INTERNATIONAL ANIMAL AGRICULTURE: **INTERNATIONAL ANIMAL PRODUCTION**

1213 (T144) Handbook for livestock research on smallholder farms in developing countries.

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Resources for on-station livestock research in many developing countries are limited, and it is common for researchers to have little direct interaction with smallholders. On-farm research offers considerable attributes, which include attention to most significant production constraints, opportunities for meaningful studies, and greater adoption by smallholders of advantageous technologies. However, few researchers perform on-farm livestock research, at least partially because of inadequate training and knowledge of the design and conduct of on-farm experiments, statistical analyses and interpretation of resultant data, and preparation of reports suitable for peer-reviewed journals. Thus, a publication has been developed as a resource for training in methods of applied livestock research, with special attention to treatments, design, implementation, analysis, interpretation, and peer-reviewed articles. The target audience is junior to mid-level professionals (e.g., MSc) and graduate students in developing countries. In addition to US participants in the publication project, there are foreign collaborators and evaluators from Ethiopia, India, China, Jordan, México, Israel, and Japan. Major sections of the publication include: introduction; on-station vs. on-farm research; topic identification; protocols; experimental design; treatment considerations; experiment implementation; statistical analyses; dissemination with an emphasis on preparation, review, and revision of scientific manuscripts; and literature cited. Furthermore, a key component is the design and analysis of numerous example study scenarios, such as: farmer research groups– missing data, nature of the data; individual smallholder households– household animals on one treatment, household animals on each treatment, missing data and household animals on one vs. each treatment, households with subplots; group or village as fixed vs. random; studies in different seasons or years; year-round performance monitoring– continuous and categorical variables; and crossovers, switchbacks, and Latin squares. There are also comparisons of P values from different analyses (e.g., SAS GLM and MIXED and GenStat). Appendices contain the relevant statistical analysis statements and inputs, results, and simulated data sets. Workshops based on the publication were held during 2013 and 2014 in Kenya, Ethiopia, China (two sites), Jordan, Malawi, México, and India (two sites) to create awareness of the resource, train junior researchers, and receive feedback for publication enhancement, with well over 200 attendees. After external peer-review in fall 2014, hardcopies will be distributed and the publication made available free on the Institute's website (www2.luresext.edu).

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Key Words: applied research, livestock, small holders

1214 (T145) Reproductive performance in United Kingdom Holstein dairies by geographic region.

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Our objectives were to compare reproductive indicators from Holstein dairies in three regions of The United Kingdom and establish benchmarks for the 20% most efficient herds. Data from 30,112 cows and 95,326 inseminations recorded on Dairy Comp 305 software were evaluated from January to December 2014 from 111 dairies in Region 1 (R1[North; n = 16 herds]), Region 2 (R2[West; n = 52]), and Region 3 (R3[South; n = 43]). Analyses were conducted with the PROC MIXED using herd as the experimental unit. Mean herd size (R1 = 252 ± 126; R2 = 267 ± 119; R3 = 284 ± 156), mean daily milk production in kilograms (R1 = 27 ± 3; R2 = 27 ± 4; R3 = 28 ± 5), days for voluntary waiting period (R1 = 40 ± 5; R2 = 42 ± 4; R3 = 40 ± 4), days for pregnancy diagnosis (R1 = 37 ± 5; R2 = 37 ± 4; R3 = 35 ± 5), days to reenrollment (R1 = 15 ± 4; R2 = 15 ± 4; R3 = 14 ± 4), conception rate for inseminations after natural estrus (R1 = 37%; R2 = 36%; R3 = 34%), insemination risk (R1 = 53%; R2 = 56%; R3 = 56%), pregnancy rate (R1 = 19%; R2 = 19%; R3 = 20%), and percentage of cows pregnant by 100 DIM (R1 = 49%; R2 = 50%; R3 = 53%), by 150 DIM (R1 = 69%; R2 = 72%; R3 = 75%) and by 300 DIM (R1 = 88%; R2 = 91%; R3 = 89%) did not differ among regions. The percentage of cows bred after synchronization was lower ($P < 0.05$) for R3 (7%) than R1 (12%), and R2 (10%) but conception rate did not differ (R1 = 29%; R2 = 28%; R3 = 28%). The 20% most efficient operations had mean pregnancy rate of 24%, mean daily milk production of 27 ± 4 kg, days to pregnancy diagnosis of 33 ± 5, days to re-enrollment of 12 ± 3, insemination risk of 61%, conception rate for inseminations after natural estrus of 39%, percentage of cows bred after synchronization of 7%, conception rate for inseminations after synchronization of 33%, and percentage of cows pregnant by 100 DIM of 61%, by 150 DIM of 83%, and by 300 DIM of 96%. The percentage of cows bred after synchronization was lower for the South region but no other regional differences were detected in reproductive parameters in United Kingdom dairies.

Key Words: fertility, reproduction, estrus

1215 (T146) Crossbreeding effects for body weight and carcass characteristics in a three-breed diallel cross. D. Norris[*1], L. Tyasi[2], and J. Ng'ambi[1], *[1]University of Limpopo, Polokwane, South Africa, [2]University of Limpopo, Sovenga, South Africa.*

A 3 × 3 complete diallel mating system involving three chicken breeds, namely Potchefstroom Koekoek (P), Venda (V) and Ovambo (O), was used to estimate crossbreeding genetic effects (heterosis, maternal effects and combining abilities) for growth and carcass characteristics. Nine genetic groups consisting of 25 chickens per group were produced which were reared from hatch to 10 wk of age. Body weights were recorded at hatch, 4, 8, and 10 wk of age while meat quality analysis (color, pH and tenderness) of the breast meat was done at slaughter age (10 wk). Meat tenderness was determined using the Instron-Warner-Bratzler Shear Force (WBSF). Potchefstroom Koekoek (P) was heavier at all different growth stages among the purebreds, while the Venda had the lowest weights at all different growth stages. The highest level of heterosis (30 and 21%) was observed in the V X P cross at 8 and 10 wk, respectively. The P x V cross showed positive estimates of maternal effects except at 10 wk of age. High and positive general combining ability (GCA) was observed in the Potchefstroom Koekoek (P) breed. The P x V showed positive effects of specific combining ability (SCA) at hatch, 4, 8, and 10 wk of age. With respect to meat characteristics, the Pochefstroom Koekoek breed had higher values of a* (redness) and b* (yellowness) color indicators in comparison to the other chicken breeds. Potchefstroom Koekoek and P x O breed had higher values of pH at 2 h and 24 h after slaughter. The pH declined in all the nine genetic groups at 2 h to 24 h, except for the P x O, which increased. The O x P had the highest shear value (74.80) while the lowest shear force (43.62) was observed in the P X V genotype. The P X V and its reciprocal cross, V X P could be further evaluated for other characteristics such as egg production and used as base for improved indigenous chicken production. It may be worthwhile to also consider developing a composite chicken breed based on these two breeds.

Key Words: crossbreeding, heterosis

1216 (T147) Total bacteria counting profile of raw milk in minas gerais state according to the storage system. A. G. Fernandes[1], L. M. Fonseca[*2,3], M. P. Cerqueira[2], M. O. Leite[2], M. C. P. P. Oliveira[2], R. M. Longo[2], G. C. Ribeiro[2], C. F. A. M. Penna[2], and M. R. Souza[2], *[1]Ministry of Agriculture, Belo Horizonte, Brazil, [2]Universidade Federal de Minas Gerais* (*School of Veterinary Medicine), Belo Horizonte, Brazil, [3]University of Wisconsin–Madison/CAPES Est. Senior 18183–12–3, Madison.*

The microbial contamination of milk is influenced by several factors and it is one of the major hindering problems for milk quality improvement in Brazil. The objective of the present work was to evaluate total bacteria counting of milk collected in different storage systems. A total of 1080 samples of milk from three regions of Minas Gerais State (Triângulo Mineiro, Sul, and Leste) were analyzed for total bacteria counting, during a 12-mo period. The samples were randomly selected from three storage systems, individual bulk tank milk, collective bulk tank milk, and cans. The last two storage systems are exceptionally allowed in Brazil under specific conditions. Each storage system was represented by 360 samples, which were preserved with azidiol, and sent to the laboratory for analysis in up to 72 h, using insulated boxes with reusable ice. All samples were evaluated by flow cytometry in the official federal net of laboratories for milk quality analysis in Brazil. Data were analyzed using general linear model and Tukey test for pairwise comparison. Collection system was the major factor correlated to the milk quality, with average countings of 5.38, 5.89, and 5.75 log CFU/mL for milk stored in bulk tank milk, collective bulk tank milk, and can, respectively. Non -compliance to the current standard of 600,000 CFU/mL was found in 47.6% of the samples, with 32.2, 61.1, and 49.7% non-compliant samples from bulk tank milk, collective bulk tank milk, and can, respectively. Considering recommended international standards, only 18.1% of the samples were in the range of up to 100,000 CFU/mL, comprising 28.6, 8.3, and 17.2% for, respectively bulk tank milk, collective bulk tank milk, and can storage. Milk quality was correlated to the seasonal variation ($P < 0.05$), with 53% of the samples above the limit of 600,000 CFU/mL during the rainy season. Regional differences were also observed. It is concluded that collecting systems, and regional and seasonal differences must be considered for strategic action by the dairy industries towards microbial quality improvement of raw milk.

Key Words: Brazil, microbial contamination, milk quality

1217 (T148) Reproductive performance in Chilean holstein dairies by geographic region. F. Arias[1], H. Lopez[2], R. Krauss[1], and C. F. Vergara[*1,2], *[1]ABS Chile Ltda, Santiago, Chile, [2]ABS Global Inc., DeForest, WI.*

Our objectives were to compare reproductive indicators from Holstein dairies in the three main productive areas of the Chilean Valley and establish benchmarks for the 20% most efficient herds. Data from 24,319 cows and over 70,000 inseminations recorded in DC305, Afi-farm, and Dairy Plan were evaluated from January to December 2013. Data included 30 dairies located in: Central Area (C [fifth, sixth, and Metro Regions]; n = 12 herds]) in dry lots and free-stall housing; South-Central Area (SC [seventh and eighth Regions]; n = 6 herds]) with free-stall and grazing systems; and South Area (S [ninth and 10th Regions]; n = 12]) with free-stall and grazing systems. Analyses were conducted with the PROC MIXED of SAS using herd as the experimental unit. The regions did not differ ($P > 0.05$) by mean (SD) herd size (C = 592 ± 315; SC = 940 ± 1612; S = 989 ± 815), days open in pregnant cows (C = 137 ± 19; SC = 135 ± 19; S = 144 ± 15), days in milk (C = 203 ± 17; SC = 209 ± 39; S = 210 ± 31), and days to first breeding (C = 71 ± 5; SC = 73 ± 10; S = 79 ± 4). Similarly, pregnancy risk (C = 19%; SC = 17%; S = 16%), insemination risk (C = 53%; SC = 48%; S = 46%), all services conception rate (C = 37%; SC = 37%; S = 38%), and removal rate by 60 d in milk (C = 7%; SC = 7%; S = 5%) were not different among regions. The S region had lower ($P < 0.05$) mean (SD) daily milk production in kilograms (25 ± 4) in comparison to the SC (34 ± 5) and C region (36 ± 5). The C region had more ($P < 0.05$) days of voluntary waiting period (51 ± 3) than regions SC and S (48 ± 4 and 47 ± 3, respectively). The 20% most efficient operations based on pregnancy risk ranking had a voluntary waiting period of 52 ± 3 d, mean pregnancy risk of 21%, insemination risk of 56%, and all services conception rate of 40%. They achieved 50% pregnant by Day 100 in milk, and mean (SD) days open and days in milk of 126 ± 8 and 184 ± 16, respectively. Conception rates for first insemination (40% vs. 35%) and for the first lactation (44% vs. 37%) were higher ($P < 0.05$) for the 20% most efficient herds. The 3 regions evaluated differed only in milk production level and voluntary waiting period. The most efficient herds had higher pregnancy risk, insemination risk, and conception rates; especially for first insemination and first lactation cows.

Key Words: fertility, reproduction, estrus

1218 (T149) In vitro fermentation and digestion characteristics of shrubs *Leucophyllum frutescens* and *Zanthoxylum fagara* browsed by white-tailed deer (*Odocoileus virginianum Texanus*). A. MS.[1], C. S. MA*[1], G. C. M.[1], G. R. H.[2], and R. L. RG.[3], *[1]Universidad Juárez del Estado de Durango, México, [2]Universidad Autónoma de Nuevo León, Linares, México, [3]Universidad Autónoma de Nuevo León, San Nicolás de los Garza, México.*

Native vegetation in northeastern México is mainly composed by shrubs and small trees, which are browsed by white-tailed deer. The aim of the study was to determine, seasonally, the in vitro fermentation profiles of *Leucophyllum frutescens* and *Zanthoxylum fagara.* Foliage was sampled from summer 2005 to spring 2006 for a total of four consecutive seasons in two country sites: Linares and Los Ramones in the state of Nuevo Leon, México. In vitro gas production was recorded at 3, 6, 9, 12, 24, 48, 72, and 96 h. As inoculum, rumen fluid from fistulated sheep was utilized. Microbial protein, ME content and in vitro organic matter digestibility (IVOMD) were also evaluated. Data were analyzed according to a multi-factorial arrangement being sites (2), shrubs (2) and seasons (4) the factors. Kinetic parameters significantly varied among shrubs, sites and seasons. The asymptotic gas production (B) ranged from 149 mL of gas/g DM in *L. frutescens* in summer 2005 in Los Ramones to 273 mL of gas/g DM in *Z. fagara* in winter 2006 in Linares country. The rate of gas production (c) was the lowest in *L. frutescens* in spring 2006 (0.028%/h) while the highest (0.104%/h) in *Z. fagara* collected in summer 2005 in Los Ramones. Values regarding lag phase (L) ranged from 0.64 to 2.07 h; in general, this variable was superior during spring seasons in both sites. Interactions sites x shrub species x seasons were significant ($P < 0.001$) for all kinetic parameters except for L. Microbial protein synthesis measured as purines varied significantly among sites, shrubs and seasons. Mean values ranged from 2.76 to 10.91 µmol, the latter was registered in *L. frutescens* collected in spring 2006 in Linares. The same scenario was registered with the ME content where values varied from 0.66 to 2.60 Mcal/kg DM. Estimates of IVOMD ranged from 56.8 to 93.1%. In general, highest digestibility values were registered in *Z. fagara*. Significant interactions related to IVOMD were registered as well. Data suggested that regardless spatiotemporal variations, variables such as constant rate of gas production, ME and microbial protein synthesis support the nutritive potential of the studied shrub species specially during the summer and autumn seasons for white-tailed deer.

Key Words: gas production, semiarid regions, white-tailed deer

1219 (T150) Characterization of goat foraging and body condition in Jhadol Block, Udaipur, India.
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India contains 125.7 million goats, 14.6% of the global goat population. Smallholder farmers own the majority of Indian goats, and animal productivity ranks far below goats' genetic potential. Our objective was to characterize the feeding practices of goat owners and the nutrition of goats in the Jhadol Block of the Udaipur District in Rajasthan, India. Sixty-four goat owners were surveyed in 10 villages of the Jhadol Block. The questionnaire focused on various aspects of the livestock system including socio–economic characteristics, livestock management, goat consumption and physical assessment of goat condition. The survey was broken into general household data, goat husbandry practices, goat diet composition, feeding habits, feed shortage mitigation, crop residue use and lactation. Most interviewees received the majority of their income as wage laborers and subsisted on their own land. Mean household landholdings were 0.52 ha with SD ± 0.248. Households owned from 1 to 22 goats with an average of 6.59 ± 4.12 goats. The highest level of education averaged 7.03 ± 3.75 yr, and 65.6% of households had electricity. Linear regression models and bivariate tables were used to compare data. Goat health was assessed using body condition scoring, which was measured by applying a five-point palpation and observation-based scale. Body condition was related to socio–economic factors, geographic location, and management practices. Body condition was significantly correlated with the household and village, in addition to whether the household cultivated forages (P = 0.0076) or lopped tree branches in the rainy season (P = 0.0385). The target population was also stratified by how many of the three local seasons (rainy, winter and summer) households took goats foraging outside of the home as a way to characterize goats' feeding regiment. Number of seasons foraged was compared to household parameters such as number of persons, number of goats, education and land. Seasons foraged was correlated with the total number of goats (P = 0.0105) and total number of other livestock owned (P = 0.0196). Aspects of the semi-extensive goat system in the Udaipur district were characterized to better understand household characteristics and practices that contribute to sound nutritional management practices and healthier goats. Information generated from these analyses advances knowledge of goat farming systems in rural Rajasthan, where there is currently limited published information to support caprine management or direct future caprine research initiatives.

Key Words: India, goat systems, semi-extensive farming

1220 (T151) Characterization of cattle manure value chains in South-Central Vietnam.
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Cattle manure value chains play an important role in smallholder crop-livestock systems in south-central Vietnam. Lowland cattle farmers sell manure through a network of chain participants to pepper, coffee, dragon fruit, and rubber farms in the Central Highlands and south coast. This study describes cattle manure value chains originating in two representative lowland communes, Nhõn Khánh (NK) and An Chấn (AC). Semi-structured interviews with value-chain participants between April and September 2013 collected information from lowland farmers (n = 101), manure collectors and traders (n = 27), rubber companies (n = 2), highland farmers (n = 50), and dragon fruit farmers (n = 20) about cattle management, manure-related labor, manure transactions, and fertilizer and manure use. Lowland cattle owners were selected using stratified random sampling. Farmer interviews identified subsequent value chain participants. Most farmers interviewed reported manure sales (AC = 78%, NK = 92%), and reported sales of 62% of farm manure with SD ± 26%. Farmers prepared manure for sale by drying it on the ground or in cakes for approximately 4 d. Dry manure (89 ± 3% DM, 18.7 ± 5.6% OM, 1.27 ± 0.37% N, and 0.59 ± 0.27% P_2O_5) was bagged and sold to local manure collectors who arranged transfer to highland farmers, south coast farmers, or traders. Manure was sold by the bag (bag volume in AC = 20.4 L, NK = 46.6 L). Sale price in farmer-reported transactions was \$34.19 ± 4.95/m^3 in AC and \$24.31 ± 3.88/m^{3}in NK. Preliminary analyses suggest annual farmer revenue of \$116 ± 102 in AC and \$120 ± 93 in NK, thus providing an important source of supplementary income. Manure not sold was composted and used for crop fertilization. Farmers reported most manure sales between February and August (during NK and AC dry season) when demand exists for organic amendments in the highlands. From NK, approximately 80% of manure sold flowed to Gia Lai Province and 20% to Đắk Lắk Province in the Central Highlands. From AC, 70% flowed to Gia Lai, 10% to Đắk Lắk, and 5% to Đắk Nông. 15% flowed to dragon fruit farmers in Bình Thuận Province late in the year. Before application, highland farmers purchasing manure often prepared a 45-d compost with manure and other amendments including potassium, urea, coffee pulp, and a commercial probiotic. This study generated descriptive information about manure value chains in Vietnam that can inform analysis of value chain dynamics via simulation modeling.

Key Words: cattle manure, value chain, Vietnam

1221 (T152) Selenium concentration in blood, milk and urine in grazing jersey herds in Costa Rica.

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The aim of this study was to determine the concentration of selenium (Se) in blood, milk and urine in grazing Jersey cows. The study was conducted on four commercial dairy herds in the highlands (≈ 2250 m of altitude) of Cartago, Costa Rica. Cows were intensively grazing kikuyu grass (*Kikuyuocloa clandestina*) and daily supplementation consisted of concentrate according to milk yield (1 kg concentrate:3 kg of milk). Blood samples were taken from the coccygeal vessels, milk samples were collected during milking from the milk yield measure container and urine was obtained using rubbing stimulation. A total of 102, 139, and 87 samples of blood, milk and urine respectively were collected and analyzed. Atomic absorption spectrophotometry was used to determine Se concentration. Soil was sampled in each farm to determine Se and sulfur (S) concentration and their associations with average Se in blood, milk and urine. A soil borer was used to obtain 20 subsamples per sample; those subsamples were collected drilling the soil surface to a depth of 10 cm. Se an S concentration in soils was analyzed using atomic absorption spectrophotometry and $Ca(H_2PO_4)_2 \cdot H_2O$ 0.008M 10:25 extraction, respectively. Average blood, milk and urine Se concentration are shown in Table 1221. Se in soils of farms 1, 2, 3, and 4 were 98, 78, 144, and 345 µg/kg respectively, S concentration in soil was 74, 35, 57, and 32 mg/L in the same order. No association was obtained between average Se concentration in the animal fluids and the soil Se or S concentration. Se concentration in blood was correlated to Se concentration in milk ($r = 0.31$, $P < 0.01$). Differences between Se concentrations in milk among herds suggest that it could be related to supplementation on each farm. Results also indicate that high values of selenium in urine in some of the farms could imply a poor utilization or excessive supplementation of this mineral with associated economic costs. More research should be done in a wider population to support these findings.

Key Words: Jersey cows, selenium, soil

Table 1221. Selenium concentration in blood, milk and urine in four grazing Jersey herds

Herd	Se in blood (µg/L)	Se in milk (µg/L)	Se in urine (µg/L)
1	41.12	32.61[a]	200.27[ab]
2	108.11	66.57[b]	263.05[a]
3	69.44	32.94[a]	47.48b[c]
4	41.44	22.35[a]	28.35[c]

[a, b] Means in the same column not sharing a common superscript are different ($P < 0.05$)