

DAFTAR PUSTAKA

- Abdeltawab, A. S., A. M. Kandil, M. A. Boraie, and M. A. I. El-Sysy. 2022. Impact Of Exogenous Fibrolytic Enzymes On Nutritional Evaluation And Productive Performance Of Growing Buffalo Calves. *Egyptian Journal of Nutrition and Feeds*. 25(2): 149-156.
- Abdullah, L., A. Tarigan, D. B. Suharlina, I. Jovinty, and T. A. Apdini. 2012. *Indigofera zollingeriana*: A promising forage and shrubby legum crop for Indonesia. In *Proceeding of the 2nd International Seminar on Animal Industry Jakarta*. (5): 6.
- Aderinboye, R. Y., A. O. Akinlolu, M. A. Adeleke, G. O. Najeem, V. O. A. Ojo, O. A., Isah, and O. J. Babayemi. 2016. In vitro gas production and dry matter degradation of four browse leaves using cattle, sheep and goat inocula. *Slovak Journal of Animal Science*. 49(1): 32-43.
- Adetunji, C. O., O. T. Olaniyan, and A. Varma. 2022. Novel microorganisms involved in the production of sustainable biogas production. In *Animal Manure: Agricultural and Biotechnological Applications*. Cham: Springer International Publishing.
- Aiswaryalakshmi, A. R., A. K. Raj, A. M. Sunil, A. P. T. Carmel, D. Suwethasri, K. M. Bharathi, and M. A. Niranjan. 2025. A Review on *Calliandra calothyrsus*: A potential fodder trees species. *Intl J Res Agron*. 8(1): 423-430.
- Alamu, E. O., M. Adesokan, S. Fawole, B. Maziya-Dixon, T. Mehreteab, and D. Chikoye. 2023. *Gliricidia sepium* (Jacq.) walt applications for enhancing soil fertility and crop nutritional qualities: a review. *Forests*. 14(3): 635.
- Aling, C., R. A. V. Tuturoong, Y. L. R. Tulung, and M. R. Waani. 2020. Kecernaan serat kasar dan BETN (bahan ekstrak tanpa nitrogen) ransum komplit berbasis tebon jagung pada sapi Peranakan Ongole. *Zootec*. 40(2): 428-438.
- Almaeda, M. E., B. Ayuningsih, and H. K. Mustafa. 2022. Kecernaan Bahan Kering Dan Bahan Organik In Vitro Beberapa Spesies Legum Yang Tumbuh Di Desa Ujungjaya, Sumedang. *Jurnal Sumber Daya Hewan*. 3(1): 17-21.
- Angelis, A. D., L. Gasco, G. Parisi, and P. P. Daniele. 2021 A Multipurpose Leguminous Plant For The Mediterranean Countries: *Leucaena leucocephala* as An Alternative Protein Source : A Review. *Animals*. 11(8): 2230.
- Antari, R., S. P. Ginting, Y. N. Anggraeny, and S. R. McLennan. 2023. The potential role of *Indigofera zollingeriana* as a high-quality forage for cattle in Indonesia. *Tropical Grasslands-Forrajes Tropicales*. 11(3): 183-197.
- Arya, A., P. M. Lunagariya, R. J. Modi, and Y. G. Patel. 2024. Rumen fermentation. *Int J Vet Sci Anim Husbandry*. 9(5): 09-12.
- Aryanto, I., I. S. Chuzaemi, I. Hartutik, and I. Mashudi. 2024. *Leguminosa Pohon, Nutrisi dan Potensi Mitigasi Metan Pada Ternak Ruminasia*. Media Nusa Creative (MNC Publishing). Jawa Timur.

- Astuti, T. dan G. Yelni. 2015. Evaluasi pencernaan nutrient pelepah sawit yang difermentasikan dengan berbagai sumber mikroorganisme sebagai bahan pakan ternak ruminansia. *Jurnal Sain Peternakan Indonesia*. 10(2): 101-106.
- Bageel, A., M. D. H. Honda, J. T. Carrilo and D. Borthakur. 2020. Giant *Leucaena* (*Leucaena leucocephala* subsp. *glabrata*) a Versalite Tree-Legume for Sustainable Agroforestry. *Agroforestry Systems*. 94: 251-268.
- Bahan, Y., M. Yunus, and H. T. Handayani. 2020. Pengaruh pemberian pakan konsentrat yang mengandung tepung tongkol jagung terfermentasi terhadap konsumsi pencernaan karbohidrat dan lemak kasar pada sapi bali dara pola peternak. *Jurnal Peternakan Lahan Kering*. 2(4): 1103-1110.
- Balai Pembibitan Ternak Unggul dan Hijauan Pakan Ternak (BPTU HPT) Padang Mengatas. 2022. Laporan Hasil Pengujian Pakan Ternak oleh Balai Pengujian Mutu dan Sertifikasi Pakan.
- Barros-Rodriguez, M., C. A. Sandoval-Castro, J. Solorio-Sánchez, L. A. Sarmiento-Franco, R. Rojas-Herrera, and A. V. Klieve. 2014. *Leucaena leucocephala* in ruminant nutrition. *Tropical and subtropical agroecosystems*. 17(2): 173-183.
- Barros-Rodríguez, M., J. Solorio-Sánchez, J. Ku-Vera, A. Ayala-Burgos, C. Sandoval-Castro, and G. Solís-Pérez. 2012. Productive performance and urinary excretion of mimosine metabolites by hair sheep grazing in a silvopastoral system with high densities of *Leucaena leucocephala*. *Tropical Animal Health and Production*. 44(8): 1873-1878.
- Basri, A. C., W. P. Yustanto, A. Kurniawati, C. Hanim, M. Al-Anas, and L. M. Yusiati. 2021. Dietary *Swietenia mahagoni* as tannin source to increase in-vitro nutrients digestibility. *Adv. Anim. Vet. Sci*. 9(12): 2184-2193.
- Bediona, P., G. Maranatha, and D. Amalo. 2024. Pengaruh Pemberian Silase Komplit Berbasis Sorgum dan *Clitoria Ternatea* Hasil Integrasi Tanaman Holtikultura yang Berbeda terhadap Konsumsi serta Pencernaan Protein Kasar dan Serat Kasar Kambing Betina Lokal. *Animal Agricultura*. 1(3): 180-189.
- Besharati, M., A. Maggiolino, V. Palangi, A. Kaya, M. Jabbar, H. Eseceli, and J. M. Lorenzo. 2022. Tannin in ruminant nutrition. *Molecules*. 27(23): 8273.
- Bhatta, R., M. Saravanan, L. Baruah, and C. S. Prasad. 2015. Effects of graded levels of tannin - containing tropical tree leaves on in vitro rumen fermentation, total protozoa and methane production. *Journal of Applied Microbiology*. 118(3): 557-564.
- Capareda S. 2013. *Introduction To Biomass Energy Conversions*. CRC Press.
- Castillo-Lopez, E., and M. G. Domínguez-Ordóñez. 2019. Factors affecting the ruminal microbial composition and methods to determine microbial protein yield. Review. *Revista mexicana de ciencias pecuarias*. 10(1): 120-148.
- Castillo-Lopez, E., H. R. Ramirez, T. J. Klopfenstein, D. Hostetler, K. Karges, S. C. Fernando, and P. J. Kononoff. 2014. Ration formulations containing reduced-fat dried distillers grains with solubles and their effect on lactation

- performance, rumen fermentation, and intestinal flow of microbial nitrogen in Holstein cows. *Journal of Dairy Science*. 97(3): 1578-1593.
- Castro-Montoya, J., R. Gownipuram, M. Mendoza, N. Solano, F. López, U. Dickhöfer, and E. E. Corea. 2019. Effects of feeding tropical forage legumes on nutrients digestibility, nitrogen partitioning and performance of crossbred milking cows. *Animal Feed Science and Technology*. 247: 32-40.
- Cherdthong, A. 2020. Potential use of rumen digesta as ruminant diet—a review. *Tropical Animal Health and Production*. 52(1): 1-6.
- Cholewińska, P., K. Czyż, P. Nowakowski, and A. Wyrostek. 2020. The microbiome of the digestive system of ruminants—a review. *Animal health research reviews*. 21(1): 3-14.
- Choudhury, P. K. 2015. Rumen Microbiology: An Overview. *Rumen Microbiology: From Evolution to Revolution*. 1: 4-16.
- Chuhaemi, I. S., A. E. IPU, I. S. D. I. Mashudi, P. H. Ndaru, and S. P. MP. 2020. Ilmu Gizi Ruminansia. Media Nusa Creative (MNC Publishing).
- Conway, E. J. and E. O'Malley. 1942. Microdiffusion methods: ammonia and urea using buffered absorbents (revised methods for ranges greater than 10 µg N). *Biochemistry Journal*. 36: 655-66.
- Cook, B. G., B. C. Pengelly, R. Schultze-Kraft, M. Taylor, S. Burkart, J. A. Cardoso Arango, J. J. González Guzmán, K. Cox, C. Jones, and M. Peters. 2020. Tropical Forages: An interactive selection tool. 2nd and Revised Edn. International Center for Tropical Agriculture (CIAT), Cali, Colombia and International Livestock Research Institute (ILRI), Nairobi, Kenya.
- Dal Pizzol, J. G., H. M. N. Ribeiro-Filho, A. Quereuil, A. Le Morvan, and V. Niderkorn. 2017. Complementarities between grasses and forage legumes from temperate and subtropical areas on in vitro rumen fermentation characteristics. *Animal Feed Science and Technology*. 228: 178-185.
- Daning, D. R. A., and B. Foekh. 2018. Evaluasi produksi dan kualitas nutrisi pada bagian daun dan kulit kayu *Calliandra callotirsus* dan *Gliricidia sepium*. *Sains Peternakan: Jurnal Penelitian Ilmu Peternakan*. 16(1): 7-11.
- De Angelis, A., L. Gasco, G. Parisi, and P. P. Danieli. 2021. A multipurpose leguminous plant for the mediterranean countries: *Leucaena leucocephala* as an alternative protein source: A review. *Animals*. 11(8): 2230.
- Ding, M., Z. Huang, Z. Jin, C. Zhou, J. Wu, D. Zhao, and C. Li. 2022. The effect of fat content in food matrix on the structure, rheological properties and digestive properties of protein. *Food Hydrocolloids*. 126: 107464.
- Djaja, W., S. Kuswaryan, dan U. H. Tanuwiria. 2007. Pengaruh substitusi konsentrat daun kering kaliandra (*Calliandra calothyrsus*) terhadap jumlah produksi 4% FCM, lemak, bahan kering, bahan kering tanpa lemak, protein, dan laktosa susu sapi perah Fries Holland. *Jurnal Sain Peternakan Indonesia*. 2(2): 45-48.

- Doreau, M., H. B. Salem and R. R. Krezminski. 1993. Effect of rapeseed oil supply on in vitro ruminal digestion in cows: comparison of hay and maize silage diets. *J. Anim. Feed Sci. and Technol.* 44: 181-189.
- Dunn, K. L., L. Yang, A. Girard, S. Bean, and J. M. Awika. 2015. Interaction of sorghum tannins with wheat proteins and effect on in vitro starch and protein digestibility in a baked product matrix. *Journal of Agricultural and Food Chemistry.* 63(4): 1234-1241.
- Dwifitri, N., D. Suherman dan E. Apriyanto. 2020. Pengaruh Pupuk Organik dan Umur Potong Terhadap Produksi Hijauan Pakan Ternak Sorgum di Daerah Pesisir. *Naturalis.* 9(1): 21-29.
- Elevitch, C. R., and J. K. Francis. 2006. *Gliricidia sepium* (gliricidia). *Species Profiles for Pacific Island Agroforestry.* 2(1): 1-18.
- Espitia-Hernandez, P., M. L. Chavez Gonzalez, J. A. Ascacio-Valdés, D. Dávila-Medina, A. Flores-Naveda, T. Silva, and L. Sepúlveda. 2022. Sorghum (*Sorghum bicolor* L.) as a potential source of bioactive substances and their biological properties. *Critical Reviews in Food Science and Nutrition.* 62(8): 2269-2280.
- Evitayani, L. Warli dan F. Rifaldy. 2021. Pengaruh *Indigofera zollingeriana* Sebagai Pengganti Konsentrat Terhadap Kecernaan Fraksi Serat dan Pertumbuhan Kambing Etawa. Atlantis Press. Seminar Internasional Produksi Ternak Tropis ke-9 (ISTAP 2021).
- Faradilla, F., L. K. Nuswantara, M. Christiyanto, dan E. Pangestu. 2019. Kecernaan bahan kering, bahan organik, lemak kasar dan total digestible nutrients berbagai hijauan secara in vitro. *Jurnal Litbang Provinsi Jawa Tengah.* 17(2): 185-193.
- Famarzi-Garmroodi, A., M. D. Mesgaran, A. Vakili, A. Hodjatpanah-montazeri, and M. Manshadi. 2014. *In vitro* rumen fermentation characteristics of intact or oil free of various protein sources. *Annu. Res. Rev. Biol.* 500–508.
- Farida, W. R., A. P. Sari, N. Inayah, dan H. A. Nugroho. 2017. Analisis kebutuhan nutrisi dan efisiensi penggunaan pakan bubur formulasi pada oposum layang (*Petaurus breviceps* Waterhouse, 1839). *J. Biologi Indonesia.* 13(2): 305-314.
- Faturohman, M. R. T., I. Haryoko, dan N. Hidayat. 2022. Kecernaan In Vitro Serat Kasar Dan Protein Kasar Pakan Ruminansia Berbasis *Indigofera* sp. Dengan Kondisi Bahan Yang Berbeda. *Angon: Journal of Animal Science and Technology.* 4(2): 247-256.
- Febrianti, N. H., A. Subrata, dan J. Achmadi. 2020. Pengaruh interaksi antara fermentasi dengan *Trichoderma Reesei* dan amoniasi terhadap kandungan komponen serat ampas aren. *Bulletin of Applied Animal Research.* 2(2): 56-60.
- Fernando, S. C., H. T. Purvis, F. Z. Najar, L. O. Sukharnikov, C. R. Krehbiel, T. G. Nagaraja, ... and U. Desilva. 2010. Rumen microbial population dynamics

- during adaptation to a high-grain diet. *Applied and environmental microbiology*. 76(22): 7482-7490.
- Fitriana, D. 2024. Analisis Kandungan Selulosa, Hemiselulosa dan Lignin Dalam Komponen Jerami Jagung (Batang, Daun Tongkol dan Kelobot). *Jurnal Sains dan Teknologi Lichen Institute*. 1(1): 45-55.
- Fitriatin, R. D. 2022. Pengaruh Penambahan Chicory Pada Ransum Domba Terhadap Kecernaan Bahan Kering dan Bahan Organik (In Vitro). *Jurnal Sumber Daya Hewan*. 3(1): 6-11.
- Fitriyani, F., E. Erwanto, L. Liman, dan M. Muhtarudin. 2024. Inkorporasi Produk Supplement Multi Nutrien Saos Ke Dalam Konsentrat Sapi Potong Dan Pengaruhnya Terhadap Konsumsi Bahan Kering, Protein Kasar Dan Pertambahan Bobot Tubuh. *Jurnal Riset dan Inovasi Peternakan (Journal of Research and Innovation of Animals)*. 8(2): 200-209.
- General Laboratory Prosedure. 1996. Departement of Dairy Science. University of Wisconsin.
- Getachew, G., D. H. Putnam, C. M. De Ben, and E. J. De Peters. 2016. Potential of sorghum as an alternative to corn forage. *American Journal of Plant Sciences*. 7(7): 1106-1121.
- Ghina, Y., D. Dwatmadji, dan T. Suteky. 2019. Kecernaan Protein Kasar dan Serat Kasar Kambing Peranakan Etawa Jantan yang diberi Pakan Fermentasi Ampas Tahu Bungkil Inti Sawit dengan Imbangan yang Berbeda. *Jurnal Sain Peternakan Indonesia*. 14(3): 272-281.
- Gunun, N., C. Kaewpila, W. Khota, S. Polyorach, T. Kimprasit, W. Phlaetita, and P. Gunun. 2022. The effect of indigo (*Indigofera tinctoria* L.) waste on growth performance, digestibility, rumen fermentation, hematology and immune response in growing beef cattle. *Animals*. 13(1): 84.
- Guo, W., X. J. Guo, B. C. Zhu, Y. Y. Guo, and X. Zhou. 2019. In situ degradation, ruminal fermentation, and the rumen bacterial community of cattle fed corn stover fermented by lignocellulolytic microorganisms. *Animal feed science and technology*. 248: 10-19.
- Gürsoy, E. 2021. Determining the nutrient content, relative feed value, and in vitro digestibility value of some legume forage plants. *Pakistan Journal of Agricultural Sciences*. 58(5).
- Guyader, J., H. H. Janzen, R. Kroebel, and K. A. Beauchemin. 2016. Forage use to improve environmental sustainability of ruminant production. *Journal of animal science*. 94(8): 3147-3158.
- Hailemariam, S., S. Zhao, Y. He, and J. Wang. 2021. Urea transport and hydrolysis in the rumen: A review. *Animal Nutrition*. 7(4): 989-996.
- Hamanay, U. M. L., A. Manu, and G. Maranatha. 2024. Pengaruh Pemberian Pakan Komplit Dengan Level Silase Campuran Shorgum dan Daun Gamal dan

- Konsentrat yang Berbeda Terhadap Konsumsi, Kecernaan BETN dan Energi Ternak Kambing Lokal Betina. *Animal Agricultura*. 1(3): 160-170.
- Hambakudo, M., A. Kaka, dan Y. T. Ina. 2020. Kajian *in vitro* kecernaan fraksi serat hijau tropis pada media cairan rumen kambing. *Jurnal Ilmu dan Teknologi Peternakan Tropis*. 7(1): 29.
- Harmini. 2021. Pemanfaatan Tanaman Sorgum Sebagai Pakan Ternak Ruminansia di Lahan Kering. *Livestock and Animal Research*. 19(2).
- Herawati, E., dan M. Royani. 2017. Pengaruh Penambahan Molases terhadap Nilai pH dan Kadar Air pada Fermentasi Daun Gamal. *JANHUS*. 2(1): 26-31.
- Herdiawan, I., dan R. Krisnan. 2014. Produktivitas dan pemanfaatan tanaman leguminosa pohon *Indigofera zollingeriana* pada lahan kering. *Wartazoa*. 24(2): 75-82.
- Hidayah, N. 2016. Pemanfaatan senyawa metabolit sekunder tanaman (tanin dan saponin) dalam mengurangi emisi metan ternak ruminansia. *Jurnal Sain Peternakan Indonesia*. 11(2): 89-98.
- Hidayatullah, A. R., dan F. C. Rini. 2024. Eksplorasi Potensi Leguminosa Pohon sebagai Pakan Konvensional. *Hidroponik: Jurnal Ilmu Pertanian Dan Teknologi Dalam Ilmu Tanaman*. 1(3): 12-27.
- Holik, Y. L. A., L. Abdullah, dan P. D. M. H. Karti. 2019. Evaluasi nutrisi silase kultivar baru tanaman sorgum (*Sorghum bicolor*) dengan penambahan legum *Indigofera* sp. pada taraf berbeda. *Jurnal Ilmu Nutrisi dan Teknologi Pakan*. 17(2): 38-46.
- Huda, A. N., M. Mashudi., K. Kuswati., T. Susilawati., S. Wahyuningsih., N. Isnaini., A. A. Y. Puspita dan A. T. Satria. 2018. Evaluasi Kecukupan Nutrisi Induk Sapi Potong di Desa Leran Wetan dan Leran Kulon, Kecamatan Palang, Kabupaten Tuban. *J. Ternak Tropika*. 19(2): 111-119.
- Ifani, M., A. A. Gunawan, dan A. P. Nugroho. 2022. Kadar Total VFA Dan N-NH₃ Pada Pakan Ruminansia Dengan Penggunaan Leguminosa Pohon Yang Berbeda Sebagai Sumber Protein Secara *Invitro*. *ANGON: Journal of Animal Science and Technology*. 4(3): 322-327.
- Ifani, M., D. Wijayanti, E. A. Rimbawanto, dan B. Hartoyo. 2023. Substitusi Konsentrat dengan Daun Gamal (*Gliricidia sepium*) Pada Ransum Sapi Potong Secara In Vitro terhadap Kecernaan Bahan Kering dan Organik. *Jurnal Peternakan Lokal*. 5(1): 32-39.
- Indralaya, O. I. 2015. Evaluasi nilai kecernaan secara in vitro ransum ternak sapi bali yang disuplementasi dengan probiotik bioplus. *Jurnal Peternakan Sriwijaya*. 4(1): 35-46.
- Indriani, N. P., A. Rochana, H. K. Mustafa, B. Ayuningsih, I. Hernaman, D. Rahmat, dan M. Mansyur. 2020. Pengaruh berbagai ketinggian tempat terhadap kandungan fraksi serat pada rumput lapang sebagai pakan hijau. *Jurnal Sain Peternakan Indonesia*. 15(2): 212-218.

- Islamiyati, R. 2022. Fraksi Serat Berbagai Legum Pohon Terpilih Sebagai Bahan Pakan Ternak. *Jurnal Ilmu dan Industri Peternakan*. 8(2): 150-160.
- Iyabo, O. O., O. Ibiyinka, and O. Abimbola Deola. 2018. Comparative study of nutritional, functional and antinutritional properties of white Sorghum bicolor (sorghum) and *Pennisetum glaucum* (pearl millet). *International journal of engineering technologies and management research*. 5(3): 151-158.
- Jayanegara, A., E. Wina, C. R. Soliva, S. Marquardt, M. Kreuzer, and F. Leiber. 2011. Dependence of forage quality and methanogenic potential of tropical plants on their phenolic fractions as determined by principal component analysis. *Animal Feed Science and Technology*. 163(2-4): 231-243.
- Jayaprakash, G., K. Shyama, P. Gangadevi, K. Ally, K. S. Anil, A. K. Raj, ... and M. A. Robert. 2016. Biomass yield and chemical composition of *Calliandra calothyrsus*, *Desmanthus virgatus* and *Stylosanthes hamata*. *International Journal of Science, Environment and Technology*. 85(4): 2290-95.
- Kamra, D. N. 2005. Rumen microbial ecosystem. *Current science*. 124-135.
- Kurniawan, W., T. Wahyono, N. Sandiah, H. Has, L. O. Nafiu, and A. Napirah. 2019. Evaluasi kualitas dan karakteristik fermentasi silase kombinasi stay green sorghum (*Sorghum bicolor* L. Moench)-*Indigofera zolingeriana* dengan perberbedaan komposisi. *Jurnal Ilmu dan Teknologi Peternakan Topis*. 6(1): 62-69.
- Lagrange, S. P., J. W. MacAdam, and J. J. Villalba. 2021. The use of temperate tannin containing forage legumes to improve sustainability in forage–livestock production. *Agronomy*. 11(11): 2264.
- Langgajanji, V. D., G. Maranatha, and Y. R. Noach. 2024. Efek Pemberian Pakan Komplit Berbasis Silase Campuran Sorghum dan Daun Gamal Pada Level Berbeda terhadap Konsumsi Kecernaan Protein Kasar dan Serat Kasar Ternak Kambing Lokal Betina. *Animal Agricultura*. 1(3): 230-240.
- Leo, S., G. Maranatha, and G. Oematan. 2023. Pengaruh level substitusi rumput (*bothriochola pertusa*) dengan kangkung terhadap pH, konsentrasi VFA dan amonia cairan rumen ternak kambing kacang. *Animal Agricultura*. 1(1): 13-23.
- Li, Z., Q. Deng, Y. Liu, T. Yan, F. Li, Y. Cao, and J. Yao. 2018. Dynamics of methanogenesis, ruminal fermentation and fiber digestibility in ruminants following elimination of protozoa: a meta-analysis. *Journal of Animal Science and Biotechnology*. 9: 1-9.
- Lima, R., M. Lourenço, R. F. Díaz, A. Castro, and V. Fievez. 2010. Effect of combined ensiling of sorghum and soybean with or without molasses and lactobacilli on silage quality and in vitro rumen fermentation. *Animal feed science and technology*. 155(2-4): 122-131.
- Lima, F. S., Oikonomou, G., Lima, S. F., Bicalho, M. L., Ganda, E. K., de Oliveira Filho, J. C., & Bicalho, R. C. 2015. Prepartum and postpartum rumen fluid

- microbiomes: characterization and correlation with production traits in dairy cows. *Applied and environmental microbiology*. 81(4): 1327-1337.
- Mabelebele, M., M. Siwela, R. M. Gous, and P. A. Iji. 2015. Chemical composition and nutritive value of South African sorghum varieties as feed for broiler chickens. *South African Journal of Animal Science*. 45(2): 206-213.
- Marianos, F., R. M. Sari, and D. Surtina. 2024. The Effect of Different Types of Manure on the Content of NDF, ADF, Hemicellulose, and Cellulose in Elephant Grass (*Pennisetum purpureum*) Cv. Taiwan at the First Cutting. *Journal of Animal Nutrition and Production Science*. 3(01): 170-182.
- McSweeney, C., S. B. Palmer, D. M. Neill, and D. O. Krause. 2001. Microbial interactions with tannins: nutritional consequences for ruminants. *Anim. Feed*. 81: 83-93.
- Miron, J., E. Zuckerman, D. Sadeh, G. Adin, M. Nikbachat, E. Yosef, ... and R. Solomon. 2005. Yield, composition and in vitro digestibility of new forage sorghum varieties and their ensilage characteristics. *Animal Feed Science and Technology*. 120(1-2): 17-32.
- Montcho, M., S. Babatounde, A. B. Aboh, V. Bougouma-Yameogo, and G. A. Mensah. 2017. In vitro digestibility and fermentation kinetics of agricultural and agro-industrial by-products used in ruminant feeding in Benin Republic. *Journal of Applied Biosciences*. 116: 11629-11641.
- Muhajir, A. L., T. Astuti, and A. Asri. 2023. Effect of Fermentation Time for a Combination of Rice Straw and Tithonia (*Tithonia diversifolia*) on the NDF, ADF, and Cellulose Content as Ruminant Feeding. *Journal of Animal Nutrition and Production Science*. 2(1): 71-81.
- Mulyani, S., and K. Setiawati. 2021. Evaluasi Kecernaan Protein Kasar dan Serat Kasar dari Kombinasi Fraksi Hijauan Rumpun Gajah (*Pennisetum purpureum*) cv Taiwan dengan Legume *Indigofera. sp* secara In-Vitro. *Jurnal Peternakan Mahaputra*. 2(1): 99-106.
- Nafifa, R. S. 2018. Kajian Nilai Nutrisi Tanaman Pada Program I-Jalapi Terhadap Pertumbuhan Sapi Di Labangka. Universitas Mataram.
- Nagaraja, T. G. 2016. Microbiology of the rumen. In *Rumenology*. Springer International Publishing. Cham, Switzerland.
- Newbold, C. J., G. De La Fuente, A. Belanche, E. Ramos-Morales, and N. R. McEwan. 2015. The role of ciliate protozoa in the rumen. *Frontiers in microbiology*. 6: 1313.
- Nisa, F., A. Subrata, dan E. Pangestu. 2018. Kehilangan bahan kering, acid detergent fiber dan N-acid detergent fiber daun *Moringa oleifera* secara in vitro. *Jurnal Sain Peternakan Indonesia*. 13(3): 282-286.
- Nisa, Z. K., B. Ayuningsih, and I. Susilawati. 2020. Pengaruh penggunaan dedak fermentasi terhadap kadar lignin dan selulosa silase rumput gajah (*Pennisetum purpureum*). *Jurnal Nutrisi Ternak Tropis dan Ilmu Pakan*. 2(3).

- Nugroho, A. D., M. Muhtarudin, E. Erwanto, dan F. Fathul. 2020. Pengaruh perlakuan fermentasi dan amoniasi kulit singkong terhadap nilai pencernaan bahan kering dan bahan organik ransum pada domba jantan. *Jurnal Riset Dan Inovasi Peternakan (Journal of Research and Innovation of Animals)*. 4(2): 119-125.
- Nurjannah S, Rahman and R. Krisnan. 2021. Digestibility of *Calliandra*, *Indigofera* sp. and the Mixture in the Ration as a Substitute for the Concentrate Given to the Tup Garut. *Advances in Biological Sciences Research*. 20: 244-249.
- Ogimoto, K., and S. Imai. 1981. *Atlas of Rumen Microbiology*. Tokyo: JSSP.
- Oktavia, R., and S. Sumardi. 2022. Kemampuan *Bacillus* sp. Sebagai Bioremediasi Bahan Pencemar. *Jurnal Bioterdidik: Wahana Ekspresi Ilmiah*. 10(2): 110-125.
- Ortiz-Domínguez, G., J. Ventura-Cordero, P. González-Pech, J. F. Torres-Acosta, C. M. Capetillo-Leal, and C. A. Sandoval-Castro. 2017. Nutritional value and in vitro digestibility of legume pods from seven trees species present in the tropical deciduous forest. *Tropical and Subtropical Agroecosystems*. 20(3): 505-510.
- Owens, F. N., and M. Basalan. 2016. Ruminant fermentation. *Rumenology*. 63-102.
- Patra, A. K., and Z. Yu. 2015. Effects of garlic oil, nitrate, saponin and their combinations supplemented to different substrates on in vitro fermentation, ruminal methanogenesis, and abundance and diversity of microbial populations. *Journal of applied microbiology*. 119(1): 127-138.
- Patric, A., A. K. Raj, T. K. Kunhamu, V. Jamaludheen, and A. V. Santhoshkumar. 2020. Productivity of tree fodder banks in a typical homegarden of Central Kerala. *Indian Journal of Agroforestry*. 22(1): 17-23.
- Pazla, R., Adrizal, and R. Sriagtula. 2021. Intake, Nutrient Digestibility and Production Performance of Pesisir Cattle Fed *Tithonia diversifolia* and *Calliandra calothyrsus* Based Rations with Different Protein and Energy Rations. *Advances in Animal and Veterinary Sciences*. 9(10): 1608-1615.
- Pazla, R., F. Agustin, R. Sriagtula, G. Yanti, and D. F. R. Nawawy. 2023. In-vitro Degistibility of Crude Fiber, Crude Fat, and Nitrogen Free Extract from Mixture Sorghum Mutants BMR (*Sorghum bicolor* L moench) and *Mirasolia diversifolia*. 3rd International Conference on Animal Production for Food Sustainability 2023. IOP Conf. Series : Earth and Environmental Science. 1341(2024): 012069.
- Pazla, R., M. Zain, H. I. Ryanto, and A. Dona. 2018. Supplementation of minerals (phosphorus and sulfur) and *Saccharomyces cerevisiae* in a sheep diet based on a cocoa by-product. *Pak. J. Nutr.* 17(7): 329-335.
- Pazla, R., N. Jamarun, dan G. Yanti. 2022. Potensi kombinasi *Tithonia diversifolia* dengan daun alpukat *Persea americana* miller sebagai pakan alternatif ternak kambing. Penerbit Adab.

- Phesatcha, K., and M. Wanapat. 2017. Tropical legume supplementation influences microbial protein synthesis and rumen ecology. *Journal of Animal Physiology and Animal Nutrition*. 101(3): 552-562.
- Polii, N. W. Diwi, M. R. Waani, dan A. F. Pendong. 2020. Kecernaan Protein Kasar dan Lemak Kasar pada Sapi Perah Peranakan FH (Friesian Holstein) yang Diberi Pakan Lengkap Berbasis Tebon Jagung. *Zootec*. 40(2): 482-492.
- Prayitno, R. S., F. Wahyono, dan E. Pangestu. 2018. Pengaruh suplementasi sumber protein hijauan leguminosa terhadap produksi amonia dan protein total ruminal secara in vitro. *Jurnal Peternakan Indonesia (Indonesian Journal of Animal Science)*. 20(2): 116-123.
- Przybylska-Balcerek, A., J. Frankowski, and K. Stuper-Szablewska. 2019. Bioactive compounds in sorghum. *European Food Research and Technology*. 245(5): 1075-1080.
- Puay, D., G. Oematan, D. Amalo, dan I. Benu. 2023. Pengaruh Substitusi Silase Rumput Kume dengan Fodder Jagung Hidroponik Terhadap Konsumsi dan Kecernaan Karbohidrat, Konsentrasi Volatile Fatty Acid dan Kadar Glukosa Darah Kambing Kacang Jantan. *Animal Agricultura*. 1(1): 24-35.
- Puja, I. W., S. S. Djunu, dan T. A. E. Nugroho. 2023. Penggunaan Lumpur Sawit Fermentasi Dalam Pakan terhadap Kecernaan Lemak Dan Serat Kasar ayam Kampung Unggul Balitnak. *Gorontalo Journal of Equatorial Animals*. 2(1).
- Putri, E. M., M. Zain, L. Warly, and H. Hermon. 2019. In vitro evaluation of ruminant feed from West Sumatera based on chemical composition and content of rumen degradable and rumen undegradable proteins. *Veterinary World*. 12(9): 1478.
- Putri, E. M., M. Zain, L. Warly, and H. Hermon. 2021. Effects of rumen-degradable-to-undegradable protein ratio in ruminant diet on in vitro digestibility, rumen fermentation, and microbial protein synthesis. *Veterinary world*. 14(3): 640.
- Putri, E. M., R. Pazla, N. Jamarun, F. Agustin, G. Yanti, Z. Ikhlas, and P. Lestari. 2024. Optimizing ruminant feed efficiency: The synergistic effects of BMR sorghum and *Tithonia diversifolia* on nutrient digestibility, rumen function, and methane mitigation. *Journal of Animal Behaviour and Biometeorology*. 12(3): 2024022-2024022.
- Rahmawati, P. D., E. Pangestu, L. K. Nuswatara, and M. Christiyanto. 2021. Kecernaan bahan kering, bahan organik, lemak kasar dan nilai total digestible nutrient hijauan pakan kambing. *Jurnal Agripet*. 21(1).
- Ramaiyulis, R., M. Zain, R. W. S. Ningrat, and L. Warly. 2019. Optimization of rumen microbial protein synthesis by addition of Gambier leaf residue to cattle feed supplement. *Pakistan Journal of Nutrition*. 18(1): 12-19.
- Ramírez-Rivera, U., J. R. Sanginés-García, J. G. Escobedo-Mex, F. Cen-Chuc, J. A. Rivera-Lorca, and P. E. Lara-Lara. 2010. Effect of diet inclusion of

- Tithonia diversifolia* on feed intake, digestibility and nitrogen balance in tropical sheep. *Agroforestry systems*. 80(2): 295-302.
- Ransa, C. P., R. A. V. Tuturoong, A. F. Pendong, and M. R. Waani. 2020. Kecernaan NDF dan ADF pakan lengkap berbasis tebon jagung pada sapi FH. *Zootec*. 40(2): 542-551.
- Rawal, S., H. Kaur, S. Bhathan, D. Mittal, G. Kaur, and S. A. Ali. 2024. Ruminant Gut Microbiota: Interplay, Implications, and Innovations for Sustainable Livestock Production. In *Sustainable Agriculture Reviews: Animal Biotechnology for Livestock Production* 4. Cham: Springer Nature Switzerland.
- Rimbawanto, E. A., and B. Hartoyo. 2018. Kecernaan Dan Produk Fermentasi Secara In Vitro Pada Campuran Legum Yang Mengandung Tanin Berbeda. In *Prosiding Seminar Nasional Teknologi Agribisnis Peternakan (STAP)*. 6: 125-130.
- Rinaldi, W., S. Efendi, and F. Razi. 2020. Pengaruh Ukuran Jerami, Penambahan Urea, dan Rasio Jerami-Air Terhadap Pembentukan Biogas. *Jurnal Inovasi Ramah Lingkungan*. 1(2): 6.
- Rustiyana, E., and F. Fathul. 2016. Pengaruh substitusi rumput gajah (*Pennisetum purpureum*) dengan pelepah daun sawit terhadap kecernaan protein kasar dan kecernaan serat kasar pada kambing. *Jurnal Ilmiah Peternakan Terpadu*. 4(2).
- Sari, R. M., M. Zain, N. Jamarun, R. W. S. Ningrat, Elihasridas, and E. M. Putri. 2022. Improving rumen fermentation characteristics and nutrient digestibility by increasing rumen degradable protein in ruminant feed using *Tithonia diversifolia* and *Leucaena leucocephala*. *International Journal of Veterinary Science*. 11(3): 353-360.
- Sari, R. W. W., N. Jamarun, R. Pazla, G. Yanti, and Z. Ikhlas. 2022. Nutritional Analysis of Mangrove Leaves (*Rhizophora apiculata*) Soaking with Lime Water for Ruminants Feed. In *iop conference series: earth and environmental science*. IOP Publishing. 1020(1): 012010.
- Say, Y. K., T. T. Nikolaus, and G. A. Lestari. 2024. Pengaruh Silase Rumput Kume dan *Alysicarpus Vaginalis* dengan Imbangan yang Berbeda terhadap Kecernaan Bahan Kering, Bahan Organik dan Metabolisme Energi Secara In Vitro. *Animal Agricultura*. 2(1): 417-425.
- Schrire, B. D., M. Lavin, N. P. Barker, and F. Forest. 2009. Phylogeny of the tribe Indigofereae (Leguminosae–Papilionoideae): Geographically structured more in succulent-rich and temperate settings than in grass-rich environments. *American Journal of Botany*. 96(4): 816-852.
- Shen, J., W. Zheng, Y. Xu, and Z. Yu. 2023. The inhibition of high ammonia to in vitro rumen fermentation is pH dependent. *Frontiers in Veterinary Science*. 10: 1163021.
- Silva, É. B. R. D., J. A. R. D. Silva, W. C. D. Silva, T. S. Belo, C. E. L. Sousa, M. R. P. D. Santos, and J. D. B. Lourenço-Júnior. 2024. A review of the rumen

- microbiota and the different molecular techniques used to identify microorganisms found in the rumen fluid of ruminants. *Animals*. 14(10): 1448.
- Singh, R. D., J. Banerjee, and A. Arora. 2015. Prebiotic potential of oligosaccharides: A focus on xylan derived oligosaccharides. *Bioact Carbohydrates Diet Fibre*. 5: 19–30.
- Singh, S., B. V. Bhat, G. P. Shukla, D. Gaharana, and U. Y. Anele. 2017. Nutritional evaluation of different varieties of sorghum stovers in sheep. *Animal Feed Science and Technology*. 227: 42-51.
- Singh, S., T. Singh, P. Koli, U. Y. Anele, B. K. Bhadoria, M. Choudhary, and Y. Ren. 2023. Nutrient and Rumen Fermentation Studies of Indian Pasture Legumes for Sustainable Animal Feed Utilisation in Semiarid Areas. *Animals*. 13(23): 3676.
- Siswanto, D., B. Tulung, K. Maaruf, M. R. Waani, dan M. M. Tindangen. 2016. Pengaruh pemberian rumput raja (*Pennisetum purpupoides*) dan tebon jagung terhadap pencernaan NDF dan ADF pada sapi PO pedet jantan. *Zootec*. 36(2): 379-386.
- Soltan, Y. A., A. S. Morsy, S. M. A. Sallam, H. Louvandini, and A. L. Abdalla. 2012. Comparative in vitro evaluation of forage legumes (*prosopis*, *acacia*, *atriplex*, and *leucaena*) on ruminal fermentation and methanogenesis. *Journal of Animal and Feed Sciences*. 21(4): 759-772.
- Somanjaya, R., dan A. Falahudin. 2021. Uji Kualitas Pakan Komplit Berbasis Hijauan Sorgum-Indigofera Untuk Induk Domba Prolifik. *Agrivet: Jurnal Ilmu-Ilmu Pertanian dan Peternakan*. 9(2): 148-157.
- Steel, R. G. D., and J. H. Torrie. 1996. *Principles and Procedures of Statistics; a Biometrical Approach*. McGraw-Hill Book Company. New York.
- Suak, J., J. J. M. R. Londok, dan Y. S. H. Kowel. 2023. Kecernaan bahan kering dan bahan organik ransum broiler yang ditambahkan mananoligosakarida (MOS) berasal dari ampas kelapa. *ZOOTEC*. 43(2): 273-279.
- Suningsih, N., S. Novianti, dan J. Andayani. 2017. Level larutan mcdougall dan asal cairan rumen pada teknik in vitro. *Jurnal Sain Peternakan Indonesia*. 12(3): 341-352.
- Suong, N. T. M., S. Paengkoum, A. Z. M. Salem, P. Paengkoum, and R. A. P. Purba. 2022. Silage fermentation quality, anthocyanin stability, and in vitro rumen fermentation characteristic of ferrous sulfate heptahydrate-treated black cane (*Saccharum sinensis* R.). *Frontiers in Veterinary Science*. 9: 896270.
- Syamsi, A. N., F. M. Suhartati, dan W. Suryapratama. 2017. Pengaruh Daun Turi (*Sesbania grandiflora*) dan Lamtoro (*Leucaena leucocephala*) dalam ransum sapi berbasis indeks sinkronisasi protein-energi terhadap sintesis protein mikroba rumen. *Pastura*. 6(2): 47-52.

- Tanuwiria, U. H., dan R. Hidayat. 2019. Efek level tanin pada proteksi protein tepung keong mas (*Pomacea canaliculata*) terhadap fermentabilitas dan pencernaan in vitro. *Jurnal Ilmu Ternak Universitas Padjadjaran*. 19(2): 122-130.
- Tanwar, R., A. Panghal, G. Chaudhary, A. Kumari, and N. Chhikara. 2023. Nutritional, phytochemical and functional potential of sorghum: A review. *Food Chemistry Advances*. 3: 100501.
- Termizi, M., A. Razak, Nasarudin, Hairolnizam, F. Amalina, S. Sulaiman, Ab Hamid and N. Samat. 2024. A review: The Utilization of *Indigofera zollingeriana* as Animal Feed Additional Supplements. *Journal of University Malaysia Pahang*. 4: 118-123.
- Tilley, J. M. A. And R. A. Terry. 1963. A two stage technique for the in vitro digestion of forage crops. *Journal Of British Grassland Society*. 18: 104 – 111.
- Tunkala, B. Z., K. DiGiacomo, P. S. A. Hess, C. P. Gardiner, H. Suleria, B. J. Leury, and F. R. Dunshea. 2023. Evaluation of legumes for fermentability and protein fractions using in vitro rumen fermentation. *Animal Feed Science and Technology*. 305: 115777.
- Turangan, G. G., B. Tulung, Y. R. L. Tulung, and M. R. Waani. 2018. Kecernaan NDF dan ADF yang mendapat suplementasi Urea Molasses Multinutrient Block (UMMB) dari beberapa jenis limbah pertanian dan rumput lapang pada sapi Peranakan Ongole (PO). *Zootec*. 38(2): 320-328.
- Uddin, M. J. Khandaker, Z. H. Khan, M. Jasimuddin, and M. M. Hasan. (2015). Dynamics of microbial protein synthesis in the rumen-A Review. *Annals of Veterinary and Animal Science*. 2(5): 116-131.
- Verdugo, A. C. 2016. Effect of lipid supplementation on ruminal epithelial membrane fatty acid composition and short-chain fatty acid absorption. Doctoral dissertation. University of Saskatchewan.
- Vila-Real, C., A. Pimenta-Martins, N. Maina, A. Gomes, and E. Pinto. 2017. Nutritional value of indigenous whole grain cereals millet and sorghum. *Nutrition and Food Science International Journal*. 4(1).
- Vinyard, J. R., and A. P. Faciola. 2022. Unraveling the pros and cons of various in vitro methodologies for ruminant nutrition: a review. *Translational Animal Science*. 6(4): 130.
- Wafaey, A. A., S. S. El Hawary, F. Kirolos, and M. F. Abdelhameed. 2023. An overview on *Gliricidia sepium* in the pharmaceutical aspect: A review article. *Egyptian Journal of Chemistry*. 66(1). 479-496.
- Wahyono, T., I. Sugoro, A. Jayanegara, K. G. Wiryawan, and D. A. Astuti. 2019. Nutrient profile and in vitro degradability of new promising mutant lines sorghum as forage in Indonesia. *Adv. Anim. Vet. Sci*. 7(9): 810-818.

- Wang, S., M. Terranova, M. Kreuzer, S. Marquardt, L. Eggerschwiler, and A. Schwarm. 2018. Supplementation of pelleted hazel (*Corylus avellana*) leaves decreases methane and urinary nitrogen emissions by sheep at unchanged forage intake. *Scientific reports*. 8(1): 5427.
- Weimer, P. J. 2022. Degradation of cellulose and hemicellulose by ruminal microorganisms. *Microorganisms*. 10(12): 2345.
- Yáñez-Ruiz, D. R., A. Bannink, J. Dijkstra, E. Kebreab, D. P. Morgavi, P. O’Kiely, and A. N. Hristov. 2016. Design, implementation and interpretation of in vitro batch culture experiments to assess enteric methane mitigation in ruminants—a review. *Animal Feed Science and Technology*. 216: 1-18.
- Yanti, G., N. Jamarun, and T. Astuti. 2021. Quality improvement of sugarcane top as animal feed with biodelignification by *phanerochaete chrysosporium* fungi on in-vitro digestibility of NDF, ADF, Cellulose and hemicellulose. In *Journal of Physics: Conference Series*. IOP Publishing. 1940(1): 012063.
- Yu, J., N. Paterson, J. Blamey, and M. Millan. 2017. Cellulose, xylan and lignin interactions during pyrolysis of lignocellulosic biomass. *Fuel*. 191: 140-149.
- Zain, M., Despal, U. H. Tanuwiria, R. Pazla, E. M. Putri, and U. Amanah. 2023. Evaluation of legumes, roughages, and concentrates based on chemical composition, rumen degradable and undegradable proteins by in vitro method. *International Journal of Veterinary Science*. 12(4): 528-538.
- Zain, M., E. M. Putri W. S. N. Rusmana, and M. Makmur. 2020. Effects of *Leucaena leucocephala* Supplementation to Total Mixed Ration Based on Ammoniated Rice Straw On fiber Digestibility and rumen fermentation characteristic in vitro. *International Journal on Advanced Science, Engineering and Information Technology*. 9(3): 2088-5334.
- Zain, M., E. M. Putri, W. S. N. Rusmana, E. Erpomen, and M. Makmur. 2020. Effects of supplementing *Gliricidia sepium* on ration based ammoniated rice straw in ruminant feed to decrease methane gas production and to improve nutrient digestibility (in-vitro). *Int. J. Adv. Sci. Eng. Inf. Technol*. 10(2): 724-729.
- Zain, M., J. Rahman, K. Khasrad, and E. Erpomen. 2015. In vitro fermentation characteristics of palm oil byproducts which is supplemented with growth factor rumen microbes. *Pakistan Journal of Nutrition*. 14(9): 625-628
- Zain, M., R. W. Ningrat, E. M. Putri, and M. Makmur. 2019. The effects of leguminous supplementation on ammoniated rice straw based completed feed on nutrient digestibility on in vitro microbial protein synthesis. In *IOP Conference Series: Earth and Environmental Science*. IOP Publishing. 287(1): 012018.
- Zain, M., U. H. Tanuwiria, J. A. Syamsu, Y. Yunilas, R. Pazla, E. M. Putri, and B. Bagaskara. 2024. Nutrient digestibility, characteristics of rumen fermentation, and microbial protein synthesis from Pesisir cattle diet

containing non-fiber carbohydrate to rumen degradable protein ratio and sulfur supplement. *Veterinary World*. 17(3): 672.

- Zhang, S. J., A. S. Chaudhry, A. Osman, C. Q. Shi, G. R. Edwards, R. J. Dewhurst, and L. Cheng. 2015. Associative effects of ensiling mixtures of sweet sorghum and alfalfa on nutritive value, fermentation and methane characteristics. *Animal Feed Science and Technology*. 206: 29-38.
- Zhang, X. X., Y. X. Li, Z. R. Tang, W. Z. Sun, L. T. Wu, R. An, and Z. H. Sun. 2020. Reducing protein content in the diet of growing goats: implications for nitrogen balance, intestinal nutrient digestion and absorption, and rumen microbiota. *Animal*. 14(10): 2063-2073.

