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Extent of the Muscatine Series in Muscatine County, Iowa¹

By PIERCE RYAN, S. M. SMITH and F. F. RIECKEN

Abstract. The morphology of the profiles of 35 randomly selected sites in Muscatine County, Iowa, was studied. None of these sites qualified as type locations for the Muscatine series, based on current concepts and definitions of this series. Originally established in Muscatine County in 1916, 38.2 per cent of the soils of the county were classified in this series. Now, Muscatine County seems to be no longer a suitable type location for the Muscatine series.

COLLECTION OF DATA

In this study the authors proposed to prepare a new and revised description for the Muscatine series using current nomenclature (USDA, 1951), and to reestablish, if suitable sites occurred, the type location in Muscatine County. It was not the intent of the authors to revise the current range and concept of the series to permit usage of the series name for the dominant soil condition included in the series in the 1916 survey of the soils of Muscatine County (Hawker and Johnson, 1916).

The 102,912 acres that made up the 38.2 percent of the soils of the county, according to the 1916 soil survey, were classified with the Muscatine series, with silt loam as the major type. The current type location is given as Tama County, Iowa (Smith, 1946a).

To aid in locating possible sites for the type location, profiles collected at 35 randomly selected sites for another purpose were examined. In making site selections, sites evidently disturbed or farmsteads were not examined. New sites were selected, three in each township. At each site a pit 4 to 5 feet deep was dug, a morphological description of the soil prepared, bulk samples collected, and a monolith tray sample taken. Details and records of these are given elsewhere (Ryan, 1959).

PRELIMINARY GROUPINGS OF THE SOIL PROFILES

As the 35 profile sites were randomly distributed over the county, many of the profiles could be excluded readily from further consideration as a possible representative for the Muscatine series. Profiles collected on sandy upland, sandy terrace, and bottomland and other alluvium sites were not considered further, since the

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Muscatine series has been described and is considered as having been developed in uplands from material high in silt and of loessial origin (Hawker and Johnson, 1916; Smith, 1946a). The profiles of the sandy uplands (upland sites that are shallow to sand or have formed part of the profile from sand-containing materials), sandy terraces, and bottomland and other alluvium sites are placed in groups 2, 3, and 4 in Table 1 and are described elsewhere (Ryan, 1959). They are therefore excluded from further consideration here.

The profiles placed in group 1 (Table 1) have formed from materials high in silt and are more than 3½ feet thick. Most of these profiles have silty material to a depth of 5 or 6 feet, some to more than 8 feet. Sand content in the profiles of this group averages about 10 percent, based on particle size analysis data for several profiles (Ryan, 1959).

As shown in Table 1, 16 of the 35 profiles examined are placed in (major) group 1. This group of profiles was next examined in regard to the thickness of the "dark" surface layer. Since the Muscatine series has been described and is considered as having a "thick" dark surface layer (Corliss, 1958; Hawker and Johnson, 1916; Smith, 1946a), those profiles with "thin" dark surface layers would not need to be considered further here as possible type sites for the Muscatine series. To qualify as a "dark" surface layer, the moist soil color must be as dark as, or darker than, very dark grayish brown (10YR 3/2, moist), very dark gray (10YR 3/1, moist), very dark brown (10YR 2/2, moist), or black (10YR 2/1, moist), using Munsell color nomenclature (USDA, 1951). Those portions

Table 1

Preliminary Grouping of the Profiles Collected at the 35 Randomly Selected Sites in Muscatine County

Major group	No. of Profiles	Sub-group	No. of Profiles
1. Profiles of silty upland sites	16	1.1 Profiles with dark surface layer thicker than 7 inches	7
		1.2. Profiles with dark surface layer thinner than 7 inches	9
2. Profiles of upland sites with sand	9		
3. Profiles of sandy terrace sites			
4. Profiles of bottomland and other alluvium sites	10		

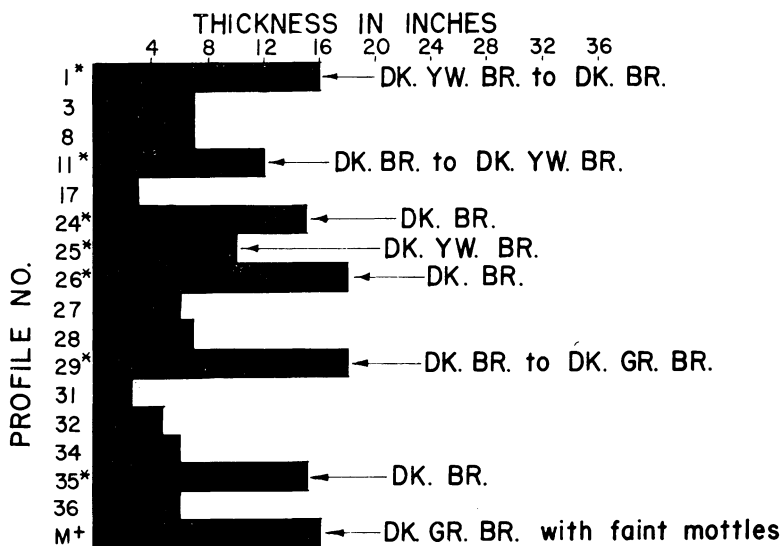
of the upper profile of group 1 profiles which qualify as dark surface layers are shaded in Figure 1.

The profiles of group 1 were subdivided into two sub-groups on the basis of the thickness of the dark surface layer. Those profiles that had a dark surface layer more than 7 inches thick were placed in sub-group 1.1. Those profiles with a dark surface layer less than 7 inches thick were placed in sub-group 1.2. Seven profiles were placed in sub-group 1.1; these will be considered further in the next section.

Though the 9 profiles placed in sub-group 1.2 had thin, dark, surface layers, which would preclude their inclusion with the Muscatine series, most had other morphological features which could have been used as additional criteria to preclude their further consideration as type sites for the Muscatine series. Of the 9 profiles placed in sub-group 1.2, 4 had platy structured A_2 horizons directly below the dark surface layer. All of the 9 profiles had moderate to strong blocky structure, some with coarse prismatic structure, in the B horizon (Ryan, 1959).

PROFILES OF SUB-GROUP 1.1

Seven profiles were placed in this sub-group. These are Nos. 1, 11, 24, 25, 26, 29, and 35. The dark surface layer averaged 15



* PLACED IN SUB-GROUP 1.1

+ MUSCATINE SILT LOAM MONOLITH

Figure 1. Generalized thickness of dark surface layer and subsoil colors of group 1 profiles, and of a Muscatine monolith.

inches in thickness for this sub-group; moist colors of the dark surface layers were mostly very dark grayish brown (10YR 3/2), though that of profile 26 graded towards very dark brown (10YR 2/2). A profile of Muscatine silt loam collected by one of the authors near State Center in Marshall County, had a 16-inch thick dark surface layer with a moist color of black (10YR 2/1) to very dark brown (10YR 2/2). Further information on surface color of other Muscatine profiles in the Marshall-Tama County area is needed to aid in evaluating whether or not any of the 7 profiles of sub-group 1.1 have dark enough surface layers for a type location of the Muscatine series.

However, morphological features other than surface layer color and thickness need to be considered in evaluating the suitability of any of the sites of the 7 profiles for type location of the Muscatine series. Color and structure of the B horizon (subsoil) were next considered. The Muscatine series has been described and is considered to have a subsoil that has brownish gray, or finely mottled brownish and grayish colors (Hawker and Johnson, 1916; Smith, 1946a; Corliss, 1958), which are often considered to be indicative of imperfect or somewhat poor natural drainage. The Muscatine profile from State Center had a dark grayish brown (10YR 4/2, moist) color in the subsoil, and was faintly mottled with yellowish brown and yellowish red.

However, 6 of the 7 profiles of sub-group 1.1, as is shown in abbreviated form in Figure 1, had dark yellowish brown (10YR 4/4, moist) or dark brown (10YR 4/3, moist) colors in the middle and upper portion B₂ and B₁) of the subsoil. That is, profiles 1, 11, 24, 25, 26, and 35 had brownish subsoil colors and therefore could not qualify for type sites for Muscatine series. With regard to moist subsoil colors, these 6 profiles are quite similar to the subsoil colors described for the Tama series (Smith, 1946b).

Profile No. 29 of sub-group 1.1 had moist subsoil colors that in part were similar to the Muscatine monolith, at least in the middle portion of the subsoil (B₂ horizon). But in the lower subsoil (B₃ horizon), profile No. 29 had a weak, medium prismatic structure which broke to a strong, coarse subangular blocky structure. This contrasts with the weak, fine subangular blocky structure of the Muscatine soil from State Center. The structure pieces (peds) in the B₃ of profile 29 were also grayer in color, especially the exterior surfaces, than those in the B₂ and B₃ of the Muscatine monolith. The B₂ and B₃ horizons of profile 29 were also more acid than similar horizons of the Muscatine monolith, though other Muscatine profiles have been reported to have pH values as low as that of profile 29 (Corliss, 1958). As shown in summary in Table 2, profile 29 has some morphological features of a representative Muscatine

profile, but the strong grades of structure with the accompanying grayish brown surfaces of the structure particles in the B₃ horizon, together with the somewhat less dark surface layer, exclude it, in the opinion of the authors, from consideration as a type site for the Muscatine series.

Table 2
Generalized Morphology of the Subsoil of Profile 29 and a Muscatine Monolith

Genetic soil horizon	Muscatine monolith (State Center)	Profile 29
B ₂	23 to 29 inches: weak, fine sub-angular blocky or moderate, medium granular. Dark grayish brown to dark brown. pH 6.1	25 to 32 inches; moderate to weak, fine to medium subangular blocky. Mixed dark grayish brown and dark brown with pale brown ped coatings. pH 5.3.
B ₃	29 to 40 inches: weak, fine sub-angular blocky or moderate, medium granular. Dark grayish brown to dark brown. Few fine faint yellowish brown mottles. pH 6.2.	32 to 44 inches: weak, medium prismatic breaking to strong medium to coarse blocky. Grayish brown ped coatings. pH 5.5.

CONCLUSIONS

The Muscatine series was originally established in Muscatine County in 1916, and 38.2 percent of the soils of the county were classified with this series. The original description of the Muscatine silt loam, the dominant type in the 1916 survey, emphasized the thick dark surface layer, the brownish gray or finely mottled yellowish and grayish subsoil colors, and the low sand and high silt content of the profile, which features are also emphasized in the 1946 description. However, as shown in Figure 1, most of the profiles with thick dark surfaces which were derived from materials high in silt had yellowish brown or dark brown subsoil colors. These profiles probably would be classified with the Tama series now (Smith, 1946b); several of these occupied sites of 3 to 8 percent slopes that are now generally considered to be sites more characteristic of Tama series than Muscatine series. In the 1916 survey, the topography of the area occupied by Muscatine silt loam was described mainly as gently rolling to rolling. Evidently at that time the range of the Muscatine silt loam was such that a soil with a thick dark surface but with dark yellowish brown or dark brown subsoil was included. This kind of soil had been subsequently included in the range of the Tama series.

A number of inclusions were recognized as being present in the Muscatine silt loam in the 1916 survey. One of these was described as having a faint development of a gray layer below the surface soil,

or a "slight hardpan" in the 3-foot section. The small scale of that map (1 inch equals 1 mile) undoubtedly was a factor in not showing such inclusions. Three profiles, Nos. 27, 28, and 32, described in detail elsewhere (Ryan, 1959), evidently are similar to those inclusions described as having a "gray layer". Profile 29 would also seem to be one of the inclusions.

Although the Muscatine series was originally established in Muscatine County, the elimination of that portion now classified with the Tama series and the deletion of several other early inclusions, probably will result in its occurrence only as a minor type in Muscatine County. Further, it seems quite likely that such Muscatine series as does occur may have some morphological features that are not characteristic of the central concept of the series. It is concluded, therefore, that some county other than Muscatine County, perhaps Tama, Jasper, Poweshiek, or Marshall County, should be considered for the type location of the Muscatine series.

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