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Original article

Impact of raking and baling patterns on alfalfa hay dry matter and quality losses

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ABSTRACT

A field study was conducted to investigate the impact of different patterns of raking and baling operations on the dry matter (DM) and quality losses of the produced alfalfa (*Medicago sativa*) hay. The experimental work was carried out on a 50 ha center pivot irrigated alfalfa field in a commercial farm located in the Eastern Region of Saudi Arabia. Raking operation was performed following two patterns corresponding to the direction of mowing operation, namely, Raking-I in the same direction of mowing (Mowing→ and Raking→) and Raking-II opposite to the direction of mowing (Mowing→ and Raking←). The baling operation; however, was performed following four patterns corresponding to the directions of both mowing and raking operations, namely, Baling-I (Mowing→, Raking→ and Baling→), Baling-II (Mowing→, Raking→ and Baling←), Baling-III (Mowing→, Raking← and Baling→) and Baling-IV (Mowing→, Raking← and Baling←). Results showed that cumulative DM losses in alfalfa hay yield of 30.93% occurred during the harvesting operations. Out of which, raking induced the most DM losses of 985.22 kg ha^{-1} (59.66% of the total DM losses and 17.35% of the total hay yield). However, the least DM losses were observed during the baling operation and were estimated at 175.81 kg ha^{-1} (10.22% of the total DM losses and 3.10% of the total hay yield). Raking opposite to the direction of mowing reduced the DM losses by 130.17 kg ha^{-1} (7.88% of the total DM losses and 2.29% of the total hay yield) compared to that with the direction of mowing. Results also indicated that out of the 21.04% losses in the total crude protein (CP) content of the produced alfalfa hay, 10.91% occurred during the raking operation. However, the baling operation induced the least amount of CP losses (only 2.32% of the total CP). Overall, the best results in terms of alfalfa hay quality and quantity losses were achieved with Baling-III, where the lowest DM losses (2.01% of the total hay yield) and the lowest CP losses (1.44% of the total CP) were recorded.

1. Introduction

Alfalfa (*Medicago sativa*) is one of the most important forage crops cultivated worldwide in more than 80 countries covering an area of more than 35 million ha (Radovic et al., 2009). The total area in Saudi Arabia cultivated with Alfalfa crop was estimated at 123,837 ha in the year 2011, with a total alfalfa hay production of 2,550,789 tons. The importance of alfalfa, as a forage for dairy and livestock animals originates from its high nutritive value and high digestibility, particularly for ruminants (Deshpande et al., 2002). Alfalfa is commonly used for livestock nutrition in different forms, such as hay, silage, dehydrated in form of briquettes and as pastures open for grazing (Radovic et al., 2009).

There are great differences between hay-making practices conducted in humid and arid regions. In humid regions, hay producers and researchers tend to improve hay drying rates under field conditions, enhance hay bale ventilation and to use preservatives, such as propionic acid, to preserve the product for a longer time period under the wet conditions. In arid regions; however, hay baling is practiced only after the dew is accumulated on soft plant tissues to reduce losses of leaves. For the same reason, researchers developed new systems to apply fine mist water on plant tissues while baling (Shinners et al., 2006). However, during the harvesting process, losses increase as the dry matter content of the crop increases (Rotz and Muck, 1994).

The quality of forage has a direct effect on animal performance, forage value and profits. Forage species, leaf to stem ratio, stage of

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