The effect of a hay tedder on the field drying rate

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Pattey, E., Savoie, P. and Dubé, P. A. 1988. The effect of a hay tedder on the field drying rate. Can. Agric. Eng. 30: 43–50. Most herdsmen in Eastern Canada conserve forage as hay to meet their livestock needs during the winter. The hay tedder can improve drying conditions by spreading and fluffing the hay swath and consequently reduce drying time and weather damage risk. The present research was initiated to quantify the effect of tedding on the hay drying rate. A hay tedder was evaluated in 1984 over four large timothy plots (37 m by 152 m) and in 1985 over three timothy plots and two alfalfa plots. The forage was mowed at three dates (10 June, 25 June, 9 July) during the first growth cycle to consider the effect of crop maturity. The cut forage was left initially either in a wide swath (1.83 m average) or in a narrow windrow (1.14 m) behind an average mowing width of 2.59 m. The crop was generally tedded in the morning of the second drying day. Under favorable weather, tedding increased the drying rate of narrow (wetter) windrows by 77% and of wide (drier) swaths by 22%, over a 3-h period. Over an 8-h period after tedding, drying rate increases were 58 and 28% for narrow and wide swaths, respectively. Under more humid conditions, tedding increased the drying rates by 46% over a 3-h period and by 39% over an 8-h period with little difference between wide or narrow windrows. Tedding was more efficient in wet and early-maturity hay. No significant differences were identified between alfalfa and timothy in their drying response to tedding. These results should eventually be integrated in a hay harvest management system to help farmers decide whether tedding is appropriate and when it might be applied profitably.

La majorité des éleveurs de l’Est du Canada recoltent le fourrage sous forme de foin pour alimenter le bétail durant l’hiver. Le faneur a toutefois un rôle important pour améliorer les conditions de séchage du foin en soulevant l’andain; de cette façon, le faneur réduit le temps de séchage au champ et le risque pour l’andain d’être avarié par la pluie. Dans ce projet de recherche, on a quantifié l’effet du faneur sur le taux de séchage du foin. On a évalué un faneur à toupies en 1984 sur quatre grandes parcelles de fléole (37 m par 152 m) et en 1985 sur trois parcelles de fléole et deux parcelles de luzerne. On a considéré l’effet de la maturité en fauchant à trois dates au cours du premier cycle végétatif (10 juin, 25 juin et 9 juillet). Les fourrages fauchés sur une largeur moyenne de 2,59 m étaient laissés soit en andain large (1,83 m en moyenne), soit en andain étroit (1,14 m). Le faneur était généralement appliqué le matin suivant la fauche. Sous des conditions climatiques favorables, le faneur a augmenté le taux de séchage d’andains étroits (plus humides) de 77% et celui d’andains larges (plus secs) de 22% pour une période de trois heures. Durant une période de huit heures après le faneur, l’augmentation du taux de séchage était de 58% et 28% dans des andains étroits ou larges, respectivement. Sous des conditions humides, le faneur a augmenté le taux de séchage de 46% pour une période de trois heures et de 39% pour une période de huit heures; il y avait peu de différence entre des andains larges et des andains étroits. Le faneur est plus utile dans le fourrage jeune et humide. On n’a pas noté de différence significative entre la fléole et la luzerne; les changements de taux de séchage étaient sensiblement les mêmes pour les deux cultures à la suite du faneur. Ces résultats pourraient éventuellement être intégrés dans un modèle décisionnel de fenaision pour évaluer l’utilité économique du faneur et établir le meilleur moment d’application.

INTRODUCTION

A majority of farmers in Eastern Canada conserve forage as hay to meet their livestock needs during the winter. Good-quality hay requires a short drying period with minimal material losses during harvest. Fast drying can be achieved with multiple mechanical treatments but such treatments may cause leaf fragmentation losses. If a treatment saves hay from being rained on and allows it to be baled quickly, small treatment losses may well be justified in comparison with the losses that would be incurred through prolonged exposure to the elements. The hay tedder generally improves the drying conditions by spreading the hay swath over a large area. Losses depend on the moisture content, the maturity of the crop and the species. The present research was initiated because of the lack of quantitative information on the drying rate and losses associated with tedding. This article describes the effect of tedding on the hay drying process; another paper deals with losses due to tedding (Savoie 1988).

LITERATURE REVIEW

The evaporative rate of mowed forage depends on the crop, forage handling and the environment. Forage maturation decreases initial moisture content and the cuticular resistance to water evaporation (Jones 1979; Jones and Prickett 1979).

Evaporation from freshly cut windrows occurs primarily from the surface exposed to direct solar radiation. Spreading the crop at mowing maximizes the energy intercepted for drying (Jones and Harris 1979). Subsequently, the thin layer becomes a disadvantage because it can promote a greater uptake of moisture per unit herbage dry matter from the soil, stubble, rain and dew. Wilman and Owen (1982) recommended raking the crop in a narrow windrow around 0.67 g/g (40% moisture on a wet basis).

Tedding soon after mowing doubled the drying rate; moisture content decreased from 4 to 2 g/g in 6 h (Jones and Prickett 1981). Frequent tedding during the initial drying period ensured a more uniform moisture content throughout the swath but had little effect on the total moisture loss compared with a single tedding treatment. However, frequent tedding was more efficient when swath water content ranged between 1 and 2 g/g. During this stage, a high resistance to water diffusion seemed to develop rapidly at the surface. Frequent disturbances led to a favorable microclimate both inside and at the surface of the swath. At moisture contents below 1 g/g, tedding had little effect on the drying rate. Physiological resistances to moisture loss became more important than the swath environment (Jones and Harris 1979).
represented one experimental unit. Initially, windrows were left
July in 1984; 10 June, 25 June and 9 July in 1985. These dates
by 51 m, to be cut at 2-wk intervals: 11 June, 27 June and 9
bud stage, 10% bloom and full bloom for alfalfa. No maturity

correspond approximately to the early boot, heading, and half-

Hesston 1091 mower using rubber roll conditioners. Windrows
were mowed lengthwise (51 m); three side-by-side windrows
were randomly as were the cutting dates inside the crops. The two

plots were divided into subplots measuring 37 m
randomly as were the cutting dates inside the crop. The two

The statistical comparison of field drying treatments required
measuring or calculating a drying parameter. Such a parameter
will usually confound biological, man-controlled and environ-
mental factors. Recent drying models have attempted, at least
partially, to single out the effect of each group of factors
(Thompson 1981; Pitt 1984; Rotz and Chen 1985). If biological
and environmental factors are identical during an experiment,
differences in the drying parameter would be the result of treat-
ment differences only. Under such conditions, an empirical
model describing moisture loss as a function of time may prove
adequate. Lewis (1921) proposed that the rate of moisture loss
was proportional to the difference between average moisture of
the drying material and an equilibrium moisture content.

\[
\frac{dM}{dr} = -k(M-M_e)
\]

(1)

where \(M\) is the average moisture content of the forage (g water/
g dry matter), \(M_e\) is the equilibrium moisture content (g/g), \(k\)

Dernedde (1979) also observed that tedding was more effi-
cient at high moisture contents. Tedding had a greater effect on
the windrows conditioned with rollers because they were wetter
than windrows conditioned with flails.

Savoie et al. (1982) noted that alfalfa talled during the first
cut had a moisture content of 38% (wet basis) while untapped
alfalfa had a moisture content of 42% after 2 or 3 days of field
drying. Moisture differences almost disappeared 1 or 2 days after
tedding had been applied.

**OBJECTIVE**

The main objective of the present paper was to quantify the
effect of tedding on the drying rate of hay. The research also
investigated the importance of initial swath width (wide or nar-
row), the effect of forage maturity confounded with the climate
and the interaction of different forage cultivars and species
(timothy, alfalfa) with each mechanical treatment.

**EXPERIMENTAL PROCEDURE**

Field experiments were carried out at the Deschambault
Research Station (Quebec) during the first growth cycle in the
summers of 1984 and 1985. The common part of the 2 yr of
experiment is constituted by three main plots, measuring 37 m
by 152 m each, containing one of three timothy cultivars
(*Phleum pratense* L.): Champ, Climax and Bounty. In 1984,
there was another plot of Bounty cultivar in the south part of
the site. In 1985, two cultivars of alfalfa (*Medicago sativa* L.):
Saranac and Dekalb were added to the three cultivars of timothy
to establish a comparison between legumes and grasses. Each
main plot was subdivided into three subplots measuring 37 m
by 51 m, to be cut at 2-wk intervals: 11 June, 27 June and 9
July in 1984; 10 June, 25 June and 9 July in 1985. These dates
correspond approximately to the early boot, heading, and half-
blooming-half-anthesis stages for timothy. They correspond to
bud stage, 10% bloom and full bloom for alfalfa. No maturity
difference was observed at the Deschambault site among either
timothy or alfalfa cultivars.

Each subplot was mowed in the morning with a 2.7-m-wide
Hesston 1091 mower using rubber roll conditioners. Windrows
were mowed lengthwise (51 m); three side-by-side windrows
represented one experimental unit. Initially, windrows were left
either in wide or narrow swaths by adjusting the windrow-form-
ing shields. On average, for the three cutting dates, the mowed
width was 2.59 m; narrow windrows were 1.14 m and wide
windrows were 1.83 m.

A Kuhn GF 452T, 5.2-m-wide tedder was planned to be used
when the moisture content was approximately 60% (wet basis
(WB)) and when no rain was forecasted; tedding was generally
applied 24 h after mowing, in the morning of the second drying
day. The tedder had four rotating elements with six fingers each
(1.63 m in diameter). Rotation speed was 235 rpm at 1700 trac-
tor rpm; fingertip speed was 20 m/sec.

Immediately after mowing, short lengths of the windrow were
lifed and deposited on 0.90-m by 1.20-m screens made of 25-
mm-mesh wire. Two trays (samples) were set at a random dis-
tance along the middle windrow of each experimental unit. At
the same time, a sample of forage was picked up near each tray
for initial moisture content measurement by drying in the oven
at 65°C for 72 h (ASAE Standard S358.1). Just before tedding
was applied to half the experimental units, another forage sam-
ple was taken on each tray located in a talled experimental
unit. Forage on the trays was then emptied in the windrow and
trays were removed temporarily as talled was applied; trays
were placed back in the windrow immediately after and forage
samples were taken near them. At the end of the drying ex-
periment, another forage sample was taken from each tray. Trays
were weighed regularly at 3-h intervals in the daytime to meas-
ure the loss of water. The dry matter on each tray at cutting and
tedding was the average of dry matters evaluated from samples
taken at time zero and at the end of the drying period. Moisture
content versus time was established on the basis of water loss
from each tray.

The statistical design for each year was a factorial split-split-
plot design with one replication. Each year, three timothy cul-
tivars constituted one replicated block; three cutting dates
(maturity stages) represented the first split and two mowing
 treatments (wide and narrow swaths) combined with two late
mechanical treatments (tedding and no tending) were the sec-
ond split and the whole factorial. At each date and within each
cultivar subplot, the four treatment possibilities were applied
randomly as were the cutting dates inside the crop. The two
trays included in the experimental unit represented two sam-
ple. The statistical design for the 2 yr was also a factorial split-
split-plot design, but with two replications constituted by the
years. The analysis of variance (ANOVA) was done on the com-
mon part of each year (Table I).

The statistical comparison of field drying treatments required
measuring or calculating a drying parameter. Such a parameter
will usually confound biological, man-controlled and environ-
mental factors. Recent drying models have attempted, at least
partially, to single out the effect of each group of factors
(Thompson 1981; Pitt 1984; Rotz and Chen 1985). If biological
and environmental factors are identical during an experiment,
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model describing moisture loss as a function of time may prove
adequate. Lewis (1921) proposed that the rate of moisture loss
was proportional to the difference between average moisture of
the drying material and an equilibrium moisture content.

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where \(M\) is the average moisture content of the forage (g water/
g dry matter), \(M_e\) is the equilibrium moisture content (g/g), \(k\)

<table>
<thead>
<tr>
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<th>1985</th>
<th>Source of variation</th>
<th>df</th>
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<td>143</td>
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Table II. Daily climatic conditions during the hay drying experiment at Deschambault, in summer 1984

<table>
<thead>
<tr>
<th>Dates</th>
<th>$T_{\text{max}}$ (°C)</th>
<th>$T_{\text{min}}$ (°C)</th>
<th>Radiation (MJ/m²/day)</th>
<th>Rain (mm)</th>
<th>Average wind (m/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st cutting date</td>
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<td>27.5</td>
<td>17.0</td>
<td>23.65</td>
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<td>12 June 1984</td>
<td>25.2</td>
<td>7.0</td>
<td>22.27</td>
<td>0.0</td>
<td>2.91</td>
</tr>
<tr>
<td>13 June 1984</td>
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<td>15.0</td>
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<td>8.4</td>
<td>1.05</td>
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<td>28.15</td>
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Table III. Daily climatic conditions during the hay drying experiment at Deschambault, in summer 1985

<table>
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<tr>
<th>Dates</th>
<th>$T_{\text{max}}$ (°C)</th>
<th>$T_{\text{min}}$ (°C)</th>
<th>Radiation (MJ/m²/day)</th>
<th>Rain (mm)</th>
<th>Average wind (m/sec)</th>
</tr>
</thead>
<tbody>
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<td>6.0</td>
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<td>2.4</td>
<td>1.40</td>
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<td>12 June 1985</td>
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<td>10.41</td>
<td>1.0</td>
<td>0.91</td>
</tr>
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<td>13 June 1985</td>
<td>13.0</td>
<td>10.5</td>
<td>7.91</td>
<td>17.6</td>
<td>0.98</td>
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</tbody>
</table>

Table IV. Average drying constants evaluated over three hours just after tedding at each cutting date in 1984 (four timothy cultivars)

<table>
<thead>
<tr>
<th>Cutting dates</th>
<th>Treatments</th>
<th>11 June 1984</th>
<th>27 June 1984</th>
<th>9 July 1984</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow, non-tedded</td>
<td>0.0887</td>
<td>0.1351</td>
<td>0.1172</td>
<td>0.0886</td>
<td>0.1137</td>
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<tr>
<td>Wide, non-tedded</td>
<td>0.1205</td>
<td>0.1762</td>
<td>0.1758</td>
<td>0.1575</td>
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<tr>
<td>Narrow, tedded</td>
<td>0.1757</td>
<td>0.2212</td>
<td>0.2612</td>
<td>0.1386</td>
<td>0.1929</td>
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<tr>
<td>Wide, tedded</td>
<td>0.1663</td>
<td>0.2004</td>
<td>0.2122</td>
<td>0.1929</td>
<td>0.1929</td>
</tr>
</tbody>
</table>

Table V. Average drying constants evaluated over three hours just after tedding at each cutting date in 1985 (three timothy cultivars and two alfalfa cultivars)

<table>
<thead>
<tr>
<th>Cutting dates</th>
<th>Treatments</th>
<th>10 June 1985</th>
<th>25 June 1985</th>
<th>9 July 1985</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow, non-tedded</td>
<td>0.0726</td>
<td>0.1238</td>
<td>0.0716</td>
<td>0.0886</td>
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<tr>
<td>Wide, non-tedded</td>
<td>0.0885</td>
<td>0.1587</td>
<td>0.0931</td>
<td>0.1122</td>
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<tr>
<td>Narrow, tedded</td>
<td>0.1130</td>
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<td>0.1084</td>
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<td>Wide, tedded</td>
<td>0.1132</td>
<td>0.2179</td>
<td>0.1406</td>
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Table VI. Average drying constants evaluated over 3 h just after tedding at each cutting date in 1984 and 1985 (three timothy cultivars)

<table>
<thead>
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<th>Cutting dates</th>
<th>Treatments</th>
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<th>Second</th>
<th>Third</th>
<th>Average</th>
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<tbody>
<tr>
<td>Narrow, non-tedded</td>
<td>0.0849</td>
<td>0.1380</td>
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<td>Wide, non-tedded</td>
<td>0.1079</td>
<td>0.1717</td>
<td>0.1439</td>
<td>0.1404</td>
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<tr>
<td>Narrow, tedded</td>
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<td>0.2241</td>
<td>0.1705</td>
<td>0.1838</td>
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<tr>
<td>Wide, tedded</td>
<td>0.1483</td>
<td>0.2220</td>
<td>0.1810</td>
<td>0.1828</td>
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</tr>
</tbody>
</table>

RESULTS AND DISCUSSION

Weather was generally favorable for field drying in 1984 but rain occurred during each drying period in 1985 (Tables II and III). The stand purity was above 80% in most fields in both years; in 1985, Champ timothy on the first cutting date and Dekalb alfalfa for all three cuttings were about 50% pure.

The initial moisture content in 1984 and 1985 is illustrated in Figs. 1 and 2. It decreased as the maturity advanced; alfalfa had a higher water content than timothy. Climax was the wettest timothy cultivar during both years.

The short-term effect of tedding on the drying rate was quantified with $k$ values calculated over a 3-h period just after the treatment (Tables IV, V and VI). In 1984, the variance was homogeneous with regard to Bartlett’s test; the analysis of variance was performed without any transformation. We obtained statistically significant differences for swath width ($\alpha = 0.0226$) and for tedding ($\alpha \approx 0.0001$) main effects, but the interaction between swath width and tedding was also highly significant ($\alpha = 0.0015$). Tedding a narrow windrow increased the drying constant by 77%; tedding a wide swath increased the drying constant by 22% (Table IV). Narrow windrows were wetter than wide windrows at the time of tedding; more water was exposed to favorable drying conditions when a narrow...
Figure 1. Water content (kg/kg dry matter) of the standing crop at the time of mowing in 1984.

Figure 2. Water content of the standing crop at the time of mowing in 1985.

windrow was spread out. Mechanical treatments had the same influence on various timothy cultivars and on cutting dates.

Differences in $k$ values between the three dates (Table IV) can be explained at least partially by the weather. During the 3-h interval just after tedding, the total solar radiation was 4.48, 6.12 and 6.50 MJ/m² on 12 June 1984, 28 June 1984 and 9 Sept. 1984, respectively, when tedding was applied. At the second date, a slight amount of rain fallen the night before tedding favored rapid drying of the superficial water.

The 1985 data revealed heterogeneity and lack of normality
due to changes in maturity and climate at the various cutting
dates; the data were transformed before doing the analysis of
variance. The transformed value \((k + 0.5)^{-1/2}\) provided homo-
geneity of the variance and normality of distribution. Table V
indicates that on average tedded windrows \((k = 0.1468 \text{ h}^{-1})\)
had a drying constant 46% greater than the unterred windrows
\((k = 0.1004 \text{ h}^{-1})\). Wide swaths \((k = 0.1331 \text{ h}^{-1})\) dried 18%
faster than narrow swaths \((k = 0.1128 \text{ h}^{-1})\). Both main effects
were statistically significant: \(\alpha = 0.0001\) for tedding and \(\alpha =
0.0005\) for swath width. Contrary to 1984 results, the tedding-
swatch width interaction was not significant in 1985: tedding
applied to narrow swaths increased \(k\) by 0.050 \(\text{h}^{-1}\); applied to
wide swaths it increased \(k\) by 0.043 \(\text{h}^{-1}\). In 1984, the drying
constant increased by either 0.088 or 0.035 \(\text{h}^{-1}\) when tedding
was applied either to narrow or wide swaths (Table IV). Because
weather was generally more favorable in 1984, there was a
greater difference in moisture content of wide and narrow
swaths at the time of tedding. So the narrow (wetter) swaths
responded very favorably to tedding while the wide (drier)
swaths responded less favorably. In 1985, since the weather had
been more humid (Table III), both wide and narrow swaths had
a more similar moisture content at the time of tedding and
responded similarly.

The absolute values of \(k\) after tedding in 1985 (Table V)
depended, for a large part, on the climatic conditions. The 10
June swaths received 11.00 MJ/m² of solar radiation during the
3-h period and were subjected to a small amount of rain that
slowed the evaporative rate after tedding. On the 25 June
swaths, no rain occurred after tedding and the radiation was
11.94 MJ/m², so \(k\) values were higher. The third date had a low
radiation level of 3.81 MJ/m² and low \(k\) values during the period
after tedding.

In 1985, the interactions swath width-cultivars \((\alpha = 0.7835)\)
and tedding-cultivars \((\alpha = 0.3001)\) were nonsignificant. We
could not reject the hypothesis that timothy and alfalfa
responded similarly to the mechanical treatments.

Table VI summarizes the drying constants of timothy grass
for the 2 yr combined analysis. The data were transformed into
\((k + 0.5)^{-1/2}\) for the analysis of variance. Tedding in interaction
with swath width was highly significant \((\alpha = 0.0030)\). Aver-
aged over 2 yr for timothy hay, the drying constants were prac-
tically the same for tedding either narrow windrows \((k =
0.1838 \text{ h}^{-1})\) or wide ones \((k = 0.1828 \text{ h}^{-1})\). However non-
teded wide swaths had a higher drying constant \((k = 0.1404
\text{ h}^{-1})\) than non-tedded narrow windrows \((k = 0.1093 \text{ h}^{-1})\). Ted-
ding increased the drying constant of narrow windrows by 68%;
it increased the drying constant of wide swaths by 30%. Aver-
aged over a 2-yr period, the effect of previous swath width was
of little consequence to the subsequent drying rate after tedding
during the three-hour period.

The effect of tedding on the drying rate over an 8-h period
was also investigated. Results for 1984 and 1985 are in Tables
VII and VIII. In 1984, the tedded windrows \((k = 0.1550 \text{ h}^{-1})\)
dried 43% faster than the unterred windrows \((k = 0.1087
\text{ h}^{-1})\) over an 8-h period. In 1985, the increase was 39%. Absolute
increases of \(k\) due to tedding correspond to 0.046 and 0.032
\(\text{h}^{-1}\) for each year. The drying rate increase observed over a 3-
hour period after tedding is practically maintained over an 8-h
period.

Figures 3, 4 and 5 illustrate the change of moisture content
versus time for Bounty timothy in 1984. During the first drying
day, wide swaths lost more water than narrow swaths. During
the second day, after tedding was applied around 0900 h, tedded
windrows lost water more rapidly than unterted windrows.

Figure 3. Water content (kg/kg dry matter) versus time of timothy grass, Bounty cultivar, mowed on 11 June 1984.
The crop was subjected to four treatment combinations: NT, narrow swath tedded subsequently; WT, wide and
teded swath; NNT, narrow and non-tedded swath; WNT, wide and non-tedded swath.
Table VII. Average drying constants evaluated over 8 h after tedding at each cutting date in 1984 (four timothy cultivars)

<table>
<thead>
<tr>
<th>Cutting dates</th>
<th>11 June 1984</th>
<th>27 June 1984</th>
<th>9 July 1984</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatments</td>
<td>Narrow, non-tedded</td>
<td>0.0729</td>
<td>0.1243</td>
<td>0.1319</td>
</tr>
<tr>
<td></td>
<td>Wide, non-tedded</td>
<td>0.0753</td>
<td>0.1470</td>
<td>0.1406</td>
</tr>
<tr>
<td></td>
<td>Narrow, tedded</td>
<td>0.1107</td>
<td>0.1848</td>
<td>0.2363</td>
</tr>
<tr>
<td></td>
<td>Wide, tedded</td>
<td>0.0953</td>
<td>0.1591</td>
<td>0.2195</td>
</tr>
</tbody>
</table>

Table VIII. Average drying constants evaluated over 8 h after tedding at each cutting date in 1985 (three timothy cultivars) and two alfalfa cultivars

<table>
<thead>
<tr>
<th>Cutting dates</th>
<th>10 June 1985</th>
<th>25 June 1985</th>
<th>9 July 1985</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatments</td>
<td>Narrow, non-tedded</td>
<td>0.0715</td>
<td>0.0848</td>
<td>0.0727</td>
</tr>
<tr>
<td></td>
<td>Wide, non-tedded</td>
<td>0.0809</td>
<td>0.0913</td>
<td>0.0914</td>
</tr>
<tr>
<td></td>
<td>Narrow, tedded</td>
<td>0.0979</td>
<td>0.1298</td>
<td>0.1058</td>
</tr>
<tr>
<td></td>
<td>Wide, tedded</td>
<td>0.0968</td>
<td>0.1281</td>
<td>0.1238</td>
</tr>
</tbody>
</table>

After rainfall the narrow unteded windrows had clearly absorbed much less water than the other windrows (Fig. 3). As the crop matured (Figs. 4 and 5), the initial water content was lower and the effects due to swath width and tedding were small.

A comparison of timothy and alfalfa drying curves (Figs. 6 and 7) in late June 1985 indicates a strong similarity. Alfalfa was initially wetter. Tedding was applied only on the third day because of slow drying during the first 2 days. The wide swaths dried faster than the narrow ones. Tedding applied to the wetter, narrow grass windrow brought the moisture level down to practically the same level as the other windrows. However, the narrow alfalfa windrow was slower to respond to the tedding treatment, perhaps because of the lower moisture content at which the treatment was applied.

CONCLUSIONS

1. In 1984, under favorable weather, tedding increased the drying rate of narrow windrows by 77% and of wide swaths by 22%, over a 3-h period. Over an 8-h period, tedding increased the drying rate of narrow windrows by 58% and of wide ones by 28%.

2. In 1985, under more humid drying conditions, tedding increased the drying rate by 46% over a 3-h period and 39% over an 8-h period. The absolute values of the drying constants were lower in 1985 than in 1984. They were practically the same for tedded hay, irrespective of previous swath width.

3. Tedding was more efficient in wet windrows. The positive effect of tedding on the drying rate is most evident early after mowing, or after a period of rain or dew.

4. Differences between alfalfa and timothy to swath width and tedding were non significant. The drying rate of both crops responded similarly to mechanical treatments.

Figure 4. Water content versus time of timothy grass (Bounty) mowed on 27 June 1984. R. stands for time of raking.
Figure 5. Water content versus time of timothy grass (Bounty) mowed on 9 July 1984.

Figure 6. Water content versus time of timothy grass (Bounty) mowed on 25 June 1985.
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