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MANAGERS OF TECHNOLOGICAL CHANGE

G.C. (Jerry) Misener
President, 1988–1989

In a paper presented to the 1988 Canadian Conference on Engineering Education, J.R. McDougall suggested that engineering has often been called the invisible profession. Engineers seldom deal directly with the public but rather with corporations and governments. However, this does not remove the responsibility of overseeing the effects of the application of technological innovation on individuals within society. Agricultural engineers, especially those in extension activities, have direct consultation with the end user and hence have assumed the unique responsibility for the client interests, safety and overall satisfaction.

If we stop to consider that in less than 11 years we will have reached the year 2000, the implications of change are staggering. The accelerated development and application of new technology will bring a demand from society for increased accountability from the entire engineering community. The challenge before us is to ensure that engineers assume the responsibility of being managers of the use, in addition to the development of technology. This is both a challenge and yet an opportunity for us that will bring corresponding visibility.

In reviewing the objectives of the Canadian Society of Agricultural Engineering, the first object addresses this point — to advance the application of engineering principles and practices for the betterment of agriculture and the applied sciences. Our society is dedicated to advancing agriculture and measuring the effect of the introduction of technological change on the overall performance of agriculture. As we look forward to the year 2000, the changing faces of not only agriculture but also of aquaculture, forestry and the entire food processing chain will emerge. The role of the agricultural engineer will widen and the management of new technologies will be complex.

We as a Society need to review our mandate and be assured that the Canadian Agri-Food system is provided with the technology and management that will ensure its competitiveness at the world level while addressing health and environmental concerns. Our Society has recently gone through an administrative change and we have strengthened our ties in the engineering field. Now it is time to focus our efforts on new challenges which, if actively pursued, will ensure that our society and its members continue to be well equipped to give leadership in a changing world.

Canadian Agricultural Engineering publishes papers covering the general field of Agricultural Engineering that fit into one of the following classifications: (1) a scientific paper based on original research; (2) a technical paper based on design, development, testing, or analysis of machines, equipment, structures, processes, or practice; (3) a general paper on education relative to curricula and philosophy or trends in science, on a survey or investigation of some phase of research or research methods, or on extension or extension methods. The Editorial Board may also publish abstracts published elsewhere and interesting news items from members of Agricultural Engineering.

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mode of deposition. Taken together, depth to compact layer or bedrock, texture of the subsoil or compact layer, and mode of deposition produce Soil Depth Groups (SDG) that are relatively uniform in composition and anticipated behavioral characteristics (Table I). These groups provide sufficient information to draw initial, informed opinion on the appropriateness of a given agricultural land development measure for any New Brunswick soil. The classification is based on existing published soil survey data and is, therefore, limited to the precision of the original soil surveys, most of which are of a reconnaisance nature (scale 1:50 000 - 1:126 720). However, the result is a useable scheme in tabular format, applicable to all mapped mineral soils in the Province. There are currently 241 unique mineral soils found in New Brunswick (Fahmy et al. 1986).

Soil depth

The four soil depth classes employed (<0.30 m, 0.30–0.65 m, 0.65–1.00 m, and >1.00 m) were determined by the data base rather than by interpretive need. Soils that are depth-restricted by bedrock rather than a dense subsoil condition (>1.6 g/cm^3) are noted in Table I by an (*r*) following the soil name.

Subsoil texture

Soil texture (sand, silt, clay, and combinations thereof) is a permanent soil property not subject to short-term change. Soil particle size affects most chemical and physical reactions. Fine particles (i.e., clays) are most important in chemical reactions, primarily because of their electrostatic charge and large external surface area. While soil texture does not account for soil structure, saturated hydraulic conductivity, and drainable porosity (soil parameters that are not consistently available from the current soils data base), it is an indicator of ease of water movement and ease of working.

Due to soil depositional processes and soil weathering over periods of geologic time, textures of subsoils or restrictive compact layers can differ from that of the overlying friable materials. Texture of the friable material is therefore given as an additional soil descriptor later in this section.

Mode of deposition

Mode of deposition refers to the placement and/or transport mechanism of soil parent material. It is, therefore, a further indicator of soil physical and chemical composition compared to the soil textural class alone. Although there are several known modes of parent material deposition, only two general types are recognized in this classification: ice-deposited (as till, T), and water-deposited (W).

Since New Brunswick was completely glaciated during the last ice age (Wisconsin) most of the Province is covered by ice-transported debris, deposited directly by glacial ice as till (T). Approximately 90% of New Brunswick's agriculturally blocked land consists of soils developed from glacial till; the majority are basal or lodgment till (Chow and Rees 1982; Saini 1980). Basal tills characteristically exhibit a shallow topsoil underlain by a massive, dense subsoil extending to considerable depth. Minor areas of colluvial and some residual parent materials have also been included with the tills.

Water-deposited materials (W) include all parent materials that are deposited in a water environment: lacustrine (lakes) or glaciolacustrine (glacial lakes), alluvial (streams), marine (ocean), and glaciofluvials (glacial streams and outwash). Although water-deposited sediments encompass a wide range of material types, they have a common denominator in that they are all sorted or semi-sorted (i.e. of uniform particle size class) and relatively homogeneous compared to the nonsorted, heterogeneous composition of glacial tills (T). Many of the chemical differences within the water-deposited group that were initially present in the parent materials as a result of saline (marine) versus nonsaline conditions have been equalized by soil development, particularly climatic impacts of the prevailing humid environment. Many of the marine sediments are actually glaciomarine in origin, deposited in a brackish water condition and thus even less different from fresh water sediments. By using depth to restricting layer and subsoil texture as first- and second-order stratifications, the difference within the water deposited categories is further minimized.

Additional soil descriptors

Table II presents an alphabetical listing of New Brunswick soils and their respective soil depth group (SDG) code. The code is broadened from that of Table I to include the following additional soil descriptors available from the data base: drainage class, described as rapid to moderately well (d_w), imperfect (d_i), poor to very poor (d_p); susceptability to flooding (h); presence of ortstein layers (o); bedrock (r); texture of the friable material, described as fine (f), medium (m), and coarse (c); recently mapped soils with published Reports containing more precise soil depth and drainage class information (*). Table II thus concisely presents soils data relevant to land development considerations, on a soil-specific basis. Note that surface slope information is not included in Table II. Site-specific slope conditions can influence land use and/or land development alternatives, and should always be considered together with the information in Tables I and II.

DISCUSSION

Previous experience with specific soils, local site conditions and other agricultural, nonsoil factors such as location, proximity to markets, farmer management skills, and degree of risk acceptable to the farmer should be considered together with the SDG (Tables I and II) when assessing land development alternatives. The classification system is not a substitute for on-site soil investigation, detailed soil resource inventories, or sound judgment. Rather, it is intended to quickly identify those soils in obvious need of site-specific information before committing further resources to the land development plan.

Use of soil depth groups (SDGs)

When grouped according to SDGs (Table I), soils of marginal agricultural use such as those with less than 0.30 m to bedrock or compacted layer become apparent. Land clearing or subdraining these soils would not be recommended. Conversely, medium-textured soils at greater than 65-cm depth, without bedrock, slope, or flooding limitations would probably be good potential candidates for agricultural development; depending on the crop grown, coarse-textured, well-drained, deep soils could require irrigation.

Unfortunately, those soils falling between the previous groups, at 30- to 65-cm depth, are most numerous. Land development recommendations for these soils are presently not well defined. Historically they have been cleared for agriculture. Subsurface drainage has also been practiced on these soils, with considerable success according to farmers (Milburn and Gartley 1988). However, drainage system performance and potential soil

Discussion on "Physical properties of cereal and oilseed cultivars grown in western Canada[1]

The authors have presented the results of a few thousand tests, but have not explained why their results are so greatly different to data in the literature, some of which they reference. For example, with wheat on galvanized steel they obtained a coefficient of friction of 0.31 while Brubaker and Pos (1965) reported 0.14; For flaxseed they report a coefficient of 0.4 on galvanized steel and 0.50 on wood-floated concrete, whereas Munroe and Moysey (1974) reported values of 0.23 and 0.29 for the same materials and moisture contents. Did the authors not notice these dicrepancies or did they choose to ignore them? The coefficient of friction is of great importance in the design of structural elements and handling facilities for grain storages. Janssen's equation predicts that lateral wall pressure varies inversely with the wall friction coefficient, so using Sinha and Muir's values as given above would produce calculated pressures only half as great as those calculated from the other authors' values. This could have dire consequences.

It seems unlikely that the friction coefficient could vary by a factor of two. Some variation might be expected with galvanized steel, depending on how well it was polished, but not with rough-textured concrete. Furthermore, the values given by Sinha and Muir for flax on concrete are much larger than published values for internal friction in flax (Moysey 1984). This being the case, one would expect that a layer of seeds would stick to the concrete and sliding would occur between layers of flaxseeds. The test method must therefore be questioned. The authors used a tilting table and a layer of seeds 18 mm thick, a simple unit to build and operate, but one which was shown many years ago to be unsatisfactory. Lorenzen (1959) demonstrated that the coefficient of friction of grain on a surface under a normal pressure of 1.5 kPa is double what it is under a pressure of 10 kPa. Ooms and Roberts (1985) measured the coefficient of friction of powdered coal on stainless steel, and obtained values of 0.6 at a pressure of 1 kPa, 0.45 at 2 kPa and 0.30 at 10 kPa. The range of results for different cereal grains given by Sinha and Muir is also considerably narrower than found by Brubaker and Pos, probably because the adhesion component provides a large part of the friction when pressure normal to the surface is small.

Table I. Results of friction coefficient measurements under different pressures

Grain	Moisture (% WB)	Pressure (kPa)	Coefficient of friction on galvanized steel	concrete
Wheat	11-8	Single layer	0.34	0.37
		0.6	0.22	0.33
		3.5	0.21	0.34
		7.0	0.20	0.37
Flax	6.7	Single layer	0.33	0.36
		0.6	0.23	0.30
		3.5	0.21	0.27
		7.0	0.20	0.26

[1]Paper by W. E. Muir and R. N. Sinha. 1988. Can. Agric. Eng. **30**: 51-55

Table I shows some results obtained with flax and wheat on two surfaces under different pressures. A tilting table was used for the experiments, but instead of a frame 18 mm thick as used by Sinha and Muir, ours was 170 mm deep. For test under pressure, weights were placed on a board on top of the grain. On galvanized steel there was a considerable difference due to pressure for both wheat and flaxseed, but pressure made very little difference with concrete. Adhesion apparently played a smaller role on concrete. Coefficients of friction on galvanized steel were exceptionally low because the surface was well polished as can occur with repeated use in bins. The value of 0.26 for flax on concrete under a pressure of 7.0 kPa is almost exactly the same as the internal friction coefficient of flax, suggesting that sliding took place within the flax, not on the concrete surface. While results were repeatable, the tilting table method of testing is unsatisfactory. Not only is it in error for low pressures, but it is too subjective in terms of operator technique and opinion as to the onset of sliding. It seems pointless to attempt to measure the difference in friction characteristics of different cultivars using a test method which is so badly flawed.

Two other points in the article by Sinha and Muir deserve comment. Brubaker and Pos (1965) found that when testing at different moisture contents it was very important to condition the surface to the corresponding moisture content and to conduct the tests in a space conditioned to the appropriate relative humidity. The authors make no mention of this. Also, the emptying angle of repose is very much affected by particle shape, as well as by friction between particles. Flaxseeds tend to stack up more than spherical shapes. The emptying angle of repose is often taken as an indication of internal friction angle. Published data from shear box and triaxial tests show that this is reasonably valid for many seeds but is grossly in error for flax.

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The manuscript should be typed double-spaced on paper 8½ × 11 inches (21.6 × 27.9 cm) with margins not less than 1¼ inches (3.3 cm). The first page should contain only the title, authors' names, addresses (including postal codes), and contribution number where applicable. Tables and captions for illustrations should be on separate pages, placed after the text. Manuscript paper with numbered lines is preferred. The original and two copies are required.

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List references alphabetically by authors at the end. Include year of publication, title in lower case except first letter of first word, and source, with volume and page numbers where applicable. Names of periodicals should be abbreviated in the form given in *BIOSIS List of Serials with Title Abbreviations* (Bioscience Information for Service of Biological Abstracts, 211 Arch Street, Philadelphia, PA, 19102). Material in press, with the name of the journal, may be used as a reference. Private communications and unpublished reports should be referred to in parentheses in the text. Avoid the use of footnotes. Use the author-date system in the manuscript when referring to articles in the Reference section.

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