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Milk Production of Dairy Cattle Supplemented with Corn-Based Total Mixed Ration with *Moringa oleifera* (C-TMR-M)

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Abstract

Dairy cattle need to be fed with an adequate amount of forage that has complete composition so that production performance will be improved. The study was conducted to determine the milk production of dairy cattle supplemented with Corn-based Total Mixed Ration with *Moringa oleifera* (C-TMR-M). Eighteen (18) dairy cattle were randomly assigned into three treatments following the layout of Randomized Complete Block Design (RCBD). Each block contained different stages of lactation as Early Lactation (EL), Mid-lactation (ML), and Late Lactation (LL). The three (3) treatments were T1 (C-TMR only), T2 (C-TMR-M with 5% *M. oleifera*), and T3 (C-TMR-M with 10% *M. oleifera*). The feeding trial was done for 30 days, and the data collected were analyzed through Analysis of Variance in RCBD and Descriptive Statistics through ranking. The average milk production revealed that T2 got the highest mean value of 10.07 kg, followed by T3 with 9.2 kg, and the lowest was T1 with 7.3 kg. The total milk production showed that T2 had the highest yield of 1,812 kg, followed by T3 with 1,650 kg, and T1 got the lowest yield of 1,428 kg. The Analysis of Variance showed a significant difference between treatment means. The findings indicate that milk production of dairy cattle was greatly enhanced with C-TMR-M supplementation. Based on the results of the study, it can be concluded that the feeding of Corn-based Total Mixed Ration with *Moringa* (C-TMR-M) can improve milk yield in dairy cattle.

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Introduction

The main goal of dairy farming is to maintain high milk production of good quality; hence adequate, effective fiber should also be maintained that is balanced for high milk production. Total Mixed Ration is known to be very helpful in dairy cows worldwide, providing a cow to attain maximum performance (Ishler *et al.*, 2023; Serpa, 2020). It is now the most approved method for feeding high-performing, in-housed dairy cattle in the world. This is usually supplemented by feeding a nutritionally-balanced ration at all times (Singh *et al.*, 2022). However, proper feeding management practices must always be employed to ensure the excellent performance of dairy cows. Feeding is sometimes accompanied by supplements to improve performance on the milk yield and milk composition in dairy cattle. On the other hand, the monitoring and updating of ration formulation is also done based on the milk production performance of dairy cows. Successful dairy farming is dependent on the management practices of the herd provided by the farmer.

Corn is one of the crops used in dairy feeding. It ranks second to wheat among the world's crops. Crop residue of corn or maize can be utilized as feed for dairy farming and is recounted to be the most used crop residue for animal nutrition (Mugerwa *et al.*, 2012). Most of the crop residues are not utilized for compost making and nutrient recycling but are preferred to be processed for animal feed processing, either straws or stovers. This will be enhanced by processing it as corn silage for cow feeding (Weiss, 2019; Hisadome, 2022). According to Ferreira *et al.* (2016), corn silage is the main ingredient for diets in dairy cattle. However, corn silage trials are needed to determine which variety can maximize production in a particular place and location as influenced by environmental factors.

Dairy cows need to be fed adequate amounts of forage that have complete nutrient composition so that milk yield and milk quality will be improved. According to Mickayla *et al.* (2018), giving sufficient forage to dairy cattle can optimize milk production. The effects of feeding a Total Mixed Ration with corn were experimented and had a significant result on the production performance of dairy cattle (Hundal *et al.*, 2004). Corn has been used in dairy cow feeding and given fresh to the animals. Dairy farmers fed corn with the other forage as fresh, but physiologically, cows can digest better ensiled than fresh forages.

The feeding whole plant silage and grain (Ipharraguerre *et al.*, 2003) were studied and ensiled together with the other forages. It is recommended to optimize the utilization and prevent wastage of forage during feeding. Further, it can be enhanced if supplementation with the inclusion of pure organic herbs is employed on the farm. *Moringa oliefera* is one of the pure organic herbs fed to dairy cattle. According to Sanchez (2011), *M. oleifera* can be fed as fresh or ensiled to dairy cows. With the increasing demand for milk nowadays, the adoption of modern technologies (Sitdikov *et al.*, 2020) is necessary to be embraced in dairy farming to have an efficient and profitable production. Every dairy farm aims to sustain high milk production to satisfy the people's need for milk. These possibilities can be realized if innovative strategies in feeding be applied to dairy production.

The supplementation of *M. oleifera* to the diet of dairy cattle can be measured as advanced technology in feeding dairy cows. Worku (2012) emphasized that the leaves of *M. oleifera* are highly nutritious with excellent palatability, digestibility, and balanced chemical composition of protein and minerals. Several studies were undertaken on Total Mixed Ration (TMR) supplementation (Hernadez *et al.*, 2014; Abdelrahman *et al.*, 2022) to assess the productivity and performance of dairy cows. This study aimed to evaluate daily milk production and total milk yield of dairy cattle supplemented with CTMR with the inclusion of different levels of *M. oleifera* in the diet of dairy cows.

Material and methods

Site selection

The processing of C-TMR-M and supplementation to dairy cattle were done at the Dairy Farm of the University of Science and Technology of Southern Philippines (USTP – Claveria Campus) at Lupok Claveria, Misamis Oriental from September 2021 to February 2022. The dairy cattle used were those with early, mid-lactation, and late lactation. The materials used were the components of C-TMR-M (Corn, Madre de cacao, *Moringa oliefera,* molasses, rice bran, copra meal), a forage chopper, a plastic drum, silo, a milking machine, and a milk bucket.

Formulation of concentrate

The preparation of concentrate was formulated through the Pearson Square Method of compounding ration that considers only two feed ingredients. The formulation was based on the standard 15% Crude Protein (%CP) requirement of dairy cows. The ration components were Copra meal as the protein source and rice bran as the energy source. The parts by weight computed per ingredient were 71.43 kg Rice bran and 28.57 kg Copra meal which is made up of 100 kg of concentrate.

Feeding scheme of dairy cattle

The experimental animals were fed based on the 2% Dry Matter (DM) requirement of dairy cows and body weight, as presented below. During the feeding test, the desired amount of concentrate was mixed into the corresponding amount of silage needed per cow per treatment provided before the milking schedule.

$$\text{DM Requirement of Dairy Cattle (kg)} = \text{Weight of cow (kg)} \times 2\%\ \text{DM}$$

$$\text{Amount of Silage (kg)} = \frac{\text{DM Requirement of Cow} \times 80\%}{25\ \%\ \text{DM of Silage}} \times 100\%$$

$$\text{Amount of Concentrate (kg)} = \frac{\text{DM Requirement of Cow} \times 20\%}{80\ \%\ \text{DM of Concentrate}} \times 100\%$$

Experimental design and treatments

Eighteen milking cows of the same parity were used in the study, randomly selected and distributed to three treatments consisting of three replications with two cattle per treatment. The study utilized the Randomized Complete Block Design (RCBD) in the experimentation and the Anova Table of RCBD in analyzing the data collected. In blocking, dairy cattle with different stages of lactation, such as Early Lactation (EL), Mid lactation (ML), and Late Lactation (LL), were considered so that accurate results would be obtained during the conduct of the study. The Dairy cattle were fed 80% C-TMR, C-TMR-M with different levels of *M. oleifera,* and 20% Formulated concentrate before milking for 30 days. The different treatments of the study were Treatment 1(C-TMR) as control, Treatment 2 (C-TMR-M with 5% *M. oleifera,* and Treatment 3 (C-TMR-M with 10% *M. oleifera*).

Data analysis

The data collected daily on the milk production of dairy cattle were measured in the morning and afternoon and recorded accordingly. The average milk produced per treatment was calculated and analyzed through the Analysis of Variance (ANOVA) Table in RCBD and the Least Significant Difference (LSD) Test. The comparison of the total amount of milk produced per treatment was analyzed using Descriptive Statistics through ranking to determine which treatment significantly affected the milk production of dairy cattle.

Results and discussion

Average daily milk production (kg)

The average daily milk production of dairy cattle was recorded from the start of feeding C-TMR-M up to 30 days of supplementation, as shown in Table 1. As presented, Treatment 2 predominantly got the highest mean value of 10.07 kg, followed by Treatment 3 with 9.2 kg, and the lowest mean value was observed in Treatment 7.93 kg. The trend of milk production is high in Treatment 2 with 5% *M. oleifera* and similarly higher yield in Treatment 3 with 10% *M. oliefera* as compared to Treatment 1 with no *M. oleifera* supplementation. The Analysis of Variance showed significant differences between treatment means, which was determined between Treatment 2 and Treatment 1. The supplementation of CTMR-M greatly influenced the production of milk in dairy cattle. In the Mid-lactation and Late Lactation stages,

the milk yield is supposedly declining. However, when supplemented with CTMR-M, it caused to increase in the milk production of dairy cattle. The study of Babu (2016) on " *M. oleifera* as a "Potential Feed for Livestock and Aquaculture Industry" showed that feeding leaves of *M. oleifera* had variable effects on DM intake and milk yield. A similar study by Sanchez *et al.* (2006) concluded that feeding *M. oleifera* as fresh and ensiled to dairy cows primarily affects the quality and quantity of milk produced. According to Bashar *et al.* (2020), feeding *M. oleifera* improved the productivity of dairy cattle.

Table 1. Average daily milk production of dairy cows with CTMR-M supplementation.

	Replication				
Treatment	R1	R2	R3	Treatment Total (T)	Treatment Mean
T1	7.8	8.5	7.5	23.8	7.93[b]
T2	10.5	10.5	9.5	30.2	10.07[a]
T3	9.8	8.5	9.3	27.6	9.2[ab]
Replication Total (R)	28.1	27.1	26.3		
Grand Total				81.6	
Grand Mean					9.07

F-test = significant (*)

CV = 6.09%

Means with not the same letters are significantly different.

Total milk produced (kg)

The total milk produced by dairy cattle after the supplementation of C-TMR-M is presented in Fig. 1. The data showed that Treatment 2 (C-TMR-M) with 5% *Moringa*) had the highest milk production of 1,812 kg, followed by Treatment 3 (C-TMR-with 10% *Moringa*) with 1,650 kg, and the lowest production was observed in Treatment 1 (C-TMR) with 1,428 kg.

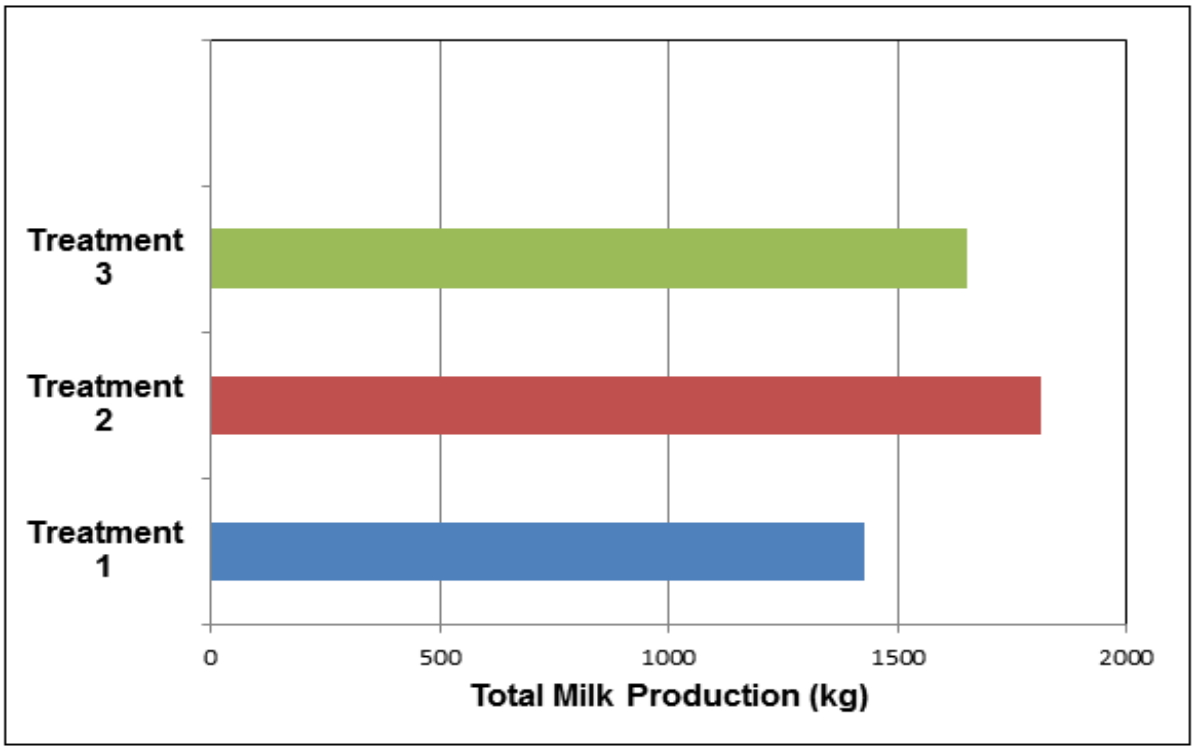

Fig. 1. Total milk production of dairy cattle after 30 days of C-TMR-M supplementation.

The treatments with the inclusion of *M. oleifera* supplementations are higher compared to Treatment 1 without *M. oleifera*. The feeding of C-TMR-M greatly influenced the milk production of dairy cattle for 30 days. According to Zhang *et al.* (2018), the supplementation of *M. oleifera* increased milk yield in dairy cows. A similar study conducted by Mendieta *et al.* (2011) showed that including *M. oleifera as a* galactagogue in dairy diets increased the milk production of dairy cattle. Likewise, the study of Cohen-Zinder *et al.* (2017) showed that dairy cattle fed *M. oleifera* silage had higher milk production.

Conclusion

The supplementation of Corn-based Total Mixed Ration with *Moringa oleifera* (C-TMR-M) showed satisfactory results, particularly in Treatment 2, with the highest milk produced compared to the other treatments. A 5% level of *M. oleifera* added in Corn-based Total Mixed Ration significantly enhanced milk production of dairy cows for 30 days. Based on the study's findings, it is suggested to supplement Corn-based Total Mixed Ration with 5% Moringa (Treatment 2) in the diet of dairy cattle. Better results were obtained in dairy cows supplemented with Corn-based Total Mixed Ration with *M. oleifera* (C-TMR-M), where the yield was also noticeably increased upon supplementation.

References

Abdelrahman MM, Alhidary IA, Matar AM, Alobre MM, Alharthi AS, Faye B, Aljumaah RS. 2022. Effect of Total Mixed Ration (TMR) Supplementation on Milk Nutritive Value and Mineral Status of Female Camels and Their Calves (Camelus dromedarius) Raised under Semi-Intensive System during Winter. **12,** 1855. https://doi.org/10.3390/agriculture12111855

Bashar MK, Huque KS, Sarker NR, Sultana N. 2020. Quality assessment and feeding impact of Moringa feed on intake, digestibility, enteric CH_4 emission, rumen fermentation, and milk yield. Journal of Advanced Veterinary and Animal Research **7(3),** 521–529. https://doi.org/10.5455/javar.2020.g449.

Babu A. 2016. *Moringa oleifera* as a Potential Feed for Livestock and Aquaculture Industry. https://www.researchgate.net/publication

Cohen-Zinder M, Weinberg Z, Leibovich H, Chen Y, Rosen M, Sagi G, Shabtay A. 2017. Ensiled *Moringa oleifera*: an antioxidant-rich that improves dairy cattle performance. The Journal of Agricultural Science **155(7),** 1174-1186. http://doi.org/10.1017/S0021859617000387

Ferreira G, Brown AN. 2016. Environmental Factors Affecting Corn Quality for Silage Production. http://doi.org/105772/64381. https://www.intechopen.com/51614

Hisadomi S, Oba M. 2022. Evaluation of dehydrated corn silage as the primary forage for lactating dairy cows. JDS Communications **3,** 408-411. https://doi.org/10.3168/jdsc.2022-0268

Hernandez-Ortega M, Martinez-Fernandez A, Solbado A, Gonzalez A, Arriaga-Jordan CM, Argamenteria A, Vicente F. 2014. Effects of total mixed ration composition and daily grazing pattern on milk production, composition and fatty acids profile of dairy cows. Journal of Dairy Research **8(14),** 471-478. http://doi.org/10.1017/S0022029914000399

Hundal J, Gupta R, Wadhwa M, Bakshi M. 2004. Effect of Feeding Total Mixed Ration on the Productive Performance of Dairy Cattle. Animal Nutrition and Feed Technology **4,** 179-186.

Ipharraguerre IR, Younker RS, Clark JH, Stanisiewski EP, Hartnell GF. 2003. Performance of lactating dairy cows fed corn as whole plant silage and grain produced from a glyphosate-tolerant hybrid (event NK603). Journal of Dairy Science **86(5),** 1734–1741. https://doi.org/10.3168/jds.S0022-0302(03)73759-X

Ishler VA, Rosemond R, Beck T, Becker C. 2023. Total Mixed Ration for Dairy Cows. College of Agricultural Sciences. The Pennsylvania State University, 323 Agricultural Administration Building, University Park, PA 16802. https://extension.psu.edu/.

Mendieta-Araica B, Spörndly E, Reyes-Sánchez N, Spörndly R. 2011. Feeding *Moringa oleifera,* fresh or ensiled to dairy cows-effects on milk yield and milk flavor. Tropical Animal Health and Production **43(5),** 1039–1047. https://doi.org/10.1007/s11250-011-9803-7

Mickayla M, Amaral DM. Feeding Corn Silage. Retrieved on September 10, 2020, at http://af3. s.ca.uky.edu/files/choosing a corn silage variety.

Mugerwa S, Kabirizi J, Zziwa E, George L. 2012**.** Utilization of crop residues and agro-industrial by-products in livestock feeds and feeding systems of Uganda. International Journal of Biosciences **2,** 82-89.

Sánchez NR, Spörndly E, Ledin I. 2006**.** Effect of feeding different levels of foliage of Moringa oleifera to Creole dairy cows on intake, digestibility, milk production and composition. *Livestock Science* **101,** 24-31. https://www.semanticscholar.org/paper

Sherpa D. 2020. Demonstration of Total Mixed Ration (TMR) Formulation for the Dairy Farmers of Western Bhutan. https://www.researchgate.net/publication/342436771

Singh N, Awasthi A, Patel P, Kumar G. 2022. Total Mixed Ration Feeding of Dairy Cows. IOSR Journal of Agriculture and Veterinary Science 15, 25-27. 10.9790/2380-1504012527.

Sitdikov F, Ziganshin B, Shaydullin R, Moskvicheva A. 2020. Introduction and Use of Modern Technologies in Dairy Animal Production. Vestnik of Kazan State Agrarian University **15,** 81-87. http://doi.org/10.12737/2073-0462-2020-81-87.

Weiss WP. 2019. Effects of feeding diets composed of corn silage and a corn milling product with and without supplemental lysine and methionine to dairy cows. Journal of Dairy Science **102(3),** 2075–2084. https://doi.org/10.3168/jds.2018-15535

WORKU A. 2016. *Moringa oleifera* as a Potential Feed for Livestock and Aquaculture Industry. African Journal of Agricultural Science and Technology **4(4),** 666-676.

Zhang T, Si B, Deng K, Tu Y, Zhou C, Diao Q. 2018. Effects of feeding a Moringa oleifera rachis and twig preparation to dairy cows on their milk production and fatty acid composition, and plasma antioxidants. Journal of the Science of Food and Agriculture **98(2),** 661–666. https://doi.org/10.1002/jsfa.8511