Dehydration curve of Tifton 85 hay dried in the sun and in the shed

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Introduction The negative consequences for a hay that wasn't dried enough, due to unfavorable environmental conditions are associated with reduced nutritional value, primarily by microbial activity, followed by heat generation, which favors the oxidation of non-structural carbohydrates, increase of fibrous components, protein degradation and the growth of fungi, which may be associated with the production of mycotoxins. These changes may decrease animal performance (Coblentz et al., 2000). The main factors affecting the rate and extension of hay-making are the initial water content, the age of re-growth and environmental factors such as: solar radiation, temperature, air humidity, soil moisture, rainfall and plant characteristics associated with the management of hay-making process, influencing both the process of drying and wetting (Rotz, 1995). The aim of this study was to access the dehydration curve of Tifton 85 hay dried in the field under the sun or in the shed.

Materials and Methods The experiment took place between October 2010 and January 2011, in a field of hay production implanted with Tifton 85 in Marechal Cândido Rondon, Paraná, Brazil (24 º 33'40"S, 54 º 04'12"W, elevation 420 m). The experimental plots were five nitrogen rates (0, 25, 50, 75 and 100 kg ha^{-1}), two ages of re-growth (28 and 35 days) and four replications. For each age of re-growth there were two ways of drying: the field under the sun and in the shed. There were performed four sampling times (0, 8, 23 and 32 hours after harvesting) for drying in the sun and twelve sampling times (0, 3, 18, 27, 42, 51, 66, 75, 90, 99, 114 and 123 hours after harvesting) for drying in shed, with turning twice a day. The curves of dehydration of both ages and shapes of dehydration were determined.

Results and Discussion For harvesting with re-growth ages of 28 and 35 days, which drying was performed at field under the sun, there was an adjustment period of dehydration by polynomial regression model of degree 3 (Figure 1). In the step until about 8 hours after the cuts, it was observed a rapid loss of water, more than 6 g g^{-1} h^{-1} of dry matter (DM). This result was favored by high moisture content of the forage, by the stomata opening in the first hour after harvesting and the deficit of steam pressure between air and dehydrating forage (Collins and Coblentz, 2007) and favorable weather conditions, resulting in an average rate of dehydration until 32 hours after harvesting of 2 g g^{-1} h^{-1} of DM. In the period between 8 and 23 hours, the reduction of dehydration intensity was attributed to the dew, the drop in temperature, reduction of radiation and the increase in average and minimum air humidity during the night. The dehydration curves of dried fodder in the shed (Figure 2) were obtained after 123 h of dehydration and adjusted to the linear regression, although the appropriate content (> 85%) of DM for the age of re-growth in 35 days were not achieved due to the maintenance of higher humidity, in consequence of rain. These environmental conditions and the way to make dehydration resulted in dehydration rates of 0.4983 and 0.3942 g g^{-1} h^{-1} DM for 28 and 35 days re-growth, respectively. The dehydration rates can achieve progressive rates near zero, due to the balance between the steam water pressure contained in the plant and the surrounding environment and may remain unchanged in moisture content indefinitely, if the environment is favorable to it (Rotz, 1995). There were no re-wetting cycles of grass in the process of Tifton 85 hay production in the shed because it was protected from dew and moisture of the soil and this is consistent with that reported by Neres et al. (2010). A possible explanation for the long period of dehydration may have not been utilization of the solar radiation in the shade of the shed. According to Wright et al. (2000), with ryegrass in controlled environmental conditions, it was found that the radiation was more important than the pressure deficit between plant and environment and wind speed, due to the effect on the evaporation of internal moisture content of the plant.

Conclusion In tropical climate, it is possible to produce hay of Tifton 85 grass with overgrowth age of 28 and 35 days in field conditions under the sun, in a cut-off time smaller than 40 hours, with rapid drying in the initial period even if there is a little re-wetting by the dew at night and with a daily revolving. The time required for the production of hay in shed is more than 120 hours and is difficult to achieve proper levels of dry matter.

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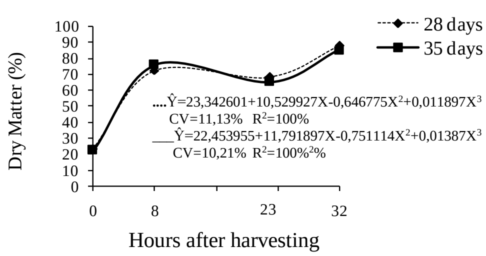

Figure 1. Dehydration curves of Tifton 85 hay drying in the sun with two ages of re-growth and two cuts. The regression coefficients were significant at 1% probability by t test.

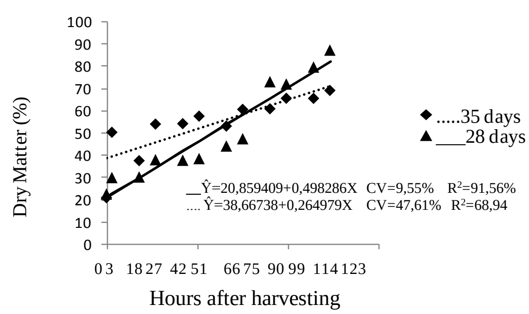

Figure 2. Dehydration curves of Tifton 85 hay dried in shed with two ages of re-growth and two cuts. The regression coefficients were significant at 1% probability by t test.