On the Determination of a Norm for the Dairy Cow.

By

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The importance of analyzing biometrically the types in farm animals was explained by Kislovsky⁽⁸⁾ in detail. The mean has hitherto been used, and the percentage expressed in withers height, as a characteristic of type; these relations, for instance, in the case of Holstein-Friesian cow in many countries, were fully discussed by Komatsuka⁽⁹⁾. On the other hand, a German anthropologist, Rautmann, proposed in 1921 a method from a biometrical standpoint which enables us to solve the problem of determining the "Norm" by making use of mean and standard deviation; he called the "Norm" all the values ranging from $M-\sigma$ to $M+\sigma$ in some morphological and physiological characters. This method was adopted by Michelsson⁽¹²⁾ and others⁽⁷⁾⁽¹⁸⁾ in anthropometrical study, but so far as the writer is aware, it is not yet applied to the field of animal breeding. Therefore the same method is here used to determine the norm in the case of the Holstein-Friesian cow.

As it was shown by three investigators⁽¹⁾⁽⁴⁾⁽¹⁵⁾ that there is a positive correlation between some physical characters and milk production in the Holstein-Friesian cow, some physical characters are taken into account in determining the norm, excepting physiological characters.

Most of the Holstein-Friesians in Japan are those derived from importations made from Holland and America since 1900⁽²⁾, and two standards of perfection, namely, American standard and that of Holland, are adopted by the Central Association of Animal Industry of Japan. A type of cattle may vary under different climatic conditions and managements in such a long course of time, and there appeared some fair Holstein-Friesian cows in Japan recently which are able to beat the world's record in quantity and quality of milk and fat⁽²⁾⁽³⁾. These facts led the writer to compare the type of Holstein-Friesian cow in Japan with that of the native home, Friesland, as well as with that of America, before proceeding to determine the norm.

In selecting the data to compare the types in these three countries the num-

ber of stocks measured, and the date as well as the method of collecting the material are taken into consideration. The data (300 cows) of the writer which were described in detail in a previous paper⁽¹⁷⁾ in 1927, were adopted to represent the type of the Holstein-Friesian cow in Japan, although the material may not be sufficient. As the representatives of the Friesians in Friesland, Momsen's data⁽¹³⁾ carried out with 499 typical cows in 1926 were taken, and Gowen's data (385 cows) appeared in 1925 was used to represent the type of the American Holstein-Friesian cow⁽⁴⁾. To characterize these types of populations eight measurements were taken: 1) withers height; 2) hip height; 3) body length; 4) chest girth; 5) chest depth; 6) chest width; 7) hip width; 8) rump length.

In comparing the type the relation between difference of mean and its error (probable or mean) should be discussed as Heubült⁽⁶⁾ and others⁽⁸⁾⁽¹⁰⁾⁽¹³⁾ have done. Representing the mean obtained by Sasaki, Momsen, and Gowen by $M_1 \pm m_1$, $M_2 \pm m_2$, $M_3 \pm m_3$, respectively first $M_1 \pm m_1$ and $M_2 \pm m_2$ are considered. It will be seen from Table I that the ratios of the differences ($M_1 - M_2$) to their probable errors ($\sqrt{m_1^2 + m_2^2}$) are larger than 3 (probable errors range from 3.1 to 13.6), excepting only one measurement, that of rump length. Therefore a significant difference is found in these two types. It may be almost similar in the case of types between Japan and America, as shown in Table I. From these results it may be concluded that the norm of the Holstein-Friesian cow in Japan should be other than that in Friesland or America; or in other words the norm of the cow suitable to Japanese conditions is needed.

Therefore the norm of the Holstein-Friesian cow in Japan is determined by the writer by Rautmann's method⁽¹⁶⁾, and shown in round numbers for the convenience of practical purposes, as is seen from Table 2. This norm may serve to synthesize a useful Ideal Type⁽¹¹⁾ or Standard of Perfection, on one side, and have a special importance in registering Holstein-Friesian cow at the Central Association of Animal Industry of Japan at present, on the other.

Summary.

1. The existence of a significant difference in type of Holstein-Friesian cow in Japan, Friesland and America is shown.
2. The norm of the Holstein-Friesian cow in Japan is determined.

In conclusion the writer desirous to express his sincere thanks to Y. Habu for kind advice and kind criticism.

Table 1.

Characters	$M_1 \pm m_1$	$M_2 \pm m_2$	$M_3 \pm m_3$	$\frac{M_1 - M_2}{\sqrt{m_1^2 + m_2^2}}$	$\frac{M_1 - M_3}{\sqrt{m_1^2 + m_3^2}}$
Withers height	135.01 $\pm$ 0.12	132.70 $\pm$ 0.12	134.11 $\pm$ 0.25	13.6	3.2
Hip height	136.28 $\pm$ 0.21	133.50 $\pm$ 0.01	136.65 $\pm$ 0.25	13.2	1.1
Body length	162.98 $\pm$ 0.25	165.30 $\pm$ 0.16	157.48 $\pm$ 0.25	7.7	15.3
Chest girth	191.14 $\pm$ 0.35	192.40 $\pm$ 0.22	185.93 $\pm$ 0.51	3.1	8.4
Chest depth	72.29 $\pm$ 0.15	73.80 $\pm$ 0.08	—	8.9	—
Chest width	48.21 $\pm$ 0.27	45.90 $\pm$ 0.10	54.10 $\pm$ 0.25	8.0	15.9
Hip width	54.11 $\pm$ 0.12	56.30 $\pm$ 0.07	—	15.6	—
Rump length	51.94 $\pm$ 0.09	51.80 $\pm$ 0.07	51.82 $\pm$ 0.25	1.3	0.4

Table 2.

Characters	M cm.	σ	M - σ	M + σ	Norm (in round number)
Withers height	135.01	4.84	130.17	139.85	130—140
Hip height	136.28	5.25	131.03	141.53	131—142
Body length	162.98	5.91	157.07	168.89	157—169
Chest girth	191.14	8.88	182.26	200.02	182—200
Chest depth	72.29	3.75	68.54	76.04	69—76
Chest width	48.21	3.49	44.72	51.70	45—52
Hip width	54.11	3.07	51.04	57.18	51—57
Rump length	51.94	2.34	49.60	54.28	50—54

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