.3 m diam., 1.7 m height, 0.6 m bottom sheeting, 0.5 m top sheeting). Forages were alfalfa haylage (HQ) (41% DM, 17% CP, 49% NDF) or fescue hay (LQ) (92% DM, 7.5% CP, 66% NDF). We hypothesized that cone and sheeting would reduce waste with LQ, but not affect HQ waste, in addition monensin would improve efficiency. HQ waste was collected at 24, 48, and 72 h while LQ was collected at 24, 48, 72 and 96 h. Total DMI was reduced ($P < 0.05$) for Mon (2.2% BW) compared with Con (2.3% BW) while ADG, final BW, G:F and final 12th rib fat depth did not differ ($P > 0.10$). An interaction ($P < 0.05$) for percent bale wasted was observed between forage and feeder where LQ Open was greatest ($P < 0.05$) (19.2%), LQ Taper was intermediate ($P < 0.05$) (13.6%) but greater than ($P < 0.05$) LQ Cone (8.9%). However, LQ Cone was not different ($P > 0.10$) from HQ Open (7.0%), or HQ Cone (6.4%) but was greater than HQ Taper (4.9%). 24, 48, 72 h and total HQ waste was not different ($P > 0.10$) due to feeder. 24 and 48 h LQ waste was greater ($P < 0.05$) for Open and Taper compared to Cone. However, 72 and 96 h LQ waste was greater ($P = 0.06$) for Open and Cone compared to Taper. Cone feeder and bottom sheeting are both effective at reducing waste of LQ while monensin reduced forage intake with no effect on cow performance.

Key Words: bale feeder, hay waste, monensin

770 Liveweight, rectal temperature and plasma prolactin responses in lambs grazing tall fescue with novel endophytes. M. Friend*, I. Allen, J. Broster, and S. Robertson, *Graham Centre for Agricultural Innovation (NSW Department of Primary Industries and Charles Sturt University), Wagga Wagga, NSW, Australia.*

An experiment was conducted between January and May 2012 at Wagga Wagga, Australia, to evaluate lamb responses to grazing novel endophytes of tall fescue. Three treatments utilized Martin 2 tall fescue with either no endophyte (E-), novel endophyte 647 (M647) or novel endophyte E3 (ME3). A fourth treatment utilized Tower tall fescue with endophyte 647 (T647), while Kentucky 31 (KY31) containing wild endophtye was also included. Crossbred lambs (n = 300, 10 per plot) grazed 0.4 ha plots (3 replicates/treatment) over 2 separate 6 week periods. Liveweight was assessed fortnightly, while rectal temperatures and blood samples (for prolactin) were taken at the start of each grazing period and then again on hot days during each grazing period. Herbage mass and quality, including ergovaline content, was estimated twice in each grazing period. Live herbage mass was always lowest in KY31, but except for late in grazing run 2 the herbage mass was unlikely to have restricted intake. Herbage quality did not differ between treatments, but declined over time ($P < 0.05$) in each grazing run. Ergovaline was detected at low levels (<0.2 ppm) in herbage from KY31 plots only. Liveweight did not differ between treatments at any time, with lambs gaining an average of 5.7 ± 0.22 kg and 7.8 ± 0.20 kg in each grazing period. On hot days, KY31 lambs had the highest rectal temperatures, although this was not always significantly greater than that of lambs in the other treatments. Compared to E-, lambs grazing M647 had a similar rectal temperature at all measurements except one. Plasma prolactin levels were lower ($P < 0.05$) in lambs grazing KY31 and ME3 treatments than for lambs grazing other treatments, in both grazing runs. Plasma prolactin levels were similar ($P > 0.05$) at all sampling times in lambs grazing E-, M647 and T647 treatments. The results show no evidence that endophyte 647 produced ergovaline in sufficient quantities to initiate toxicoses in sheep. Based on plasma prolactin levels, the E3 endophyte may pose a risk for fescue toxicoses.

Key Words: fescue, endophyte, lamb

771 Intake, digestibility, and passage rate of three warm-season grass hays consumed by beef steers. K. E. Turner*[1], S. W. Coleman[1], and C. C. Chase Jr.[2], *[1]USDA ARS, El Reno, OK [2]USDA ARS, Clay Center, NE.*

Florida-44 bermudagrass [*Cynodon dactylon* (L.) Pers.] is a fine-stemmed forage selected from a Tifton-44 field near Brooksville, FL, that had drifted from the original and is highly desired for horses. The

objective here was to assess quality of warm-season grass hays at different maturities in stall-fed beef steers. Florida-44 bermudagrass (FL44); Tifton-85 bermudagrass (TF85); and Tifton-9 bahiagrass (*Paspalum notatum* Flueggé; TF9) were staged and harvested as hay at 5-wk and 7-wk intervals beginning 25 June from the ARS Station in Brooksville. Thirty-six steers were allotted to 1 of 6 hays fed in individual pens. After a 13-d adaptation, individual steers received a continuous release bolus containing C32 and C36 alkane wax as external markers to estimate fecal output, and a pulse-dose of Yb-labeled forage to estimate passage rate. Fecal samples were collected daily while forage and refusal samples were collected weekly. Fecal and forage samples were lyophilized and analyzed for n-alkane concentrations by GC and Yb by ICP. Forage digestibility (D) was estimated as the mean of D by the ratio of C31, C33, and C35 n-alkanes in forage and feces. Rate of passage was calculated by non-linear regression of Yb appearance on time from dosing. There was a hay × maturity stage interaction for DMI (g/kg BW; $P < 0.05$), D ($P < 0.03$) and passage rate ($P = 0.09$). Intake of hays at 5-wk regrowth was not different, but at 7-wk, rank was FL44 > TF85 > TF9. The DMI of 5- and 7-wk regrowth were similar for FL44 (mean 21 g/kg) and TF85 (mean 19 mg/kg), while DMI of 5-wk TF9 (18 g/kg BW) hay was greater ($P < 0.05$) than 7-wk TF9 hay (15 g/kg BW). The D of TF85 and TF9 (mean 59.4%) at 5-wk regrowth was greater ($P < 0.01$) than FL44 (52.8%) at 5-wk regrowth, whereas D of TF85 (57.3%) was greater ($P < 0.02$) than TF9 (52%) at 7-wk regrowth. Passage rate of the 3 hays at 5-wk regrowth were all similar (mean 4%/h), while at 7-wk regrowth TF85 and FL44 were similar (mean 5%/h); both were greater ($P < 0.01$) than TF9 (3%/h). Quality of TF9 bahiagrass declined more rapidly than bermudagrass.

Key Words: warm-season grass, intake, alkanes

772 Does addition of cofactors to exogenous fibrolytic enzymes increase digestion of bermudagrass by the enzymes? J. J. Romero*[1], Z. X. Ma[1], F. H. Kamada[1], U. Carneiro[1], C. F. Gonzalez[2], C. R. Staples[1], and A. T. Adesogan[1], *[1]Department of Animal Sciences, IFAS, University of Florida, Gainesville, [2]Department of Microbiology and Cell Science, IFAS, University of Florida, Gainesville.*

The objective was to determine if adding different doses of cofactors to exogenous fibrolytic enzymes (EFE) increases their hydrolytic effect on Tifton 85 bermudagrass haylage (BH). Nanopure water or each of 3 cellulase-xylanase enzymes (2A, 11C, 13D) from *Trichoderma longibrachiatum* were applied (4.5, 10, and 7.5 g EFE/kg, respectively) with 0, 0.1, 1 and 10 mM of Mn^{2+} or Fe^{2+} cofactors to BH. Mn^{2+} was added to 11C and Fe^{2+} was added to 2A or 13D based on sugar release potential from BH in earlier studies. Treatments were applied to BH (0.5 g, 1 mm) in quadruplicate, incubated for 24 h at 25°C before addition of buffered rumen fluid and further incubation for 24 h at 39°C in 2 runs. Data for each enzyme were analyzed separately as a randomized complete block design with a 2 × 4 factorial arrangement and a model including enzyme (E), cofactor dose (C), run, and interaction effects. Increasing the Mn^{2+} rate with or without 11C linearly increased ($P < 0.01$) digestibility of DM, NDF, cellulose and ADF but DMD and NDFD responses were greatest when 11C and 10 m*M* of Mn^{2+} were applied (E × C, $P < 0.05$). Adding 10 m*M* of Mn^{2+} with 11C increased NDFD by 8.2% beyond the 15.3% increase due to 11C alone, whereas 10 m*M* of Mn^{2+} alone only increased NDFD by 6.2%. Adding 10 m*M* of Mn^{2+} with 11C also increased total VFA and decreased acetate to propionate (A:P) beyond values observed with 11C alone (E × C, $P < 0.05$). Increasing the rate of Fe^{2+} application linearly decreased ($P < 0.01$) digestibility of DM, NDF, hemicellulose, ADF and cellulose. Similar but less pronounced decreases occurred when 13D was added to the Fe^{2+} doses (E × C, $P < 0.05$), but no effects were detected when 2A was added to the Fe^{2+} doses. Hence, adding Fe^{2+} to 13D and 2A attenuated or prevented decreases in BH digestibility caused by Fe^{2+} alone, whereas adding Mn^{2+} to 11C synergistically increased the digestibility of BH.

Key Words: forage, enzyme, cofactor dose

773 Nutrient digestibility of annual summer forages using different indigestible markers and fecal collection schedules in growing beef heifers. C. A. Njombwa, F. M. Ciriaco*, D. D. Henry, V. R. G. Mercadante, M. J. Ruiz-Moreno, G. C. Lamb, and N. DiLorenzo, *North Florida Research and Education Center, University of Florida, Marianna.*

Twelve Angus crossbred heifers were used to determine the effects of indigestible markers and fecal sample collection schedules on apparent total tract digestibility of nutrients in 3 annual summer forages. Forages were Mulato II (hybrid Brachiaria), pearl millet, and sorghum Sudan. On d 0 heifers were randomly assigned to treatments (2 heifers/pen) and were offered daily fresh cuts of each forage treatment for the duration of the study. Intake was monitored using a GrowSafe system. From d 7 to 19, heifers received 10 g/d of Cr_2O_3 and 10 g/d of TiO_2 at 1200 h. Fecal samples were collected from d 15 to 19 by rectal grab at 0800, 1200 and 1600 h, and composited within heifer using 2 samples/d (2s; 0800 and 1600 h only) or 3 samples/d (3s; all sampling times). Indigestible NDF (iNDF) was used as an internal digestibility marker. Data were analyzed as a split-split plot design with the whole plot testing forage treatment effect, the split plot testing the fecal collection schedule (2s vs. 3s) and the split-split plot testing the marker. No effect ($P > 0.10$) of forage or forage × marker interaction was found for nutrient digestibility. Across forage treatments, mean apparent nutrient digestibility in the total tract were 60.1%, 69.1%, 71.2%, 54.3% and 38.7% for DM, OM, CP, NDF, and ADF, respectively. A sampling schedule × marker interaction ($P < 0.05$) was found for nutrient digestibility of DM, OM, CP, and NDF. Under a 2s schedule, digestibility of nutrients was underestimated ($P < 0.05$) when using Cr_2O_3 or TiO_2 vs. iNDF. Under a 3s schedule, digestibility of all nutrients was underestimated with Cr_2O_3 vs. iNDF and tended ($P < 0.10$) to be underestimated for DM, OM, CP, and NDF digestibility when using TiO_2 vs. iNDF. Digestibility of ADF was underestimated ($P < 0.05$) with TiO_2 and Cr_2O_3 vs. iNDF, regardless of sampling schedule. No difference ($P > 0.10$) was observed in nutrient digestibility between 2s and 3s when using iNDF as a marker. The use of iNDF as an internal digestibility marker with a 2s fecal sampling schedule appears most suitable to evaluate nutrient digestibility in summer annual forages.

Key Words: forage, digestibility, marker

774 The effects of rumen digestion and in vitro exposure of small intestinal fluid on viability and germination of common Indiana weed seeds. L. Unruh Snyder*[1], E. Kiley[1], K. Burger[2], N. Baird[2], R. Lemenager[2], S. Lake[3], and J. Santini[2], *[1]North Carolina State University, Raleigh, [2]Purdue University, West Lafayette, IN, [3]University of Wyoming, Laramie.*

An experiment was conducted to examine the germination of velvetleaf (*Abutilon theophroasti*), Venice mallow (*Hibiscus trionum*), and redroot pigweed (*Amaranthus retroflexus*) after exposure to various digestion treatments. The objective of this study was to see if seed germination was affected by digestion either in vitro or in situ and if time within the rumen influenced germination rates of the weed seeds either going through the intestinal digestion phase or not. These weed species were

selected because they are the most common pasture weeds in Indiana. To recover seeds a sample tube made of PVC which contained the seeds that where were placed into 2 different bag types: the Ankom fiber filter bags (F57) with a 25-µm porosity with a size of 5 cm by 4 cm and a polyester monofilament bag with a 53-µm (±10) porosity cut to the same size of 5 cm by 4 cm, all nitrogen free and sealed closed. We tested if the type of bag influenced our results whether in the in vitro or in situ digestion setting. The seeds had 2 fates either they were exposed only to rumen digestion phase or continued on to an in vitro intestinal incubation phases to see if the additional exposure time would influence seed germination. We tested the hypothesis that ruminal incubation (for 12 or 24 h) and a more complete digestion process affects germination regardless of incubation bag type used. After 7 d, germination rates were determined and seeds were evaluated for hard or non-living seed. Redroot pigweed germination was enhanced by 20 to 25% going through the entire digestion process, mostly like because it was one of the smallest (1.2 mm) seeds investigated and needed more time to imbibe water. Velvetleaf germination decreased going through the small intestinal procedures and having the longest retention time in the rumen. Velvetleaf has been reported to have a seed coat that is highly lignified, which would enable the seed to survive for longer periods of harsh conditions. Venice mallow with a seed size of (2 mm) germinated and was most successful when going through the longest period of digestion.

Key Words: digestion, pasture, weed