LAND USE - EDAPHIC RELATIONSHIPS

LAND USE - EDAPHIC RELATIONSHIPS IN TWO SELECTED AREAS OF WOOLWICH TOWNSHIP

By

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A Thesis

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In the process of researching this topic very little published material was found to exist on the study. In view of this fact, the author had to rely on certain unpublished material made available by various research institutions. In this respect many thanks are due to Professor D. W. Hoffman of the Soils Science Department at the University of Guelph, who gave of his time and provided a detailed unpublished soil map. Sincere thanks also go to the staff of the Crops Division at the Canada Census Department in Ottawa, who made available data pertaining to average gross income and productivity. The author, however, accepts the ultimate responsibility for any interpretive errors which may occur in the material presented.

I deeply appreciate the computer programming assistance of Mr. M. F. Goodchild, McMaster University, and the cartographic aid of Mr. K. W. Perrin, Dryden and Smith Planning Consultants, Kitchener. I am also indebted to Mrs. H. Schmidt and my wife Carol who patiently typed the drafts and final manuscripts. These people made the technical production of the paper possible.

Special thanks are in order for my faculty advisor,

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Julius A. Mage
July, 1967

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I

INTRODUCTION

"Agricultural geography is concerned with areal differentiation of agricultural phenomena. Its objectives are to describe and explain the variable geographical patterns of agricultural development and to discover the causes and consequences of areal distributions".[1] Working within this context, the purpose of the thesis is to study and evaluate the significance of soil type on agricultural land use in two selected areas in Woolwich Township.[2] The inherent characteristics of the soil, namely: texture, drainage, slope, stoniness, depth to bedrock, and erosion, will be studied individually and collectively to determine to what extent, if any, they influence the land use pattern and agricultural productivity.

Land use studies in agricultural geography usually tend to concentrate on the relationship of crops to certain physical conditions. This thesis will attempt to go beyond such customary studies. To attain this goal, the term "land use" has been broadened to include not only the

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[1] L. G. Reeds, "Agricultural Geography: Progress and Prospects", The Canadian Geographer VIII, 2, 1964, p. 62.

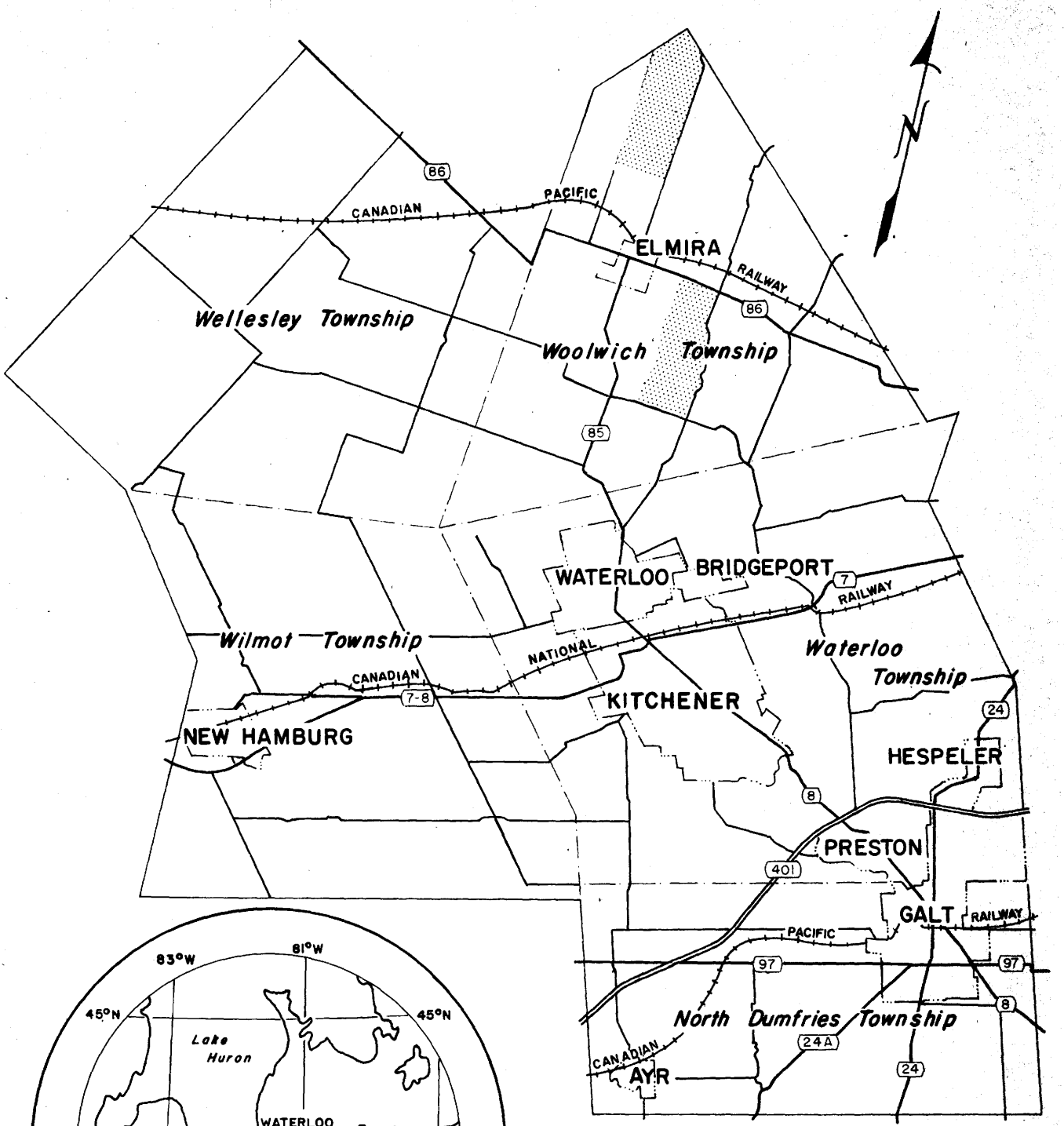
[2] The exact definition of the term "soil type" will be further explained in a later section.

vegetative cover, but also the spectrum of human or cultural factors. Such factors are usually referred to in a generalized verbal manner with no attempt made to properly map them at a scale which would permit meaningful interpretation and correlation. These human or cultural elements are taken to include: rotation methods, amount of fertilizer applied, type of equipment utilized, the extent of soil improvement (eg. the installation of tiles to improve drainage), the farm operation and types of crops grown, the yield or return from each field, the total productivity per farm unit and per cultivated acre, and a measure of the man-hours or day-hours expended per farm unit.

The study was undertaken in two sections of Woolwich Township, a triangular shaped area in the northeastern portion of Waterloo County. The selected areas are located in central Woolwich and in northwestern Woolwich. They are separated latitudinally by 2 miles and longitudinally by half a mile (Figure 1).

The two strips were chosen on the premise that their chief difference was one of soils and associated minor variations of relief. Both strips are underlain by marine sedimentary strata of Silurian age. Specifically, the bedrock is comprised of the Salina formation which consists of brown dolomite, shaly dolomite, limy shale, and gypsum. There are no rock outcrops and well-log

LOCATION OF STUDY AREA IN WATERLOO COUNTY



Base Map: After Ontario Department of Highways

J. A. M. '67

records indicate that the study areas are covered with 130 feet to 200 feet of unconsolidated overburden.

Available climatic statistics indicate that the macro-climate is similar in both strips. Precipitation averages 33 inches to 34 inches per year. The frost free period is about 140 days with the growing season approaching 190 days. In the spring, the last frost occurs about May 17th and the first fall frost about September 29th. Since there is no major physiographic break between the two strips and no appreciable difference in latitude and longitude, and taking into account the preceding climatic information, it appears logical to state that there is no significant difference in the macro-climate.

Economic and social conditions are generally similar in both areas. Most of the farmers, over 85 per cent, are Mennonite and have strong agrarian customs and traditions. Thus, the attitude of the people to farming is similar. Indeed, the whole township is fairly "stable" in terms of acreage of occupied farmland. For example, for each of the census periods, except one, from 1911 to 1961, Woolwich Township exhibited less than 500 acres increase or decrease of occupied farmland. Furthermore, no appreciable difference occurs between the two study sections in such factors as market

accessibility and road service.

Both strips are almost equal in area. Calculations have indicated that the central strip, containing mainly uniform soils, embraces 3,321.2 acres, while the other strip, containing variable soils, covers 3, 468.0 acres.[1] The former section is dominated by Silt Loams (over 75 per cent) and contains minor patches of Gravelly Loam Till, Very Fine Sandy Loam, Very Fine Silty Loam, Gravels, Muck, Alluvium, and others, mainly poorly drained areas.[2] The latter section, or variable soil strip, contains no soil type which has a clear majority areally and is comprised as follows:

1) Silty and Sandy Loam
2) Gravelly Loam
3) Very Fine Sand
4) Muck
5) Silt Loam and Loam
6) Alluvium
7) Silty Clay Loam (Lacustrine)
8) Gravelly Loam Till
9) Gravel
10) Clay Loam and Clay Till
11) Medium and Coarse Sand

The major soil types of the two areas reflect the differences of the parent material which can be traced back to the pleistocene geology deposits. Apart from these

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[1] All calculations, involving absolute area, were made from aerial photographs at a scale of 4 inches per mile with areagraph charts and are accurate to at least 97 per cent.

[2] A full description of each soil type occurs in a subsequent chapter.

differences and the associated differences of relief, that is, the flat till plains of the "uniform" strip as opposed to the rolling moraine and outwash areas of the "variable" strip, the two areas are similar (Figure 2). Thus, any differences in agricultural land use can be suspected to be caused by soil type variation.

The uniform-soil section is meant to act as a "control" strip to determine whether a uniformity of soils will indicate a general uniformity of land use and productivity. The variable-soil strip was not chosen because it represented deliberately poorer soils, but was rather chosen because it constituted a good agricultural area with a variety of soil types.

Each of the two study areas contains nearly 30 farms averaging about 100 acres in size. Within the uniform soil strip there are 20 full farms, or farm units contained entirely within the boundaries of the study area, 9 part farms, (5 of which have 50 per cent or more of their area within the strip and 4 of which have 30 per cent or more within the strip), and 3 rural non-farm dwellings containing only a small acreage. The variable-soil strip is comprised of 24 full farms, four part farms and 10 small holdings. For convenience sake, it was decided to utilize Township roads as the boundary for each study area. Thus, in some cases, properties were

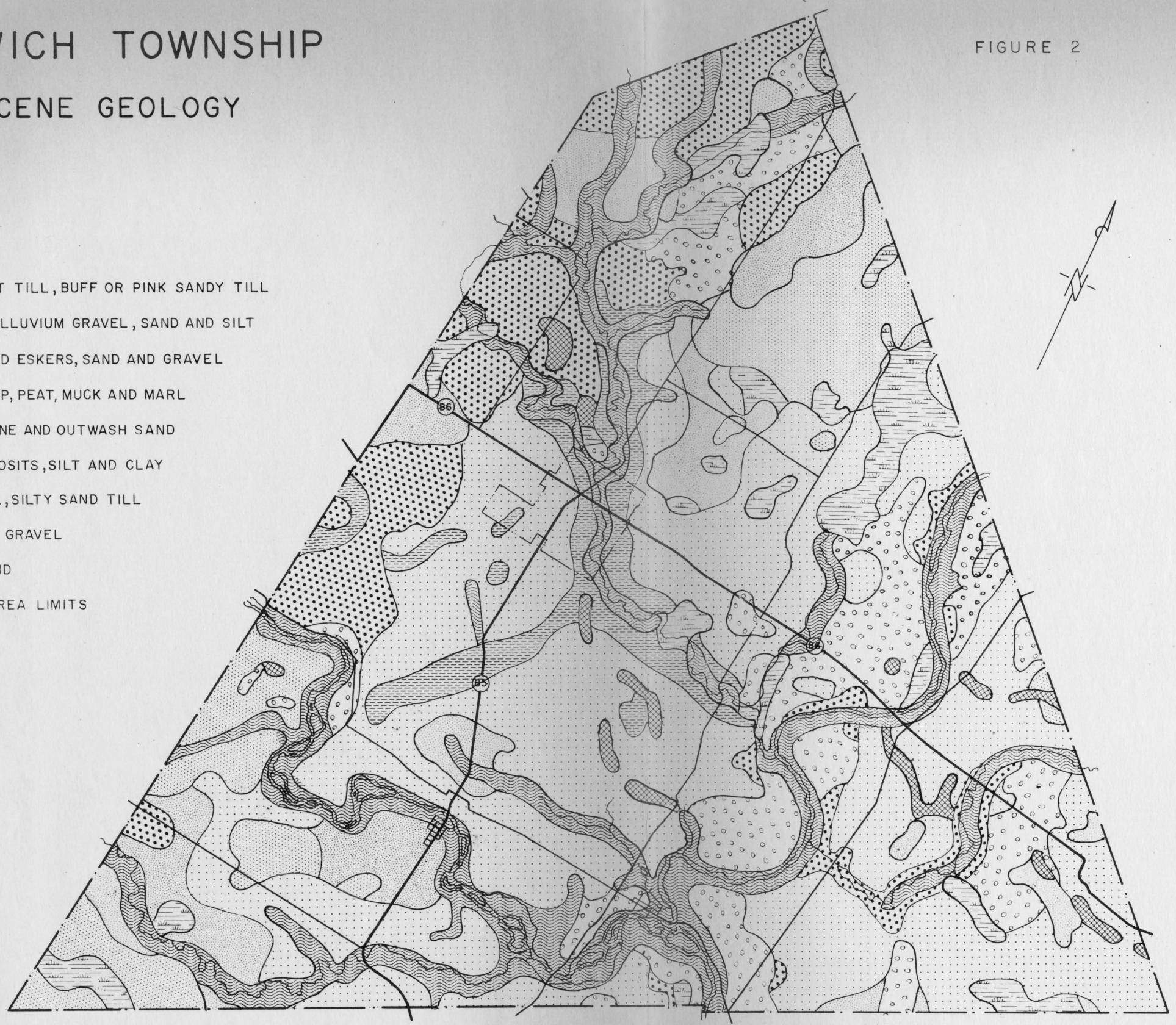
WOOLWICH TOWNSHIP

PLEISTOCENE GEOLOGY

FIGURE 2

LEGEND

- WENTWORT TILL, BUFF OR PINK SANDY TILL
- MODERN ALLUVIUM GRAVEL, SAND AND SILT
- KAMES AND ESKERS, SAND AND GRAVEL
- BOG, SWAMP, PEAT, MUCK AND MARL
- LACUSTRINE AND OUTWASH SAND
- POND DEPOSITS, SILT AND CLAY
- CLAY TILL, SILTY SAND TILL
- OUTWASH GRAVEL
- KAME SAND
- STUDY AREA LIMITS



0 5000 10000
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SOURCE: P. F. KARROW, CIVIL ENGINEERING DEPARTMENT, UNIVERSITY OF WATERLOO

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split. However, the majority of farms lie wholly within each study section (Figures 3 and 4).

In evaluating the significance of soil type on agricultural land use and in establishing, as accurately as possible, edaphic-land use relationships, a digital computer is employed. The two study areas were divided into square 10 acre grids within which a sample point was chosen at random. Correlations between the various soil types and land use characteristics were then computed.[1] Certain productivity factors, such as gross income per farm unit were analyzed qualitatively rather than quantitatively because of the confidential nature of the individual farm's income. Thus, gross income and associated characteristics are presented on a 3 or more farm unit basis which precludes statistical analysis by reason of the small sample size. Nevertheless, income comparisons can be made between the two study areas and between groups of farms situated on differing soil type. The average income and productivity per farm as established in this study can be used for comparative purposes with other areas of Southern Ontario.

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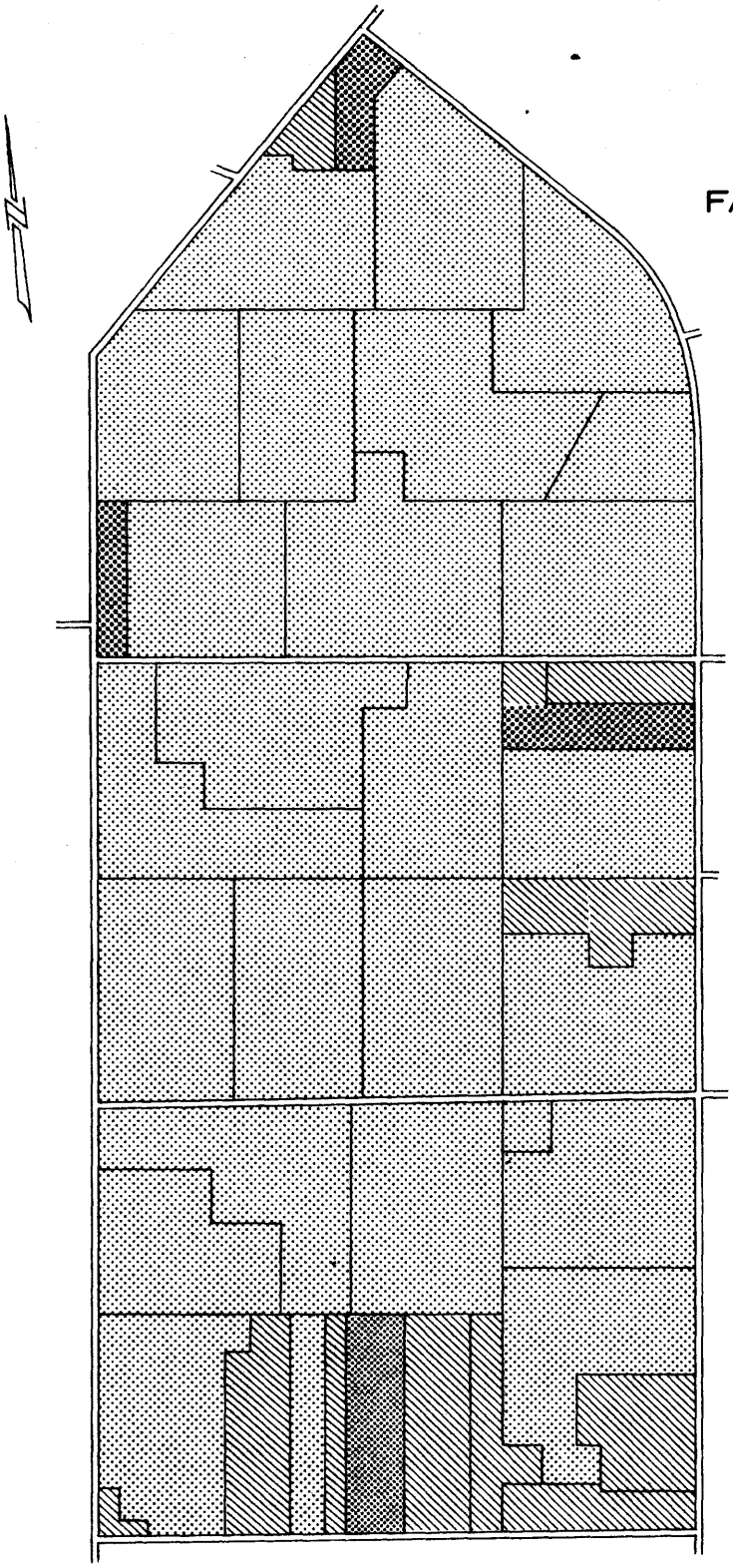
[1]Methodology will be fully discussed in the following section.

VARIABLE SOIL SECTION

FIGURE 3



FARM UNIT BOUNDARIES

FARM SIZE

- FULL FARMS
- PART FARMS
  MORE THAN 50% IN STUDY AREA
- PART FARMS
  LESS THAN 50% IN STUDY AREA
- PART TIME FARMS & RURAL NON-FARM

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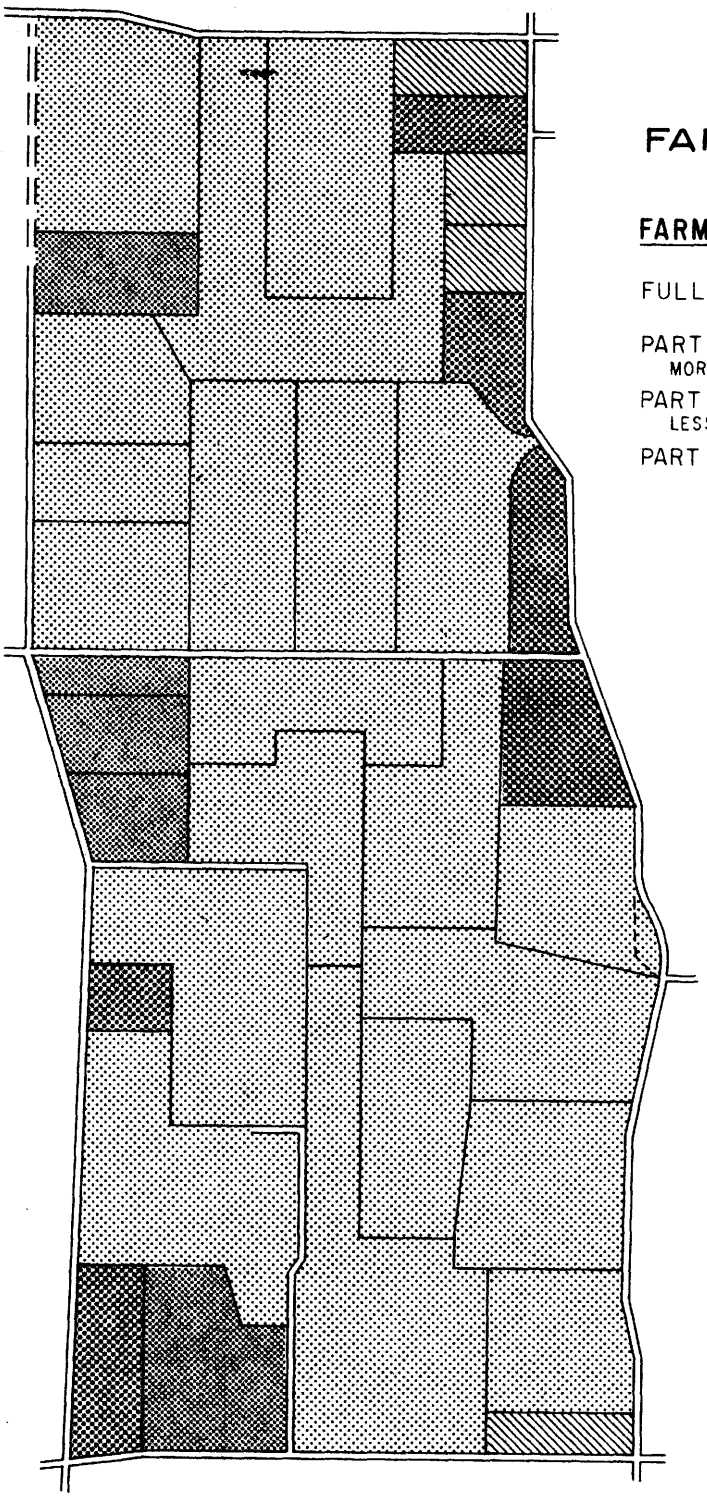
UNIFORM SOIL SECTION

FIGURE 4



FARM UNIT BOUNDARIES

FARM SIZE

FULL FARMS

PART FARMS
MORE THAN 50% IN STUDY AREA

PART FARMS
LESS THAN 50% IN STUDY AREA

PART TIME FARMS & RURAL NON-FARM-

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SCALE IN FEET

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Review of Literature

A study of the literature dealing with agricultural geography has revealed numerous macro-studies which have been carried out to examine the relationship of crop distribution to the physical environment. There have been too few intensive investigations of small areas with conclusive findings. Excellent comments, about this branch of geography, have been put forth by writers such as H. H. McCarty[1], D. F. Putnam[2], and L. G. Reeds[3]. Any further elaboration on this topic is beyond the scope of the investigation and would consist of subject matter that has been adequately covered elsewhere.

A review of literature pertinent to this study has indicated few references which elucidate specifically land use - soil type relationships. Numerous writers associate Great Soil Groups to certain crop types. C. E. Kellog, for example, recognises that Chernosem soils are considered to be primarily adopted to wheat, whereas Podsol soils may be

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[1]H. H. McCarty, "Agricultural Geography", American Geography, Inventory and Prospect, ed. P. E. James, and C. F. Jones (Syracuse University Press, Syracuse, 1954), p. 259 - 277.

[2]D. F. Putnam, "Soils and Their Geographical Significance", Geography in the 20th Century, ed. C. Taylor (London: Methuen, 1962), p. 221 - 247.

[3]Reeds, pp. 51 - 63.

more important for oats.[1] Such generalizations are quite common and are representative of regional studies whose areal scope may range from a township to the whole earth. Within these generalizations, statements emerge which are indicative of the importance of soil types to farm planning as one soil type could be better suited for a crop than another.[2] Furthermore, it is generally accepted that "within larger regions soil variations play a prominent part in determining the agricultural utilization of particular areas."[3] Such statements set the stage for other studies which may indicate more precisely the significance of variations in soil to agricultural land use.

Soil - land use investigations have been more prominent in the United States and Europe than in Canada. A major portion of this problem can be attributed to the lack of detailed soil maps in Canada. Indeed, at the present, published soil survey reports are unavailable for some of the most highly developed agricultural portions of Southern Ontario. Thus, perhaps similar investigations such as J. B. Cruickshank's land use study of the Black Isle in Ross Shire which

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[1] C. E. Kellog, The Soils That Support Us, (New York: The Macmillan Co., 1941), p. 209.

[2] Ibid, p. 289.

[3] K. H. W. Klages, Ecological Crop Geography, (New York: The Macmillan Co., 1942), p.80.

provided "an interesting example of land utilization that has been influenced by the physical environment, especially by the soil" are justifiably scarce.[1]

Detailed case studies are available for various agricultural regions in the United States. For example, R. D. Rudd describes in minute detail the physical and economic characteristics of a beef cattle farm in the Corn Belt,[2] and W. C. Found relates the distribution of citrus fruit to certain preferred soil types and winter temperature in Orange County, Florida.[3] The Michigan State College has conducted research into the types of farming in the State of Michigan and has associated certain recognisable farm types with general topography and soils. For example, the dairy and cash crops area occurs mostly on level loams and silt loams.[4] The Michigan study, although referring, on certain occasions, to a range of characteristics which are representative of a

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[1] J. B. Cruickshank, "The Black Isle, Ross-Shire, A Land Use Study", The Scottish Geographical Magazine, LXXVII, No. 2 (1961), p. 14.

[2] R. D. Rudd, "A Beef Cattle Farm in the Corn Belt", Case Studies in World Geography, ed. R. M. Highsmith, Jr. (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1965), pp. 47 - 54.

[3] W. C. Found, "The Relation of the Distribution of Citrus to Soil Type and Winter Temperature in Orange County, Florida", Canadian Geographer, IX, 2, (1965), pp. 63 - 73.

[4] E. B. Hill and R. G. Mawby, Types of Farming in Michigan (East Lansing: Michigan State College, September, 1954), p. 34.

typical farm in each farm-type area, is limited in depth as it encompasses the whole State of Michigan. Nevertheless, productivity differences, though not analysed, have been observed within the same farm-type area and have been attributed to variations in soil and in cultural practises.[1] In spite of the fact that the results of the three afore-mentioned studies may not be directly applicable to this investigation, the methodology and the statements made with reference to land use and soil certainly merit consideration.

Studies pertaining directly to Southern Ontario fall into two groups. The first group deals with specific phenomenon for limited areas. For example, R. R. Krueger established relationships between tender tree-fruit soil and the extent of orchards in the Niagara Peninsula[2] and the Louth Township Report analysed in great detail the capability and productivity of the various soil types for orchards and vineyards.[3] Furthermore, the Ontario Department of Agriculture has published a number of pamphlets which relate specific crops to specific

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[1]Ibid, p. 58.

[2]R. R. Krueger, "Changing Land-Use Patterns in the Niagara Fruit Belt", Transactions of the Royal Canadian Institute, XXXII, Part 2, No. 67, (October, 1959).

[3]R. M. Irving, Factors Affecting Land Use in a Selected Area in Southern Ontario (Guelph: The Ontario Department of Agriculture, 1957).

soil types and make recommendations with respect to management and harvesting.[1]

The second group of studies emphasises a broader, regional approach and concerns itself with a variety of phenomena. B. C. Matthews and R. W. Basil have divided Southern Ontario into dominant Great Soil Groups and then have related certain agricultural activity to each Group.[2] The result has been more of a physiographic than a soil type approach with a highly generalized and rather limited discussion of land use.

L. G. Reeds has conducted numerous investigations of agricultutal land utilization in Southern Ontario. Most of his writings contain statements to the effect that "land use is determined to considerable degree by the pattern of soil type".[3] Many of his studies are carried out within the context of a land type or a grouping of main soil types on the basis of similar topography, drainage, capability and other inherent

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[1]See Ontario Department of Agriculture, The Grape in Ontario, Bulletin 487 and Ontario Department of Agriculture, Potato Production in Ontario, Publication 534, which were used as representative examples.

[2]B. C. Matthews and R. W. Basil, "The Soils of the Great Lakes-St. Lawrence Lowlands", A Look at Canadian Soils (Ottawa: Agricultural Institute of Canada, March - April, 1960), pp. 37 - 40.

[3]L. G. Reeds, "Land Utilization in Southern Ontario", Economic Geography, p. 291. See also pp. 298 - 302 for specific examples of statements covering soil type and land use.

characteristics. Various economic factors can then be associated with land types or groups of land types to form agricultural regions.[1]

H. F. Noble, in conjunction with the Ontario Department of Agriculture, has classified farms on an economic and soil capability basis in Southeastern Ontario.[2] His research consisted of classifying randomly selected farms into categories comprised of adjusted acres of crop soil. Gross productivity and land use were noted for each farm category or class. These results are of interest to this investigation for comparative purposes as the fact emerged that gross incomes of $10,000.00 appeared only on farms whose total area exceeded 300 acres and whose adjusted acreage was at least 130.[3] However, apart from grouping soils according to their capability for the purposes of adjusted acreage, no mention is made of soil type and no description of soils is offered.

Where available, the county soil surveys by the Ontario Department of Agriculture and the Canada Department of Agriculture are the most authoritative sources for the

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[1]L. G. Reeds, "Agricultural Regions of Southern Ontario 1880 and 1951", Economic Geography, XXXV, No. 3, (July, 1959) pp. 219 - 227.

[2]H. F. Noble, An Economic Classification of Farms in Eastern Ontario, (Toronto: Ontario Department of Agriculture, May, 1965).

[3]H. F. Noble, Variations of FarmsIncome of Farms in Eastern Ontario, (Toronto: Ontario Department of Agriculture, November, 1965), p. 4.

description and distribution of individual soil types.[1] For each soil series, these publications present the range of crops, the capability and the general agricultural activity which are prevalent. However, a specific analysis of land use and productivity is beyong their scope and purpose.

A review of the available and pertinent literature has indicated a lack of studies which may be directly applicable to this investigation. The relative abundance, on the other hand, of detailed studies which correlate, for example, orchards and sandy soils, and, on the other hand, of broader, regional reports which associate certain land uses to certain land types or capability classes, is indicative of the trend which has existed in Southern Ontario for quite some time. Throughout the majority of these references the impression or theme prevails that "general" or"mixed farming" is a catch-all phrase reserved for farming that occurs in any area where specialization of some sort is not obvious. The connotation also exists that general farming areas are poorer than those which can be associated with specialization. Finally, no precise definition, other than that based on subjective emperical evidence, is put forth on just what constitutes mixed farming in terms of specific land use and productivity ratios for any

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[1] It has been generally accepted that some of the finest pedogeographical interpretations can be found in soil survey reports. See Putnam, p. 238.

given area.

If a study in detail of a fruit-growing area can reveal variations in income and yield based, in part, on variations of the "fruit" soil,[1] perhaps similar variations obtain within a mixed farming area. Furthermore, perhaps a detailed study of a mixed farming district could reveal the presence of a new kind of specialty area - ie. farming consisting of good income and high yields based on a variety of land use.

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[1]Irving, p.110.

II

METHODOLOGY

The following sections outline in chronological order the various phases of research followed in the attempt to establish land use - edaphic relationships.

Soils and Soils Mapping

To date, no Soil Survey Report has been published for Waterloo County. An existing generalized soil map, at the scale of 1:108,000, indicated rather broad homogeneous soil-type areas for the two study sections and proved to be of limited use. However, the Soil Science Department at the University of Guelph is currently preparing a very detailed soil map for Waterloo County; and permitted this information to be used. All soil mapping was done on aerial photographs at a scale of 4 inches to the mile, thus affording the wealth of detail needed in the delineating of boundaries around small patches of differing soil type and in the establishing of certain characteristics such as the various degrees of slope and drainage within each soil type.

Several soil types in Waterloo County have, as yet, not been assigned with a specific name such as, for example, Burford Loam or Huron Clay Loam. Thus, all soils are referred to in this thesis on the basis of the

material comprising the soil horizons. In effect, a "Soil Type" connotes areas of soil whose profile, drainage and parent material characteristics are the same. Wherever an existing name for a soil type is available, that name will be utilized in order to allow the reader to associate a certain soil with a well known conventional soil name in Southern Ontario. However, throughout the body of this thesis, the various soil types will be referred to by the designations presented in the introductory section, for example, Gravelly Loam and Very Fine Sand.

Each soil type area was examined for sub-areas differing in slope and drainage characteristics. In the Variable Soil Strip, a change in slope or drainage usually signified a change in soil type. However, patches of poorly drained soil, within the same soil type, were mapped separately. In the Uniform Soil Strip, where 79 per cent of all soils are Silt Loams, minute variations of slope and drainage were recognised to allow for the comparison of land use within a similar soil type. Figure 5 presents the variable soil pattern occurring in the northern strip and Figure 6 outlines the areal extent of the soils in the Uniform Strip. The overlay, on Figure 6, presents a breakdown of the drainage and slope characteristics of the Silt Loam.

FIGURE 5

VARIABLE SOIL SECTION

LEGEND

(1) SILTY and SANDY LOAM

(2) GRAVELLY LOAM

(3) VERY FINE SAND

(4) MUCK

(5) SILT LOAM and LOAM

(6) ALLUVIUM

(7) SILTY CLAY LOAM

(8) GRAVELLY LOAM TILL

(9) GRAVEL

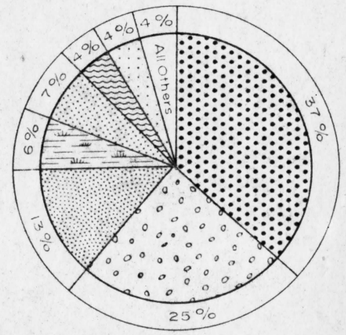
(10) CLAY LOAM and CLAY TILL

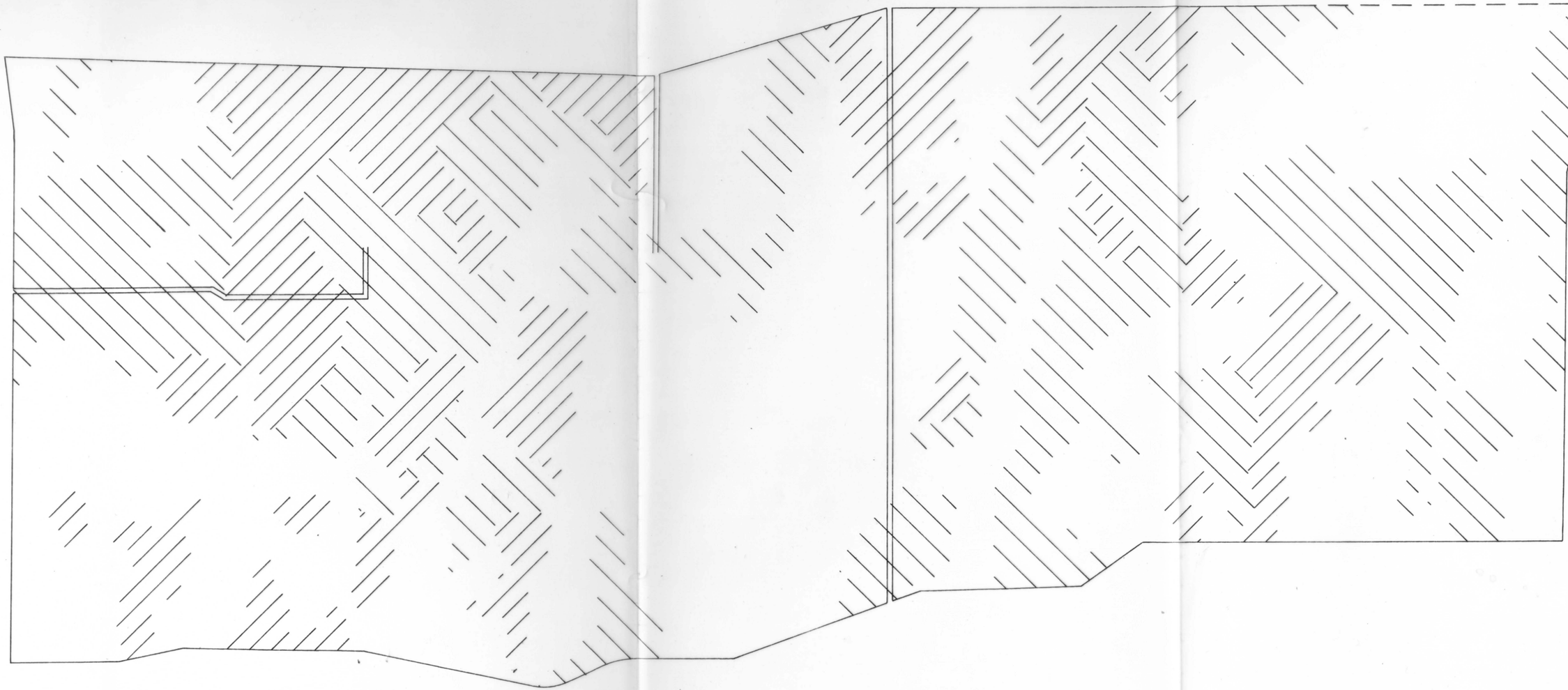
(11) MEDIUM and COARSE SAND

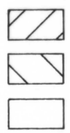
500 0 500 1000
SCALE IN FEET

SOURCE: SOIL SCIENCE DEPARTMENT, UNIVERSITY OF GUELPH

SOIL TYPE







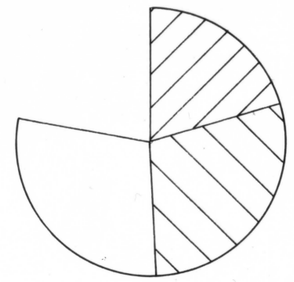
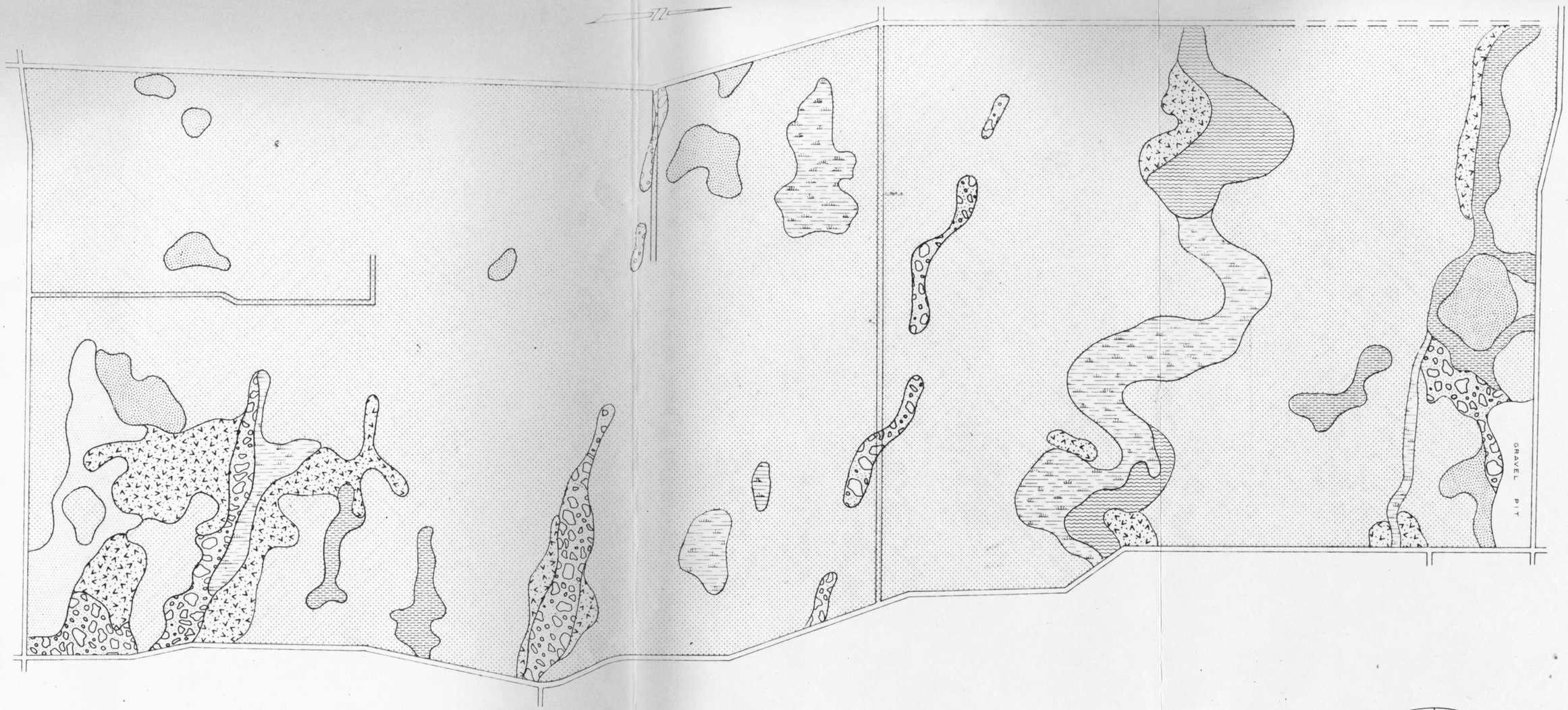


FIGURE 6

UNIFORM SOIL SECTION



LEGEND

(1) SILT LOAM UP TO 3% SLOPE

(2) SILT LOAM 3 TO 6% SLOPE

(3) SILT LOAM IMPERFECTLY DRAINED

(4) GRAVELLY LOAM TILL

(5) MUCK

(6) POORLY DRAINED SOILS

(7) GRAVEL

(8) ALLUVIUM

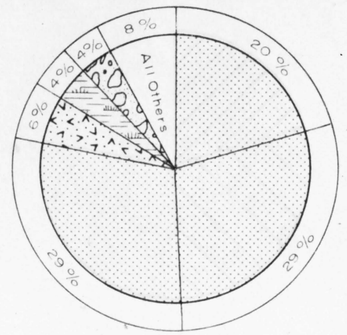
(9) VERY FINE SANDY LOAM

(10) VERY FINE SILTY LOAM

500 0 500 1000
SCALE IN FEET

SOURCE SOIL SCIENCE DEPARTMENT, UNIVERSITY OF GUELPH

SOIL TYPE



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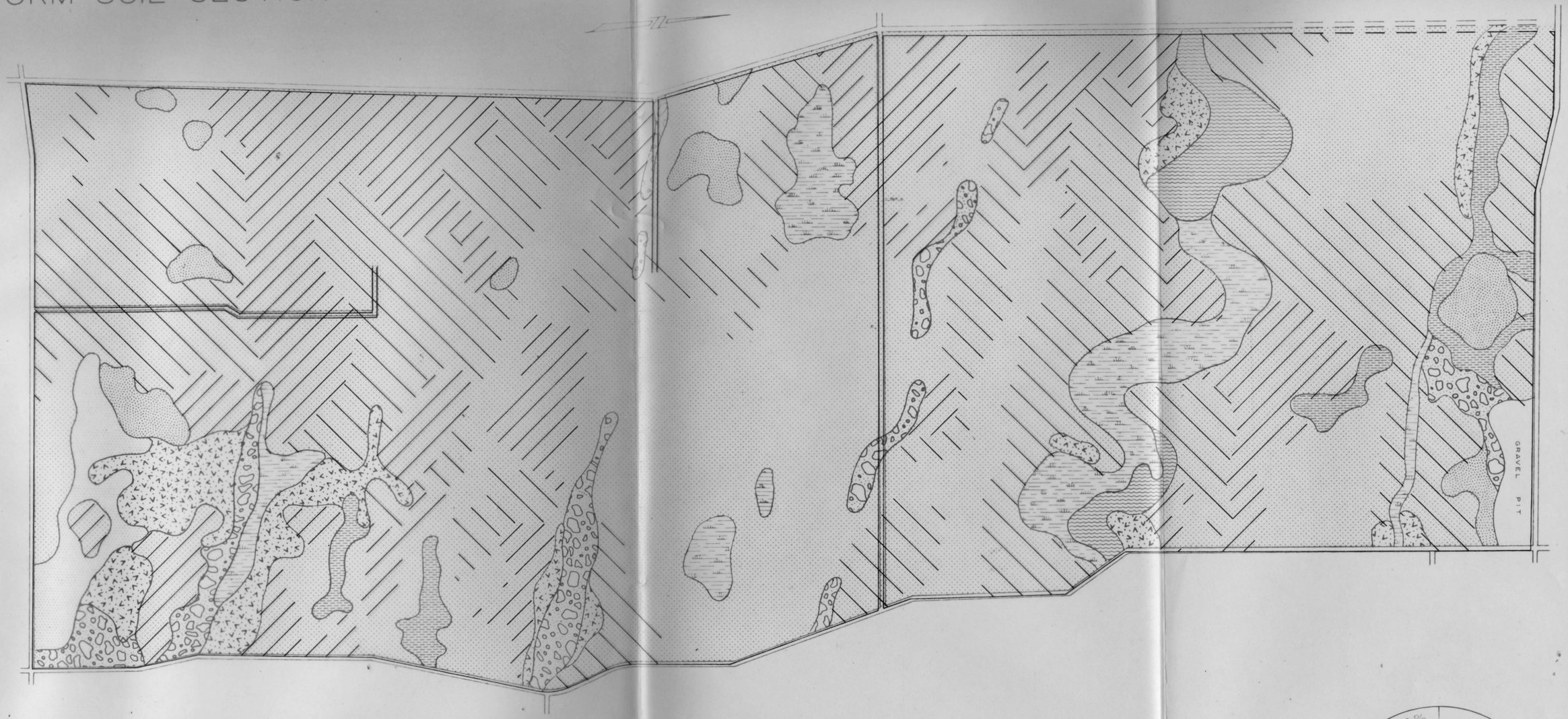
UNIFORM SOIL SECTION



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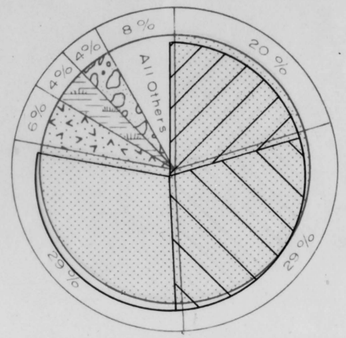
SCALE IN FEET

SOURCE SOIL SCIENCE DEPARTMENT, UNIVERSITY OF GUELPH

SOIL TYPE



Sampling Technique and Data Storage

To facilitate comparative analysis of land use, soil type, yield and certain farm management factors, a practical method of sampling, coding and storing data is used. This method is patterned upon that developed by Brian J. L. Berry, although the actual sampling and storing technique has been modified to suit the purposes of this study.[1]

The two study sections were divided into square 10 acre grids and a random sample point was established within each square. The mapping of all variables took place at a scale of 4 inches per mile. Thus each 10 acre square is enclosed by grid lines spaced ½ inch apart, or every 220 yards in the field. A random set of co-ordinates was generated by a computer to locate a sample point to the nearest yard for every 10 acre square. The programming was such that these co-ordinates were printed across and down the page every ½ inch.[2] Consequently, these stratified, random sample points could be located directly on each map by means of an overlay. This method ensures

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[1] B. J. L. Berry, Sampling, Coding and Storing Flood Plain Data, Agricultural Handbook No. 237, Farm Economics Department, U. S. Department of Agriculture.

[2] All computer programmes are presented in the appendix.

that the whole study area will be covered, while at the same time allowing for random samples to be selected every ten acres.

Since the nature of the study is such that the smallest mapping unit is about 2 acres, it appeared logical to take advantage of the fact that a computer could be programmed to transform each set of co-ordinates into an asterisk (*) and print this symbol at the required point. Thus, the accuracy of each sample point is now reduced from 1 square yard within every 10 acre grid to 0.5 acres as only a possible maximum of 20 symbol, or asterisk, spaces exist in each square. This fact, however, does not detract from the sampling technique because a readable pen-point symbol, or dot, at this mapping scale, would approximate closely the size of the asterisk. Furthermore, it is doubtful whether a point, accurate to within one yard, could be located either on a map or in the field.

Each sample point was traced unto a transparent overlay sheet, and grid and location lines were drawn in corresponding locations on maps containing various data. In this way, the variables could be related at exactly the same point in each square. The precise (yard) co-ordinates can be utilized in the event that the sample point occurs directly over a boundary line separating two areal distributions.

After suitable maps had been prepared, which showed the actual distribution of soil type, land use type, yields and certain field management factors, the sample point system was used for coding and storing the variables. A simple numerical system was devised which assigned a specific number to each type of variable possible in the soil type and land use type categories. Specifically, each soil type of the northern variable section was given a nominal value, from 1 to 11, for purposes of identification. The values assigned are as follows:

1 - Silty and Sandy Loam
2 - Gravelly Loam
3 - Very Fine Sand
4 - Muck
5 - Silt Loam and Loam
6 - Alluvium
7 - Silty Clay Loam
8 - Gravelly Loam Till
9 - Gravel
10 - Clay Loam and Clay Till
11 - Medium and Coarse Sand

Up to this point, it does not matter what numerical value is assigned to what soil type. The sequence used here merely follows the order of areal extent of each soil type as established in a previous section. Similarly, the soils of the southern, uniform section were given identifying nominal values. Here, however, the large areas of the silt loams were divided into sub-areas according to variations of slope and drainage. The

values in this instance are:

1 - Silt Loam (up to 3% slope)
2 - Silt Loam (3% to 6% slope)
3 - Silt Loam (imperfectly drained)
4 - Gravelly Loam Till
5 - Muck
6 - Poorly Drained Soils
7 - Gravels
8 - Alluvium
9 - Very Fine Sandy Loam
10 - Very Fine Silty Loam

Fourteen types of land use were recognized in the study area.[1] As in the case of the soil types, each was given an identification number. This land use code is presented below.

1 - Hay
2 - Oats
3 - Barley
4 - Mixed Grain
5 - Wheat
6 - Corn (Silage)
7 - Pasture
8 - Permanent Pasture
9 - Idle Grasslands
10 - Woodland
11 - Gravel Pits
12 - Farm Yards and Buildings
13 - Roads and Lanes
14 - Other (rural non-farm lands)

Information, with respect to yield, was obtained for certain land uses which included, hay, oats, barley, mixed grain and wheat. Yield data was coded as the actual number of bushels per acre and, in the case of hay, as bales per acre. Thus, these ordinal numbers could vary and were represented by either a 2 or 3 digit figure. Two management factors were considered for quantitative

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[1] Methodology regarding land use classifications is presented subsequently.

analysis. The first of these involves tiling.[1] If, at a sample point, a field was tiled, the tiling variable received a value of 1. If no tiles had been constructed, the value was 0. The second factor is the amount of artificial fertilizer applied. In this instance, as with yields, the actual number of pounds applied per acre was noted. Although no significant differences occurred in fertilizer type, the amount applied to corn varied considerably with that applied to grain and hay crops. Thus, fertilizer applications to corn was considered separately.

Certain productivity factors were available for certain land use types. Agricultural statistics, for the same year, involving the actual per bushel value of oats, barley, mixed grain and wheat and the per bale value of hay were coded as the absolute dollar and cent value at each sample point for the appropriate crop.[2] In 1965, the per bushel values were as follows: wheat, $1.64; oats, $.79; barley, $1.04; mixed grain, $.87; and hay at $.45 per bale.

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[1]A tiled field is taken to mean an area in which artificial sub-surface drains have been installed.

[2]All per unit values represent averages for Waterloo County as found in Agricultural Statistics for Ontario, 1965, Ontario Department of Agriculture and Food, pp. 70, 72, 73, 77, 85.

Data Storing

Once the above data had been collected and coded it was transferred unto standard 80 column punch cards. Each data card contained all the variables that were present at each sample point. Ten pieces of information, involving 25 columns, were punched on each card for each sample point. For the sake of compactness, the observations at two consecutive sample points were recorded on one card, thus cutting in half the number of data cards required.

A brief note is necessary here on the actual data entry method. The first four columns were reserved for the identification of the 10 acre grids. Since the computer was programmed to print 20 sample points across the page for 40 rows down the page, each 10 acre square could be represented by co-ordinates whose X axis (west - east) ranged from 1 to 20 and whose Y axis (north - south) ranged from 1 to 40. In this way, any desired sample point can be easily located by scanning through the data cards.

Column 5 indicates whether a sample point is located in the northern variable soil strip (designated by the numeral 1) or in the southern uniform soil strip (designated by the numeral 2). In this manner, the same random sample point overlay can be utilized for both study areas. Columns 6 to 8 merely assign an identification

number to each sample point. These numbers are in chronological order and are numbered consecutively through both study strips. In the case of this thesis, there were 692 observation points of which 364 existed in the variable soil section.

As indicated previously, up to two digits were required to code the various soil types and land use types. Thus, columns 9 and 10, 11 and 12, were reserved for soil and land use data respectively. If a land use type consisted of either hay, oats, barley, and mixed grain or wheat, then the actual yield was entered in columns 13 to 15.[1] If none of the above land uses existed, these spaces were not punched.

Column 16 indicates whether tiling is present (1) or absent (0) at a point and columns 17 to 19 and 20 to 22 specify the absolute number of pounds of fertilizer applied per acre for corn and for other crops respectively.

The per unit value of certain crop types required up to three cell spaces on each data card. Space 23 was reserved for the dollar amount and spaces 24 and 25 for the cent values. Thus, the actual per unit return could be noted at each sample point where a crop type with a known yield existed. Table 1 depicts graphically the type

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[1]All yields are in bushels per acre, except hay, which is in bales per acre.

TABLE 1

POINT DATA PERTAINING TO COLUMNS 11-25

LAND USE (11-12)	YIELD (13-15)	TILING	FERTILIZER CORN (17- 19)	FERTILIZER OTHER (20-22)	$ VALUE (23-25)
1. Hay	*	*		*	.45
2. Oats	*	*		*	.79
3. Barley	*	*		*	1.04
4. Mixed Grain	*	*		*	.87
5. Wheat	*	*		*	1.64
6. Corn		*	*		
7. Pasture		*			
8. P. Pasture		*			
9. Idle Grassland		*			
10. Woodland		*			
11. Gravel Pits		*			
12. Farm Yards		*			
13. Roads & Lanes		*			
14. Other		*			

of information which was recorded, at each point, beyond column 12. Each variable that was considered appears with an asterisk opposite the appropriate land use type.

Data Utility

This section presents what can be done with data which has been coded and stored in the above manner, and how this data is actually utilized for the purposes of establishing land use - edaphic relationships. A subsequent chapter will indicate the results of all cross-sectional analysis.

Statistical Operations

Seven operations, utilizing the above data, were carried out. In each case the first 364 sample points, of Strip 1, were manipulated separately from the 328 sample points of Strip 2. The only exception to this fact existed in the final operation where certain phenomena of the two strips as a whole were compared.

1) Estimate of the Percentage Cover of Each Distribution. In estimating the percentage cover of each phenomena involving an areal distribution, the computer is programmed to scan the data deck for the number of occurrences of that particular distribution. Thus from the simple ratio of, $\frac{\text{number of occurrences of each phenomena}}{364} \times \frac{100}{1}$, the estimate

of percentage cover can be calculated,[1] If the number of occurrences of each phenomena is multiplied by ten, the resulting figure represents an estimate of the number of acres for each distribution. The phenomena considered in this instance consisted of the various soil type and land use type distributions and the areal extent of tiled land.

2) Estimate of Percentage Occurrences of Land Use Type per Soil Type. In this operation, each land use type is tested for the amount of its areal extent on each soil type. The data deck is scanned for the number of occurrences of each land use in turn on each soil type, taking one soil type at a time. From operation 1, presented above, the total number of occurrences of each soil type can be determined. Thus, the estimate of the percentage occurrence of land use type per soil type can be calculated from the following ratio:

$$\frac{\text{number of occurrences of a land use on a soil type}}{\text{total number of occurrences of that soil type}} \times \frac{100}{1}$$

3) Estimate of Percentage Occurrence of Tiling per Soil Type. Basically, this operation is similar to Number 2 immediately above. In this case, however, each

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[1] For Strip 2, 328 is substituted for 364.

soil type is tested for the degree to which it has been tiled. The ratio,

$$\frac{\text{number of occurrences of tiling per soil type}}{\text{total number of occurrences of that soil type}} \times \frac{100}{1},$$

indicates the estimate of percentage occurrence per soil type. Again, it is a simple matter to convert each ratio into an estimate of the number of acres.

4, 5, & 6) Applying the "t" Test. It has been argued that the testing of the significance of the difference between two sample means is the most common kind of problem met with in the social sciences.[1] The t test is the most commonly used method of making this kind of test. In the case of this thesis, t testing was carried out to determine if, for each crop, there was a significant difference in yield from soil type to soil type, and if there was a significant difference in the amount of fertiliser applied. A third t test established if there was a significant difference in crop value as soil type changed.[2] For each crop,

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[1] C. McCollough and L. VanAtta, Statistical Concepts (Toronto: McGraw - Hill Inc., 1963), p. 233.

[2] The common formula for t is: $t = \frac{\overline{x1} - \overline{x2}}{\sqrt{\frac{\sigma 1^2}{n1} + \frac{\sigma 2^2}{n2}}}$

where n1 and n2, x1 amd x2 and $\sigma 1$ and $\sigma 2$ represent the number, the mean and the standard deviation of two distributions respectively.

a matrix of t was constructed in turn for each of the variables of the yield, fertilization and dollar return or value per acre. Furthermore, for each crop and each variable, the ranked mean values of the variables were computed and printed by soil type. Thus, for example, the mean or average yield of hay for each soil type was printed in ascending order below the t matrix for hay and the yield variable. In this way, one can tell at a glance which soil has the higher yield and it is a simple operation to test the differing yields of any two soils at a time for significant differences by utilising the t values and the degrees of freedom established in the t matrix. As will become apparent in a later section, differences were considered significant only beyond the .05 level in this thesis.[1]

7) Mapping of Dollar Value. In order to obtain an estimate of the dollar value distribution over each study area, the computer was programmed to print, within each sample grid, the product of crop yield and crop value. Since crop yield was recorded as bushels or bales per acre, and crop value as the actual dollar and cent value per bushel or bale, therefore each

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[1] Each t matrix is presented in Appendix B for Strip 1 (Variable Soil Section) and in Appendix C for Strip 2 (Uniform Soil Section).

figure printed by the computer represents the dollar return per acre, for all field crops except corn. Since the mapping scale of this value map is the same as the land use soil map, visual comparisons between value and land use or soil type are possible by means of overlays.

Land Use and Land Use Mapping

Whereas the previous section outlined the statistical procedure for the analysis of certain quantifiable data, this section concerns itself with the methodology of obtaining the actual land use characteristics which are being related to edaphic factors.[1]

Land Use Classification

The system of land use classification utilised in this study follows closely that devised for the Canada Land Inventory. The fourteen categories, presented above, embrace the range of possible land uses that exist in the study areas. Based upon empirical evidence in the field, those categories which are not self explanatory, or which have been modified to suit this

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[1] The term "land use" is applied here as defined in the Introduction.

study, are defined as follows:

Mixed Grain - Oats and Barley sowed and harvested together.

Pasture - Improved pasture which was utilized at the time of the land use survey as a grazing field. In each case, lands bearing such a designation were in the "pasture" stage of the crop rotation cycle.

Permanent Pasture - Lands which are not included in the rotation cycle but which are consistently used for grazing purposes.

Idle Grassland - Lands which are not included in the crop rotation cycle and which are unused for any agricultural purposes at the present through management choice.

Gravel Pits - Any area whose soil profile has been disturbed for the purposes of extracting parent material.

Farm Yards and Farm Buildings - Included in this category are any small domestic gardens and orchards which are logically a part of the farm yard and building unit.[1]

Other - All uses which do not conform to any of the other 13 use classes are termed as "other". In effect, only rural non-farm dwellings, churches, schools and village areas occur in this category. Because of the almost total rural nature of the study area and infrequent occurrence of any one of the above uses, it was expedient to use this broad general class.

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[1] A previous investigation has indicated that fruit trees, mostly apple, occur in concentrations of less than two dozen trees and in areas adjacent to the main farm house. See J. A. Mage, The Physical Basis for a Land Capability and Land Use Classification in Woolwich Township, unpublished B. A. Thesis, University of Waterloo, 1965.

Land Use Mapping

All land use characteristics were mapped on a field by field basis from air photos at a scale of 4 inches per mile. Such a scale permits readable land use units representing areas as small as 2 acres. Since the smallest areal extent of agricultural land use in the study area was about 6 acres and since all soil type data was available at the same scale, there was no advantage in increasing the mapping scale as no increase of detail would result.

Because there was not a land use map available a detailed land use survey was carried out in the field in June and July of 1966. The names of the farmers involved were obtained from the Waterloo County Assessment roles. These roles also indicated the religion of the farmers, the size of farms, and the assessed value of each farm holding.

Over 85 per cent of the farmers in the study area are of the Mennonite faith. These people, especially the Old Order Mennonites, tend to be very conservative and choose to remain aloof from modern society as much as possible.[1] Since about 56 per cent

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[1]See R. Murdie, A Geographical Study of the Mennonite Settlement in Waterloo County, unpublished B.A. Thesis, Waterloo Lutheran University, 1961, for an adequate discussion of the cultural characteristics of the Mennonites.

of the Mennonites in the study area are of the Old Order, the method of interview became a prime consideration. The possibility of sending questionnaires to each farmer was quickly discarded as the probability that these people would complete and return answers to an individual was low. The nature of the information desired necessitated "on the spot" interviews with each farmer.

Briefly, the interview procedure went as follows:

1) Requesting the farmer to delimit his property lines on the air photo.

2) Requesting the farmer to indicate land use type and yield at each sample point (which had been plotted on the air photo as outlined previously).[1]

3) Noting the areal extent of tiling.

4) Obtaining from the farmer the rotation cycle utilized and the amount of fertilizer applied.

5) Recording, in so far as was possible, the economic characteristics which would indicate the general productivity and gross income of each farm unit. These characteristics consisted of: the type and turnover of livestock and poultry, the general productivity of livestock and poultry, and any other economic return realized, eg. the amount of maple syrup produced.

6) Noting the various input characteristics such as the amount of hired help and the total number of "man-days" expended, the value of equipment and the type of farm operation.

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[1]All land use and yield data was for the year 1965.

Gross Farm Productivity and Income

Since one of the primary purposes of this investigation is to determine the total productivity of the two study strips as well as the productivity of individual soil types within the two strips, it became necessary to obtain income figures in addition to those computed from crop yield data. Although the farmers were willing to disclose various productivity characteristics, they hesitated to reveal their yearly gross income. Thus, in order to calculate the gross dollar return per acre, on a farm unit basis, the writer was forced to seek other sources of information.

Census data in Ottawa for the year 1961 was made available for groups of 3 or more farms. This information contained over 175 categories pertaining to gross productivity, land use and other economic characteristics such as the amount of hired help.[1]

The two study areas were divided into Super-Blocks or sub-areas of at least 3 farms. In each instance, an attempt was made to group together 3 or more adjacent farms which existed on a similar soil type and which were of approximately equal area. As far as possible,

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[1]This research was allowed only after the writer had sworn not to reveal any figures from any one individual farm. Indeed, no figures, other than averages for 3 or more farm units, were allowed to be taken from the Census Building in Ottawa.

dairy or specialty farms were placed within the same Super-Block. This criteria worked rather well in both study areas. In Strip 1 (Variable Soil Section) there were no "specialty" farms and, as farm sizes were rather equal, it was a simple matter to approximate the boundaries of 3 farms to a similar soil type. For Strip 1, nine such Blocks exist (Figure 7). Four of these Blocks are on similar soil type, four have about equal proportions of mixed soils and one Block embraces a group of small, part-time farms which was concentrated along the southern edge of Strip 1.

In Strip 2 (Uniform Soil Section) eight Super-Blocks were created (Figure 8). Six of the Blocks each contain 3 full farms, one Block contains 2 full farms and one part farm and the remaining Block consists of various small holdings belonging to farm units outside of the study area. This last Block was not used in the computation of per farm income for Strip 2.

By coincidence, the only three dairy farms in Strip 2 were located adjacent to each other and thus were placed in the same Super-Block. The majority of the Blocks contain mainly Silt Loam soils, with minor pockets of varying soil type occurring throughout in no set pattern. Because of this fact and, taking into consideration the grouping criteria, meaningful results can be obtained with respect to the farm economy.

patterns of both Strips, even though each individual figure, value or income range represents an average of at least 3 farm units.

It must be noted that the various income characteristics presented on the Super-Block basis are representative of the year 1961, whereas the land use type and yield data represent the year 1965. In spite of this discrepancy in years, meaningful interpretation can occur for the following reasons:

a) The greater majority of farm units operate in a mixed agriculture economy. Thus, the crop type pattern will change from year to year only on the basis of the rotation cycle utilized.[1] Since it is highly unlikely that each farm unit will be at exactly the same stage in the cycle, it can therefore be assumed that the present (1965) pattern, over the area as a whole, does not differ significantly from the pattern which existed 4 years ago. Indeed, as was pointed out in the Introduction, stability is a characteristic of the whole Township.

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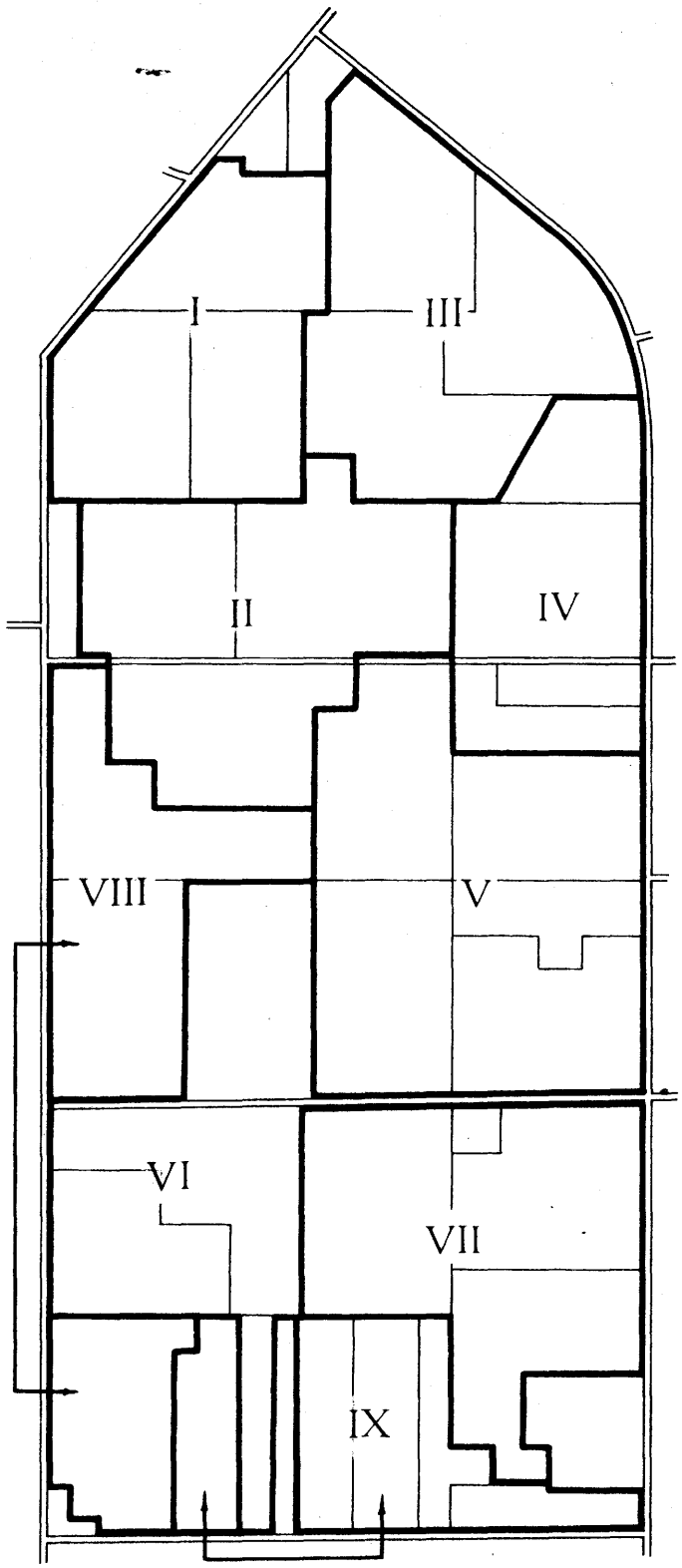
[1]Rotation methods will be further elaborated upon in the following chapter. However, the common cycle is four years with the "initial" crop appearing again in the fifth year.

VARIABLE SOIL SECTION

FIGURE 7



SUPER-BLOCKS

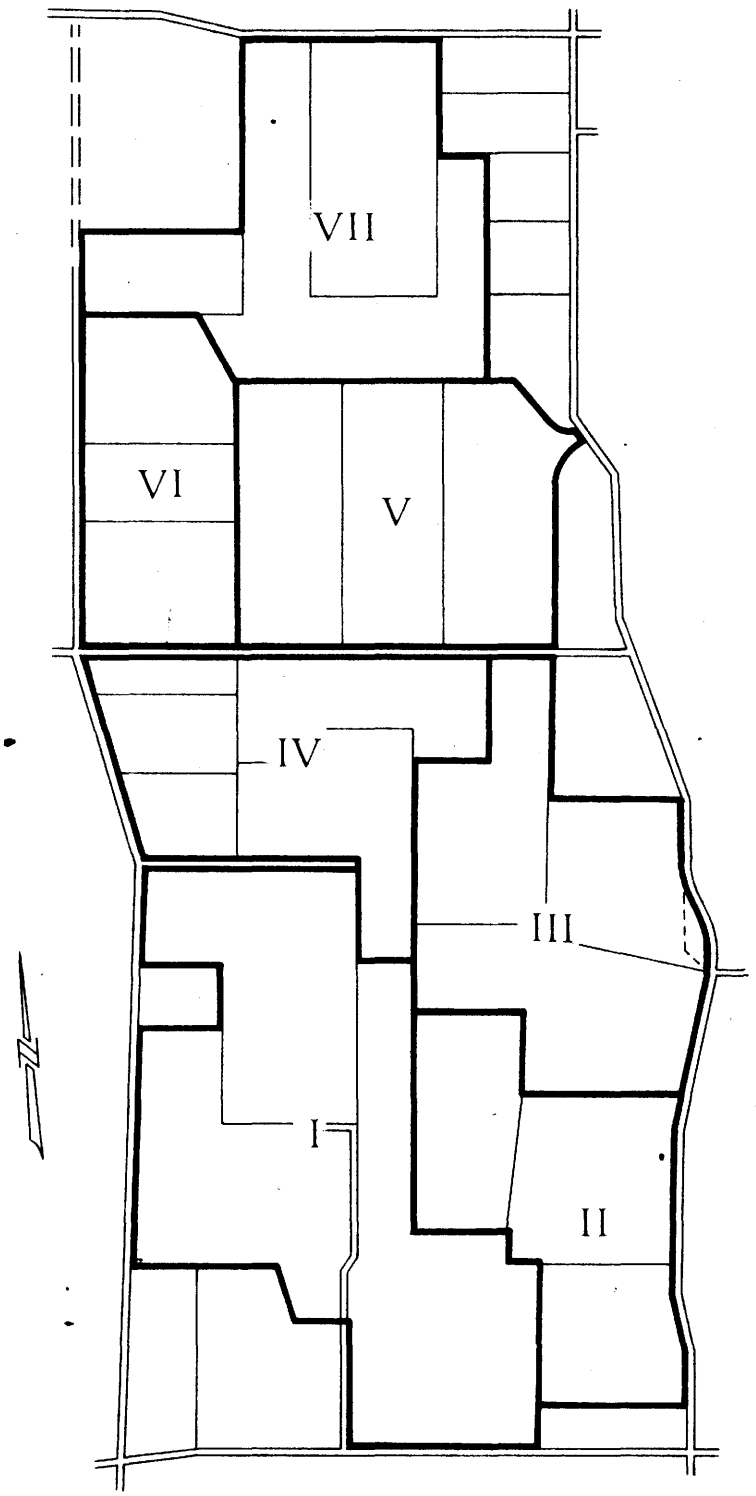
EACH BLOCK CONTAINS
AT LEAST THREE FARMS

1000 0 1000 2000
SCALE IN FEET

J.A.M.'67

FIGURE 8

UNIFORM SOIL SECTION



SUPER-BLOCKS

EACH BLOCK CONTAINS
AT LEAST THREE FARMS

1000 0 1000 2000
SCALE IN FEET

b) A check of farm ownership revealed that all but two of the farm units, in both study areas, were either owned or managed by the same individual in 1961 and in 1965. Thus, one can conclude that there were no appreciable changes in farming methods during this period.

III

DESCRIPTION OF THE SOIL TYPES

Soils of the Variable Section (Figure 5)

Silty and Fine Sandy Loam (Soil Type 1)

The Silty and Fine Sandy Loam soil type, associated with the Brant Series, comprises the greatest single soil type covering in the Variable Soil Section. Soil development has produced a profile that has the characteristics of the Grey-Brown Podzolic Great Group. The stony loam till, constituting the most recent geological deposit, is covered with 5 to 6 feet of stonefree material consisting of silty loam and fine sandy loam.

The soil materials are calcareous alluvial deposits, are often varved and consist of alternate layers of silt loam and fine sand. The surface, or A_1 horizon is dark greyish-brown and about 5 inches thick. The Ae, or A_2 horizon, which shows most clearly the effects produced by the process of leaching, is yellowish-brown and varies in thickness from 10 to 17 inches because of the wavy nature of the B horizon. The B horizon itself is easy to identify because of its dark brown colour, its blacky stucture and the concentration of clay. The general thickness of this horizon is about 10 inches. The C

horizon is usually found at a depth of about 30 inches. It is light brown in colour, calcareous and consists of varved fine sand and silt loam.

The topography is gently rolling and both external and internal drainage is good. Slopes approach 6 per cent and only very small pockets of poorly drained depressions are evident. The soil capability of this soil type is Class 1.[1]

Gravelly Loam (Soil Type 2)

The Gravelly Loams, covering about one fourth of the total Variable Soil Section, constitute the soil type referred to as Burford Gravelly Loam in Southern Ontario. These are well drained soils consisting of loam surface horizons on gravel deposits. The gravel

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[1] The purpose of presenting a capability class is to indicate that the agricultural potential of the two strips does not vary significantly, and to allow comparisons to be made between these two study sections and any other area in Southern Ontario on the basis of soil capability. The capability classification used is the 7 Class System devised by the Canada Department of Agriculture for the Canada Land Inventory. In this system, which need not be explained in detail here, soils are categorized, according to their inherent characteristics, into one of seven classes. Classes 1 to 3 represent excellent to fair agricultural soils, Class 4 represents marginal soils, Classes 5 and 6 are suitable for only occasional cultivation and permanent pasture and Class 7 is non-agricultural land.

was deposited by glacial meltwaters in the form of spillways or outwash areas (Figure 2). Thus, these deposits are stratified with a wide range in the size of material from one stratum to the other. Although the underlying material is usually coarse gravel, the surface soil, to a depth of one or two feet, may consist of fine sand. Cobbles are not uncommon and, in the study area, several minor pockets of Burford Cobbley Loam exist.

The Burford Gravelly Loams are also Grey-Brown Podzolics. They have a characteristic very dark greyish brown surface soil, A_1 horizon, about 4 inches in thickness. The yellowish brown A_2 horizon is usually less than 4 inches thick and is slightly acid. The B horizon always exists immediately above the calcareous gravel. It is dark brown and varies from 5 to 10 inches in thickness. The C horizon, or parent material, consists of pale brown calcareous gravel and is located at depths below 18 inches. The upper, A and B, horizons are friable and range from a fine crumb structure to a medium blocky structure.

In the study area, these soils have formed on gently rolling land with simple slopes varying from 3 to 6 per cent. Minor sections, adjacent to streams, have slopes as high as 12 per cent. Such soils are recognized as good to fair mixed-agricultural soils. The open

nature of the soil, conducive to moisture deficiencies in this climatic regime, and the stoniness of the soil material, which causes a low to medium content of the essential plant nutrients, leads to a soil capability rating ranging from Class 2 to Class 4. The majority of the soils pertinent to this study are Class 3. The underlying gravel substratum, which is characteristic of these soils, is much in demand for the construction of highways and roads and the manufacturing of certain building materials. Thus, most of the gravel pit operations in the study area are located on this soil type.

Very Fine Sand (Soil Type 3)

The soil type referred to as "Very Fine Sand" actually approaches a fine sandy loam commonly known as Waterloo Fine Sandy Loam. This soil was formed on the calcareous outwash sand deposits and exists adjacent to the gravelly loams described above. It also exhibits Grey-Brown Podsolic characteristics.

The dark brown surface horizon is usually quite thin and rests on a yellowish brown subsurface which can vary from 5 to 30 inches. The parent materials, originating as glacial outwash, occur at 3 to 8 feet beneath the surface. They are very permeable and have low moisture-holding capacities. The A_1 horizon is dark

brown in colour and about 3 inches thick. It is friable, has a fine crumb structure and consists of sandy loam. The A_{21} layer is the thickest of the A horizon, being about 11 inches thick. It is light yellowish brown in colour and very friable. The A_{22} horizon is about 4 inches in thickness and has acquired a pale brown colour. The B horizon occurs at about 18 inches. It is 9 inches thick, brown in colour and has a firmer consistency than the upper horizon. The parent material is calcareous, light grey, sand of loose consistency.

In the study area, deposits of this soil type obtain on land with 3 to 6 per cent slopes. Nominal patches occur with 6 to 12 per cent slopes. The soil capability of the gently undulating Very Fine Sands is Class 1. However, in those minor areas where slopes approach 12 per cent, the capability rating drops to Class 4, or marginal, as the loose consistency and open nature of the soil creates an erosion hazard when cultivation is practised. As a whole, these soils are adversely affected by droughtiness and have a naturally low fertility level.

Silt Loam and Loam (Soil Type 5)

The Silt Loam and Loam soil type represents the fourth largest agricultural soil category, in terms of areal extent, in the Variable Soil Section, although

its absolute area accounts for less than 7 per cent of the total acreage. The common name for this soil type is Honeywood Silt Loam and its silty texture gives it characteristics that are usually associated with water-laid or wind-laid deposits. These soils, however, occur in association with morainic soils such as the Guelph Loams. Thus according to the Ontario Soil Survey, modification and deposition by water was probably the more active process. Indeed, in the study area the silt loams exist adjacent to the kame moraine deposits and have formed on stony loam till. (Compare Figure 2 with Figure 5).

The silt loam deposits are generally not deep, varying in thickness from 12 inches to 36 inches over the calcareous loam till. They are a member of the Grey-Brown Podzolic group and their profile is similar to that of the well known Guelph Series. The A_1 horizon is about 4 inches thick and consists of a very dark greyish brown silt loam which is friable and of a fine crumb structure. The A_{21} horizon, 6 inches in thickness, is also a friable silt loam, although it is dark brown in colour and has a fine granular structure. The 8 inch A_{22} horizon consists of a pale brown loam of fine angular structure and friable consistency. The B horizon is a yellowish brown loam about 12 inches thick. It is still

of friable consistency; however, its structure is medium sub-angular blocky. The C horizon, or parent material, occurs at a depth of about 35 inches and consists of yellowish brown calcareous loam till.

These soil deposits exist on a rolling landscape with slopes approaching 6 per cent. They are well drained, have an ideal texture and are considered very important agricultural soils. Because of the small area of these soils, they do not contribute substantially to the good agricultural soils in the Variable Soil Section. However, the Silt Loams are classified as Class 1 soils and thus their excellence for a mixed-farming economy has to be recognised.

Minor Soil Deposits

The following five soil types comprise the remaining agricultural soils in the Variable Soil Section.

a) Silty Clay Loam (Soil Type 7): Two deposits of about 45 acres each occur in the study area (Figure 5). This soil type consists of brownish silty clay loam and silty clay and formed on calcareous lacustrine deposits. The capability of this well drained soil is Class 1.

b) Gravelly Loam Till (Soil Type 8): One deposit of about 53 acres exists in the extreme

northern tip of the Variable Soil Section. This soil type is commonly known as Guelph Loam and, like all the other agricultural soils in this section, is a Grey-Brown Podzolic. It consists of loam over a gravelly loam till parent material and is well drained. The agricultural capability is Class 1 and the Guelph Loams are considered to be among the best soils in Southern Ontario.

c) Gravel (Soil Type 9): Two small patches of gravelly soil, having a total area of 43 acres, occur in the study area. The soil material consists of stratified sands and gravels mixed with stones. The profile is thin, about 12 to 18 inches, and both internal and external drainages are rapid. At best, this is a Class 5 soil and is rather unimportant agriculturally.

d) Clay Till (Soil Type 10) and Medium Coarse Sands (Soil Type 11): These soil types are found in two small "pockets" of about 17 acres each. The former is a heavy, moderately well drained soil, while the latter is open-textured, coarse and well drained. Their soil capability rating is Class 2.

Bottom Land and Muck The two remaining soil groups, Bottom Land (Soil Type 6) and Muck (Soil Type 4) were developed on recent alluvium deposits and organic deposits respectively. Bottom Land (also referred to as Alluvium) occurs along most of the stream channels and consists of variable alluvial material whose texture depends on the type of soil being eroded upstream. Bottom Land soils have no profile development but consist mainly of alternating layers of coarse and fine materials. In the study area, these materials are comprised of silt loams and loams. These soils are arable when not flooded and are excellent as pasture lands. Because of the annual hazard of inundation by streams, the soil capability is Class 5.

Muck soils develop in areas that are water-saturated for the whole of the year. Such areas are common in undrained depressions which accumulate organic material. These organic soils do not have profile development but rather have various layers associated with different degrees of decomposition. In the study area, Muck soils are usually greater than 36 inches in thickness and have a bush covering. All Muck areas have a special capability rating of Class 0. Such a designation signifies that they are presently non-arable.

Soils of the Uniform Section (Figure 6)

Silt Loam (Soil Type 1 - 3) The silt loam soil types, representing the greater majority of soils of the Uniform Section, are associated with extensive deposits of stony till. They are generally imperfectly drained and occur on gently undulating areas where surface runoff is slow and internal drainage is moderate. Previously, the Ontario Soil Survey associated the common name of London Loam with this soil type. However, the new soil survey presently being completed, has indicated a higher proportion of silt than is usually attributed to the London Loams; hence, the re-classification of this soil type.[1]

The parent materials consist of lacustrine sediments and a stony loam till. The soil is a Grey-Brown Podzol. The A_1 horizon is very dark brown and about 6 inches thick. It has a fine granular structure and is very friable. The A_2 horizon has a fine granular structure, is slightly mottled, and varies in thickness from 8 to 10 inches. The yellowish-brown B horizon is mottled, friable and of a medium blocky structure. The wavy boundary of this horizon causes the thickness to vary from 2 to 8 inches. Some fine grit and gravel is also present

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[1] Although the Waterloo County Soil Survey is yet to be published, the Soils Science Department at the University of Guelph has indicated that the name "Conestoga Silt Loam" will probably be applied to this soil type. Such a name appears logical as the village of Conestoga borders the south-eastern portion of the study area.

here. The C horizon is usually found at a depth of about 19 inches. It is brown in colour, calcareous and consists of a stony loam till with numerous weathered dolomitic and sandstone pebbles.

These soils are important agricultural soils in Woolwich Township. In areas of imperfect drainage, the water table level remains fairly high during much of the year. However, the water table level drops during spring and summer. Thus, its effect upon the agricultural use of the soil is limited to delaying seeding operations in the spring. The soil capability of this soil type is Class 1.

Minor Soil Deposits The following seven soil types comprise the remaining soils of the Uniform Section.

a) Gravelly Loam Till (Type 4), Gravels (Type 7), Muck (Type 5), and Alluvium (Type 8). These soil types also exist in the Variable Section and have been previously described.

b) Poorly Drained Soils (Soil Type 6). This soil type occurs in poorly drained depressions which act as catch basins for excess run-off water. These soils are classified as Dark Grey Gleysolic and consist of a silt loam or a fine sandy loam. The common name is Colwood Silt Loam. The small areal extent and the poor capability rating limit the use of these soils for agricultural purposes.

c) Very Fine Sandy Loam (Soil Type 9) and Very Fine Silty Loam (Soil Type 10). These two soil types each comprise about 2 per cent of the study area. The former is well drained and occurs in small patches as outwash and sand while the latter is moderately drained and exists in the south-eastern portion of the area. Both soil types are Class 1 soils.

IV

DATA ANALYSIS

Statistical Data Analysis

Percentage Estimate of Areal Phenomena

The first statistical operation determined the percentage estimate of the various soil types, land use types and extent of tiled land in the study areas. Since some of the results are only as accurate as the estimates derived from the sampling technique, these estimates were tested for any discrepancy from "reality". The soils of Strip 1 (Variable Section) were measured to determine their actual percentage cover of Strip 1. These results were then compared with the percentage estimate of each corresponding soil type. The findings, summarized in Table II, are as follows:

a) The estimate discrepancy ranged from a low of 0.04 per cent to a high of 0.57 per cent.

b) The sample estimate did not tend to be consistently higher or lower as five soil types had a higher percentage estimate and six had a lower estimate.

c) The amount of areal extent did not influence the degree of discrepancy. Thus, one can

conclude that estimates for soil types covering small areas are just as accurate as those for soil types covering a greater proportion of the study area.

d) The average estimate discrepancy was 0,29 per cent.

From the above findings, it was concluded that for the purpose of this thesis, sufficient accuracy could be obtained from the sample method, in estimating the areal distribution of the various phenomena studied.

TABLE II

PERCENTAGE DISTRIBUTION OF SOIL TYPE (VARIABLE SECTION)

SOIL TYPE	MEASURE OF PERCENTAGE	ESTIMATE OF PERCENTAGE	DIFFERENCE
1	37.24	36.81	0.43
2	24.82	25.00	0.18
3	12.92	13.46	0.54
4	6.89	6.32	0.57
5	6.80	6.59	0.21
6	3.72	4.12	0.40
7	3.68	4.12	0.44
8	1.69	1.65	0.04
9	1.24	1.10	0.14
10	0.5	0.55	0.05
11	0.48	0.27	0.21
	99.99	99.99	

Soil Type Distribution

In the Variable Soil Section, no one soil type has a clear majority areally. The Silty and Sandy Loams, covering some 36.81 per cent, or nearly 1,340 acres, of the study area, represent the largest single soil

type. Gravelly (Burford) Loam accounts for 25 per cent (910 acres) and Very Fine Sand extends over 13.46 per cent, or about 489 acres. Of the remaining eight soil types, two cover 6 per cent, two over 4 per cent, two over 1 per cent and two less than 1 per cent. Table III indicates the percentage and acreage of each soil type. These values will be used throughout the remainder of the thesis.

The Uniform Soil Section is dominated by the Silt Loam deposits which cover over 78 per cent, or about 2,591 acres of the study area. Within this soil type there are sub-areas which are delineated according to slope and drainage. Thus, the Silt Loams encompass some 29.27 per cent of imperfectly drained soil, 20.43 per cent of soil with slopes up to 3 per cent and 28.96 per cent of soils with slopes up to 6 per cent. Each of the remaining 7 soil types in the Uniform Soil Section covers less than 6 per cent of the study area, with 6 of these soil types combined, accounting for less than 15 per cent. Hence, the term "Uniform" can be convincingly applied to this study strip. Table IV presents the areal distribution of each soil type in this area.

Distribution of Tiled Land

For both study strips the amount of tiling was calculated as a percentage of each total area by

TABLE III

AREAL EXTENT OF SOILS
OF THE VARIABLE SECTION

	SOIL TYPE	NUMBER OF ACRES	PERCENTAGE
1	Silty & Sandy Loam	1,339.88	36.81
2	Gravelly Loam	910.00	25.00
3	Very Fine Sand	488.94	13.46
4	Muck	230.04	6.32
5	Silt Loam & Loam	239.8	6.59
6	Alluvium	149.96	4.12
7	Silty Clay Loam	149.96	4.12
8	Gravelly Loam Till	60.06	1.65
9	Gravel	40.04	1.10
10	Clay Loam & Clay Till	20.02	0.55
11	Medium & Coarse Sand	9.72	0.27
	TOTAL	3,639.42	99.99

TABLE IV

AREAL EXTENT OF SOILS
OF THE UNIFORM SECTION

	SOIL TYPE	NUMBER OF ACRES	PERCENTAGE
1	Silt Loam (up to 3% slope)	670.1	20.43
2	Silt Loam (3% to 6% slope)	949.88	28.96
3	Silt Loam (Imperfectly drained)	960.05	29.27
4	Gravelly Loam Till	189.9	5.79
5	Muck	129.8	3.96
6	Poorly Drained Soils	80.03	2.44
7	Gravels	129.88	3.96
8	Alluvium	40.01	1.22
9	Very Fine Sandy Loam	69.9	2.13
10	Very Fine Silty Loam	60.02	1.83
	TOTAL	33279.65	99.99

soil type and as a percentage of each soil type itself. This indicates on what soil type tiling occurs and the degree to which each soil type is tiled.

In the Variable Soil Section nearly 20 per cent of the total land area is tiled. Of that 20 per cent, over 9 per cent occurs on Soil Type 1 (Silty and Sandy Loam), nearly 2 per cent occurs on Soil Type 2 (Gravelly Loam) and over 3 per cent occurs on Soil Type 3 (Very Fine Sand). These three soil types, representing over 75 per cent of the study area, contain over 70 per cent of all tiling. However, a much more meaningful way of depicting tiling is to state the actual degree to which each soil type is tiled. Table V presents this information. Note that, of the three dominant soil types, tiling exists on nearly one-fourth of Soil Type 1 and 3, while it covers less than 7 per cent of Soil Type 2. This latter phenomenon is not surprising in view of the fact that Soil Type 2 (Gravelly Loam) contains a fairly "open" or permeable sub-stratum which permits water to pass through rather quickly.

For the purposes of statistical analysis, the percentage occurrence of tiling is considered valid only if the soil type in question covers more than 5 per cent of the total area.[1] Of the two remaining soils, in this category,

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[1]This practice arose because certain minor patches of soil exhibited suspiciously high percentages of tiling occurrence. Such findings need not necessarily be wrong and they can best be explained by the fact that these minor patches occur in association with soil types of greater extent which are tiled. Thus, one can reason that it is highly unlikely that a farmer would break his line of tiles to exclude a soil type of very limited extent.

TABLE V

DEGREE OF TILING IN THE VARIABLE SECTION

	SOIL TYPE	PERCENTAGE OF AREAL EXTENT	TOTAL PERCENTAGE OF TILING EXTENT	PERCENTAGE OF SOIL TYPE TILED
(1)	Silty & Sandy Loam	36.81	9.1	24.6
(2)	Gravelly Loam	25.00	1.6	6.6
(3)	Very Fine Sand	13.46	3.0	22.4
(4)	Muck	6.32	0.3	4.3
(5)	Silt Loam & Loam	6.59	1.9	29.1
(6)	Alluvium	4.12	0.3	6.6
(7)	Silty Clay Loam	4.12	1.4	33.2
(8)	Gravelly Loam Till	1.65	1.4	83.0
(9)	Gravel	1.10	0.6	50.0
(10)	Clay Loam & Clay Till	0.55	0.0	0.0
(11)	Medium & Coarse Sand	0.27	0.2	100.0
	Total	99.99	19.76 (717.1 acres)	

Silt Loam and Loam deposits have over 29 per cent of their area tiled (the highest percentage of any soil in the Variable Soil Section) and Muck has over 4.3 per cent of its area tiled. This latter figure indicates that about 10 acres out of a possible 230 have been reclaimed by the installation of sub-surface drains.

In the Uniform Soil Section over 45 per cent, or about 1,480 acres, of the total area is tiled. Of this 45 per cent, 38 per cent exists in conjunction with the Silt Loam deposits. Thus, as expected, the Silt Loams not only embrace over 78 per cent of the total area, but also contain nearly 85 per cent of all tiled soil.

An analysis of the degree to which each individual soil sub-type and soil type is tiled reveals an interesting fact. Soil Type 3 (the imperfectly drained member of the Silt Loam) has over 65 per cent of its areal extent tiled. As anticipated, this figure represents the highest degree to which any individual soil is tiled. However, a comparison of Soil Type 1 (slopes up to 3%) and Soil Type 2 (slopes 3 to 6%) indicates that Soil Type 2, with over 43 per cent of tiling occurrence is tiled to a greater degree than Soil Type 1 which has nearly 30 per cent of tiling occurrence. Since, as will be shown in the following section, the amount of cropland does not vary appreciably between these two sub-types,

one can suspect that economic factors determining the ability of a farmer to install drainage tiles come into play.

Table VI summarizes the drainage data for the Uniform Section. Note that Soil Type 4 (Gravelly Loam Till), the only other soil type, apart from the Silt Loams, which covers over 5 per cent of the study section, has over 47 per cent of its area tiled. Note, furthermore, that over 15 per cent of the Muck deposits have been tiled and are thus utilized for crop land purposes.

Summary of Tiling - An analysis of the extent of tiling on each of the two study areas revealed the following facts:

a) The Variable Soil Section has less than 20 per cent (717 acres) of its area tiled whereas the Uniform Soil Section has tiles installed over more than 45 per cent (1,482 acres) of its area. This phenomenon can be attributed to the differences in topography, the relatively flat till areas of the Uniform Section as opposed to the more diversified, though only gently rolling, moraine and out-wash areas of the Variable Section, and the differences in the inherent characteristics of the soil types. Thus, the imperfectly drained member of the Silt Loams (in the

TABLE VI

DEGREE OF TILING IN THE UNIFORM SECTION

SOIL TYPE	PERCENTAGE OF AREAL EXTENT	TOTAL PERCENTAGE OF TILING EXTENT	PERCENTAGE OF SOIL TYPE TILED
(1) Silt Loam (up to 3% slope)	20.43	6.1	29.8
(2) Silt Loam (3% to 6% slope)	28.96	12.5	43.1
(3) Silt Loam (Imperfectly drained)	29.27	19.2	65.8
(4) Gravelly Loam Till	5.80	2.7	47.3
(5) Muck	3.96	0.6	15.4
(6) Poorly Drained Soils	2.44	1.8	75.0
(7) Gravels	3.96	0.9	22.9
(8) Alluvium	1.22	0.0	0.0
(9) Very Fine Sandy Loam	2.13	1.2	57.2
(10) Very Fine Silty Loam	1.83	0.0	0.0
Total	99.99	45.2 (1,482.6 acres)	

Uniform Section) has over 65 per cent, or over 640 acres, of its area tiled, while the highest occurrence of tiling, on the three dominant soil types of the Variable Section, is only about 25 per cent (335 acres) on Soil Type 1 (Silty and Sandy Loam).

b) In the Uniform Section a greater percentage of the Silt Loams, with slopes up to 6 per cent, are tiled than those with slopes up to 3 per cent. This fact appears to contradict the general trends established in the above section. However, a subsequent check revealed that about 25 per cent of Soil Type 1 (slopes up to 3%) occurs in the south-central section of the study area. Here, in conjunction with most of this deposit, exist the three dairy farms of Super-Block I. No portion of these holdings on Soil Type 1 is tiled. Nevertheless, this area contains two fairly extensive surface drainage ditches which, according to the farmers, provide an adequate means of drainage. This explanation appears as a logical reason for the discrepancy of tiling occurrence.

c) In both study sections, a certain percentage

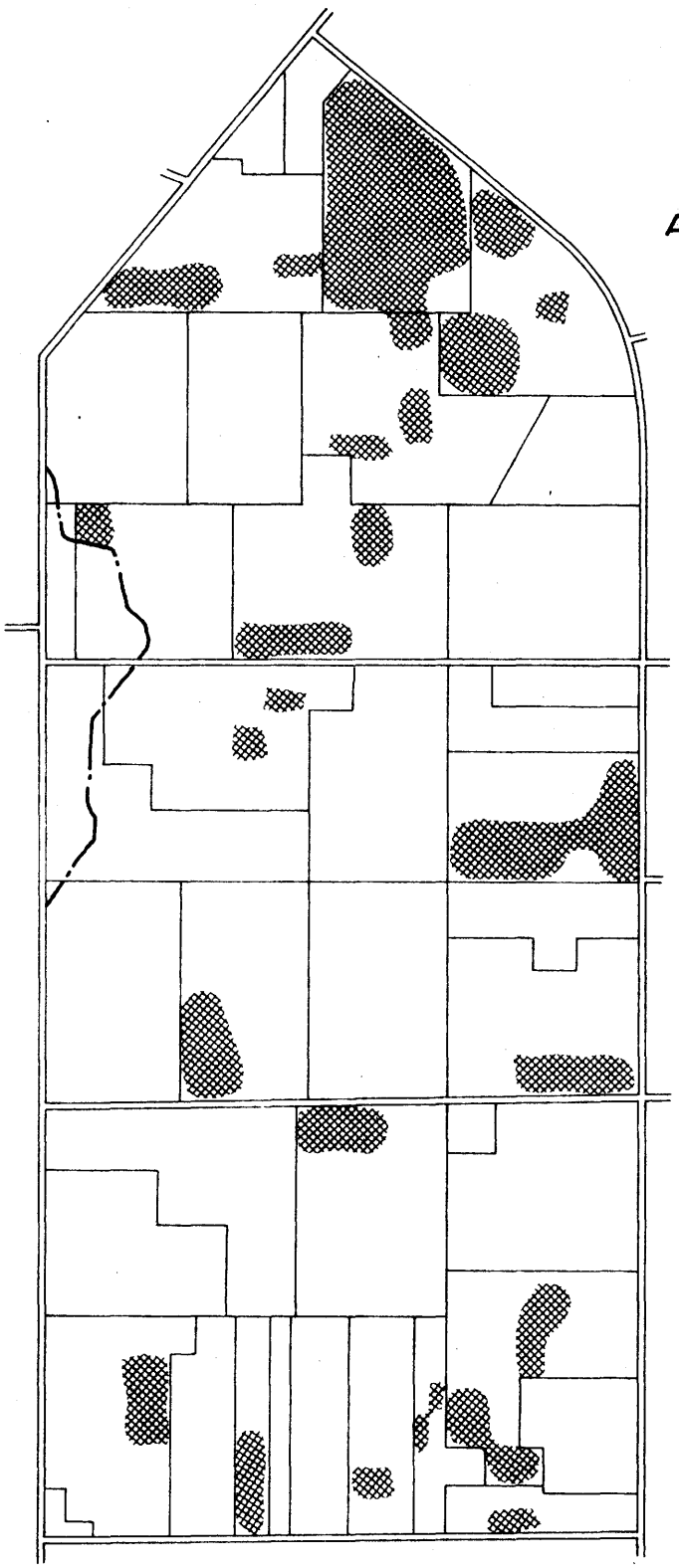
of Muck soils are utilized for crop land purposes. In the Variable Section over 4 per cent (about 10 acres) has been reclaimed, while in the Uniform Section over 15 per cent (about 20 acres) has been tiled.

d) The average percentage occurrence of tiling of all agricultural soils covering more than 5 per cent of each study area, approaches, to within 1 per cent, the total tiling occurrence of that section. More specifically, in the Variable Section the average is 20.7 per cent per soil type and the total occurrence is 19.7 per cent. In the Uniform Section the average occurrence is 46.2 per cent per soil type and the total occurrence is 45.2 per cent. Thus, the individual occurrence of tiling for minor soil deposits is treated with caution. Although, as was pointed out earlier, there is no reason to suspect the share of the total distribution.

The actual areal distribution of tiled fields and drainage ditches is shown on Figure 9 (Variable Section) and Figure 10 (Uniform Section).

VARIABLE SOIL SECTION

FIGURE 9



ARTIFICIAL DRAINAGE

LEGEND

TILED AREAS

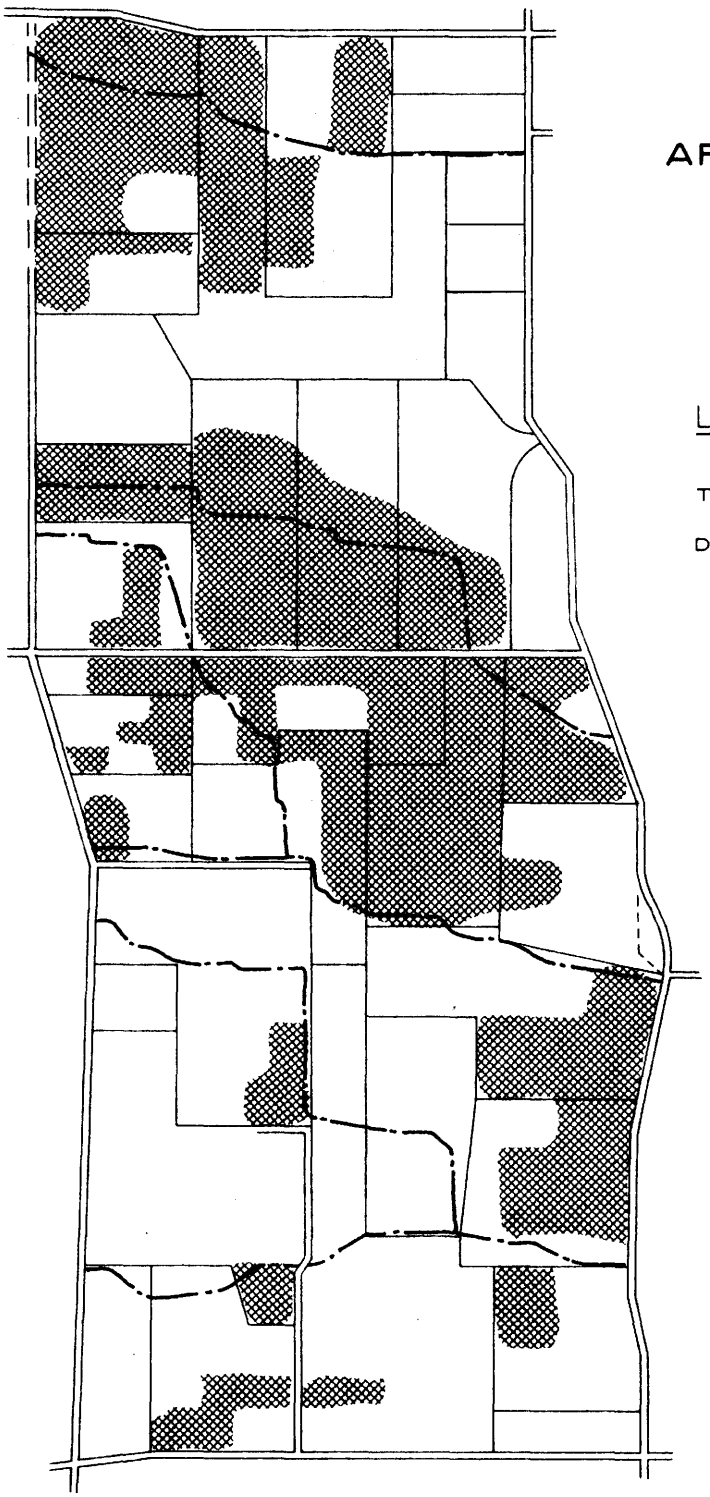
DRAINAGE DITCHES

1000 0 1000 2000

SCALE IN FEET

JAM'67

UNIFORM SOIL SECTION



ARTIFICIAL DRAINAGE

LEGEND

TILED AREAS

DRAINAGE DITCHES

1000 0 1000 2000

SCALE IN FEET

J.A.M. '67

Land Use Type Distribution

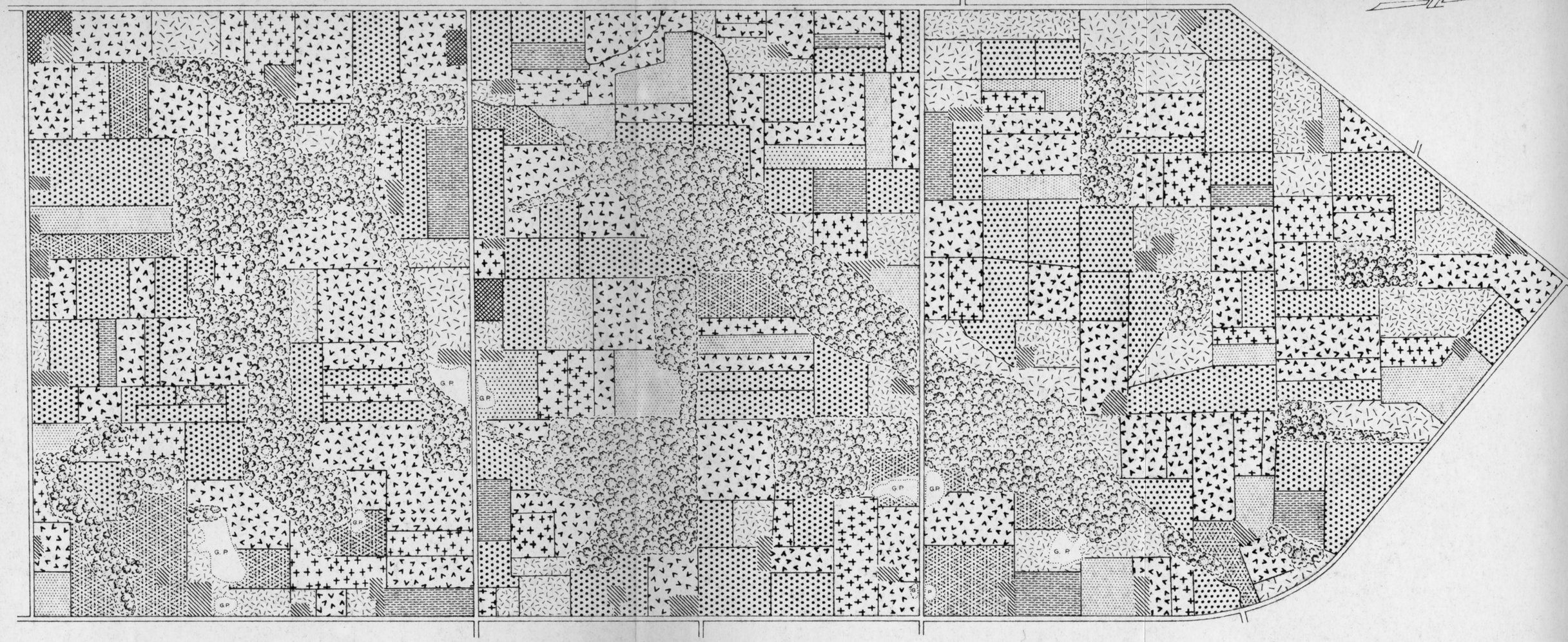
An examination of the percentage distribution of land use types in the study areas reveals several interesting facts. In the Variable Section (Figure 11) over 56 per cent of the total area is devoted to cropland which is comprised of hay, oats, barley, mixed grain, wheat and corn. Pasture and idle grasslands account for over 16 per cent and woodlands add another 20 per cent. The remaining 8 per cent consists of gravel pits, farmyards and buildings, roads and lanes and other uses.

Mixed grain, covering over 21 per cent of the total area, represents the largest single land use type in the section. Woodland follows closely with over 20 per cent and hay is third with nearly 20 per cent. Thus, the cropland is dominated by mixed grain and hay, with corn (6 per cent), oats (5 per cent), wheat (3 per cent) and barley (0.5 per cent) existing as minor cropland types. Farmyards and buildings collectively extend over more than 2 per cent (about 80 acres) of the area. Table VII indicates the areal extent of each land use type and the corresponding percentage distribution.

From the above information, the land use type composition for a hypothetical "average" farm for the Variable Section can be determined. Such a composition, based on the number of full farms in the study section, assumes that each land use type is equally distributed among all the farms.

FIGURE 11

VARIABLE SOIL SECTION



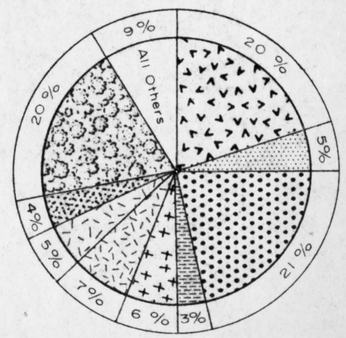
LEGEND

(1) HAY *
(2) OATS *
(3) BARLEY *
(4) MIXED GRAIN (OATS AND BARLEY) *
(5) WHEAT *
(6) CORN (SILAGE CORN)
(7) PASTURE
(8) PERMANENT PASTURE
(9) IDLE GRASSLANDS
(10) WOODLAND
(11) GRAVEL PITS — G.P
(12) FARM YARDS and BUILDINGS
(13) ROADS
(14) OTHER (RURAL NON FARM LANDS)

500 0 500 1000
SCALE IN FEET

* CROPS WHICH INCLUDE YIELD AND VALUE DATA

LAND USE TYPE
1965



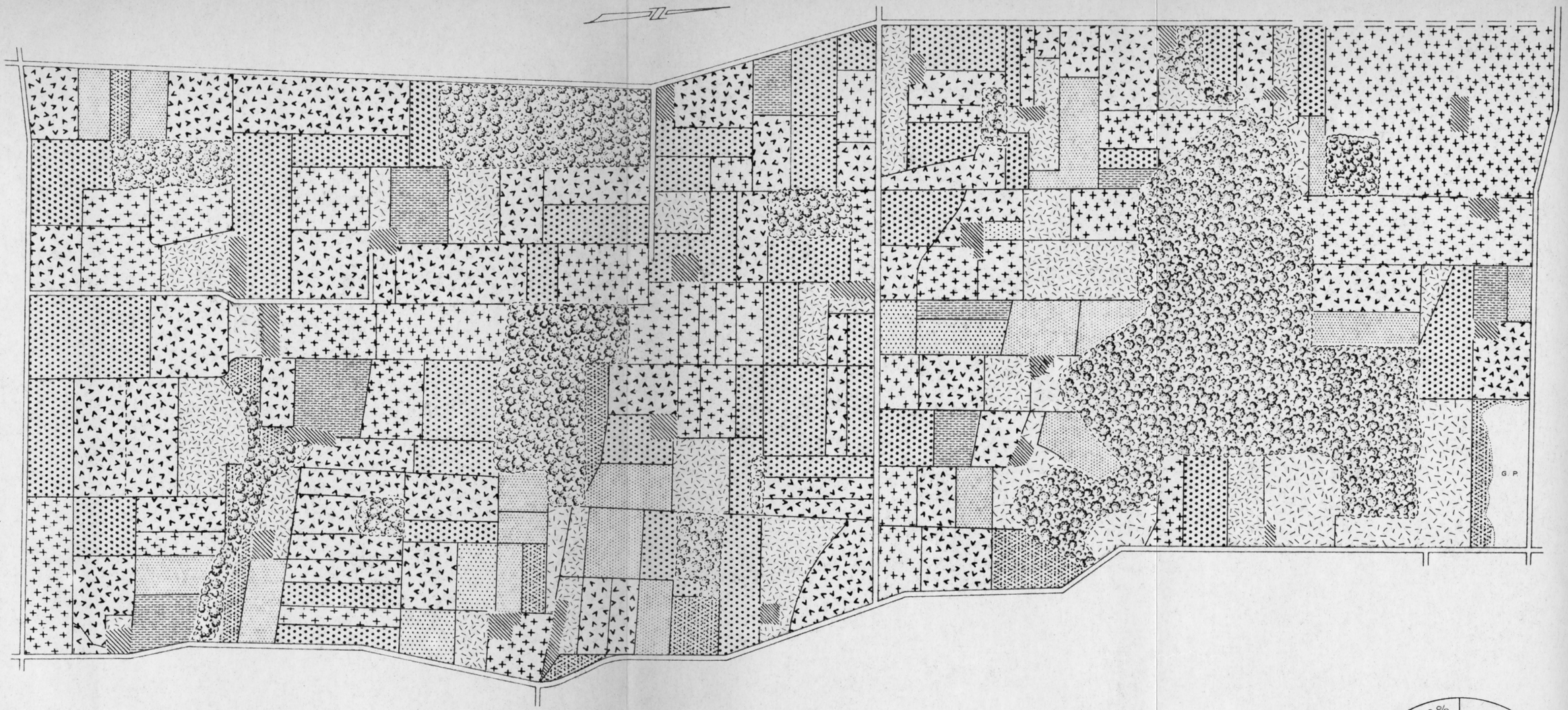
This assumption may or may not be true for any or more farms in the study area. However, for purposes of comparison with other areas, this hypothetical farm unit is valid for it eliminates the bias associated with choosing a "typical" farm. Further substantiation of this method exists in the fact that the study area is one of relative homogeneity in terms of farm operators and agrarian customs. The actual farm unit characteristics will be presented, as far as census data permits, in a subsequent section.

The average farm unit in the Variable Section embraces slightly less than 135 acres. It contains about 26 acres of hay, 28 acres of mixed grain, 8 acres of corn, 7 acres of oats, 4 acres of wheat and less than an acre of barley. The non-cropland land uses consist of about 10 acres of pasture, 7 acres of permanent pasture, 5 acres of idle grassland and 27 acres of woodland. Each farm unit also includes over 2 acres of gravel pits, nearly 3 acres of farmyards and buildings, over 3 acres of roads and lanes and over 1 acre of other uses. Table VII presents the actual average values for such a farm.

In the Uniform Section (Figure 12) about 64 per cent of the total area is devoted to cropland, over 10 per cent to pasture and idle grassland and nearly 20 per cent to woodland. The remaining 6 per cent consists of gravel pits, about 1 per cent, farmyards and buildings, less than 2 per cent, and roads and lanes, about 3 per cent. Land use type

FIGURE 12

UNIFORM SOIL SECTION



LEGEND

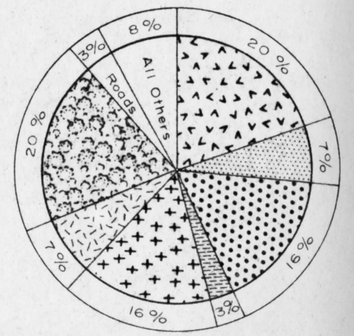
(1) HAY * —
(2) OATS * —
(3) BARLEY * —
(4) MIXED GRAIN (OATS AND BARLEY) * —
(5) WHEAT * —
(6) CORN (SILAGE CORN) —
(7) PASTURE —
(8) PERMANENT PASTURE —
(9) IDLE GRASSLANDS —
(10) WOODLANDS —
(11) GRAVEL PIT — GP
(12) FARM YARDS and BUILDINGS —
(13) ROADS —
(14) OTHER (RURAL NON FARM LANDS) —

500 0 500 1000
SCALE IN FEET

* CROPS WHICH INCLUDE YIELD AND VALUE DATA

LAND USE TYPE

1965



14 did not occur in this sample.

Hay, covering nearly 20 per cent of the total area, represents the largest single land use type in this section, although woodland, also covering nearly 20 per cent is a mere fraction of a per cent behind. Mixed grain and corn are third and fourth respectively as they both extend over more than 16 per cent of the area. Thus, in this study section, the cropland is dominated by hay, mixed grain and corn. Oats (7 per cent), wheat (nearly 3 per cent), and barley (about 2 per cent) represent the minor cropland types. The areal extent of each land use type and the corresponding percentage distribution are outlined in Table VII.

As in the Variable Section, a hypothetical "average" farm unit can be constructed. This farm embraces slightly more than 136 acres. It contains about 27 acres of hay, 22 acres of mixed grain, 22 acres of corn, 9 acres of oats, nearly 4 acres of wheat and over 2 acres of barley. The non-cropland land uses comprise nearly 10 acres of pasture, about 2 acres of permanent pasture, nearly 3 acres of idle grassland and about 27 acres of woodland. The remainder of each farm unit consists of about 1 acre of gravel pits, nearly 3 acres of farmyards and buildings and over 4 acres of roads and lanes. The actual average values for each land use are presented in Table VII.

A comparison of the land use type distribution in

TABLE VII

PERCENTAGE DISTRIBUTION OF LAND USE TYPE

LAND USE TYPE	VARIABLE SECTION			UNIFORM SECTION		
	TOTAL ACRES	ACRES PER FARM	PERCENTAGE	TOTAL ACRES	ACRES PER FARM	PERCENTAGE
(1) Hay	719.9	26.60	19.78	650.0	27.08	19.82
(2) Oats	190.0	7.03	5.22	229.9	9.57	7.01
(3) Barley	20.0	.74	0.55	60.0	2.50	1.83
(4) Mixed Grain	769.8	28.51	21.15	539.8	22.49	16.46
(5) Wheat	120.[illegible]	4.44	3.30	89.8	3.74	2.74
(6) Corn	230.0	8.51	6.32	530.0	22.08	16.16
(7) Pasture	259.8	9.62	7.14	229.9	9.57	7.01
(8) Permanent Pasture	190.0	7.00	5.22	49.8	2.07	1.52
(9) Idle Grasslands	140.1	5.18	3.85	60.0	2.50	1.83
(10) Woodland	729.8	27.02	20.05	639.9	26.66	19.51
(11) Gravel Pits	60.0	2.22	1.65	29.8	1.24	0.91
(12) Farm Yards & Buildings	80.0	2.96	2.20	60.0	2.50	1.83
(13) Roads and Lanes	89.9	3.32	2.47	109.8	4.57	3.35
(14) Other	40.0	1.48	1.10	0.0	0.0	0.0
TOTAL	3,639.4	134.63	99.99	3,279.7	136.57	99.99

the Variable and Uniform Sections reveals the following phenomena:

a) Over 7 per cent less area is devoted to cropland in the Variable Section than in the Uniform Section. Of the cropland area, significant differences between the two sections occur only in the distribution of corn, Indeed, corn occupies about 16 per cent of the Uniform Section and only about 6 per cent of the Variable Section. Doubtless, the presence, on the latter Section, of three large dairy farms and a feed farm, whose entire crop consists of corn, has increased the percentage occurrence of this crop type. Minor variations exist in the distribution of mixed grain, barley and oats. The former crop covers nearly 5 per cent more of the Variable Section, while the latter two crops encompass slightly more of the Uniform Section. Hay occurs with a nearly identical frequency on both sections and there is less than one-half of one per cent difference in the occurrence of wheat. Thus, with the possible exception of corn, the crop type distribution of both study strips is similar.

b) Of the non-cropland land uses, pasture occurs on about 7 per cent and woodland on about 20

per cent of both areas. Permanent pasture and idle grassland are more prevelant on the Variable Section where they are found on about 5 per cent and 4 per cent of the area respectively. On the Uniform Section, each of these uses occupies less than 2 per cent. No appreciable difference exists in the percentage distribution of farmyards and buildings and roads and lanes.

c) The total acreage of a hypothetical farm on either section is similar, differing by less than 2 acres. On a per farm unit basis the expected acreage of each land use is governed by its percentage occurrence within the study section. Note, with the aid of Table VII, that the number of acres of the majority of corresponding land uses of both sections is similar. Discrepancies do, however, arise. The average farm on the Variable Section can be expected to contain nearly 14 fewer acres of corn, 6 acres more of mixed grain, about 5 acres more of permanent pasture and nearly 3 acres more of idle grassland than its counterpart on the Uniform Section. Thus, one can conclude that a variability of soil will signify a greater proportion of mixed grain, permanent pasture

and idle grassland and a lesser extent of total cropland.

Land Use Type Occurrence Per Soil Type

General Relationships The relationships between soil type and land use are presented on the basis of the matrix of percentage occurrence of each land use for each soil type[1] and the matrix of percentage occurrence of each land use out of the total number of occurrences of that land use throughout the study area for each soil type. That is, the first matrix indicates the percentage distribution of all land uses found only on any one given soil type, the total of which equals 100 per cent for that soil type; the second matrix reveals the proportion to which any one land use type, the total of which equals 100 per cent, can be attributed to any soil type.[2] Table VIII serves as a representative example of the above statements. In this case, Column A indicates the percentage occurrence of land use on Soil Type 1 and Column B portrays the percentage distribution of Land Use Type 1 (Hay) on each soil type in the Variable Section.

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[1] As defined under "Methodology".

[2] All matrices are found in Appendix B (Variable Section) and Appendix C (Uniform Section).

TABLE VIII

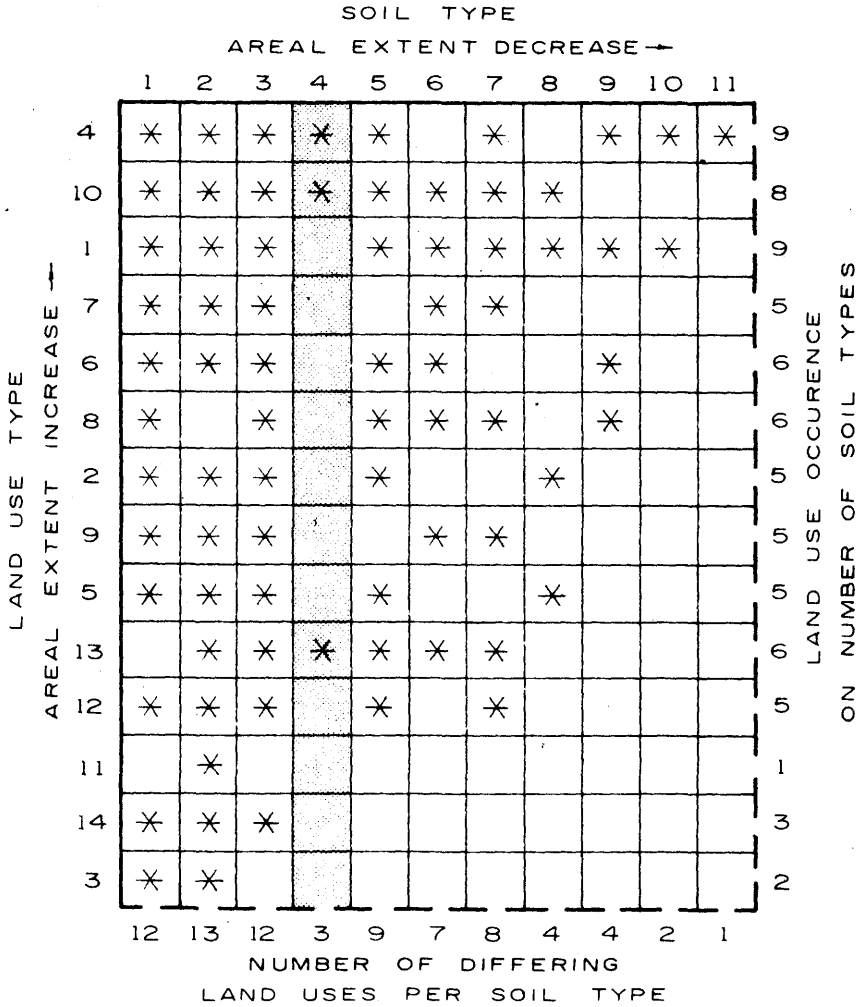
REPRESENTATIVE EXAMPLE OF MATRIX
OF LAND USE OCCURRENCE IN THE VARIABLE SECTION

Column A		Column B	
Soil Type 1		Land Use Type 1 (Hay)	
Land Use	Percentage	Soil Type	Percentage
1	21.64	1	40.28
2	6.72	2	26.39
3	0.75	3	18.06
4	28.36	4	0.00
5	3.73	5	8.33
6	5.97	6	1.39
7	8.21	7	1.39
8	6.72	8	1.39
9	2.24	9	1.39
10	12.69	10	1.39
11	0.00	11	0.00
12	1.49		
13	0.00		
14	1.49		
	99.99		99.99

Based on the matrices of occurrence, several statements can be made with respect to the number of land use types which occur within the study areas and within each soil type itself. By constructing a scatter diagram which combines land use type and soil type occurrence, a visual correlation can be achieved. Figure 13 represents such a scatter plot for the Variable Soil Section. Each of the 11 soil types occupies a cell space along the top east-west axis. The soil types are arranged in descending order of areal extent from west to east. Similarly, each land use type occupies a cell space along the western

VARIABLE SOIL SECTION

FIGURE 13



SCATTER DIAGRAM

J.A.M. '67

north-south axis with the areal extent arranged in ascending order from south to north. The numbers along these two axes represent the code form for the various land use types and soil types and are not necessarily in chronological numerical order. The lower east-west axis shows the number of differing land uses which exist for the appropriate soil type immediately above, and the eastern north-south axis portrays the number of differing soil types which any single land use type occupies.

Several inferences for this study can be drawn from Figure 13.

a) As an agricultural soil increases in area it will contain an increasing number of differing land use types. Thus, the number of differing land uses ranges from a high of 13 on Soil Type 2 (Gravelly Loam) to a low of one on Soil Type 11. Wherever this direct correlation is absent, such as on Soil Type 3 (Muck), Soil Type 6 (Alluvium) and Soil Type 2 (Gravelly Loam), which contains one land use more than would be expected) the discrepancy can be explained by the presence of a non-agricultural soil or a non-agricultural land use that is characteristic of only a certain soil type. Both explanations hold true in this case as Muck and Alluvium are considered to be non-

agricultural and Land Use Type 11 (Gravel Pits) was indicated to be present only on Soil Type 2 (Gravelly Loam). In this way, the three dominant soil types of the Variable Section, representing nearly 37 per cent, 25 per cent and over 13 per cent of the area respectively, each contain at least 12, or about 85 per cent, out of a possible 14 land use types.

b) Since, for the purposes of this study, agricultural land uses are those comprising Land Use Types 1 through 10, as defined in the "Methodology", it can be stated that for all agricultural soils, ie. those occurring in capability classes 1 through 3, that embrace at least 13 per cent of the total area, contain 90 per cent or 9 out of the 10 agricultural land uses. Furthermore, any combination of the remaining agricultural soils that comprises 13 per cent of the total study area also contains 90 per cent of all agricultural land uses and nearly 80 per cent of the total land use types.

Taking into account the inferences presented above, one can derive a definition of a mixed agricultural area based on land use occurrence and distribution. The premise

within which such a definition can be formulated is that each of the soil types in question be an agricultural soil ie. capability class 1, 2 or 3. For the study area, the following definition holds true.[1]

a) Any agricultural soil, embracing more than 13 per cent of the study area, contains 90 per cent of all agricultural land use types and 85 per cent of all land use types found within the study area.

b) Any combination of agricultural soil types that constitutes 13 per cent of the study area also contains the above percentage of agricultural and total land use types.

c) Any soil type displaying the preceding characteristics can be suspected to give rise to mixed agricultural farming.

A similar scatter diagram was constructed for the Uniform Section (Figure 14) and each agricultural soil, including the breakdown of the Silt Loam, was tested against the definition established previously. The percentage requirements for land use type were met by all agricultural soil types, except one, and by a combination of the remaining agricultural soils. Soil Type 1 (Silt

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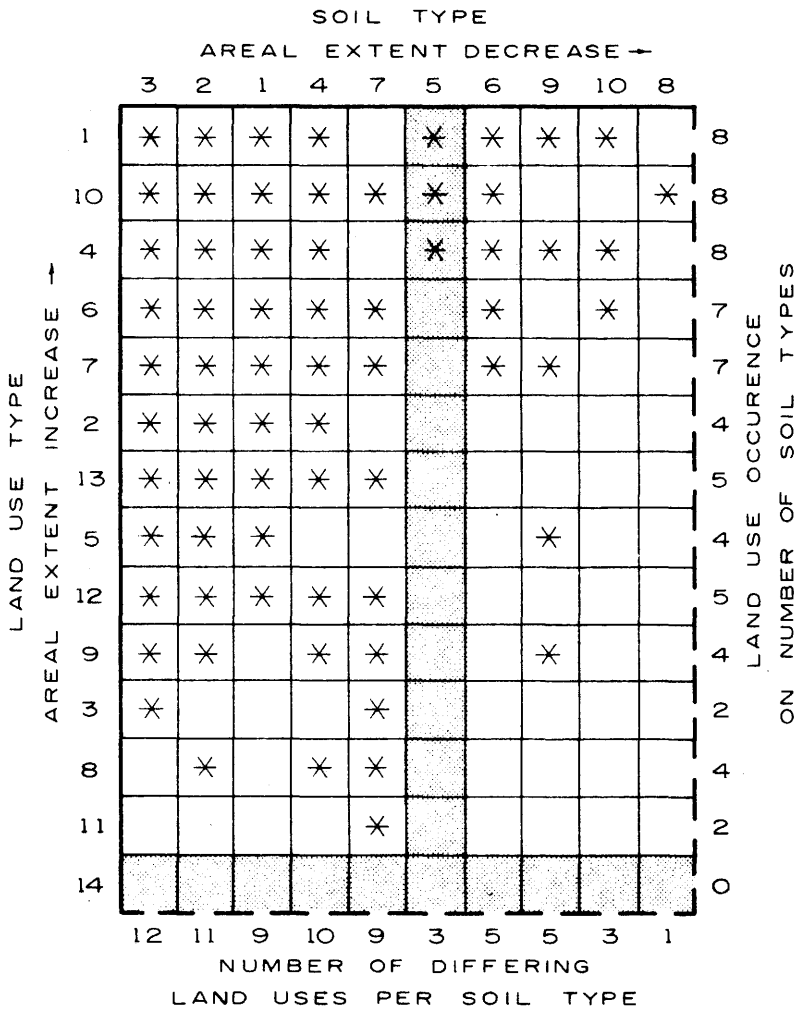
[1]It should be remembered that each of the study sections contains over 3,200 acres.

UNIFORM SOIL SECTION

FIGURE 14



SCATTER DIAGRAM

J.A.M. '67

Loam up to 3 per cent slope) contains only 70 per cent of the required agricultural land uses.[1] Thus, according to the definition, a type of farming other than mixed agriculture is taking place on this soil type. A subsequent check revealed that is the case as three large dairy farms, referred to previously, exist on about 25 per cent of this soil type. One can therefore conclude that the definition appears to be satisfactory in both study sections and can be utilized as an indicator of the presence or absence of mixed farming.

Specific Occurrence of Land Use Type Per Soil Type - This section relates the specific percentage occurrence of a land use type to a soil type. In the Variable Soil Section, 14 land use types and 11 soil types were recognized. Thus, in order for any given land use type to occur simultaneously at least once on each soil type, that land use type has to occur at least 11 times. Since the total number of possible occurrences is 364, each land use type has to cover at least 3 per cent of the study area. Similarly, each soil type has to occur at least 14 times or cover 3.8 per cent of the area before it could contain all land use types. In this way, only those soil and land use types that exceeded the above

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[1] Barley, Permanent Pasture and Idle Grasslands were absent.

areal requirements were considered to be valid for this analysis.[1] The soil types consist of Soil Types 1 through 10 and land use types consist of Land Use Types 1, 2 and 4 through 10, as Land Use Type 3, barley, embraces less than 1 per cent of the area (Table VII).

The previous section indicated that the majority of agricultural soil types contained at least 90 per cent of all agricultural land use types. Such a finding is not surprising in light of the premise that the study area represents mixed agricultural farming. However, it is of some importance and interest to note the degree to which a specific land use occurs on each soil type. For this purpose, a ratio of occurrence was devised as follows:

a) The percentage occurrence of each land use type was noted.[2] This figure represents the probability of occurrence of a land use on a soil type, but, utilized alone, it cannot indicate the percentage difference of a certain land use type over a variety of soil types.

b) The actual percentage distribution of each land use within the study area was divided into the percentage occurrence of that land use on each

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[1]The total area of all valid soils represents nearly 97 per cent of the study area.

[2]As defined under "Methodology" and presented in Appendix B (Variable Soil Section).

soil type. The resultant figure represents a ratio of occurrence for a land use which can then be compared from one soil type to another.

Table IX portrays these ratios for all valid[1] land use types and soil types in the Variable Section. Note, for example, that the ratio of occurrence of Land Use Type 1 (Hay) on Soil Type 1 (Silty and Sandy Loam) is 1.09. This signifies that it occurs 9 per cent more frequently on Soil Type 1 than for the study area as a whole. No claim can be made at this time whether or not the ratio of occurrence can be used to indicate any significant preference of one land use type for one soil type. In fact, it may be futile to do so in view of the general associations established previously and the fact that each farm unit regardless of soil types will contain a variety of land use types. The ratio merely indicates whether a land use type occurs to a greater or lesser degree from one soil type to another when all other factors are considered to be equal.

For the purposes of this investigation, any ratio exceeding 2.00 was regarded as indicative of a strong relationship between a land use type and a soil type. At this level a land use would have to occupy a soil type in twice the percentage proportion that it occupies the whole study

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[1] As defined above.

TABLE IX

RATIO OF OCCURRENCE IN THE VARIABLE SECTION

SOIL TYPE	Land Use Type 1	2	4	5	6	7	8	9	10
1	1.09	1.28	1.34	1.13	.94	1.14	1.28	.58	.63
2	1.05	1.05	.72	1.00	1.38	1.53		2.28	.54
3	1.34	.39	.67	1.23	.96	.85	.39	.52	1.42
4			.41						4.33
5	1.26	.79	1.18	1.26	1.31		1.39		.62
6	.33				1.05	.93	3.83	1.73	2.32
7	.33		2.20			.93	2.55	1.73	.33

area. Specific explanations or further study are required where a land use - soil type combination exhibits very high or very low ratios.[1]

From Table IX, several land use - soil type associations emerge. Hay, oats, wheat, corn and pasture occur on all agricultural soil types well within the ratio limits. Moreover, mixed grain exceeds the 2.00 ratio only on Soil Type 7 (Silty Clay Loam). This latter soil type embraces only about 4 per cent of the study area and so offers the theoretical possibility that each land use type could occur at least once. However, in view of its marginal areal extent and, taking into consideration the fact that mixed grain represents the largest single land use type, it appears logical to accept, without further questioning, the high occurrence of mixed grain. Based on the above, one can conclude that all valid cropland types appear with a similar percentage occurrence frequency on all valid agricultural soils.

Permanent pasture exists in a surprisingly high proportion on Soil Type 7 (Silty Clay Loam). The fact that this soil type is at the marginal end of the validity scale has been pointed out. Furthermore, a field check indicates

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[1]A check revealed that variations from the mean, of valid distributions, approached 2 standard deviations only when the ratio exceeded 2.00.

that on 3 farms in the northern portion of the Variable Soil Section the farm boundaries have created several odd-shaped small fields which have reverted to permanent pasture use. These fields occur on Soil Type 7. Thus, it is highly probable that permanent pastures are not a characteristic use of this soil type.

Idle grasslands occur with twice the expected frequency on Soil Type 2 (Gravelly Loam) as over the whole study area. In this instance idle grasslands are a distinct characteristic of Soil Type 2. This mediocre agricultural soil has prompted several of the less enterprising farmers to abandon fields.[1] Associated with the idle grasslands are gravel pits which dot the landscape occupied by this soil type. Gravel pits present a hazard to animals that are grazing and impede, to a certain extent, cultivation. A logical consequence is the preponderance of idle grasslands.

Land Use Type 10 (Woodland) is a distinct characteristic of Soil Type 4 (Muck) and Soil Type 6 (Alluvium) with ratios of occurrence of 4.33 and 2.32 respectively, and is the only land use type that exists on all valid soil types. Note, in Table IX, that Alluvium gives rise to hay,

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[1]It is of interest to note that 3 of the 6 farm holdings which exist for the most part on Soil Type 2, are operated on a part-time basis and the farm operators are not of the Mennonite faith.

corn, pasture, permanent pasture, idle grassland and woodland, with permanent pasture exhibiting a high ratio of occurrence (3.83). Muck, however, contains only mixed grain and woodland. Such findings are not surprising in view of the fact that tiling has reclaimed a certain amount of these soils.[1] Nevertheless, their main use is devoted to woodland and permanent pasture.

In the Uniform Soil Section, 13 land use types and 10 soil types were recognized. Based on methodology presented above, each land use type has to embrace at least 3 per cent of the total area and each soil type has to cover at least 3.9 per cent of the total areal extent in order to be considered valid. In effect only 4 soil types, comprised of the Silt Loams (Types 1 - 3) and Gravelly Loam Till (Soil Type 4), met this requirement. Of the 10 agricultural land uses only 6 exceeded the necessary percentage. These 6 are: Land Use Type 1 (Hay), 2 (Oats), 4 (Mixed Grain), 6 (Corn), 7 (Pasture) and 10 (Woodland). Table X presents the ratios of occurrence for the Uniform Section.

An analysis of Table X indicates that all valid soils contain all valid land use types. The ratio of occurrence exceeded the 2.00 level only in the case of oats and Soil Type 4. Oats then, represents the only

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[1] As discussed previously.

TABLE X

RATIO OF OCCURRENCE IN THE UNIFORM SECTION

SOIL TYPE	LAND USE TYPE 1	2	4	6	7	10
1	1.20	.63	1.26	.73	.85	1.07
2	.95	1.35	.83	1.43	.45	.97
3	.90	1.20	1.40	1.10	1.51	.48
4	1.32	2.25	.32	.65	1.50	.27

characteristic land use of a soil type in the Uniform Section. The three sub-areas of the Silt Loams, although not giving rise to any characteristic land use types, did display variations in the degree of association. Each sub-area contained two land use types whose ratio of occurrence exceeded that of similar land uses on the other sub-areas. In this way, hay and woodland tended to associate with Soil Type 1 (up to 3% slopes), oats and corn tended to exist more on Soil Type 2 (slopes 3% to 6%), and mixed grain and pasture occurred to a greater degree on Soil Type 3 (imperfectly drained).

The dominant feature of the Uniform Section, in this instance, is that only 6 of the 10 agricultural land use types are valid. A possible explanation for this phenomenon lies in the existance of the specialty farms, which together embrace some 23 per cent of the total area. It appears logical to conclude that the presence of these farms is sufficient to upset the mixed agricultural balance and concentrate land use type to only 6 valid categories over the area as a whole. Even when the Silt Loams are treated as one soil type, no additional land use types become valid.

Summary of Ratio of Occurrence - It is submitted that the ratio of occurrence is a useful technique to indicate the degree to which a land use type occupies any soil type

compared to the occurrence of that land use type in the study area as a whole. By placing a high degree of association only when the ratio exceeds 2.00, one can state qualitatively if a land use type is characteristic of a soil type.[1]

As utilized in this investigation, the ratio has pointed out characteristic trends over all valid soil types in the study area. It has indicated that the Variable Section is indeed a mixed agricultural area as 90 per cent of all agricultural uses are valid and are distributed in relatively the same proportion over all valid agricultural soils. In the Uniform Section, where only 60 per cent of agricultural land use types are valid, one can suspect that certain non-mixed farming elements have affected the patterns of land use.

A corollary to the definition of a mixed farming area as it applies to the Variable Section is to be noted. The fact has emerged that 90 per cent of all agricultural uses in the study area must be valid. This study of land use occurrence and distribution has indicated that the Uniform Section exhibits certain elements that are not typical of mixed farming.

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[1]This point raises the philosophical problem which is not unique to agricultural geography, ie. just how deep does one probe to establish significant differences which become obscured when any meaningful statement is to be made about an area greater than an individual field, farm unit or even soil type.

Yield - Soil Type Associations

This section analyses the variations in yield that occur from soil type to soil type. Significant differences were established by the use of the t test. Since the per acre value of each crop type is a function of the yield, the range of values and any significant differences are also discussed here. The characteristics of the Variable Soil Section will be dealt with first. All specific values of t are presented in Appendix B for the Variable Section and Appendix C for the Uniform Section.

Land Use Type 1 (Hay) - The average yields of hay ranged from a low of 90 bales per acre on Soil Type 3 (Very Fine Sand) to a high of 125 bales per acre on Soil Type 6 (Alluvium). Slightly over 95 bales per acre were obtained from Soil Type 1 (Silty and Sandy Loam) and Soil Type 2 (Gravelly Loam or, conventionally known as Burford Gravelly Loam). Soil Type 5 (Silt Loam and Loam) averaged over 116 bales per acre with each of the remaining 4 soil types yielding 100 bales to the acre. The per acre dollar return, as explained under "Methodology", varied from a low of $40.50 to a high of $56.25, ie. in the same proportion for each soil type as yields. Table XI presents yield and value data for hay.

The t test indicates that significant differences exist only in the case of soils whose yields fall below

TABLE XI

PER ACRE YIELD AND VALUE OF LAND USE TYPE 1 (HAY) IN THE VARIABLE SECTION

Soil Type	Yield in Bales	Dollar Value	Percentage of Hay Area
3	90.00	40.50	18.1
2	95.26	42.87	26.4
1	95.38	42.92	40.3
7	100.00	45.00	1.3
8	100.00	45.00	1.3
9	100.00	45.00	1.3
10	100.00	45.00	1.3
5	116.67	52.50	8.3
6	125.00	56.25	1.3

96 bales per acre when compared with soils whose yields exceed 116 bales. Thus, the yields of Soil Types 1, 2 and 3 vary significantly from the yields of Soil Types 5 and 6.[1] Since Soil Types 5 and 6 embrace less than 10 per cent of all hay while Soil Types 1, 2 and 3 contain nearly 85 per cent of the total hay area, it follows that the average hay yield for the Variable Section is about 95 bales per acre. This figure represents a dollar return of nearly $43.00 per acre. However, the high yields of Soil Types 5 and 6 should be noted, especially in view of the fact that Soil Type 6 (Alluvium) is generally considered non-arable. It may be concluded that a variability of soil type has produced significant differences

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[1]Differences were considered significant only beyond the 0.05 level of significance.

of hay yields in only 10 per cent of the total hay area.

Land Use Type 2 (Oats) - Oats were prevalent on only 5 soil types and ranged in yield from a low of 68.3 bushels per acre on Soil Type 1 to a high of 80 bushels per acre on Soil Type 8. The yields of each of Soil Types 2, 3 and 5 were 70 bushels. The corresponding values varied from $53.98 per acre to $63.20 (Table XII).

TABLE XII

PER ACRE YIELD AND VALUE OF LAND USE TYPE 2 (OATS) IN THE VARIABLE SECTION

Soil Type	Yield in Bushels	Dollar Value	Percentage of Oats Area
1	68.33	53.98	47.3
2	70.00	55.30	26.3
3	70.00	55.30	5.3
5	70.00	55.30	5.3
8	80.00	63.20	15.8

Significant differences existed only between Soil Type 1 and Soil Type 8 (Gravelly Loam Till or Guelph Loam) as there was nearly a 12 bushel per acre difference. The average yield per soil type was 71.7 bushels per acre. However, the average yield of Soil Types 1, 2, 3 and 5 (which embrace over 85 per cent of all the oats acreage) was just under 70 bushels. Hence, it may be concluded that the average yield of oats for the Variable Strip is about 70 bushels per acre. Furthermore, it has been established that the higher yields of Soil Type 8 are

superior only to the lower yields of Soil Type 1.

Land Use Type 3 (Barley) - Barley occurred on Soil Type 1 and 2 with respective yields of 75 bushels per acre and 50 bushels per acre. Because of the limited sample size, a statistical test revealed no significant difference between these two yields. The corresponding values were $78.00 and $52.00 per acre. As these two soil types each contained 50 per cent of all barley acreage, the average yield for the Variable Section is 62.5 bushels per acre.

Land Use Type 4 (Mixed Grain) - Mixed grain was found over a variety of soil types and ranged in yield from 60 bushels per acre on Soil Type 4 and 9 to over 85 bushels per acre on Soil Type 5. As may be suspected, such a range in yield contains significant differences. These significant differences, however, do not necessarily occur whenever yields appear to vary substantially. Table XIII presents the average per acre yield and value of mixed grain.

Because the test for significance was carried out for only 2 soil types at a time and because of the rather complicated patterns which emerged, the results can best be stated by means of a table. Table XIV indicates all cases where soil types portrayed significantly greater yields. In each instance, the soil type in column A exhibits significantly higher yields than each soil type

TABLE XIII

PER ACRE YIELD AND VALUE OF LAND USE TYPE 4 (MIXED GRAIN) IN THE VARIABLE SECTION

	Soil Type	Yield In Bushels	Dollar Value	Percentage of Mixed Grain
(4)	Muck	60.00	52.20	2.6
(9)	Gravel	60.00	52.20	1.3
(2)	Gravelly Loam	60.36	52.51	18.1
(3)	Very Fine Sand	69.29	60.28	9.1
(1)	Silty and Sandy Loam	70.00	60.90	49.3
(10)	Clay Loam and Clay Till	70.00	60.90	1.3
(7)	Silty Clay Loam	72.14	62.76	9.0
(11)	Medium and Coarse Sand	75.00	65.25	1.3
(5)	Silt Loam and Loam	85.83	74.67	7.8

in column B. Any soil type that does not appear in column A does not have a significantly higher yield of mixed grain when compared to any other soil type.

TABLE XIV

SIGNIFICANT VARIATION OF MIXED GRAIN YIELDS BY SOIL TYPE

A Soil Type	B Soil Type
1	2, 9, 4
10	2
7	2, 9, 4
11	1, 2

Four soil types displayed yields significantly greater than one or more of the other soil types. The yields of Soil Types 1, 10, 7 and 11 were all significantly higher than those of Soil Type 2. Furthermore, Soil Types

1 and 7 were significantly better than Soil Types 4 and 9; with Soil Type 11 surpassing Soil Type 1. The average yield per soil type was 68.07 bushels per acre while the average yield of the four leading mixed grain soil types, in terms of areal coverage of mixed grain was 67.9.[1] One can assume that the average mixed grain yield for the Variable Strip is about 68 bushels per acre.

Several relationships should be noted. Whenever a significant difference existed, Soil Type 2 (Gravelly Loam or Burford Loam) always exhibited lower yields. Moreover, next to Soil Types 4 (Muck) and Soil Type 9 (Gravel), Gravelly Loam portrayed the lowest per acre yield of any soil. Therefore, low yields of mixed grain are a characteristic of Gravelly Loam when compared with other agricultural soils in this area. Finally, the highest average yields were recorded on Soil Type 5 (Silt Loam and Loam), although these yields did not achieve the required level of significance when compared with the yields of other soils.

In the case of mixed grain, variations in soil type produced a variation of yield.

Land Use Type 5 (Wheat) - Wheat occurred on 5 soil types and ranged in yield from a low of 30 bushels per acre on

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[1] These four soil types embraced over 85 per cent of all mixed grains and consisted of Soil Type 1 (49.3%), Soil Type 2 (18.2%), Soil Type 3 (9.1%) and Soil Type 7 (9.1%).

Soil Type 8 (Gravelly Loam Till) to a high of 37.5 bushels per acre on Soil Type 3 (Very Fine Sand). The corresponding dollar return values were $49.20 and $61.50 per acre respectively. The t test failed to reveal any significant differences in yields. Table XV indicates the average per acre yield and value of wheat by soil type. The average yield for the Variable Strip as a whole was nearly 34 bushels per acre. In this instance, a variability of soil did not produce a significant variability of yield, although yields tended to be higher on the gravelly loams and sands.

TABLE XV

PER ACRE YIELD AND VALUE OF LAND USE TYPE 5 (WHEAT) IN THE VARIABLE SECTION

Soil Type	Yield in Bushels	Dollar Value	Percentage of Wheat
8	30.0	49.20	8.3
1	31.2	51.17	41.6
2	35.0	57.40	25.0
5	35.0	57.40	8.3
3	37.5	61.50	16.6

The following section comprises crop yields in the Uniform Strip.

Land Use Type 1 (Hay) - Hay yields varied from a low of 80 bales per acre on Soil Type 5 (Muck) to a high of 112 bales per acre on Soil Type 4 (Gravelly Loam Till). This range represents a respective dollar value of $36.00 and $50.40 per acre (Table XVI). Significant differences existed in

TABLE XVI

PER ACRE YIELD AND VALUE OF LAND USE TYPE 1 (HAY) IN THE UNIFORM SECTION

Soil Type	Yield in Bales	Dollar Value	Percentage of Hay Area
5	80.0	36.00	1.4
3	87.6	39.44	26.1
6	91.6	41.25	4.6
2	96.6	43.50	27.7
9	100.0	45.00	3.0
10	103.3	46.50	4.6
1	110.7	49.84	24.6
4	112.0	50.40	7.7

all cases between yields of over 100 bales and under 88 bales per acre. Specifically Soil Types 1, 4 and 10, each obtained significantly higher yields than Soil Types 3 and 5, while Soil Type 2 portrayed superior yields to Soil Type 5 only. The low yields of Soil Type 5 (Muck) are not surprising in view of the fact that they are representative of a reclaimed non-agricultural soil. However, at least 26 per cent of the total hay area gives rise to significantly lower yields because of the association with Soil Type 3 (Silt Loam, imperfectly drained). One can conclude the imperfectly drained member of the Silt Loams and Muck soils occasion significantly lower hay yields. The average hay yield for the Uniform Section is slightly over 98 bales per acre.

Land Use Type 2 (Oats) - Oats existed on 4 soil types and varied in yield from 82 bushels per acre on Soil Type 3 to 88 bushels on Soil Type 1. These yields represent a value

range from $65.37 to $69.78 per acre. No significant differences were noted, with the average yield of oats for the Uniform Section being nearly 86 bushels per acre.

Land Use Type 3 (Barley) - As indicated previously, barley constituted minor portions of only 2 soil types. Yields on Soil Type 3 were 82 bushels per acre and on Soil Type 7 were 90 bushels per acre. The corresponding values are $85.28 and $93.60 per acre respectively. As in the case of oats, no significant differences were evident. The average yield for the Uniform Section is 86 bushels per acre.

Land Use Type 4 (Mixed Grain) - Mixed grain yields fluctuated from a low of 60 bushels per acre on Soil Type 5 (Muck) to a high of 100 bushels per acre on Soil Type 6 (Poorly Drained Soils) with the appropriate dollar values being $52.20 to $87.00 per acre. Significant yield differences did not emerge between any two members of the Silt Loams. Nevertheless, each of the Silt Loams had a significantly better yield than Soil Type 9 (Very Fine Sandy Loam) and Soil Type 5 and, the yield of Soil Type 6 was significantly higher than that of each of the Silt Loams. This latter phenomenon can probably be attributed to the excellent efforts of the farmers as 75 per cent of the Poorly Drained Soils have been tiled and are cultivated.

The average per soil yield of mixed grain is about

82 bushels per acre. Because the Silt Loams contain nearly 91 per cent of all the mixed grain, the average yield for the Uniform Section as a whole is about 86 bushels per acre. Apart from the yield variations produced by the minor soil deposits, the yield of mixed grain is similar throughout this area. Table XVII presents the yield and value data for this crop.

TABLE XVII

PER ACRE YIELD AND VALUE OF LAND USE TYPE 4 (MIXED GRAIN) IN THE UNIFORM SECTION

Soil Type	Yield in Bushels	Dollar Value	Percentage of Mixed Grain Area
5	60.0	52.20	1.8
9	70.0	60.90	1.8
4	85.0	73.95	1.8
10	85.0	73.95	1.8
3	85.2	74.15	40.7
2	86.2	74.95	24.1
1	88.2	76.75	25.9
6	100.0	87.00	1.8

Land Use Type 5 (Wheat) - Wheat was found on 4 soil types and varied in yield form 31 bushels per acre on Soil Type 3 (Imperfectly Drained Silt Loam) to 48 bushels per acre on Soil Type 1 (Silt Loam, slopes up to 3%). Although representing one of the highest per bushel values, the dollar return per acre was one of the lowest of the grains because of the inherently lower yields of wheat on a bushel per acre basis. These values ranged from $50.84 per acre to

$79.95 per acre.

The above values did not differ significantly. Consequently, the average yield of about 37 bushels per acre is representative of the Uniform Section as a whole.

Summary of Yield - Soil Type Relationships - In each study area several characteristic patterns emerged. In the Variable Section, only 4 agricultural soils exist that have an areal extent of over 6 per cent of the total area. Soil Type 1 (Silty and Sandy Loam), 2 (Gravelly Loam), 3 (Very Fine Sand) and 5 (Silt Loam and Loam) collectively embrace nearly 82 per cent of this section. In this way, yield patterns in the Variable Strip are dominated by these soil types. Significant variations in yield exist in the case of hay and mixed grain. Soil Type 5 gives rise to significantly higher yields of hay than any of the other 3 soil types and Soil Type 1 produces significantly more mixed grain than does Type 2. Moreover, in each of the examples of hay and mixed grain, Soil Type 5 obtained the highest yields and Soil Types 1, 2 and 3 the lowest yields of any agricultural soil in the Variable Section. Indeed, the latter 3 soil types also displayed the lowest yields in the case of oats.

The conclusion reached is that a variability of soil has produced significant differences in yield for at least 10 per cent of the total hay area as the more permeable Sandy Loams, Gravelly Loams and Very Fine Sands fall behind

the Silt Loams and Loams. Furthermore, the Gravelly Loams have significantly lesser yields of mixed grain than the Silty and Sandy Loams. Finally, the Silt Loams and Loams (Soil Type 5) have emerged as excellent agricultural soils as they portray significantly higher yields of hay and substantially higher yields of mixed grain. The general conclusion is that a variability of soil has produced more of a variability in the yield of mixed grain than it has in the yield of hay.

In the Uniform Section, where nearly 79 per cent of the total area is comprised of the Silt Loams, significant differences in yields within this soil area existed only in the case of hay. Yields, in this instance, were significantly lower on 26 per cent of the hay area which occupied the imperfectly drained member of the Silt Loams. With the exception of the preceding, there is a general uniformity of yield. It should be noted, that in all cases where all the members of the Silt Loam occurred, ie. hay, oats, mixed grain and wheat, the lowest yields were always recorded for Soil Type 3 (imperfectly drained Silt Loam) and the highest were prevalent on Soil Type 1 (Silt Loam, slopes up to 3%). The yields of Soil Type 2 always fell somewhere in between. As a result, lower yields are associated with imperfect drainage.

A comparison of the average yield of each crop in

the Variable Section, the Uniform Section and in Waterloo County leads to several specific characteristics. Table XVIII presents the average yields by crop type for each of the above areas.

TABLE XVIII

AVERAGE YIELDS IN THE STUDY AREAS AND IN WATERLOO COUNTY

Land Use Type	Variable Section[a]	Uniform Section	Waterloo County[b]
(1) Hay	95	98	92
(2) Oats	70	86	66
(3) Barley	62.5	86	55
(4) Mixed Grain	68	86	65
(5) Wheat	34	37	33

[a]All yields are in bushels per acre, except hay which is in bales per acre.

[b]After, Agricultural Statistics for Ontario, 1965, Ontario Department of Agriculture and Food, pp. 70, 72, 73, 77, 85.

Note that all crops displayed higher yields in the other two areas with oats, barley and mixed grain, having substantially higher yields. Each of the yields of the Variable Section was slightly higher than the average for Waterloo County. However, this latter difference did not exceed 4 bushels or bales per acre except in the case of barley when 7.5 more bushels per acre were recorded for the Variable Strip. A logical conclusion is that, on the basis of crop yields, the Variable Section is representative of

the county as a whole. A second conclusion is that a uniformity of soils produced substantially higher yields of oats, barley, and mixed grains.[1]

Fertilizer - Soil Type Associations

Research into the amount of fertilizer applied per acre in the study areas has raised more questions than provided positive answers. Non-specialty farmers seemed more intent on applying manure to all their crop fields at least once every two years than in utilising artificial fertilizers in an amount recommended by a soil sample analysis. The majority of farmers, nevertheless, did apply artificial fertilizer and did indicate the number of pounds per acre. Usually two figures were quoted, one for corn and one for all other crops. This was characteristic of all farmers. Since no yield data was available for corn, the amount of fertilizer applied to corn fields, although noted, was not analysed.

The number of pounds applied per acre varied,

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[1]Research into climatic statistics has indicated that, for the study year, the precipitation for May and June was 1.8 inches and 0.97 inches respectively, whereas the normal precipitation for these same months is 3.17 inches and 3.14 inches respectively. (See Agricultural Statistics for Ontario, 1965, Ontario Department of Agriculture and Food, p. 139). The interesting possibility exists that the Silt Loams of the Uniform Section with their excellent water retention characteristics have given rise to higher yields because of certain climatic factors attributable to the study year. Speculations of this sort, however, are beyond the present scope of this thesis.

on a farm unit basis, from 100 pounds to over 200 pounds.[1] Corn fields consistently received between 200 and 250 pounds per acre. The amount of fertilizer varied in an inconsistent manner from farm unit to farm unit and seemed dependent more on the personal whims of the farmer than on soil type. In spite of this fact, by noting the pounds applied per acre at each sample point involving a crop type within the farm units, a general pattern has emerged for the study area as a whole.

In the Variable Section, for the four dominant agricultural soil types, the average amount of fertilizer varied from a low of 132 pounds per acre on Soil Type 1 (Silty and Sandy Loam) to a high of 172 pounds per acre on Soil Type 3 (Very Fine Sand) (Table XIX). For each crop, whenever a significant difference in yield occurred on any

TABLE XIX

AVERAGE AMOUNT OF FERTILIZER APPLIED PER ACRE IN THE VARIABLE SECTION

Soil Type	Pounds Per Acre
(1) Silty and Sandy Loam	132
(2) Gravelly Loam	156
(3) Very Fine Sand	171
(5) Silt Loam and Loam	162

[1]The popular ratio of Nitrogen, Phosphate and Potash was 10, 20, 20.

of the above soil types, the varying differences in the amount of fertilizer applied to that crop were tested for significance. In the case of hay, Soil Type 5 obtained significantly better yields than Soil Type 2 or 3, but no corresponding significance occurred in the amount of fertilizer applied. For mixed grain, the yields of Soil Type 1 were significantly higher than those of Soil Type 2, but the amount of fertilizer applied to Soil Type 2 was not significantly higher than that applied to Soil Type 1. Thus, from the above statements, the general conclusion arises that Soil Type 5 (Silt Loam and Loam) is a far superior producer of hay inherently than either of Soil Type 2 (Gravelly Loam) or Soil Type 3 (Very Fine Sand). Moreover, in the case of mixed grain, the inherent inferiority of Soil Type 2 becomes evident again as yields are significantly lower in spite of the greater average amount of fertilizer applied. On the basis of the above statements, it appears that, in certain cases of hay and mixed grain, a variability of soil has produced a variability of crop return when the amount of fertilizer did not differ significantly.

In the Uniform Section, the amount of fertilizer applied on the Silt Loams ranged from 153 pounds per acre on Soil Type 3 (imperfectly drained) to 190 pounds per acre on Soil Type 1 (up to 3% slope). Table XX indicates the averages in pounds per acre for each of the Silt Loams.

TABLE XX

AVERAGE AMOUNT OF FERTILIZER APPLIED PER ACRE IN THE UNIFORM SECTION

Soil Type	Pounds Per Acre
(1) Silt Loam (up to 3% slope)	190
(2) Silt Loam (3% - 6% slope)	165
(3) Silt Loam (imperfectly drained)	153

As indicated previously, significant differences in yields among the Silt Loams existed only in the case of hay as Soil Type 1 obtained better yields than Soil Type 3. Corresponding significant differences were not evident in the amount of fertilizer applied to hay fields. Although no significant yield differences occurred in the example of mixed grain, the t test indicated that both Soil Types 1 and 2 received a significantly greater amount of fertilizer than did Soil Type 3. Furthermore, the fact emerges that the soil types were ranked in the same order for yields and the amount of fertilizer applied. (Compare Tables XVI, XVII and XX). In each case Soil Type 1 had the highest and Soil Type 3 the lowest averages.

Because fertilizer data was presented, by the farmers, on a per farm basis and included a variety of crops, it is difficult to state specific conclusions other than general observations which seem to hold true over the area as a whole. For example, in the Uniform

Section, lower and higher average yields on the Silt Loams are associated with lower and higher amounts of fertilizer applied, and, in the Variable Section, although the average number of pounds spread per acre is higher on Soil Type 2 (Gravelly Loam), the yields of hay, barley and mixed grain are higher (the latter being significantly higher) on Soil Type 1 (Silty and Sandy Loam).

The inconclusive results of the above section can be resolved only through further research. At this time, it is not apparent that a variety of soil type has led to significant variations in the amount of fertilizer utilized, which in turn would influence the crop yield or productivity.

V

ECONOMIC DATA ANALYSIS

Productivity and Gross Income

This section presents an analysis of the Census data pertaining to the agricultural activity and economic return of each Super-Block. Whenever possible, the Census data is supplemented with materials obtained in the field during the summer of 1966. All statistics, unless indicated otherwise, are representative of the year 1961. The supplementary material has been useful in providing further details of production and in understanding the characteristics of the economic patterns.

Land Use Characteristics

In the Variable Section the 9 Super-Blocks include 30 farms. Two of these Blocks (Block IV and Block IX) are composed of part-time farmers and semi-retired farmers and will be discussed separately. Direct comparisons can be made, however, between the remaining seven Blocks. At the present time the simplest way of illustrating the range of characteristics for each group of farms is by means of a table. The following discussion is based on the statistical data found in Table XXI.[1]

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[1] Appendix B presents more specific data.

The average size of farms varied from 116 acres to 133 acres with the average for the strip as a whole being 121 acres. About 80 acres are devoted to cropland, and woodland ranges from 6 acres to over 31 acres per unit. The dominant crops consist of hay and mixed grain (nearly 25 acres each) with one field, 6 to 8 acres, being devoted to corn. This latter acreage is sufficient to fill a 12 foot by 40 foot silo, a size which is most popular in the area. Pasture lands occupy about 11 acres of the average full-time farm.[1]

Although rotation methods are not strictly adhered to, and farmers claim that they decide on a year to year basis, the common practice is to grow grass or hay for 2 years, then corn, oats and some wheat the third year and finish with 2 years of mixed grain. During this cycle the cropland is heavily manured at least 3 times. The Mennonite farmers take great pride in utilizing as much of their land as possible every year. Hence very little workable soil is left fallow and pasture lands are kept down to a minimum. An analysis of the Super-Blocks with a high occurrence of pasture land revealed that Super-Block VII, with nearly 43 acres of pasture per farm, embraced 2 non-Mennonite farms. As will be shown subsequently, this

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[1]Note, that these figures do not vary substantially from those presented for the hypothetical farm in Table VII.

TABLE XXI

VARIABLE SECTION SELECTED CENSUS DATA

	BLOCK I 3 farms	BLOCK II 3 farms	BLOCK III 3 farms	BLOCK IV 3 farms	BLOCK V 4 farms	BLOCK VI 3 farms	BLOCK VII 3 farms	BLOCK VIII 3 farms	BLOCK IX 5 farms
BASIC FACTS									
(Acres)									
Farm size	133.6	120	124.6	60.7	115.5	119.7	120	117	38
Cropland	90.3	96.3	89.7	23	70.7	68.7	48.3	82	25
Pasture	29.3	7.7	11.7	7.7	12.7	6	42.7	11	8
Woodland	11.7	6	13.3	18.7	21.7	31.3	16.7	8	4
LIVESTOCK									
Cattle	49	36.3	37.7	8.3	33.7	35	39	48	11
Pigs	93	71	68	30.6	62	79.7	48	70	60
Horses	5.3	4	4	-	3.8	5.7	1	1	-
Hens	372.3	1,016.7	271.7	416.7	1,087.5	563.3	366	370	450
Turkeys	-	-	-	-	-	-	-	-	-
ECONOMIC FACTS									
Farm Value	$19,800.00	$25,000.00	$23,000.00	$13,500.00	$22,500.00	$20,666.00	$17,333.00	$22,500.00	$17,000.00
Machine Value	4,866.00	5,327.00	5,138.00	2,101.67	3,867.50	4,583.00	3,235.00	5,100.00	3,500.00
SALES									
Value of Crops	$ -	$ 16.67	$ 111.00	$ 58.67	$ -	$ 26.70	$ -	$ 1,000.00	$ -
Value of Cattle	2,847.00	8,403.00	6,757.00	39.00	4,880.00	4,851.00	3,163.33	5,000.00	1,320.00
Pigs	3,738.60	5,273.00	5,654.00	1,139.00	4,019.00	4,007.00	1,459.30	4,201.00	3,010.00
Hens	138.00	597.00	76.67	-	367.00	105.00	69.33	-	600.00
Turkeys	-	-	-	-	-	-	-	-	-
Dairy	2,026.00	1,475.00	1,671.00	418.67	1,945.00	1,395.30	1,411.00	2,000.00	820.00
Eggs	672.67	3,247.00	928.00	192.00	3,065.00	1,270.00	608.00	720.00	1,200.00
Maple Syrup	64.00	83.00	-	-	125.00	460.67	171.67	240.00	-
Gross Income	$9,586.94	$19,078.67	$15,198.34	$1,847.34	$14,412.00	$12,723.64	$6,907.00	$13,261.00	$6,950.00
Gross Income per acre	72.07	158.98	122.56	30.78	125.32	106.02	57.55	113.34	182.89
Hired Help - Year	-	.67	.33	-	.25	.33	-	-	-
Part-time help (No. of weeks)	9.3	34.7	20.7	33	13	4	1.3	20	-

factor influences economic characteristics as well.

During the course of researching this topic an effort was made to determine the number of man-hours or man-days expended per field or per field unit as soil type changed. The farmers involved claimed they could not indicate, other than in a very general sense, the amount of time or effort devoted to certain fields or the farm as a whole. The typical Mennonite, during the growing season, starts his day at 5.30 A.M. and works for about 3 hours. He then eats his breakfast and, with his family, studies the Bible until about 9.30 A.M.. A one hour break for dinner occurs at 2.00 P.M. and supper is begun at about 7.00 P.M.. Evening chores may last until about 8.45 P.M. and shortly after the family retires for the night. The actual working time may be 12 or more hours per day, except Sunday; but the breakdown into individual chores or jobs is more difficult to ascertain. Moreover, the farmer's children and wife are just as devoted to the land and dedicated to work as the farmer himself.

Because the Mennonite constitute a tightly-knit community a farmer may do as much work on his neighbour's land as on his own. The sharing of equipment such as forage harvesters and threshing machines is quite common. Indeed, in one section of the study area no less than 5 farms are owned by members of the immediate family. Because of this fact, in this community it is difficult to measure a man's

effort or the value of his equipment.

According to the Census data it is possible to state the amount of hired help per Super-Block. Two farms of Super-Block II and one farm of Super-Blocks III, V and VI retained the services of one hired man on a year round basis. Furthermore, the farms of all Super-Blocks except Block IX hired additional help for the periods of a few weeks to a few months of the year (Table XXI). Thus none of the full-time farms were operated without the hiring of specific additional men. As indicated by Table XXI the length of time for which the help was hired varied from less than 2 weeks to over 34 weeks. Further research revealed that this phenomenon could not be attributed to either farm size or to the location of a farm or to a certain soil type. However, as will be elaborated later, hired help on a year round basis existed only on those farms whose gross income exceeded $12,700 per year.

Farm Value - The average value of farms in each Super-Block is representative of the market value of land and buildings at the time of enumeration. In each case this value is based on the farmer's estimate of what his property is worth. There is some reason to suspect that the figures quoted are somewhat conservative. Nevertheless, as this factor would be consistent throughout the area, the stated values can be utilized for comparative purposes.

For the 7 Super-Blocks representing full-time farms, the land and building values ranged from a low of $17,333 to a high of $25,000. Five Super-Blocks, representing 16 farms, varied from about $20,000 to $23,000 per farm unit. As substantiated by Table XXI and a comparison of Figure 7 with Figure 5, no association exists between farm size, farm value and soil type. The farms of Super-Block V, averaging nearly 116 acres in area, $22,500 in value and existing mainly on Soil Type 2 (Gravelly Loam) differ only very slightly from those of Super-Block VIII which average 117 acres in size, $22,500 in value and exist mainly on Soil Type 1 (Silty and Sandy Loam). Furthermore the high value of farms of Super-Block II at $25,000 per farm unit, are smaller in size than those of Super-Block I at about $20,000 per unit. But both Blocks exist mainly on Soil Type 1. The conclusion is reached that a variability of agricultural soil has not influenced the size or market value of farms that are operated on a full-time basis in this area.

The value of farm equipment does not vary substantially from Block to Block and averages about $4,500 per farm unit. Although the Mennonites make use of horses as motive power for carriages and wagons, very few of them plough with horse power. Thus the most expensive machinery is the tractor (less than $2,000). Grain binders and

threshing machines represent the other major equipment expenses. In no case did the equipment value exceed $5,400. As in the example of farm value, substantial differences were not noted from soil type to soil type, although not surprising, the highest valued farm also contained the highest valued equipment (note Block II).

Income Characteristics

As in the case of the above section, the following discussion is based on the data of Table XXI.

Livestock and Poultry - A useful and accepted technique is to transform the number of livestock and poultry into animal units.[1] On the full-time farms at the time of enumeration, the number of these units varied from 54 to 78 (for the 7 Blocks). However, on 5 of these Blocks the animal units ranged from 61 to 67. Therefore livestock and poultry are quite evenly distributed throughout this study area. It is of interest to indicate the average number of the type of livestock per Block. Block I and Block VIII contain 49 and 48 cattle per farm respectively while the remaining full-time farming Blocks contain between 34 and 39 cattle per farm unit. The cattle population is comprised of almost equal ratios of calves, steers and cows and heifers.

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[1] An animal unit is the equivalent of 1 cow, 1 horse, 5 hogs or 100 hens.

Pigs varied in number from 48 to 93 per farm unit and consist mainly of young pigs under 6 months. Hens exist in number from about 400 on the majority of farms to over 1,000 in Block II and Block V and are comprised of chicks under 2 months and hens and pullets kept for laying. The economic returns from these animal units are discussed subsequently.

Gross Income - The gross income per farm unit represents the value of all agricultural products sold during the past 12 months. The constituent categories comprising gross income include the selling value of crops, livestock, poultry, dairy products and eggs. For each Super-Block the gross income was also calculated on a per acre basis.

The average gross income for full-time farms fluctuated from a low of about $7,000 per year on Block VII to a high of $19,000 per year on Block II (Table XXI). The income of Block I was nearly $9,600 and the remaining Blocks all portrayed incomes between about $13,000 and $15,000. Thus special explanations are in order for the 2 Blocks with under $10,000 of gross income and Block II with over $19,000 of gross income.

An analysis indicates that in all cases about 70 per cent of the total income is derived from the sale of cattle and pigs, with cattle sales usually bringing in about $1,000 more than the revenue from the sale of pigs. In no

instance did the value of any one product exceed, or equal, 50 per cent of the total income. The premise that the Variable Section embraces a mixed agricultural economy has now been thoroughly substantiated.

The sale of dairy products, mainly cream, and eggs brings in about $3,000 per farm unit with the dairy products usually ahead of the eggs. Notable exceptions occur on Blocks II and V. Here, where the poultry population is nearly double that of the other Blocks, the sale of eggs alone accounts for over $3,000. In nearly all examples the dollar selling value of eggs was about three times that of the numerical hen population.

Only the farms of one Super-Block reported significant sales of field crops. All the remaining farms utilize for their own purposes what they harvest from the fields.

The per acre income varied from a low of about $58 on Block VII to a high of $159 on Block II with 5 of the 7 Super-Blocks exhibiting returns in excess of $100 per acre. By this time it is obvious that the farms of Block II are representative of the highest farm value, highest gross income and highest per acre return. It is difficult to ascertain whether a combination of factors, such as the selling off of livestock immediately prior to the time of the Census, has inflated the gross income to

a point higher than it would normally be, compared to the other farms, at a later date. The high number of hens, over 1,000, on these farms has also increased the gross productivity. Other than the above, the farms of Block II do not differ substantially from those of the other Blocks. The difference in productivity can not be attributed to any variation of soil type as the farms of Block I, immediately north, are representative of a lower income group yet are situated on the same soil type.

Throughout this discussion the fact has emerged that the farms of Block VII have the lowest returns and values. These farms exist on a mixture of Gravelly Loam, Very Fine Sand and Gravel. No doubt more effort is required to bring forth a good return on these soils. However, two of the farmers involved are non-Mennonite and have permitted extensive gravel-pit operations on their land. Consequently, less than 50 acres, out of an average of 120 per farm, are in cropland. As a direct comparison, the farms of Block V, adjacent to Block VII, exist on the same soil types, have slightly less areal extent and their gross income, at $14,412 per year, is double that of their neighbours'. Furthermore, two of the farms in Block V do not have electricity. Hence the conclusion that even inherently poorer soil types can give rise to fairly high gross incomes when managed in the proper manner for agricultural purposes.

For the Variable Section as a whole, taking into account all farms, the average gross income is $11,106 per farm unit or $107.72 per acre. The average farm contains 106 acres and is valued at $20,144. The equipment is valued at an average of $4,190 per farm unit and one out of every three farms does not have hydro-electric power. Figure 15 indicates the gross productivity, the per acre productivity, the crop value per acre and the number of animal units per farm on a Super-Block basis.

The Uniform Soil Section

In the Uniform Soil Section, 7 Super-Blocks were utilized for the purposes of income analysis (Table XXII). Since specialization was prevalent on 3 of the Blocks, the discussion here will be based on the analysis of specific Super-Blocks or groups of Super-Blocks.

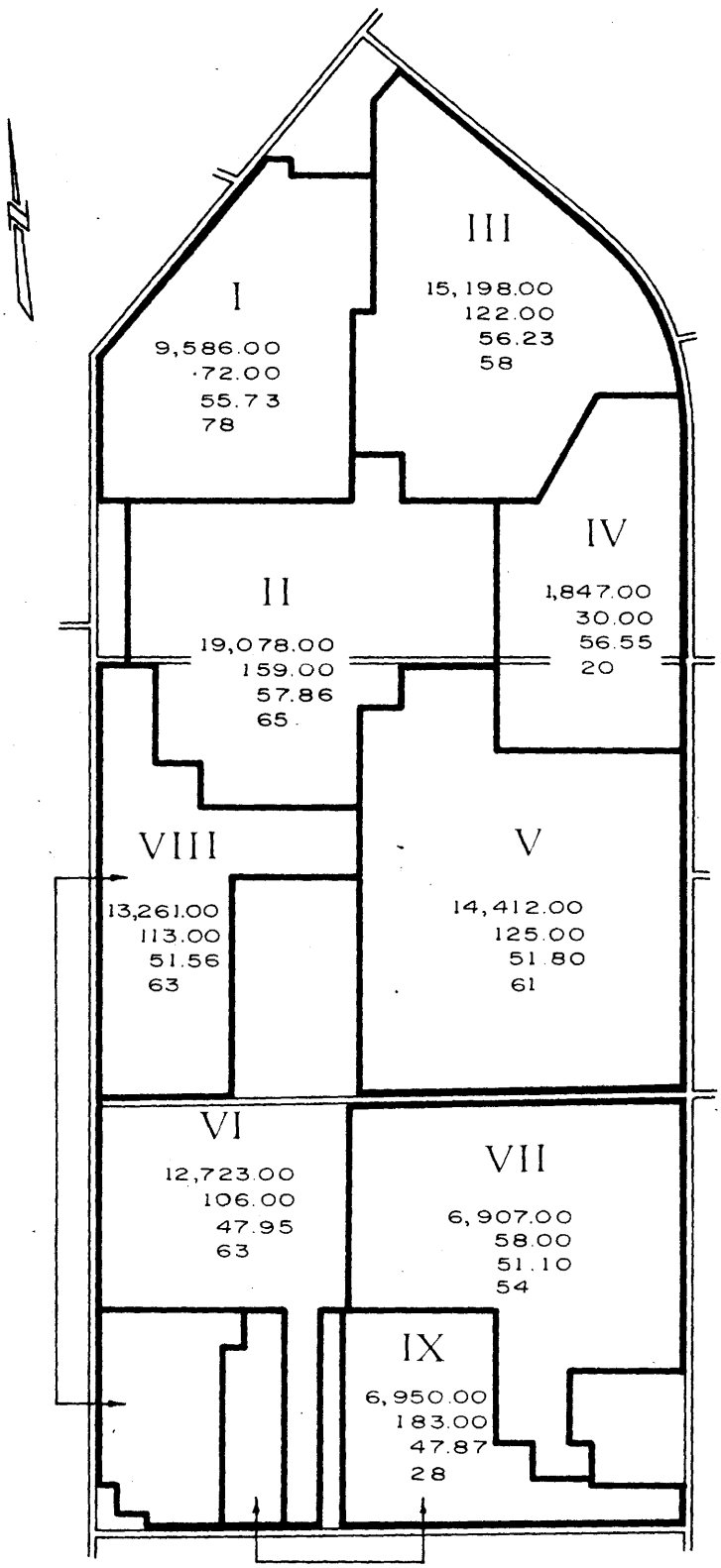
Super-Block I comprises 3 dairy farms which have an average area of 203 acres. Nearly 130 acres of each farm are devoted to cropland, 47 acres to pasture and 22 acres to woodland. The average value of each farm exceeds $54,000 with the equipment valued at over $19,000.

Nearly 90 cattle are stabled per farm. Usually 34 Holsteins are milked daily and produce about 1100 pounds of milk. Other than 700 chickens and one horse, no other livestock exists on these farms.

The gross yearly income is over $20,000 of which

VARIABLE SOIL SECTION

FIGURE 15



FARM PRODUCTIVITY

BY

SUPER - BLOCK

LEGEND

1) GROSS INCOME IN DOLLARS

2) PER ACRE INCOME IN DOLLARS

3) 1965 CROP VALUE PER ACRE IN DOLLARS

4) NUMBER OF ANIMAL UNITS

1000 0 1000 2000

SCALE IN FEET

J.A.M.'67

TABLE XXII

UNIFORM SECTION SELECTED CENSUS DATA

	BLOCK I 3 farms	BLOCK II 3 farms	BLOCK III 3 farms	BLOCK IV 4 farms	BLOCK V 3 farms	BLOCK VI 3 farms	BLOCK VII 3 farms
BASIC FACTS							
(Acres)							
Farm Size	203	119	111	90	122	80	147
Cropland	129	89	78	63	73	62	61
Pasture	47	11	21	14	17	7	20
Woodland	22	6	7	14	21	6	57
LIVESTOCK							
Cattle	89	34	50	54	35	33	38
Pigs	-	59	55	63	96	100	49
Horses	.7	5	5	3	3	1.3	4.3
Hens	700	660	470	1,223	473	338.3	551.3
Turkeys	-	-	-	-	4,000	-	-
ECOMONIC FACTS							
Farm Value	$54,300.00	$26,000.00	$31,338.00	$26,000.00	$32,333.00	$28,333.00	$45,000.00
Machine Value	19,246.00	3,331.00	3,000.00	3,899.00	4,878.00	5,793.00	3,259.00
SALES							
Value of Crops	$ 508.00	$ 17.00	$ 265.00	$ 208.00	$ 153.00	$ 78.00	$ 6.00
Value of Cattle	2,973.00	6,080.00	5,446.00	4,669.00	1,700.00	5,407.00	8,466.00
Pigs	-	4,005.00	3,932.00	4,423.00	4,073.00	8,438.00	2,541.00
Hens	408.00	78.00	154.00	1,298.00	33.00	120.00	284.00
Turkeys	-	-	-	-	17,600.00	-	-
Dairy	16,563.00	1,654.00	1,037.00	4,621.00	1,507.00	2,033.00	1,237.00
Eggs	-	1,361.00	909.00	2,466.00	391.00	1,022.00	794.00
Maple Syrup	-	-	-	-	-	-	331.00
Gross Income	$20,452.00	$13,795.00	$11,743.00	$17,752.00	$25,452.00	$17,174.00	$14,668.00
Gross Income per acre	101.00	115.92	105.79	197.24	208.62	214.67	99.78
Hired Help - Year	1	1	1	1	1	-	1
Part time Help (No. of weeks)	41	17	36	13	17	-	17

milk sales account for $16,500. The sale of cattle brings in less than $3,000 and of hens less than $500. No revenue is derived from the sale of eggs. The per acre income of each dairy farm is nearly $101.

Two of the dairy farms are operated by non-Mennonites and all farms contain the latest milking equipment and cooling facilities. Two additional hired men work on these farms for at least 41 weeks of the year.

Super-Blocks II, III, IV and VI embrace farm units operating under a mixed-agriculture economy. Farms are rather small, averaging exactly 100 acres per holding, of which 71 acres are in cropland, 12 acres in pasture and 8 acres in woodland. All of these farms are Mennonite-owned and the rotation methods and work habits are similar to those described before.

The average value of each farm varied from a low of $26,000 to a high of $31,338 and about $4,000 was invested in equipment.. No correlation is evident between farm size, farm value and equipment value. Note, from Table XXII, that the farms of Block III have an average area of 111 acres which is slightly higher than the average for the 4 Blocks. The value of these farms at $31,338, is the highest of the 4 Blocks, yet their equipment at $3,000 represents the lowest value of any Block in the Uniform Section. Furthermore, the small farms of Block VI, averaging 80 acres in area, are valued at $28,333 and contain over

$5,700 worth of equipment.

The number of animal units on this group of Blocks ranged from 59 on Block VI to 83 on Block IV. The higher reading of the latter Block is caused by the presence of 10 more cattle than the average of 44 per farm, and nearly double the hen population which averages over 670 per farm. On Super-Blocks II, III and IV the number of pigs was similar, varying from 55 to 63 per farm. The smaller farms of Block VI tended to emphasize hog-raising as the average pig population was 100 per farm unit.

Blocks IV and VI each portrayed gross incomes of over $17,000 per year, while the incomes of Blocks II and III were $13,795 and $14,743 respectively. As was the case of mixed farms in the Variable Section, 70 to 75 per cent of the total income is derived from the sale of cattle and pigs. The sale of dairy products and eggs usually follow in that order. No single product accounted for over 50 per cent or more of the gross revenue. However, the two higher income Blocks, which averaged only 85 acres per farm unit, sold off an average of 130 pigs compared to a normal 60 or 70 for the other Blocks. Indeed, pig sales alone accounted for about $8,400, or just short of 50 per cent of the total income, on Block VI. The sale of dairy products, especially milk, was also higher. Thus the two groups of smaller sized farms, although operating under a mixed-agricultural economy tend to lean more to the raising of hogs and selling

of milk than do the other groups of farms.

The per acre income varied from $106 on Super-Block III to $215 on Super-Block VI. The high values of the latter Super-Block can be attributed to the combination of high gross incomes and small acreages of the farms involved.

The remaining 2 groups of farms, encompassed by Block V and Block VII, displayed income characteristics which were dominated by the sale of one product. But the range of agricultural products associated with the mixed-farming Blocks was also evident. The farms of Super-Block V average 122 acres in area of which 73 acres are in cropland, 17 acres in pasture and 21 acres in woodland. The value of each farm is $32,333 and the equipment is worth nearly $5,000.

The number of animal units was 102 and represented the highest number of any Super-Block in the study area. This phenomenon can be attributed directly to the presence of a turkey farm which added an average of 4,000 turkeys to each farm unit. The cattle, pig and hen population did not differ substantially from those Blocks containing mixed-agricultural farms.

The total gross income exceeded $25,400 and was the highest recorded for the Uniform Section. The income from the sale of turkeys, at $17,600, accounted for over 70 per cent of the total gross income. The sale of pigs,

cattle and dairy products represented the remaining sources of income. It must be noted, that field research has indicated the presence of only one turkey barn which is capable of a turnover of some 24,000 turkeys per year. In effect, the actual income from turkeys is much higher and the income characteristics as a whole have been distorted somewhat by this specialty operation. This has in turn influenced the per acre productivity of 20 which is higher than normal for the 2 mixed-farming units involved and lower than it should be for the unit containing the turkey barn.

The remaining group of farms, in Super-Block VII, exhibited an average area of 147 acres. Cropland amounted to only 61 acres, pasture to 20 acres and woodland was a high 57 acres. The average farm value reached $45,000 but the equipment was worth less than $3,300. A subsequent check revealed that one of the farms contained 230 acres of which 150 acres were in woodland. Because of this fact the average values do not approximate closely what exists on each farm unit. Despite this statement the number of animal units (59) does not differ substantially from the mixed-farming Blocks.

The average gross income for Super-Block VII approached $15,000 per year. Nearly 60 per cent or $8,466 of this income was derived from the sale of cattle, with proceeds from the sale of pigs, dairy products and eggs

following in the usual order. Further research revealed that the owner of the largest farm was contemplating retirement and had liquidated most of his livestock during the Census year, which led to the high value of cattle sales. At the present, a large feed and poultry enterprise is renting his cropland for the purposes of corn growing. The extensive woodland, however, still produces a fairly substantial revenue each year from the sale of maple products (Table XXII). The per acre income for this rather complicated Block was $100.

Figure 16 indicates the areal distribution of the income and productivity characteristics discussed above.

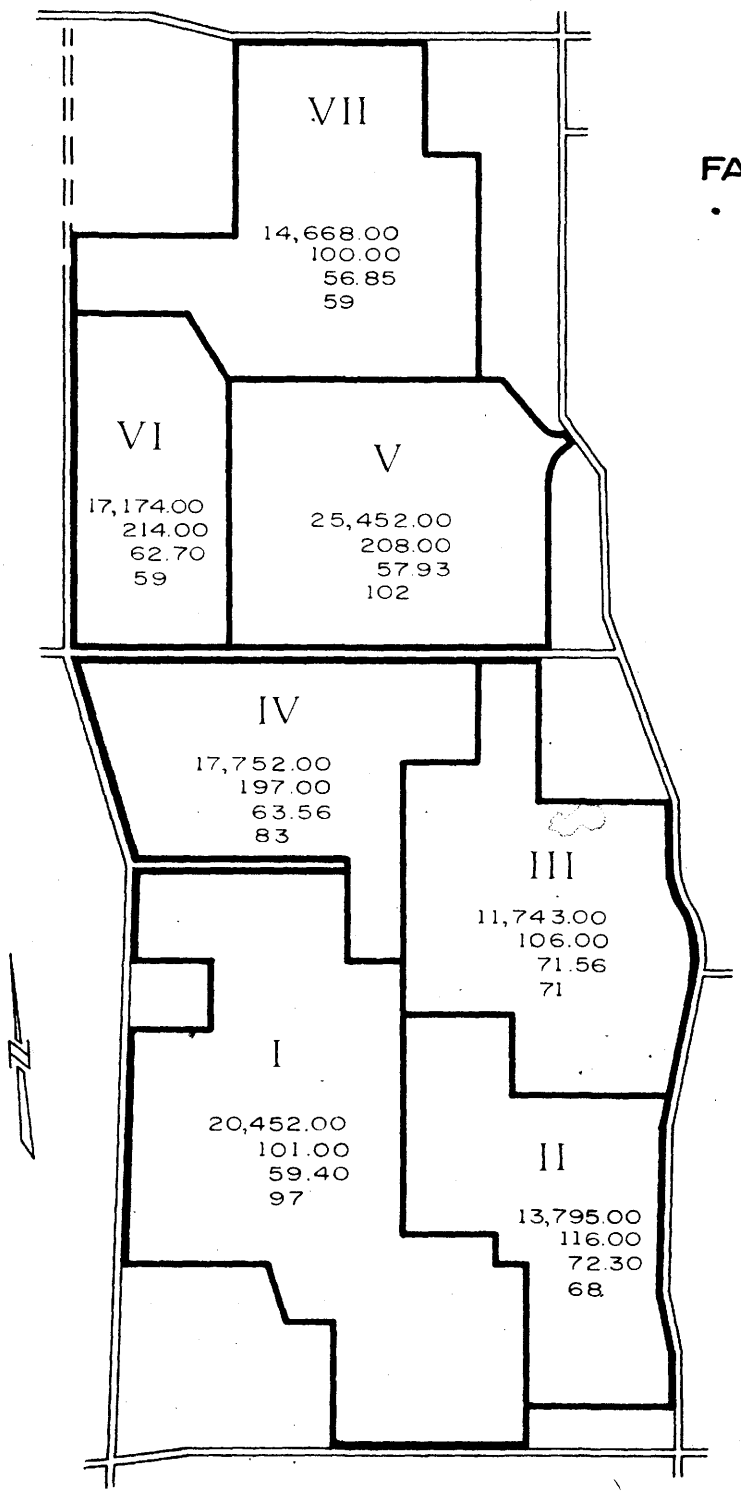
Summary of Income and Productivity

In the Variable Soil Section, 7 of the 9 Super-Blocks studied embraced mixed farms. The remaining 2 Blocks contained small part-time farms which collectively amounted to only about 300 acres. Income varied from a low of about $7,000 to a high of over $19,000 with the average for the area as a whole being $11,106 per farm. The sale of cattle and pigs accounts for about 70 per cent of the total income.

No relationship is evident between income, farm size and soil type, although the lower income farms of Block VII and the part-time farms of Block IV were situated on Soil Type 2 (Gravelly Loam) and contained extensive gravel pits. Such extractive operations are the choice of individual

UNIFORM SOIL SECTION

FIGURE 16



FARM PRODUCTIVITY BY SUPER-BLOCK

LEGEND

1) GROSS INCOME IN DOLLARS
2) PER ACRE INCOME IN DOLLARS
3) 1965 CROP VALUE PER ACRE IN DOLLARS
4) NUMBER OF ANIMAL UNITS

1000 0 1000 2000
SCALE IN FEET

J.A.M. '67

farmers and, where gravel pits are not prevalent, incomes may be substantially higher on the same soil type (eg. Super-Block V has an income of over $14,000 per farm).

The income and productivity patterns in the Uniform Soil Section are slightly more complex. It has three large dairy farms, a turkey farm and hog raising operations. The former two specialty Blocks each produce an average gross income of over $20,000 per farm. The income for mixed-farming Super-Blocks varies from nearly $12,000 to over $17,000 per farm. As in the Variable Section, no correlation exists between farm size and income.

Table XXIII presents selected average values per farm unit for both study areas. All values are higher on the Uniform Soil Section. Farm sizes are greater by 19 acres as the respective acreages are 105 and 124 acres. Nevertheless, in each section, the cropland accounts for about 62 per cent of the farm area. There are 21 more animal units per farm, equipment is worth $2,000 more, and the average of a Uniform Section farm, at nearly $35,000 is $14,600 higher than its Variable Section counterpart.

Gross income, at $11,106 per farm in the Variable Section and $17,290 per farm in the Uniform Section, differs by 35 per cent. The corresponding per acre income is $107 and $149 and varies by 28 per cent.

Although the average income for all farms is higher

TABLE XXIII

SELECTED AVERAGE VALUES PER FARM[a]

	Variable Section	Uniform Section
Farm Size	105 acres	124 acres
Cropland	66 acres	78 acres
Pasture	15 acres	20 acres
Woodland	15 acres	19 acres
Animal Units	56	77
Farm Value	$20,144.00	$34,757.00
Equipment Value	$ 4,190.00	$ 6,200.00
Gross Income	$11,106.00	$17,290.00
Per Acre Income	$ 107.72	$ 149.00

[a]The values represent averages for all farms in each study area.

in the Uniform Section, the discrepancy becomes less when only those Super-Blocks of both study areas that contain mixed-farming are compared. For example, in the Uniform Section the income range is between $11,700 and $17,700 per year for the non-specialty farms, whereas in the Variable Section gross income varies from $9,600 to $19,000 for full-time farm units. In this way, even though income exhibits less of a range in the Uniform Section, the highest income for a mixed farm is found on the Variable Section. Furthermore, the average income of full-time Super-Blocks, being about $14,000 in the Variable Section and $15,000 in the Uniform Section, differs only by $1,000.

One must also recognize the fact that the lowest average income on the Uniform Section is about $12,000,

while, on the Variable Section, the presence of part-time farms has lowered gross incomes, on certain farms, to less than $2,000 per year. Thus, in several instances, the poorer gravelly soil was conducive to the intrusion of farmers who supplement their income by such means as the exploitation of gravel deposits. Conversely, the uniformity of soil gave rise to larger holdings which specialize in certain agricultural products. This trend is continuing at the present as there is evidence that some of the smaller mixed-farming units are coming under pressure to sell their land to specialty feed and poultry establishments.

A final, rather important finding must be stated. When utilizing Census material representing the average value for 3 or more farms, great care should be taken to group, insofar as possible, similar farm units. This fact implies a rather intimate knowledge of the study area beforehand so that any unusually high or low figures which emerge can be explained by and attributed to factors which are known to exist on a farm or group of farms. The indiscriminate grouping of 3 or more adjacent farms may reveal the gross income and productivity characteristics of the area as a whole, but it may also obscure important micro-variations which would emerge if similar farms were assembled for study purposes.

VI

SUMMARY AND CONCLUSIONS

Summary

The two study areas were chosen on the premise that their chief difference was one of soils and associated minor variations of relief. In this part of Woolwich Township, where over 85 per cent of all farmers are of the Mennonite faith, the cultural and agrarian characteristics are similar. Moreover, physical characteristics such as macro-climate are also similar. It follows then, that any differences in land use and productivity may be attributed to variation of soil type.

Each study area was divided into ten acre square grids. A random sample point was chosen within each grid and the soil type, land use type, yield, tiling and amount of fertilizer applied were noted for each point. A digital computer was utilized to calculate the estimate of the extent of each areal distribution and to correlate certain soil type, land use type and productivity phenomena.

Both study areas were divided into Super-Blocks containing 3 or more similar farm units. Gross income and productivity characteristics were obtained from Census returns for each Super-Block. On this basis, the average

income of the farms of each section could be compared.

The following constitutes a point by point summary of the major findings in the attempt to establish land use-edaphic relationships.

a) The percentage area estimates derived from the sampling technique differed by no more than 0.57 per cent from "reality". It was concluded that for purposes of this investigation a stratified random sample point for every 10 acres could provide sufficient accuracy in estimating the areal distributions of the various phenomena studied.

b) In the Variable Soil Section no single soil type embraced more than 37 per cent of the total area (3,640 acres), while in the Uniform Soil Section the Silt Loam deposits covered over 78 per cent of the area (2,380 acres).

c) The Variable Section had less than 20 per cent of its area tiled whereas the Uniform Section had tiles installed over more than 45 per cent of its area. Furthermore, the imperfectly drained member of the Silt Loams (in the Uniform Section) had over 65 per cent of its area tiled.

d) A comparison of the land use type distribution in the two study areas revealed that cropland constituted over 56 per cent of the Variable

Section and 64 per cent of the Uniform Section. A greater proportion of mixed grain, permanent pasture and idle grassland and a lesser extent of corn are associated with the more variable soils. In the Variable Section the dominant crops were mixed grain, covering 21 per cent of the area, and hay, extending over 20 per cent of the area. In the Uniform Section the leading crop was hay, embracing 20 per cent of the area, with mixed grain (16.5 per cent) and corn (16.1 per cent) comprising the remaining dominant crop types. Both study areas portrayed lesser, though similar distributions of oats, barley and wheat.

e) Based on land use occurrence and distribution a definition of a mixed agricultural area was formulated. In the study area any agricultural soil or combination of agricultural soil types that constitutes 13 per cent of the total area, contains 90 per cent of all agricultural land use types and 85 per cent of all land use types found within the study area. There was one soil type in the Uniform Section that did not meet these conditions and was found to have a type of farming other than mixed agriculture.

f) A ratio of occurrence was devised to indicate the degree to which a land use type occupies any soil type compared to the occurrence of that land use type in the study area as a whole. Any ratio exceeding 2.00 was regarded as indicative of a strong relationship between a land use type and a soil type. In the Variable Section idle grassland is a characteristic of Soil Type 2 (Gravelly Loam), woodland is characteristic of Soil Type 4 (Muck) and permanent pasture and woodland are characteristic of Soil Type 6 (Alluvium). All the remaining valid cropland types appear with a similar percentage frequency on all valid agricultural soils.

In the Uniform Section no agricultural land use type was characteristic of any of the Silt Loams. Furthermore, whereas in the Variable Section 90 per cent of all agricultural land use types were valid (ie. obtaining a sufficient areal extent to occur on all agricultural soil types), in the Uniform Section only 60 per cent were valid. In this way a uniformity of soil has influenced more specialisation in certain crops, mainly corn, which detracts areally from the importance of other crops.

g) Significant variations in yield of the various crops from one soil type to another were determined by means of the t test. In the Variable Section significant differences were noted in the case of hay and mixed grain as the Gravelly Loams produced lesser yields. In the Uniform Section only one example of a significant difference in yield was evident. The imperfectly drained member of the Silt Loams produced significantly lower yields of hay. With this exception there was a general uniformity of yield. However, in all cases the lowest yield was always recorded for the imperfectly drained Silt Loam. All crops displayed higher yields in the Uniform Section than in the Variable Section with oats, barley and mixed grain having substantially higher yields.

h) The t test for significant differences in the amount of fertilizer applied indicated that there was no significant correlation between yield and fertilizer applied. Generally, more pounds per acre were applied in the Uniform Section than in the Variable Section with the absolute range varying from a high of 190 pounds per acre on the former section to a

low of 132 pounds per acre on the latter. The inconclusive results of this portion of the study can be resolved only through further research. It was not apparent that a variety of soil type had led to significant variations in the amount of fertilizer utilized.

1) A study of gross income and productivity characteristics revealed that 7 of the 9 Super-Blocks in the Variable Soil Section embraced mixed-agricultural farms whose income varied from a low of about $7,000 to a high of over $19,000 per year. No general relationship was evident between income, farm size and soil type although the lower income farms and part-time farms were situated on the Gravelly Loam soils. In the Uniform Soil Section specialty operations have become established with 3 of the Super-Blocks supporting dairy farms, or turkey farms and hog-raising farms. Gross incomes of two of the specialty Blocks exceeded $20,000 per year. Mixed-farming Super-Blocks in the Uniform Section displayed gross incomes ranging from $12,000 per year to over $17,000 per year, per farm.

Although the average per farm income

for the Uniform Section was about 35 per cent higher than for the Variable Section, a comparison of full-time mixed-farming units indicated that income and productivity characteristics were similar with gross income being about $1,000 higher per farm on the Uniform Section. The highest farm values ($54,300 per farm) and the greatest capital investment in equipment ($19,246) occurred on the dairy farms. Nevertheless, these farms recorded one of the lowest per acre returns (at $101) of any farms. The highest per acre returns were noted for the turkey-farm Block ($208) and for the Block emphasizing hog-raising ($214). Yet the farm value and capital investment in equipment was below the average for the Uniform Section on both of these Blocks.

Conclusions

The purpose of this investigation was to study and evaluate the significance of soil type on agricultural land use and productivity in two selected areas of Woolwich Township. The study was based on the premise that such variables as macro-climate, market accessibility and cultural characteristics were similar. The main difference between the study areas was the fact that the northern

strip contained a variety of agricultural soil types while the southern strip was covered mainly by Silt Loams.

Both study areas contained 6 cropland types, namely, hay, oats, barley, mixed grain, wheat and corn. The only appreciable difference in the percentage distribution of these land use types was in the case of silage corn which covered 16 per cent of the Uniform Section and only 6 per cent of the Variable Section. A uniformity of soil has led to higher yields of the various crops with the grains achieving substantially higher yields. In the two sections, t testing of the yields produced by individual soil types has revealed that the Gravelly Loams are inherently inferior producers of mixed grain and hay in the Variable Section, while the imperfectly drained Silt Loams give rise to lower yields of hay in the Uniform Section. Therefore the main factors affecting yields were the coarse nature of the Gravelly Loams and the imperfect drainage of the Silt Loams.

Of the non-cropland land use types, idle grassland and permanent pasture cover over 9 per cent of the Variable Section and about 3.3 per cent of the Uniform Section. Therefore one can conclude that a variability of soil type has been conducive to more land being taken out of agricultural production. Furthermore, Land Use Type 14, rural non-farm and urban, was not evident in the Uniform Section,

but constituted over 1 per cent of the Variable Section.

A uniformity of soil type has led to specialization. Large dairy farms and poultry farms have become established. These units are of high value and produce high average gross incomes. Capital investment in equipment is also substantially higher than on a mixed-farming garm. Yet the fact exists that mixed-farming units on both study areas were of similar size and value, contained a similar number of animal units and the same land use type distribution and differed in average gross income by only $1,000 per year. Indeed, productivity and income characteristics, of the mixed-farming units, bore little close relationship to soil type. The one notable exception was in the case of the Gravelly Loams in the Variable Section. Here all comparatively low income farms were located on this soil type. Most of these farms were, however, operated on a part-time basis by non-Mennonite farmers. The importance of the concentration of conservative and competent Mennonite farmers can not be overemphasized. Proof of this statement lies in the fact that even the inherently poorer soils such as the Gravelly Loams, can produce a fairly high gross income, over $14,000 per year on Block V, when properly managed. Thus, relatively small farms with low capital investments become viable units under this special circumstance where the human factor has erased some of the

usual effects of physical variation. This human factor has been responsible for a uniformity in farming practices which is the keynote to the rotation methods, amount of fertilizer applied, the number of livestock kept, size of farm and capitalization.

As might be suspected, the most significant variation relates to whether or not a farm is operated on a part-time or full-time basis. There was no evidence of part-time farming on the Uniform Section, but part-time farming did emerge on the Gravelly Loams in the Variable Section. Consequently, average incomes for the latter section as a whole were lower.

The result of this investigation, as far as income is concerned, can not be put in its proper context because of the lack of data relating income to soil types in other parts of Southern Ontario. The Eastern Ontario study is one of few that deals with the relationship of farm income to soil qualities.[1] This report states that a Class A full-time farm (ie. a farm occurring on agricultural soil types of similar capabilities of those found in this study area) contained a total of 308 acres of which 196 acres were tillable and produced an average gross income of $10,000 per year. Moreover, only 2 out of 3 such farms

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[1]Noble, Variations of Farm Income of Farms in Eastern Ontario, p. 4.

had gross incomes of $6,000 or more.[1] Hence the diligent management, by Woolwich Township farmers, of relatively small mixed farms on average quality soils has resulted in incomes that are substantially higher, on the average, than those produced by other farmers on similar quality soils in other parts of Southern Ontario.

With respect to the two study areas, the general conclusion is reached that the Uniform Soil Section, with its heavier textured soils and flatter terrain, is more productive, in terms of grain yields, contains fewer acres proportionately, of permanent pasture and idle grassland and exhibits a higher average gross income. The reasons for the higher productivity are undoubtedly related to the heavier texture of the soils generally and the flatter relief. It is also of importance to note that in these unique areas land speculation is, as yet, not evident although the large urban complex of Kitchener - Waterloo is a mere 5 minute drive from the southern extremities. It is highly probable that the intensive agricultural land use pattern will diminish in the future as pressures force the Mennonites to move northwestward into Wellington County.

Several conclusions have emerged with reference to the methodology employed in this investigation. The

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[1] Ibid, p. 5.

most satisfactory approach to the obtaining of information from individual farmers was to request each farmer to indicate on an air photo (scale 4 inches per mile) the limits of his holding. Such a practice initiated freer discussion about land use, yields and other characteristics and was much superior to a stereo-typed questionnaire.

A stratified random sample point every 10 acres can be satisfactorily utilized for research in agricultural geography in a mixed-farming area. Sufficient accuracy is derived for estimating the extent of the various areal phenomena and certain correlations, such as yield and soil type relationships or land use and soil type occurrences can be measured and tested for significance. On the basis of the sample points, a definition of a mixed-farming area according to land use type occurrence was formulated. This definition holds true for this study only and should be applied to other agricultural areas for comparative purposes and, if necessary, for modification. Another technique utilized in this investigation was the ratio of occurrence. It is submitted that this ratio is a useful method of indicating a strong or weak relationship between a land use type and a soil type. In the study areas strong or "characteristic" relationships emerged only for woodland and Muck soils, for woodland and permanent pasture and Alluvial soils, and for idle grass-

land and Gravelly Loam. Varying degrees of association were also prevalent. For example, oats and corn tended to exist more on the higher sloped land while mixed grain and pasture occurred to a greater degree on imperfectly drained soils.

Gross income and productivity characteristics were based on Census data which represented average values for 3 or more farm units grouped into Super-Blocks. Satisfactory results can be achieved by this method only if care is taken to group similar farms so that the average value will approximate the true returns of each farm. If such a grouping is not possible, special explanation is required for that Super-Block in order to elucidate any abnormally high or low values. This practice requires an intensive survey of the study area before the Census data can be applied.

Further research of this type is needed in other parts of Southern Ontario in order that a fuller understanding may be gained regarding the relationship of the patterns of agricultural land use, productivity and income. Furthermore, if it is discovered that income and productivity vary substantially in other areas of similar conditions of soil capability and markets one could then conclude more definitely that the variations were related directly to management and practices.

Photo 1

Imperfect drainage on the Silt Loams in the Uniform Section. Tiles are absent at this location. Photo was taken in late spring.

Photo 2

An abandoned gravel pit on the Gravelly Loam in the Variable Section. Such practices have taken numerous acres of good cropland out of production.

Photo 3

The layout of a mixed farm in the Variable Section. A typical unit contains a small vegetable garden, some fruit trees and neatly kept buildings.

Photo 4

Mixed Grain is the leading agricultural crop in the Variable Section and second only to Hay in the Uniform Section.

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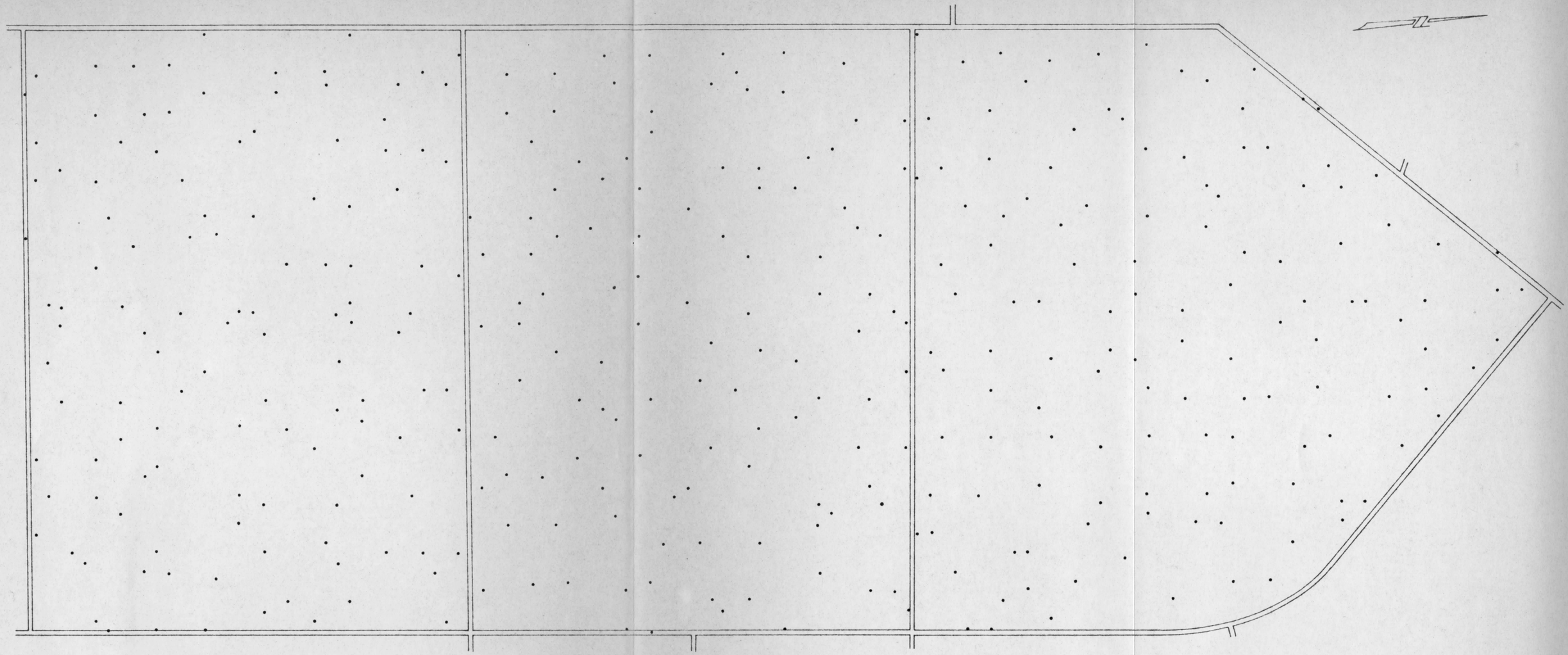
APPENDIX A

FIGURE 17

VARIABLE SOIL SECTION



RANDOM SAMPLE POINT LOCATIONS

500 0 500 1000
SCALE IN FEET

J.A.M.

FIGURE 18

UNIFORM SOIL SECTION

RANDOM SAMPLE POINT LOCATIONS

500 0 500 1000
SCALE IN FEET

JAM '67

```
      $JØB    WATFØR  001106 M F GØØDCHILD 3  060   010   030                $$
      $IBJØB          NØDECK                                                  $$
      $IBFTC TEST                                                             $$
1           DIMENSIØN I(2,20,40),A(125,4)                                     $$
2           X=0.7347                                                          $$
3           C=64.3289                                                         $$
4           DØ 20 L=1,2                                                       $$
5           DØ 20 J=1,20                                                      $$
6           DØ 20 K=1,40                                                      $$
7           M=X*C                                                             $$
10          X=(X*C-FLØAT(M))                                                  $$
11       20 I(L,J,K)=X*220.0                                                  $$
12          WRITE (6,30)                                                      $$
13       30 FØRMAT (1H1,18HRANDØM CØØRDINATES)                                $$
14          DØ 21 K=1,40                                                      $$
15          DØ 21 L=1,2                                                       $$
16       21 WRITE (6,31) (I(L,J,K),J=1,20)                                    $$
17       31 FØRMAT (1H0,20(2X,I3))                                            $$
20          DATA AL1,AL2,AL3/1H ,1H*,1H+/                                     $$
21          WRITE (6,32)                                                      $$
22       32 FØRMAT (1H1,15HPØINT LØCATIØNS)                                   $$
23          DØ 23 K=1,40                                                      $$
24          DØ 22 J=1,125                                                     $$
25          DØ 22 L=1,4                                                       $$
26       22 A(J,L)=AL1                                                        $$
27          DØ 25 J=1,20                                                      $$
30          I(1,J,K)=I(1,J,K)/44                                              $$
31          I(2,J,K)=I(2,J,K)/55+1                                            $$
32          DØ 25 L=1,4                                                       $$
33          IF (I(2,J,K).NE.L) GØ TØ 25                                       $$
34          KA=5*J-I(1,J,K)                                                   $$
35          A(KA,L)=AL2                                                       $$
36       25 CØNTINUE                                                          $$
37          DØ 23 L=1,4                                                       $$
40          AK=AL1                                                            $$
41          IF (L.EQ.1) AK=AL3                                                $$
42       23 WRITE (6,33) AK,(A(KA,L),KA=1,125)                                $$
43       33 FØRMAT (1H ,A1,125A1)                                             $$
44          STØP                                                              $$
45          END                                                               $$
      $ENTRY
```

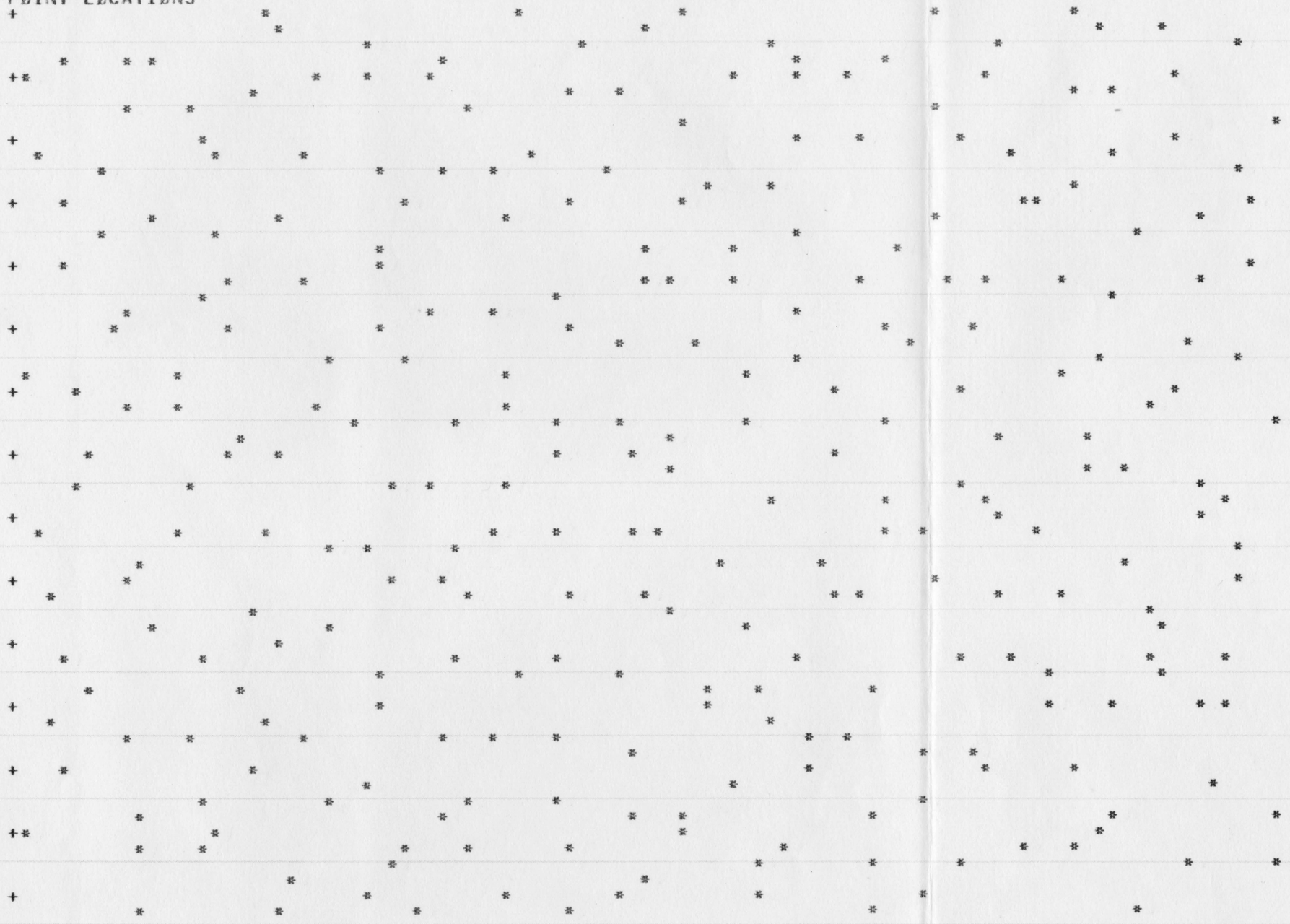
RANDØM CØØRDINATES

57	45	206	11	209	97	69	2	4	28	111	26	163	71	90	97	69	190	186	164
202	183	189	35	79	144	198	26	124	83	27	113	174	208	39	119	45	104	65	147
194	67	78	50	52	89	93	189	64	98	109	171	152	200	99	137	48	149	132	16
52	118	116	107	52	32	33	152	107	108	211	13	7	0	123	18	98	97	54	217
171	173	16	198	105	62	50	103	182	147	15	26	149	157	35	54	47	134	144	172
85	152	32	80	56	132	151	141	102	133	174	208	33	23	28	85	192	84	4	147
59	161	202	214	179	83	179	80	83	21	108	159	173	5	100	2	207	84	69	117
28	125	87	148	100	171	40	98	2	206	14	186	149	179	80	4	42	131	93	20
61	63	39	149	113	65	95	110	117	35	134	138	145	165	78	166	117	157	87	94
43	178	119	62	101	38	193	180	147	66	66	98	176	102	86	65	95	124	86	29
185	123	128	162	18	64	219	86	52	114	77	107	147	76	195	179	89	215	111	168
178	25	182	29	148	36	142	182	23	83	98	176	133	12	96	47	180	117	58	121
41	44	106	97	78	161	18	55	90	96	169	99	10	52	10	111	17	15	144	33
36	103	60	167	62	152	149	84	161	120	189	122	17	147	29	177	189	55	5	119
15	198	52	136	208	39	119	45	104	65	147	23	11	82	36	162	16	100	59	180
131	30	155	11	49	125	128	155	49	21	83	184	16	219	114	174	69	78	119	180
142	1	105	8	0	123	18	98	97	54	217	217	85	57	165	131	210	89	85	142
83	178	102	56	132	140	140	90	93	94	88	211	209	62	92	28	56	180	16	164
120	64	212	87	23	28	85	192	84	4	147	127	9	162	103	90	112	21	201	150
76	40	213	135	178	9	35	84	103	108	163	194	56	81	11	73	108	162	203	45
70	196	21	123	179	80	4	42	131	93	20	62	145	115	25	78	170	43	182	201
59	186	87	165	49	157	59	162	60	139	171	189	98	170	78	102	141	85	130	58
130	82	65	28	102	86	65	95	124	86	29	36	131	196	132	190	175	146	47	212
78	115	121	79	135	0	119	111	145	177	54	79	164	160	190	209	54	23	52	47
51	31	10	71	12	96	47	180	117	58	121	141	112	110	147	154	62	153	1	13
10	193	141	52	160	63	175	145	111	201	184	56	46	176	145	38	4	208	91	176
219	41	22	195	147	29	177	189	55	5	119	52	215	90	12	41	77	213	97	9
2	107	60	46	189	151	66	109	107	218	19	126	104	144	117	81	87	4	135	152
49	9	120	47	219	114	174	69	78	119	180	64	32	106	133	54	167	65	137	177

153	108	165	118	78	38	107	10	80	0	185	10	147	86	54	207	135	94	155	144
123	146	75	173	62	92	28	56	180	16	164	167	90	47	13	184	14	46	37	190
180	186	100	141	18	40	121	27	134	36	52	46	216	75	192	176	121	141	114	41
29	160	34	168	81	11	73	108	162	203	45	0	81	206	185	201	46	140	9	139
198	114	92	98	116	163	93	214	97	125	97	113	72	20	38	150	114	98	81	10
124	209	23	57	170	78	102	141	85	130	58	35	206	106	41	14	118	29	170	162
32	87	12	167	44	197	60	132	95	184	134	70	43	0	78	201	75	196	174	14
117	81	216	170	160	190	209	54	23	52	47	96	100	44	1	41	116	168	204	86
135	134	164	196	200	168	176	138	178	5	56	134	164	31	7	2	21	74	0	72
95	195	52	217	176	145	38	4	208	91	176	73	117	195	119	55	32	89	171	53
135	83	41	129	166	71	152	133	65	122	108	45	21	36	34	143	64	145	18	22
7	49	77	143	144	117	81	87	4	135	152	121	48	34	211	21	122	65	61	155
118	111	48	164	144	219	148	28	37	207	132	82	78	159	41	212	176	149	68	133
18	75	171	10	86	54	207	135	94	155	144	117	50	22	195	47	153	30	25	89
145	129	34	45	52	70	79	58	204	157	142	47	10	155	35	46	123	134	207	23
113	215	56	12	75	192	176	121	141	114	41	46	154	139	32	3	166	7	101	61
127	181	213	58	52	122	53	213	156	1	141	0	211	99	59	150	55	92	147	198
33	215	121	154	20	38	150	114	98	81	10	150	30	183	124	204	157	11	160	2
85	215	78	211	74	153	166	67	166	121	69	13	173	33	69	205	63	27	52	12
194	33	115	49	0	78	201	75	196	174	14	13	2	148	81	176	216	101	190	137
213	1	4	166	165	191	181	144	138	137	42	177	159	157	51	23	140	24	84	124
3	204	150	95	31	7	2	21	74	0	72	198	170	96	212	148	39	147	131	56
104	107	54	160	99	9	46	29	130	46	80	0	163	32	202	191	43	30	175	98
16	166	190	14	36	34	143	64	145	18	22	1	189	38	61	116	96	22	125	121
91	98	205	180	19	202	141	153	6	116	117	26	160	87	56	201	187	218	100	168
202	161	165	33	159	41	212	176	149	68	133	125	121	44	8	0	45	113	175	92
197	203	47	175	161	46	92	171	3	13	47	138	215	138	127	181	187	180	76	38
45	56	115	195	155	35	46	123	134	207	23	145	110	28	82	44	47	53	100	209
134	140	180	67	38	105	202	60	217	192	173	123	194	90	54	36	195	181	54	34

62	86	144	16	99	59	150	55	92	147	198	143	88	90	56	214	194	122	60	83
65	31	150	181	68	160	40	146	160	48	159	52	202	131	185	169	66	21	202	11
65	77	32	198	33	69	205	63	27	52	12	183	165	130	107	146	214	161	135	67
42	22	216	28	22	174	178	215	11	21	130	91	52	93	20	128	109	94	64	97
7	162	142	206	157	51	23	140	24	84	124	141	71	26	106	163	173	43	113	148
100	158	86	81	141	0	25	195	91	35	59	134	54	74	21	132	211	112	218	96
72	98	153	87	32	202	191	43	30	175	98	104	181	166	48	168	178	144	64	121
66	105	86	195	85	41	92	48	168	113	116	43	189	179	55	191	153	198	5	27
61	157	203	120	87	56	201	187	218	100	168	116	17	175	47	81	18	27	165	83
103	170	38	9	202	21	205	44	38	26	8	190	86	97	69	2	4	28	111	26
190	28	130	27	138	127	181	187	180	76	38	21	30	45	204	192	110	212	70	118
32	168	36	194	45	94	215	6	30	193	81	133	43	89	93	189	64	98	109	171
136	61	64	4	90	54	36	195	181	54	34	93	209	83	156	33	52	38	160	146
123	82	127	218	71	164	23	209	214	106	152	11	153	62	50	103	182	147	15	26
170	209	202	46	131	185	169	66	21	202	11	93	25	115	148	163	73	52	203	154
55	1	45	201	179	215	204	73	146	55	155	69	179	83	179	80	83	21	108	159
157	42	43	114	93	20	128	109	94	64	97	70	82	176	86	188	81	48	87	57
21	128	74	176	132	191	203	115	172	26	74	83	113	65	95	110	117	35	134	138
203	73	173	96	74	21	132	211	112	218	96	105	217	144	75	27	181	54	134	152
65	94	161	163	185	214	126	192	109	196	143	111	18	64	219	86	52	114	77	107
96	95	164	40	179	55	191	153	198	5	27	197	155	45	35	209	37	173	53	112
6	126	38	199	80	139	205	39	206	72	217	108	78	161	18	55	90	96	169	99

PØINT LØCATIØNS



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01106 M F GØØDCHILD 3  060    000MIN 58SEC CØST$004.38 REM. TIME 0012MIN 22SEC
          $IBSYS                                                          $$

CØMPILE TIME          194     TØTAL TIME          3467
ØBJECT PRØG           374     DATA STØRAGE        2112     AVAILABLE CØRE      9495     SYMBØL TABLE        176
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APPENDIX B

VARIABLE SOIL SECTION
CENSUS DATA BY SUPER-BLOCK
1961
(all figures are averages for at least 3 farms)

	BLOCK I 3 farms	BLOCK II 3 farms	BLOCK III 3 farms	BLOCK IV 3 farms	BLOCK V 4 farms	BLOCK VI 3 farms	BLOCK VII 3 farms	BLOCK VIII 3 farms	BLOCK IX 5 farms
Total area in acres	133.6	120.	124.6	60.7	115.5	119.7	120.4	117.	38.
Market value	$19,800.	$25,000.	$23,000.	$13,500.	$22,500.	$20,666.	$17,333.	$22,500.	$17,000.
Total cropland	90.3	96.3	89.7	23.	70.7	68.7	48.3	82.	25.
Improved pasture	29.3	7.7	11.7	7.7	12.7	6	42.7	12.	8.
Fallow	-	-	-	.67	-	23.	.33	-	-
Barn yards and garden	2.	2.3	3.	1.7	2.	2.	4.	1.	2.
Woodland	11.7	6.	13.3	18.7	21.7	31.3	16.7	8.	4.
Other improved	2.3	7.	6.7	9.	7.7	8.7	8.	15.	6.
VALUE OF MACHINERY									
Automobiles	$ 133.	$ 200.	$ 800.	$ 333.	$ 300.	-	$ 1,000.	$ 1,300.	$ 700.
Trucks	-	67.	-	1,266.	50.	-	666.	600.	600.
Tractors	2,033.	1,960.	1,533.	333.	575.	$ 1,700.	1,133.	1,400.	750.
Grain Binders	158.	200.	567.	266.	141.	300.	83.67	75.	80.
Threshing Machines	400.	833.	367.	-	625.	400.	666.	-	400.
Balers	333.	233.	400.	-	175.	-	233.	-	-
Milking Machines	218.	183.	75.	25.	94.	120.	166.	200.	200.
Other	1,533.	1,700.	1,345.	103.	1,225.	2,063.	1,250.	1,900.	1,050.
TOTAL	4,866.	5,327.	5,138.	2,101.67	3,867.50	4,583.	3,235.	5,222.	3,500.

VARIABLE SOIL SECTION
CENSUS DATA BY SUPER-BLOCK
1961

	BLOCK I 3 farms	BLOCK II 3 farms	BLOCK III 3 farms	BLOCK IV 3 farms	BLOCK V 4 farms	BLOCK VI 3 farms	BLOCK VII 3 farms	BLOCK VIII 3 farms	BLOCK IX 5 farms
LIVESTOCK									
Total cattle	49.	36.3	37.7	8.3	33.7	35.	39.	48.	11.
a) calves	16.7	9.7	7.3	2.7	6.3	9.	9.7	14.	5.
b) steers	9.7	10.3	12.7	-	15.3	11.	15.3	9.	3.
c) bulls	.67	.33	1.	-	.67	.33	.67	-	-
d) heifers	6.	5.7	3.	1.3	2.3	4.	3.7	9.	1.
e) cows & heifers	16.	10.3	13.7	4.3	12.3	10.7	9.7	16.	4.
Number milked daily	13.	9.7	8.7	4.3	8.3	7.3	7.	9.	4.
Pounds of milk daily	343.3	267.	318.3	113.3	270.	214.7	197.3	370.	180.
Total pigs	93.	71.	68.	30.6	62.	79.7	48.	71.	60.
a) under 6 mos.	78.7	67.7	63.7	23.	54.5	59.7	43.6	63.	35.
b) over 6 mos.	14.3	3.3	4.3	7.7	6.7	20.	4.6	8.	6.
Sows	4.3	3.	4.	5.	3.5	8.3	-	-	3.
Total horses	5.3	4.	4.	-	3.8	5.7	1.	1.	-
Total Hens	372.3	1,016.7	271.7	416.7	1,087.5	563.3	366.	370.	450.
a) chicks	-	400.	100.	333.	656.	100.	-	202.	200.
b) pullets	160.7	233.	-	-	-	200.	166.	-	-
c) hens	211.7	386.7	171.7	33.	431.	263.3	166.	168.	350.
d) other	-	-	-	50.	-	-	33.	-	-
Turkeys	-	-	-	-	-	-	-	-	-
MAPLE SYRUP									
No. of Buckets	100.	83.3	22.	-	177.5	295.	151.7	160.	-
No. of Gallons	23.3	20.7	5.3	-	44.	73.7	27.7	40.	-

VARIABLE SOIL SECTION
CENSUS DATA BY SUPER-BLOCK
1961

	BLOCK I 3 farms	BLOCK II 3 farms	BLOCK III 3 farms	BLOCK IV 3 farms	BLOCK V 4 farms	BLOCK VI 3 farms	BLOCK VII 3 farms	BLOCK VIII 3 farms	BLOCK IX 5 farms
No. of days employed off farm	-	-	-	165	-	-	173	-	100
Hired help, no. of weeks	9.3	34.7	20.7	.33	13	4	1.3	1	-
Year round hired help	-	.67	.33	-	.25	.33	-	-	-
Gal. of milk sold (May)	-	-	-	-	306.7	-	111	-	-
Gal. of cream sold (May)	93.7	87	78	31	43.7	54.3	30.3	100	35
Total lbs. milk produced (May)	9,530	8,830	8,103	3,196.7	7,636.71	5,760	4,453.3	10,205	3,000
Cash wages paid	$ 184.00	$ 973.33	$ 410.00	$ 8.00	$ 325.00	$ 155.67	$ 53.33	$ 40.00	-
Feed & Seed purchases	$2,494.00	$6,145.33	$2,765.00	$1,222.00	$6,498.00	$6,858.67	$2,906.00	$3,900.00	$3,250.00

VARIABLE SOIL SECTION
CENSUS DATA BY SUPER-BLOCK
1961
(all figures are averages for at least 3 farms)

	BLOCK I 3 farms	BLOCK II 3 farms	BLOCK III 3 farms	BLOCK IV 3 farms	BLOCK V 4 farms	BLOCK VI 3 farms	BLOCK VII 3 farms	BLOCK VIII 3 farms	BLOCK IX 5 farms
GROSS INCOME (in dollars)									
Value of crop sold	-	16.67	111.00	58.67	-	26.70	-	1,550.00	-
a) Value of calves sold	-	-	87.00	-	-	-	25.00	-	320.00
b) Other cattle sold	2,847.00	8,403.00	6,670.00	39.00	4,880.00	4,851.00	3,163.33	5,000.00	1,000.00
a) Weanling pigs sold	-	-	-	1,139.00	-	-	153.30	-	1,000.00
b) Other pigs sold	3,738.00	5,273.00	5,654.00	-	4,019.00	4,007.00	1,306.00	4,205.00	2,010.00
Horses sold	100.00	-	-	-	11.00	158.00	-	-	-
Hens sold	138.00	597.00	76.67	-	367.00	105.00	69.33	-	600.00
Turkeys sold	-	-	-	-	-	-	-	-	-
Dairy products sold	2,026.00	1,475.00	1,671.00	418.67	1,945.00	1,395.30	1,411.00	2,000.00	820.00
Eggs sold	672.67	3,247.00	928.67	192.00	3,065.00	1,270.00	608.00	360.00	1,200.00
Maple products sold	64.00	83.00	-	-	125.00	460.67	171.77	240.00	-
Forest products sold	-	-	-	-	-	476.00	-	26.00	-
TOTAL GROSS INCOME	$9,586.94	$22,428.67	$15,198.34	$1,847.34	$14,412.00	$12,723.64	$6,907.00	$13,321.00	$6,950.00

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ISN     SØURCE STATEMENT
    0 $IBFTC
    1       DIMENSIØN B(3),A(8),IV(10,2),ISC(14,14,2),IST(14,2),F(3),S1(14,14,
           18),S2(14,14,8),F2(21,40,2),ISS(14),ICC(14),P1(5,6),P2(5,6),D(14),
           2NR(14),DR(14),NDF(14),T(14)
    2       DATA B/18HYIELD FERT  VALUE /
    3       DATA A(7),A(8)/6HSØIL  ,6HCRØP  /
    4    40 READ(5,10) IV
    6    10 FØRMAT (2(2I2,I1,3X,2I2,I3,I1,3I3,15X))
    7       IF (IV(1,1).EQ.21) GØ TØ 41
   12       DØ20 J=1,2
   13       I=IV(3,J)
   14       IS=IV(4,J)
   15       IC=IV(5,J)
   16       ISC(IS,IC,I)=ISC(IS,IC,I)+1
   17       IT=IV(7,J)
   20       IF (IT.EQ.1) IST(IS,I)=IST(IS,I)+1
   23       F(1)=IV(6,J)
   24       F(2)=IV(8,J)+IV(9,J)
   25       F(3)=IV(10,J)*IV(6,J)
   26       F(3)=F(3)/100.0
   27       DØ 21 K=1,3
   30       KK=K+I*3-3
   31       S1(IS,IC,KK)=S1(IS,IC,KK)+F(K)
   32    21 S2(IS,IC,KK)=S2(IS,IC,KK)+F(K)**2
   34       IX=IV(1,J)
   35       IY=IV(2,J)
   36    20 F2(IX,IY,I)=F2(IX,IY,I)+F(3)
   40       GØ TØ 40
   41    41 DØ 56 I=1,2
   42       ISSCC=0.0
   43       DØ 300 J=1,14
   44       ISS(J)=0.0
   45   300 ICC(J)=0.0
   47       DØ 24IS=1,11
   50       DØ 23 IC=1,14
   51       ISS(IS)=ISS(IS)+ISC(IS,IC,I)
   52    23 ICC(IC)=ICC(IC)+ISC(IS,IC,I)
   54    24 ISSCC=ISSCC+ISS(IS)
   56       DØ 25 IS=1,11
   57       DØ 25 IC=1,14
   60       FF=FLØAT(ISC(IS,IC,I))
   61       S1(IS,IC,7)=FF/FLØAT(ISS(IS))*100.0
   62    25 S1(IS,IC,8)=FF/FLØAT(ICC(IC))*100.0
   65       DØ 26 J=7,8
   66       WRITE(6,30) A(J),I
   67    30 FØRMAT (1H1, 58HMATRIX ØF ØCCURRENCES SØIL ACRØSS CRØP DØWN AS PER
           1CENT ØF ,A6,16HTØTAL FØR STRIP ,I1)
   70    26 WRITE (6,31)((S1(IS,IC,J),IS=1,14),IC=1,14)
  102    31 FØRMAT (1H ,14F9.2)
  103       WRITE (6,32)
  104       DØ 27 J=1,14
  105       FF=FLØAT(ISSCC)/100.0
  106       FS=FLØAT(ISS(J))/FF
  107       FC=FLØAT(ICC(J))/FF
  110       FT=FLØAT(IST(J,I))/FF
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 ISN      SØURCE STATEMENT

 111     27 WRITE (6,33) J,FC,FS,FT
 113     33 FØRMAT (1H0,I2,3F15.2)
 114     32 FØRMAT(1H1,23HPERCENT SØIL,CRØP,TILED)
 115        DØ 54 K=1,3
 116        KK=K+I*3-3
 117        DØ 54 IC=1,5
 120        DØ29 IS=1,11
 121        FF=FLØAT(ISC(IS,IC, I))
 122        S2(IS,IC,KK)=(S2(IS,IC,KK)-S1(IS,IC,KK)**2/FF)/(FF*(FF-1.0))
 123     29 D(IS)=S1(IS,IC,KK)/FF
 125        DØ 51 J=1,11
 126        AM=1000000.
 127        DØ 50 IS=1,11
 130        IF (D(IS).GE.AM) GØ TØ 50
 133        AM=D(IS)
 134        ISK=IS
 135     50 CØNTINUE
 137        NR(J)=ISK
 140        DR(ISK)=D(ISK)
 141     51 D(ISK)=1000000.
 143        WRITE(6,35) IC,B(K),I
 144     35 FØRMAT (1H1, 20HMATRIX ØF T FØR CRØP,I1,9HAND VBLE ,A6,9HFØR STRIP
           1,I2,6HRANKED)
 145        DØ 52 IS=1,10
 146        IA=IS+1
 147        DØ 53 IB=IA,11
 150        NDF(IB)=ISC(IS,IC,I)+ISC(IB,IC,I)-2
 151     53 T(IB)=(DR(IS)-DR(IB))/(S2(IS,IC,KK)+S2(IB,IC,KK))**0.5
 153        WRITE(6,34)(T(IB),IB=1,11)
 160     52 WRITE(6,36)(NDF(IB),IB=1,11)
 166     34 FØRMAT(1H ,11F10.2)
 167     36 FØRMAT(1H ,11I10)
 170        WRITE(6,37)
 171     37 FØRMAT (1H0,5HMEANS)
 172        DØ 54 IN=1,11
 173        IS=NR(IN)
 174     54 WRITE (6,38) IS,IN,DR(IS)
 200     38 FØRMAT (1H ,4HSØIL,I3,5H RANK,I3,5HMEAN ,F10.2)
 201        WRITE (6,60) I
 202     60 FØRMAT (1H1,23HMAP ØF VALUE FØR STRIP ,I1)
 203        DØ 56 IY=1,40
 204     56 WRITE (6,39) (F2(IX,IY,I),IX=1,20)
 213     39 FØRMAT (1H0,20F5.0//)
 214        STØP
 215        END

000MI 50SEC00900=

001MI 11SEC00900=
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MATRIX ØF ØCCURRENCES SØIL ACRØSS CRØP DØWN AS PERCENT ØF SØIL TØTAL FØR STRIP 1

21.64	20.88	26.53	0.00	25.00	6.67	6.67	16.67	25.00	50.00	0.00	0.00	0.00	0.00
6.72	5.49	2.04	0.00	4.17	0.00	0.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00
0.75	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28.36	15.38	14.29	8.70	25.00	0.00	46.67	0.00	25.00	50.00	100.00	0.00	0.00	0.00
3.73	3.30	4.08	0.00	4.17	0.00	0.00	16.67	0.00	0.00	0.00	0.00	0.00	0.00
5.97	8.79	6.12	0.00	8.33	6.67	0.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00
8.21	10.99	6.12	0.00	0.00	6.67	6.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.72	0.00	2.04	0.00	12.50	20.00	13.33	0.00	25.00	0.00	0.00	0.00	0.00	0.00
2.24	8.79	2.04	0.00	0.00	6.67	6.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.69	10.99	28.57	86.96	12.50	46.67	6.67	16.67	0.00	0.00	0.00	0.00	0.00	0.00
0.00	6.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.49	3.30	2.04	0.00	4.17	0.00	6.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3.30	4.08	4.35	4.17	6.67	6.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.49	1.10	2.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MATRIX ØF ØCCURRENCES SØIL ACRØSS CRØP DØWN AS PERCENT ØF CRØP TØTAL FØR STRIP 1

40.28	26.39	18.06	0.00	8.33	1.39	1.39	1.39	1.39	1.39	0.00	0.00	0.00	0.00
47.37	26.32	5.26	0.00	5.26	0.00	0.00	15.79	0.00	0.00	0.00	0.00	0.00	0.00
50.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
49.35	18.18	9.09	2.60	7.79	0.00	9.09	0.00	1.30	1.30	0.00	0.00	0.00	0.00
41.67	25.00	16.67	0.00	8.33	0.00	0.00	8.33	0.00	0.00	0.00	0.00	0.00	0.00
34.78	34.78	13.04	0.00	8.70	4.35	0.00	0.00	4.35	0.00	0.00	0.00	0.00	0.00
42.31	38.46	11.54	0.00	0.00	3.85	3.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47.37	0.00	5.26	0.00	15.79	15.79	10.53	0.00	5.26	0.00	0.00	0.00	0.00	0.00
21.43	57.14	7.14	0.00	0.00	7.14	7.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23.29	13.70	19.18	27.40	4.11	9.59	1.37	1.37	0.00	0.00	0.00	0.00	0.00	0.00
0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25.00	37.50	12.50	0.00	12.50	0.00	12.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	33.33	22.22	11.11	11.11	11.11	11.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50.00	25.00	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PERCENT SØIL,CRØP,TILED

1	19.78	36.81	9.07
2	5.22	25.00	1.65
3	0.55	13.46	3.02
4	21.15	6.32	0.27
5	3.30	6.59	1.92
6	6.32	4.12	0.27
7	7.14	4.12	1.37
8	5.22	1.65	1.37
9	3.85	1.10	0.55
10	20.05	0.55	0.00
11	1.65	0.27	0.27
12	2.20	0.00	0.00
13	2.47	0.00	0.00
14	1.10	0.00	0.00

MATRIX ØF T FØR CRØPLAND VBLE YIELD FØR STRIP 1RANKED

0.00	0.02	0.61	18.38	-2.17	-5.71	-0.89	-0.89	-0.89	-0.89	18.38
0	46	40	27	33	28	28	28	28	28	27
0.00	0.02	0.58	16.70	-2.12	-5.21	-0.83	-0.83	-0.83	-0.83	16.70
0	46	30	17	23	18	18	18	18	18	17
0.00	0.02	0.58	12.61	-2.43	-4.90	-1.40	-1.40	-1.40	-1.40	12.61
0	46	30	11	17	12	12	12	12	12	11
0.00	0.02	0.58	12.61	-14.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00
0	46	30	11	4	-1	-1	-1	-1	-1	-2
0.00	0.02	0.58	12.61	-14.00	-1.00	2.00	2.00	2.00	2.00	14.00
0	46	30	11	4	5	5	5	5	5	4
0.00	0.02	0.58	12.61	-14.00	-1.00	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	0.02	0.58	12.61	-14.00	-1.00	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	0.02	0.58	12.61	-14.00	-1.00	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	0.02	0.58	12.61	-14.00	-1.00	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	0.02	0.58	12.61	-14.00	-1.00	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1

MEANS

SØIL 4	RANK 1	MEAN	0.00
SØIL 11	RANK 2	MEAN	0.00
SØIL 3	RANK 3	MEAN	90.00
SØIL 2	RANK 4	MEAN	95.26
SØIL 1	RANK 5	MEAN	95.38
SØIL 7	RANK 6	MEAN	100.00
SØIL 8	RANK 7	MEAN	100.00
SØIL 9	RANK 8	MEAN	100.00
SØIL 10	RANK 9	MEAN	100.00
SØIL 5	RANK 10	MEAN	116.67
SØIL 6	RANK 11	MEAN	125.00

MATRIX ØF T FØR CRØP2AND VBLE YIELD FØR STRIP 1RANKED

0.00	-0.33	-0.67	27.33	-0.67	27.33	27.33	-4.67	27.33	27.33	27.33
0	12	8	7	8	7	7	10	7	7	7
0.00	-0.33	0.00	15.65	0.00	15.65	15.65	-2.24	15.65	15.65	15.65
0	12	4	3	4	3	3	6	3	3	3
0.00	-0.33	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	0	-1	-1	2	-1	-1	-1
0.00	-0.33	0.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-2	-2	1	-2	-2	-2
0.00	-0.33	0.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-1	2	-1	-1	-1
0.00	-0.33	0.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	-2	-2	-2
0.00	-0.33	0.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	-2	-2	-2
0.00	-0.33	0.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	1	1	1
0.00	-0.33	0.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	1	-2	-2
0.00	-0.33	0.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	1	-2	-2

MEANS

SØIL	4 RANK	1MEAN	0.00
SØIL	6 RANK	2MEAN	0.00
SØIL	7 RANK	3MEAN	0.00
SØIL	9 RANK	4MEAN	0.00
SØIL	10 RANK	5MEAN	0.00
SØIL	11 RANK	6MEAN	0.00
SØIL	1 RANK	7MEAN	68.33
SØIL	2 RANK	8MEAN	70.00
SØIL	3 RANK	9MEAN	70.00
SØIL	5 RANK	10MEAN	70.00
SØIL	8 RANK	11MEAN	80.00

MATRIX ØF T FØR CRØP3AND VBLE YIELD FØR STRIP 1RANKED

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2

MEANS

SØIL	3	RANK	1MEAN		0.00
SØIL	4	RANK	2MEAN		0.00
SØIL	5	RANK	3MEAN		0.00
SØIL	6	RANK	4MEAN		0.00
SØIL	7	RANK	5MEAN		0.00
SØIL	8	RANK	6MEAN		0.00
SØIL	9	RANK	7MEAN		0.00
SØIL	10	RANK	8MEAN		0.00
SØIL	11	RANK	9MEAN		0.00
SØIL	2	RANK	10MEAN		50.00
SØIL	1	RANK	11MEAN		75.00

MATRIX ØF T FØR CRØP4AND VBLE YIELD FØR STRIP 1RANKED

0.00	2.99	0.08	4.43	-0.91	31.04	-0.65	31.04	4.43	0.00	-2.22
0	50	43	38	42	36	43	36	37	37	37
0.00	2.99	-1.03	0.15	-1.46	26.10	-3.53	26.10	0.15	-4.17	-6.33
0	50	19	14	18	12	19	12	13	13	13
0.00	2.99	-1.03	1.11	-0.86	8.31	-0.33	8.31	1.11	-0.09	-0.69
0	50	19	7	11	5	12	5	6	6	6
0.00	2.99	-1.03	1.11	-1.49	0.00	-5.05	0.00	0.00	-0.00	-0.00
0	50	19	7	6	0	7	0	1	1	1
0.00	2.99	-1.03	1.11	-1.49	4.95	0.78	4.95	1.49	0.91	0.62
0	50	19	7	6	4	11	4	5	5	5
0.00	2.99	-1.03	1.11	-1.49	4.95	-30.00	0.00	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	-2	-1	-1	-1
0.00	2.99	-1.03	1.11	-1.49	4.95	-30.00	30.00	5.05	0.89	-1.19
0	50	19	7	6	4	5	5	6	6	6
0.00	2.99	-1.03	1.11	-1.49	4.95	-30.00	30.00	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	5	-1	-1	-1
0.00	2.99	-1.03	1.11	-1.49	4.95	-30.00	30.00	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	5	-1	0	0
0.00	2.99	-1.03	1.11	-1.49	4.95	-30.00	30.00	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	5	-1	0	0

MEANS

SØIL	6	RANK	1MEAN	0.00
SØIL	8	RANK	2MEAN	0.00
SØIL	4	RANK	3MEAN	60.00
SØIL	9	RANK	4MEAN	60.00
SØIL	2	RANK	5MEAN	60.36
SØIL	3	RANK	6MEAN	69.29
SØIL	1	RANK	7MEAN	70.00
SØIL	10	RANK	8MEAN	70.00
SØIL	7	RANK	9MEAN	72.14
SØIL	11	RANK	10MEAN	75.00
SØIL	5	RANK	11MEAN	85.83

MATRIX ØF T FØR CRØPSAND VBLE YIELD FØR STRIP 1RANKED

0.00	-1.27	-1.62	10.43	-1.27	10.43	10.43	0.40	10.43	10.43	10.43
0	6	5	3	4	3	3	4	3	3	3
0.00	-1.27	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	6	3	1	2	1	1	2	1	1	1
0.00	-1.27	-1.00	15.00	1.00	15.00	15.00	3.00	15.00	15.00	15.00
0	6	3	0	1	0	0	1	0	0	0
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-2	-2	-1	-2	-2	-2
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-1	0	-1	-1	-1
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-2	-2	-2
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-2	-2	-2
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-1	-1	-1
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-1	-2	-2
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-1	-2	-2

MEANS

SØIL	4	RANK	1MEAN	0.00
SØIL	6	RANK	2MEAN	0.00
SØIL	7	RANK	3MEAN	0.00
SØIL	9	RANK	4MEAN	0.00
SØIL	10	RANK	5MEAN	0.00
SØIL	11	RANK	6MEAN	0.00
SØIL	8	RANK	7MEAN	30.00
SØIL	1	RANK	8MEAN	31.20
SØIL	2	RANK	9MEAN	35.00
SØIL	5	RANK	10MEAN	35.00
SØIL	3	RANK	11MEAN	37.50

MATRIX ØF T FØR CRØP1AND VBLE FERT FØR STRIP 1RANKED

0.00	-2.74	-2.00	23.79	-1.02	-1.42	0.26	6.98	6.98	3.62	23.79
0	46	40	27	33	28	28	28	28	28	27
0.00	-2.74	1.05	16.87	0.86	2.34	3.31	7.19	7.19	5.25	16.87
0	46	30	17	23	18	18	18	18	18	17
0.00	-2.74	1.05	21.29	0.14	1.43	2.75	8.05	8.05	5.40	21.29
0	46	30	11	17	12	12	12	12	12	11
0.00	-2.74	1.05	21.29	-10.30	-0.00	-0.00	-0.00	-0.00	-0.00	0.00
0	46	30	11	4	-1	-1	-1	-1	-1	-2
0.00	-2.74	1.05	21.29	-10.30	0.54	1.19	3.80	3.80	2.49	10.30
0	46	30	11	4	5	5	5	5	5	4
0.00	-2.74	1.05	21.29	-10.30	0.54	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	-2.74	1.05	21.29	-10.30	0.54	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	-2.74	1.05	21.29	-10.30	0.54	0.00	0.00	0.00	-0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	-2.74	1.05	21.29	-10.30	0.54	0.00	0.00	0.00	-0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	-2.74	1.05	21.29	-10.30	0.54	0.00	0.00	0.00	-0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1

MEANS

SØIL 4	RANK 1	MEAN	0.00
SØIL 11	RANK 2	MEAN	0.00
SØIL 8	RANK 3	MEAN	100.00
SØIL 9	RANK 4	MEAN	100.00
SØIL 10	RANK 5	MEAN	120.00
SØIL 7	RANK 6	MEAN	140.00
SØIL 1	RANK 7	MEAN	141.55
SØIL 6	RANK 8	MEAN	150.00
SØIL 5	RANK 9	MEAN	158.33
SØIL 3	RANK 10	MEAN	160.77
SØIL 2	RANK 11	MEAN	174.21

MATRIX ØF T FØR CRØP2AND VBLE FERT FØR STRIP 1RANKED

0.00	-1.71	-2.36	10.24	0.39	10.24	10.24	2.36	10.24	10.24	10.24
0	12	8	7	8	7	7	10	7	7	7
0.00	-1.71	-4.00	76.00	13.50	76.00	76.00	26.00	76.00	76.00	76.00
0	12	4	3	4	3	3	6	3	3	3
0.00	-1.71	-4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	12	4	-1	0	-1	-1	2	-1	-1	-1
0.00	-1.71	-4.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-2	-2	1	-2	-2	-2
0.00	-1.71	-4.00	0.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-1	2	-1	-1	-1
0.00	-1.71	-4.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	-2	-2	-2
0.00	-1.71	-4.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	-2	-2	-2
0.00	-1.71	-4.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	1	1	1
0.00	-1.71	-4.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	1	-2	-2
0.00	-1.71	-4.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	1	-2	-2

MEANS

SØIL	4	RANK	1MEAN	0.00
SØIL	6	RANK	2MEAN	0.00
SØIL	7	RANK	3MEAN	0.00
SØIL	9	RANK	4MEAN	0.00
SØIL	10	RANK	5MEAN	0.00
SØIL	11	RANK	6MEAN	0.00
SØIL	8	RANK	7MEAN	100.00
SØIL	5	RANK	8MEAN	125.00
SØIL	1	RANK	9MEAN	130.00
SØIL	2	RANK	10MEAN	152.00
SØIL	3	RANK	11MEAN	160.00

MATRIX ØF T FØR CRØP3AND VBLE FERT FØR STRIP 1RANKED

0.00 0	-0.00 0	0.00 -1	0.00 -1	0.00 -1	0.00 -1	0.00 -1	0.00 -1	0.00 -1	0.00 -1	0.00 -1
0.00 0	-0.00 0	0.00 -1	0.00 -1	0.00 -1	0.00 -1	0.00 -1	0.00 -1	0.00 -1	0.00 -1	0.00 -1
0.00 0	-0.00 0	0.00 -1	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2
0.00 0	-0.00 0	0.00 -1	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2
0.00 0	-0.00 0	0.00 -1	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2
0.00 0	-0.00 0	0.00 -1	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2
0.00 0	-0.00 0	0.00 -1	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2
0.00 0	-0.00 0	0.00 -1	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2
0.00 0	-0.00 0	0.00 -1	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2
0.00 0	-0.00 0	0.00 -1	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2	0.00 -2

MEANS

SØIL	3	RANK	1MEAN	0.00
SØIL	4	RANK	2MEAN	0.00
SØIL	5	RANK	3MEAN	0.00
SØIL	6	RANK	4MEAN	0.00
SØIL	7	RANK	5MEAN	0.00
SØIL	8	RANK	6MEAN	0.00
SØIL	9	RANK	7MEAN	0.00
SØIL	10	RANK	8MEAN	0.00
SØIL	11	RANK	9MEAN	0.00
SØIL	1	RANK	10MEAN	100.00
SØIL	2	RANK	11MEAN	150.00

MATRIX ØF T FØR CRØP4AND VBLE FERT FØR STRIP 1RANKED

0.00	0.88	-0.20	1.02	-0.44	9.89	1.71	9.89	3.64	2.39	0.52
0	50	43	38	42	36	43	36	37	37	37
0.00	0.88	-1.32	0.14	-1.59	10.69	0.82	10.69	3.06	1.53	-0.76
0	50	19	14	18	12	19	12	13	13	13
0.00	0.88	-1.32	1.51	-0.30	15.34	2.56	15.34	5.88	3.99	1.15
0	50	19	7	11	5	12	5	6	6	6
0.00	0.88	-1.32	1.51	-1.78	11.00	0.68	11.00	3.00	1.40	-1.00
0	50	19	7	6	0	7	0	1	1	1
0.00	0.88	-1.32	1.51	-1.78	15.81	2.90	15.81	6.32	4.43	1.58
0	50	19	7	6	4	11	4	5	5	5
0.00	0.88	-1.32	1.51	-1.78	15.81	-14.70	0.00	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	-2	-1	-1	-1
0.00	0.88	-1.32	1.51	-1.78	15.81	-14.70	14.70	3.14	0.83	-2.64
0	50	19	7	6	4	5	5	6	6	6
0.00	0.88	-1.32	1.51	-1.78	15.81	-14.70	14.70	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	5	-1	-1	-1
0.00	0.88	-1.32	1.51	-1.78	15.81	-14.70	14.70	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	5	-1	0	0
0.00	0.88	-1.32	1.51	-1.78	15.81	-14.70	14.70	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	5	-1	0	0

MEANS

SØIL	6	RANK	1MEAN	0.00
SØIL	8	RANK	2MEAN	0.00
SØIL	9	RANK	3MEAN	100.00
SØIL	10	RANK	4MEAN	120.00
SØIL	7	RANK	5MEAN	127.14
SØIL	4	RANK	6MEAN	137.50
SØIL	2	RANK	7MEAN	140.00
SØIL	11	RANK	8MEAN	150.00
SØIL	1	RANK	9MEAN	158.29
SØIL	3	RANK	10MEAN	162.14
SØIL	5	RANK	11MEAN	166.67

MATRIX ØF T FØR CRØPSAND VBLE FERT FØR STRIP 1RANKED

0.00	-1.41	-1.52	6.50	-3.50	6.50	6.50	-1.00	6.50	6.50	6.50
0	6	5	3	4	3	3	4	3	3	3
0.00	-1.41	-0.80	10.00	-2.00	10.00	10.00	1.00	10.00	10.00	10.00
0	6	3	1	2	1	1	2	1	1	1
0.00	-1.41	-0.80	4.56	0.11	4.56	4.56	1.22	4.56	4.56	4.56
0	6	3	0	1	0	0	1	0	0	0
0.00	-1.41	-0.80	4.56	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-2	-2	-1	-2	-2	-2
0.00	-1.41	-0.80	4.56	-0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-1	0	-1	-1	-1
0.00	-1.41	-0.80	4.56	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-2	-2	-2
0.00	-1.41	-0.80	4.56	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-2	-2	-2
0.00	-1.41	-0.80	4.56	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-1	-1	-1
0.00	-1.41	-0.80	4.56	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-1	-2	-2
0.00	-1.41	-0.80	4.56	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-1	-2	-2

MEANS

SØIL	4	RANK	1MEAN	0.00
SØIL	6	RANK	2MEAN	0.00
SØIL	7	RANK	3MEAN	0.00
SØIL	9	RANK	4MEAN	0.00
SØIL	10	RANK	5MEAN	0.00
SØIL	11	RANK	6MEAN	0.00
SØIL	1	RANK	7MEAN	130.00
SØIL	8	RANK	8MEAN	150.00
SØIL	2	RANK	9MEAN	166.67
SØIL	5	RANK	10MEAN	200.00
SØIL	3	RANK	11MEAN	205.00

MATRIX ØF T FØR CRØP1AND VBLE VALUE FØR STRIP 1RANKED

0.00	0.02	0.61	18.38	-2.17	-5.71	-0.89	-0.89	-0.89	-0.89	18.38
0	46	40	27	33	28	28	28	28	28	27
0.00	0.02	0.58	16.70	-2.12	-5.21	-0.83	-0.83	-0.83	-0.83	16.70
0	46	30	17	23	18	18	18	18	18	17
0.00	0.02	0.58	12.61	-2.43	-4.90	-1.40	-1.40	-1.40	-1.40	12.61
0	46	30	11	17	12	12	12	12	12	11
0.00	0.02	0.58	12.61	-14.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00
0	46	30	11	4	-1	-1	-1	-1	-1	-2
0.00	0.02	0.58	12.61	-14.00	-1.00	2.00	2.00	2.00	2.00	14.00
0	46	30	11	4	5	5	5	5	5	4
0.00	0.02	0.58	12.61	-14.00	-1.00	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	0.02	0.58	12.61	-14.00	-1.00	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	0.02	0.58	12.61	-14.00	-1.00	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	0.02	0.58	12.61	-14.00	-1.00	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1
0.00	0.02	0.58	12.61	-14.00	-1.00	0.00	0.00	0.00	0.00	0.00
0	46	30	11	4	5	0	0	0	0	-1

MEANS

SØIL 4	RANK 1	MEAN	0.00
SØIL 11	RANK 2	MEAN	0.00
SØIL 3	RANK 3	MEAN	40.50
SØIL 2	RANK 4	MEAN	42.87
SØIL 1	RANK 5	MEAN	42.92
SØIL 7	RANK 6	MEAN	45.00
SØIL 8	RANK 7	MEAN	45.00
SØIL 9	RANK 8	MEAN	45.00
SØIL 10	RANK 9	MEAN	45.00
SØIL 5	RANK 10	MEAN	52.50
SØIL 6	RANK 11	MEAN	56.25

MATRIX ØF T FØR CRØP2AND VBLE VALUE FØR STRIP 1RANKED

0.00	-0.33	-0.67	27.33	-0.67	27.33	27.33	-4.67	27.33	27.33	27.33
0	12	8	7	8	7	7	10	7	7	7
0.00	-0.33	-0.00	15.65	-0.00	15.65	15.65	-2.24	15.65	15.65	15.65
0	12	4	3	4	3	3	6	3	3	3
0.00	-0.33	-0.00	0.00	0.00	0.00	0.00	-1751.45	0.00	0.00	0.00
0	12	4	-1	0	-1	-1	2	-1	-1	-1
0.00	-0.33	-0.00	0.00	-0.00	0.00	0.00	-14011.60	0.00	0.00	0.00
0	12	4	-1	-1	-2	-2	1	-2	-2	-2
0.00	-0.33	-0.00	0.00	-0.00	0.00	0.00	-1751.45	0.00	0.00	0.00
0	12	4	-1	-1	-1	-1	2	-1	-1	-1
0.00	-0.33	-0.00	0.00	-0.00	0.00	0.00	-14011.60	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	-2	-2	-2
0.00	-0.33	-0.00	0.00	-0.00	0.00	0.00	-14011.60	0.00	0.00	0.00
0	12	4	-1	-1	-1	-2	1	-2	-2	-2
0.00	-0.33	-0.00	0.00	-0.00	0.00	0.00	-14011.60	14011.60	14011.60	14011.60
0	12	4	-1	-1	-1	-2	1	1	1	1
0.00	-0.33	-0.00	0.00	-0.00	0.00	0.00	-14011.60	14011.60	0.00	0.00
0	12	4	-1	-1	-1	-2	1	1	-2	-2
0.00	-0.33	-0.00	0.00	-0.00	0.00	0.00	-14011.60	14011.60	0.00	0.00
0	12	4	-1	-1	-1	-2	1	1	-2	-2

MEANS

SØIL	4	RANK	1MEAN	0.00
SØIL	6	RANK	2MEAN	0.00
SØIL	7	RANK	3MEAN	0.00
SØIL	9	RANK	4MEAN	0.00
SØIL	10	RANK	5MEAN	0.00
SØIL	11	RANK	6MEAN	0.00
SØIL	1	RANK	7MEAN	53.98
SØIL	2	RANK	8MEAN	55.30
SØIL	3	RANK	9MEAN	55.30
SØIL	5	RANK	10MEAN	55.30
SØIL	8	RANK	11MEAN	63.20

MATRIX ØF T FØR CRØP3AND VBLE VALUE FØR STRIP 1RANKED

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	-1	-2	-2	-2	-2	-2	-2	-2	-2

MEANS

```
SØIL  3 RANK  1MEAN      0.00
SØIL  4 RANK  2MEAN      0.00
SØIL  5 RANK  3MEAN      0.00
SØIL  6 RANK  4MEAN      0.00
SØIL  7 RANK  5MEAN      0.00
SØIL  8 RANK  6MEAN      0.00
SØIL  9 RANK  7MEAN      0.00
SØIL 10 RANK  8MEAN      0.00
SØIL 11 RANK  9MEAN      0.00
SØIL  2 RANK 10MEAN     52.00
SØIL  1 RANK 11MEAN     78.00
```

MATRIX ØF T FØR CRØP4AND VBLE VALUE FØR STRIP 1RANKED

0.00	2.99	0.08	4.43	-0.91	31.04	-0.65	31.04	4.43	-0.00	-2.22
0	50	43	38	42	36	43	36	37	37	37
0.00	2.99	-1.03	0.15	-1.46	26.10	-3.53	26.10	0.15	-4.17	-6.33
0	50	19	14	18	12	19	12	13	13	13
0.00	2.99	-1.03	1.11	-0.86	8.31	-0.33	8.31	1.11	-0.09	-0.69
0	50	19	7	11	5	12	5	6	6	6
0.00	2.99	-1.03	1.11	-1.49	0.00	-5.05	0.00	0.00	-0.00	-0.00
0	50	19	7	6	0	7	0	1	1	1
0.00	2.99	-1.03	1.11	-1.49	4.95	0.78	4.95	1.49	0.91	0.62
0	50	19	7	6	4	11	4	5	5	5
0.00	2.99	-1.03	1.11	-1.49	4.95	-30.00	0.00	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	-2	-1	-1	-1
0.00	2.99	-1.03	1.11	-1.49	4.95	-30.00	30.00	5.05	0.89	-1.19
0	50	19	7	6	4	5	5	6	6	6
0.00	2.99	-1.03	1.11	-1.49	4.95	-30.00	30.00	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	5	-1	-1	-1
0.00	2.99	-1.03	1.11	-1.49	4.95	-30.00	30.00	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	5	-1	0	0
0.00	2.99	-1.03	1.11	-1.49	4.95	-30.00	30.00	-0.00	-0.00	-0.00
0	50	19	7	6	4	5	5	-1	0	0

MEANS

SØIL	6	RANK	1MEAN	0.00
SØIL	8	RANK	2MEAN	0.00
SØIL	4	RANK	3MEAN	52.20
SØIL	9	RANK	4MEAN	52.20
SØIL	2	RANK	5MEAN	52.51
SØIL	3	RANK	6MEAN	60.28
SØIL	1	RANK	7MEAN	60.90
SØIL	10	RANK	8MEAN	60.90
SØIL	7	RANK	9MEAN	62.76
SØIL	11	RANK	10MEAN	65.25
SØIL	5	RANK	11MEAN	74.67

MATRIX ØF T FØR CRØPSAND V6LE VALUE FØR STRIP 1RANKED

0.00	-1.27	-1.62	10.43	-1.27	10.43	10.43	0.40	10.43	10.43	10.43
0	6	5	3	4	3	3	4	3	3	3
0.00	-1.27	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	6	3	1	2	1	1	2	1	1	1
0.00	-1.27	-1.00	15.00	1.00	15.00	15.00	3.00	15.00	15.00	15.00
0	6	3	0	1	0	0	1	0	0	0
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-2	-2	-1	-2	-2	-2
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-1	0	-1	-1	-1
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-2	-2	-2
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-2	-2	-2
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-1	-1	-1
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-1	-2	-2
0.00	-1.27	-1.00	15.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00
0	6	3	0	-1	-1	-2	-1	-1	-2	-2

MEANS

SØIL	4 RANK	1MEAN	0.00
SØIL	6 RANK	2MEAN	0.00
SØIL	7 RANK	3MEAN	0.00
SØIL	9 RANK	4MEAN	0.00
SØIL	10 RANK	5MEAN	0.00
SØIL	11 RANK	6MEAN	0.00
SØIL	8 RANK	7MEAN	49.20
SØIL	1 RANK	8MEAN	51.17
SØIL	2 RANK	9MEAN	57.40
SØIL	5 RANK	10MEAN	57.40
SØIL	3 RANK	11MEAN	61.50

MAP ØF VALUE FØR STRIP 1

0.	0.	0.	0.	0.	45.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	45.	65.	65.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	45.	0.	63.	63.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	70.	70.	0.	0.	63.	0.	148.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	45.	70.	68.	0.	45.	45.	0.	61.	61.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	45.	65.	70.	70.	0.	61.	49.	41.	0.	0.	0.	0.	0.	0.	0.	0.
61.	61.	61.	52.	45.	45.	47.	52.	0.	0.	29.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	61.	61.	52.	45.	0.	0.	52.	29.	29.	29.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	45.	27.	0.	61.	61.	0.	45.	65.	65.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	65.	87.	56.	56.	0.	-0.	0.	44.	0.	0.	0.	0.	0.	0.	0.	0.
57.	57.	17.	51.	87.	50.	0.	0.	0.	0.	0.	57.	57.	0.	0.	0.	0.	0.	0.	0.
52.	0.	17.	0.	0.	87.	87.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	41.	48.	50.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	45.	45.	41.	0.	55.	55.	0.	0.	0.	0.	63.	0.	0.	0.	0.	0.	0.	0.	0.
49.	59.	38.	66.	0.	55.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

90.	70.	38.	65.	0.	0.	63.	61.	52.	0.	52.	56.	65.	0.	0.	0.	0.	0.	0.	0.
0.	45.	78.	65.	0.	0.	63.	0.	52.	56.	0.	65.	0.	0.	0.	0.	0.	0.	0.	0.
0.	70.	70.	0.	0.	0.	0.	34.	56.	0.	57.	65.	65.	0.	0.	0.	0.	0.	0.	0.
0.	43.	45.	0.	0.	44.	36.	47.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
45.	0.	48.	0.	68.	44.	36.	36.	47.	0.	0.	61.	0.	0.	0.	0.	0.	0.	0.	0.
59.	0.	0.	34.	44.	0.	0.	0.	0.	0.	45.	0.	0.	0.	0.	0.	0.	0.	0.	0.
48.	0.	0.	0.	52.	57.	57.	52.	45.	52.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	55.	66.	48.	0.	0.	0.	0.	0.	52.	0.	52.	57.	0.	0.	0.	0.	0.	0.	0.
55.	55.	52.	0.	0.	0.	0.	0.	45.	45.	0.	68.	0.	0.	0.	0.	0.	0.	0.	0.
44.	0.	0.	0.	45.	45.	45.	0.	61.	45.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
34.	34.	0.	0.	45.	45.	50.	0.	0.	0.	0.	0.	45.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	45.	0.	0.	0.	0.	0.	27.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	27.	0.	0.	0.	0.	0.	44.	87.	27.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	32.	32.	0.	0.	52.	52.	45.	52.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

45.	0.	0.	44.	63.	52.	52.	52.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
45.	0.	44.	44.	0.	45.	45.	0.	0.	87.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	45.	45.	44.	0.	52.	0.	0.	55.	0.	50.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

APPENDIX C

UNIFORM SOIL SECTION
CENSUS DATA BY SUPER-BLOCK
1961
(all figures are averages for at least 3 farms)

	BLOCK I 3 farms	BLOCK II 3 farms	BLOCK III 3 farms	BLOCK IV 4 farms	BLOCK V 3 farms	BLOCK VI 3 farms	BLOCK VII 3 farms
Total area in acres	203	118	111	90	122	80	147
Market value	$54,300.	$26,000.	$31,338.	$26,000.	$32,333.	$28,333.	$45,000.
Total Cropland	129	82	78	63	73	62	61
Improved pasture	47	11	21	14	17	7	20
Fallow	-	2	-	-	2	-	-
Barn Yards & Garden	5	4	4	3	2	3	1.3
Woodland	22	6	7	14	21	6	57
Other improved	-	13	1	-	7	1	8
VALUE OF MACHINERY							
Automobiles	$ 3,433.	-	$ 100.	$ 300.	$ 500.	$ 1,500.	$ 300.
Trucks	267.	-	-	63.	33.	-	133.
Tractors	3,350.	3,233.	375.	938.	1,478.	1,293.	333.
Grain binders	233.	333.	95.	125.	166.	450.	109.
Threshing machines	166.	366.	440.	850.	67.	567.	-
Balers	400.	-	-	462.	-	616.	216.
Forage harvester	383.	-	-	-	833.	-	-
Milking machines	316.	125.	73.	268.	125.	226.	67.
Other	$10,423.	$ 1,556.	$ 918.30	$ 1,132.	$1,515.	$ 990.	$ 2,033.
TOTAL	$19,246.	$ 3,331.	$ 3,000.00	$ 3,899.	$4,878	$ 5,793.	$ 3,259.

UNIFORM SOIL SECTION
CENSUS DATA BY SUPER-BLOCK
1961
(all figures are averages for at least 3 farms)

	BLOCK I 3 farms	BLOCK II 3 farms	BLOCK III 3 farms	BLOCK IV 4 farms	BLOCK V 3 farms	BLOCK VI 3 farms	BLOCK VII 3 farms
LIVESTOCK							
Total cattle	89.	34.	50.	54.	35.	33.	38.
a) calves	16.	8.	10.	17.	8.	4.	8.
b) steers	-	14.	23.	14.	6.	13.	20.
c) bulls	1.	.7	.3	.3	1.	-	.33
d) heifers	18.	3.	7.	7.	4.	3.	2.
e) cows and Heifers	54.	8.	9.	16.	15.	13.	8.
Number milked daily	33.	7.	7.	13.	11.	7.	8.
Pounds of milk daily	1,100.	243.	163.	440.	450.	293.	262.
Total pigs	-	59.	55.	63.	96.	100.	49.
a) under 6 mos.	-	58.	45.	53.	57.	98.	33.
over 6 mos.	-	3.	10.	10.	39.	2.	.33
Sows	-	3.	4.	5.	.3	1.3	-
Total horses	.7	5.	5.	3.	3.	1.3	4.3
Total Hens	700.	660.	470.	1,223.	473.	338.3	551.3
A) chicks	566.	175.	233.	450.	166.	-	-
B) pullets	-	300.	-	365.	166.	133.	317.
C) hens	-	185.	237.	363.	120.	205.	217.
D) other	133.	-	-	12.	-	-	18.
Turkeys	-	-	-	-	4,000	-	-
MAPLE SYRUP							
No. of buckets	-	-	-	-	33.	-	673
No. of gallons	-	-	-	-	5.	-	155

UNIFORM SOIL SECTION
CENSUS DATA BY SUPER-BLOCK
1961
(all figures are averages for at least 3 farms)

	BLOCK I 3 farms	BLOCK II 3 farms	BLOCK III 3 farms	BLOCK IV 4 farms	BLOCK V 3 farms	BLOCK VI 3 farms	BLOCK VII 3 farms
No. of days employed off farm	-	-	-	-	-	17	
Hired help, no. of weeks	41	17	36	13	17	-	17
Year round hired help	1	1	1	1	1	-	1
Gal. of milk sold (May)	3,533	412	-	953	702	53.3	-
Gal. of cream sold (May)	-	18	25	14	39	40	60
Total lbs. milk produced (May)	36,636	6,304	2,617	12,388	11,033	4,868	6,381
Cash wages paid	$ 1,049.	$ 260.	$ 470.	$ 198.	$ 228.	-	$ 787.
Feed & Seed purchases	$ 3,255.	$ 4,232.	$ 3,142.	$ 5,919.	$18,296.	$ 5,553.	$ 3,075.

UNIFORM SOIL SECTION
CENSUS DATA BY SUPER-BLOCK
1961
(all figures are averages for at least 3 farms)

	BLOCK I 3 farms	BLOCK II 3 farms	BLOCK III 3 farms	BLOCK IV 4 farms	BLOCK V 3 farms	BLOCK VI 3 farms	BLOCK VII 3 farms
GROSS INCOME (in dollars)							
Value of crop sold	$ 508.	-	$ 215.	$ 165.	$ 153.	$ 78.	$ 6.
a) Value of calves sold	$ 251.	-	-	-	-	-	-
b) Other cattle sold	$ 2,722.	$ 6,080.	$ 5,446.	$ 4,669.	$ 1,700.	$ 5,407.	$ 8,466.
a) Weanling pigs sold	-	-	$ 1,735.	-	-	-	-
b) Other pigs sold	-	$ 4,005.	$ 2,197.	$ 4,423.	$ 4,073.	$ 8,438.	$ 2,541.
Horses sold	-	-	-	$ 58.	-	-	$ 84.
Hens sold	$ 408.	$ 78.	$ 154.	$ 1,298.	$ 33.	$ 120.	$ 284.
Turkeys sold	-	-	-	-	$17,600.	-	-
Dairy products sold	$16,563.	$ 1,654.	$ 1,037.	$ 4,621.	$ 1,501.	$ 2,033.	$ 1,237.
Eggs sold	-	$ 1,361.	$ 909.	$ 2,466.	$ 391.	$ 1,022.	$ 794.
Maple products sold	-	-	-	-	-	-	$ 331.
Forest products sold	-	-	-	-	-	$ 76.	$ 931.
TOTAL GROSS INCOME	$20,452.	$13,795.	$11,743.	$17,753.	$25,452.	$17,174.	$14,668.

MATRIX ØF ØCCURRENCES SØIL ACRØSS CRØP DØWN AS PERCENT ØF SØIL TØTAL FØR STRIP 2

23.88	18.95	17.71	26.32	7.69	37.50	0.00	0.00	28.57	50.00	0.00	0.00	0.00	0.00
4.48	9.47	8.33	15.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	5.21	0.00	0.00	0.00	7.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.90	13.68	22.92	5.26	7.69	12.50	0.00	0.00	14.29	16.67	0.00	0.00	0.00	0.00
5.97	2.11	2.08	0.00	0.00	0.00	0.00	0.00	14.29	0.00	0.00	0.00	0.00	0.00
11.94	23.16	17.71	10.53	0.00	12.50	7.69	0.00	0.00	33.33	0.00	0.00	0.00	0.00
5.97	3.16	10.42	10.53	0.00	12.50	7.69	0.00	28.57	0.00	0.00	0.00	0.00	0.00
0.00	2.11	1.04	5.26	0.00	0.00	7.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	3.16	0.00	5.26	0.00	0.00	7.69	0.00	14.29	0.00	0.00	0.00	0.00	0.00
20.90	18.95	9.38	5.26	84.62	25.00	38.46	100.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	2.08	0.00	0.00	0.00	7.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.49	2.11	1.04	5.26	0.00	0.00	7.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.48	3.16	2.08	10.53	0.00	0.00	7.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MATRIX ØF ØCCURRENCES SØIL ACRØSS CRØP DØWN AS PERCENT ØF CRØP TØTAL FØR STRIP 2

24.62	27.69	26.15	7.69	1.54	4.62	0.00	0.00	3.08	4.62	0.00	0.00	0.00	0.00
13.04	39.13	34.78	13.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	83.33	0.00	0.00	0.00	16.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25.93	24.07	40.74	1.85	1.85	1.85	0.00	0.00	1.85	1.85	0.00	0.00	0.00	0.00
44.44	22.22	22.22	0.00	0.00	0.00	0.00	0.00	11.11	0.00	0.00	0.00	0.00	0.00
15.09	41.51	32.08	3.77	0.00	1.89	1.89	0.00	0.00	3.77	0.00	0.00	0.00	0.00
17.39	13.04	43.48	8.70	0.00	4.35	4.35	0.00	8.70	0.00	0.00	0.00	0.00	0.00
0.00	40.00	20.00	20.00	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	50.00	0.00	16.67	0.00	0.00	16.67	0.00	16.67	0.00	0.00	0.00	0.00	0.00
21.88	28.13	14.06	1.56	17.19	3.13	7.81	6.25	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	66.67	0.00	0.00	0.00	33.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16.67	33.33	16.67	16.67	0.00	0.00	16.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27.27	27.27	18.18	18.18	0.00	0.00	9.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PERCENT SØIL,CRØP,TILED

1	19.82	20.43	6.10
2	7.01	28.96	12.50
3	1.83	29.27	19.21
4	16.46	5.79	2.74
5	2.74	3.96	0.61
6	16.16	2.44	1.83
7	7.01	3.96	0.91
8	1.52	1.22	0.00
9	1.83	2.13	1.22
10	19.51	1.83	0.00
11	0.91	0.00	0.00
12	1.83	0.00	0.00
13	3.35	0.00	0.00
14	0.00	0.00	0.00

MATRIX ØF T FØR CRØPLAND VBLE YIELD FØR STRIP 2RANKED

0.00	1.49	2.57	-0.10	4.23	1.73	15.23	15.23	0.87	0.93	15.23
0	32	31	19	15	17	14	14	16	17	14
0.00	1.49	1.12	-1.34	2.74	0.48	15.91	15.91	-0.28	-0.96	15.91
0	32	33	21	17	19	16	16	18	19	16
0.00	1.49	1.12	-2.20	1.44	-0.41	16.52	16.52	-1.09	-2.50	16.52
0	32	33	20	16	18	15	15	17	18	15
0.00	1.49	1.12	-2.20	3.30	1.59	11.55	11.55	0.86	0.85	11.55
0	32	33	20	4	6	3	3	5	6	3
0.00	1.49	1.12	-2.20	3.30	-1.40	0.00	0.00	-2.00	-7.00	0.00
0	32	33	20	4	2	-1	-1	1	2	-1
0.00	1.49	1.12	-2.20	3.30	-1.40	11.00	11.00	-0.64	-1.30	11.00
0	32	33	20	4	2	1	1	3	4	1
0.00	1.49	1.12	-2.20	3.30	-1.40	11.00	0.00	-10.00	-31.00	0.00
0	32	33	20	4	2	1	-2	0	1	-2
0.00	1.49	1.12	-2.20	3.30	-1.40	11.00	0.00	-10.00	-31.00	0.00
0	32	33	20	4	2	1	-2	0	1	-2
0.00	1.49	1.12	-2.20	3.30	-1.40	11.00	0.00	-10.00	-0.32	10.00
0	32	33	20	4	2	1	-2	0	3	0
0.00	1.49	1.12	-2.20	3.30	-1.40	11.00	0.00	-10.00	-0.32	31.00
0	32	33	20	4	2	1	-2	0	3	1

MEANS

SØIL	7	RANK	1MEAN	0.00
SØIL	8	RANK	2MEAN	0.00
SØIL	11	RANK	3MEAN	0.00
SØIL	5	RANK	4MEAN	80.00
SØIL	3	RANK	5MEAN	87.65
SØIL	6	RANK	6MEAN	91.67
SØIL	2	RANK	7MEAN	96.67
SØIL	9	RANK	8MEAN	100.00
SØIL	10	RANK	9MEAN	103.33
SØIL	1	RANK	10MEAN	110.75
SØIL	4	RANK	11MEAN	112.00

MATRIX ØF T FØR CRØP2AND VBLE YIELD FØR STRIP 2RANKED

0.00	0.34	0.66	0.17	12.16	12.16	12.16	12.16	12.16	12.16	12.16
0	10	9	4	1	1	1	1	1	1	1
0.00	0.34	0.49	-0.14	21.67	21.67	21.67	21.67	21.67	21.67	21.67
0	10	15	10	7	7	7	7	7	7	7
0.00	0.34	0.49	-0.50	19.65	19.65	19.65	19.65	19.65	19.65	19.65
0	10	15	9	6	6	6	6	6	6	6
0.00	0.34	0.49	-0.50	13.00	13.00	13.00	13.00	13.00	13.00	13.00
0	10	15	9	1	1	1	1	1	1	1
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2

MEANS

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SØIL  5 RANK  1MEAN       0.00
SØIL  6 RANK  2MEAN       0.00
SØIL  7 RANK  3MEAN       0.00
SØIL  8 RANK  4MEAN       0.00
SØIL  9 RANK  5MEAN       0.00
SØIL 10 RANK  6MEAN       0.00
SØIL 11 RANK  7MEAN       0.00
SØIL  3 RANK  8MEAN      82.75
SØIL  2 RANK  9MEAN      85.56
SØIL  4 RANK 10MEAN      86.67
SØIL  1 RANK 11MEAN      88.33
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MATRIX ØF T FØR CRØP3AND VBLE YIELD FØR STRIP 2RANKED

0.00	0.00	-41.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	-2	-2	-2	-1	-2	-2	-2	-2
0.00	0.00	-41.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	-2	-2	-2	-1	-2	-2	-2	-2
0.00	0.00	-41.00	41.00	41.00	41.00	-4.00	41.00	41.00	41.00	41.00
0	-2	3	3	3	3	4	3	3	3	3
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-2	-2	-2	-2
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-2	-2	-2	-2
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-2	-2	-2	-2
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-1	-1	-1	-1
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-1	-2	-2	-2
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-1	-2	-2	-2
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-1	-2	-2	-2

MEANS

SØIL	1	RANK	1MEAN	0.00
SØIL	2	RANK	2MEAN	0.00
SØIL	4	RANK	3MEAN	0.00
SØIL	5	RANK	4MEAN	0.00
SØIL	6	RANK	5MEAN	0.00
SØIL	8	RANK	6MEAN	0.00
SØIL	9	RANK	7MEAN	0.00
SØIL	10	RANK	8MEAN	0.00
SØIL	11	RANK	9MEAN	0.00
SØIL	3	RANK	10MEAN	82.00
SØIL	7	RANK	11MEAN	90.00

MATRIX ØF T FØR CRØP4AND VBLE YIELD FØR STRIP 2RANKED

0.00	0.48	0.88	1.01	8.90	-3.72	27.82	27.82	5.74	1.01	27.82
0	25	34	13	13	13	12	12	13	13	12
0.00	0.48	0.29	0.40	9.03	-4.78	29.76	29.76	5.58	0.40	29.76
0	25	33	12	12	12	11	11	12	12	11
0.00	0.48	0.29	0.18	20.15	-11.80	68.09	68.09	12.17	0.18	68.09
0	25	33	21	21	21	20	20	21	21	20
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	0.00	0.00	0.00
0	25	33	21	0	0	-1	-1	0	0	-1
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-1	0	0	-1
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	0.00	0.00	0.00
0	25	33	21	0	0	-1	-1	0	0	-1
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	-1	-2
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	-1	-2
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	0	-1
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	0	-1

MEANS

SØIL	7	RANK	1MEAN	0.00
SØIL	8	RANK	2MEAN	0.00
SØIL	11	RANK	3MEAN	0.00
SØIL	5	RANK	4MEAN	60.00
SØIL	9	RANK	5MEAN	70.00
SØIL	4	RANK	6MEAN	85.00
SØIL	10	RANK	7MEAN	85.00
SØIL	3	RANK	8MEAN	85.23
SØIL	2	RANK	9MEAN	86.15
SØIL	1	RANK	10MEAN	88.21
SØIL	6	RANK	11MEAN	100.00

MATRIX ØF T FØR CRØP5AND VBLE YIELD FØR STRIP 2RANKED

0.00	7.81	11.09	39.00	39.00	39.00	39.00	39.00	11.00	39.00	39.00
0	4	4	2	2	2	2	2	3	2	2
0.00	7.81	1.39	22.33	22.33	22.33	22.33	22.33	-1.00	22.33	22.33
0	4	2	0	0	0	0	0	1	0	0
0.00	7.81	1.39	31.00	31.00	31.00	31.00	31.00	-4.00	31.00	31.00
0	4	2	0	0	0	0	0	1	0	0
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-1	-1
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-1	-2

MEANS

```
SØIL  4 RANK  1MEAN      0.00
SØIL  5 RANK  2MEAN      0.00
SØIL  6 RANK  3MEAN      0.00
SØIL  7 RANK  4MEAN      0.00
SØIL  8 RANK  5MEAN      0.00
SØIL 10 RANK  6MEAN      0.00
SØIL 11 RANK  7MEAN      0.00
SØIL  3 RANK  8MEAN     31.00
SØIL  2 RANK  9MEAN     33.50
SØIL  9 RANK 10MEAN     35.00
SØIL  1 RANK 11MEAN     48.75
```

MATRIX ØF T FØR CRØPLAND VBLE FERT FØR STRIP 2RANKED

0.00	0.51	1.87	-0.69	2.69	3.15	17.05	17.05	-1.28	-5.38	17.05
0	32	31	19	15	17	14	14	16	17	14
0.00	0.51	1.34	-1.00	2.15	2.66	17.62	17.62	-1.58	-6.56	17.62
0	32	33	21	17	19	16	16	18	19	16
0.00	0.51	1.34	-1.71	0.91	1.72	25.61	25.61	-2.29	-12.99	25.61
0	32	33	20	16	18	15	15	17	18	15
0.00	0.51	1.34	-1.71	2.02	2.28	8.76	8.76	-0.49	-1.77	8.76
0	32	33	20	4	6	3	3	5	6	3
0.00	0.51	1.34	-1.71	2.02	2.00	0.00	0.00	-2.60	-0.00	0.00
0	32	33	20	4	2	-1	-1	1	2	-1
0.00	0.51	1.34	-1.71	2.02	2.00	46.00	46.00	-2.84	-29.00	46.00
0	32	33	20	4	2	1	1	3	4	1
0.00	0.51	1.34	-1.71	2.02	2.00	46.00	0.00	-9.00	-0.00	0.00
0	32	33	20	4	2	1	-2	0	1	-2
0.00	0.51	1.34	-1.71	2.02	2.00	46.00	0.00	-9.00	-0.00	0.00
0	32	33	20	4	2	1	-2	0	1	-2
0.00	0.51	1.34	-1.71	2.02	2.00	46.00	0.00	-9.00	-1.00	9.00
0	32	33	20	4	2	1	-2	0	3	0
0.00	0.51	1.34	-1.71	2.02	2.00	46.00	0.00	-9.00	-1.00	0.00
0	32	33	20	4	2	1	-2	0	3	1

MEANS

SØIL	7	RANK	1MEAN	0.00
SØIL	8	RANK	2MEAN	0.00
SØIL	11	RANK	3MEAN	0.00
SØIL	6	RANK	4MEAN	153.33
SØIL	5	RANK	5MEAN	160.00
SØIL	3	RANK	6MEAN	165.88
SØIL	2	RANK	7MEAN	182.22
SØIL	1	RANK	8MEAN	190.00
SØIL	4	RANK	9MEAN	208.00
SØIL	9	RANK	10MEAN	225.00
SØIL	10	RANK	11MEAN	250.00

MATRIX ØF T FØR CRØP2AND VBLE FERT FØR STRIP 2RANKED

0.00	1.53	1.39	-0.93	47.00	47.00	47.00	47.00	47.00	47.00	47.00
0	10	9	4	1	1	1	1	1	1	1
0.00	1.53	0.03	-1.70	5.28	5.28	5.28	5.28	5.28	5.28	5.28
0	10	15	10	7	7	7	7	7	7	7
0.00	1.53	0.03	-1.64	4.58	4.58	4.58	4.58	4.58	4.58	4.58
0	10	15	9	6	6	6	6	6	6	6
0.00	1.53	0.03	-1.64	6.44	6.44	6.44	6.44	6.44	6.44	6.44
0	10	15	9	1	1	1	1	1	1	1
0.00	1.53	0.03	-1.64	6.44	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	1.53	0.03	-1.64	6.44	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	1.53	0.03	-1.64	6.44	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	1.53	0.03	-1.64	6.44	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	1.53	0.03	-1.64	6.44	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	1.53	0.03	-1.64	6.44	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2

MEANS

```
SØIL  5 RANK  1MEAN     0.00
SØIL  6 RANK  2MEAN     0.00
SØIL  7 RANK  3MEAN     0.00
SØIL  8 RANK  4MEAN     0.00
SØIL  9 RANK  5MEAN     0.00
SØIL 10 RANK  6MEAN     0.00
SØIL 11 RANK  7MEAN     0.00
SØIL  3 RANK  8MEAN   120.00
SØIL  2 RANK  9MEAN   121.11
SØIL  1 RANK 10MEAN   156.67
SØIL  4 RANK 11MEAN   183.33
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MATRIX ØF T FØR CRØP3AND VBLE FERT  FØR STRIP 2RANKED
       0.00       0.00      -0.00       0.00       0.00       0.00      -0.00       0.00       0.00       0.00       0.00
          0         -2          3         -2         -2         -2         -1         -2         -2         -2         -2
       0.00       0.00      -0.00       0.00       0.00       0.00      -0.00       0.00       0.00       0.00       0.00
          0         -2          3         -2         -2         -2         -1         -2         -2         -2         -2
       0.00       0.00      -0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00
          0         -2          3          3          3          3          4          3          3          3          3
       0.00       0.00      -0.00       0.00       0.00       0.00      -0.00       0.00       0.00       0.00       0.00
          0         -2          3          3         -2         -2         -1         -2         -2         -2         -2
       0.00       0.00      -0.00       0.00       0.00       0.00      -0.00       0.00       0.00       0.00       0.00
          0         -2          3          3         -2         -2         -1         -2         -2         -2         -2
       0.00       0.00      -0.00       0.00       0.00       0.00      -0.00       0.00       0.00       0.00       0.00
          0         -2          3          3         -2         -2         -1         -2         -2         -2         -2
       0.00       0.00      -0.00       0.00       0.00       0.00      -0.00       0.00       0.00       0.00       0.00
          0         -2          3          3         -2         -2         -1         -1         -1         -1         -1
       0.00       0.00      -0.00       0.00       0.00       0.00      -0.00       0.00       0.00       0.00       0.00
          0         -2          3          3         -2         -2         -1         -1         -2         -2         -2
       0.00       0.00      -0.00       0.00       0.00       0.00      -0.00       0.00       0.00       0.00       0.00
          0         -2          3          3         -2         -2         -1         -1         -2         -2         -2
       0.00       0.00      -0.00       0.00       0.00       0.00      -0.00       0.00       0.00       0.00       0.00
          0         -2          3          3         -2         -2         -1         -1         -2         -2         -2

MEANS
SØIL  1 RANK  1MEAN        0.00
SØIL  2 RANK  2MEAN        0.00
SØIL  4 RANK  3MEAN        0.00
SØIL  5 RANK  4MEAN        0.00
SØIL  6 RANK  5MEAN        0.00
SØIL  8 RANK  6MEAN        0.00
SØIL  9 RANK  7MEAN        0.00
SØIL 10 RANK  8MEAN        0.00
SØIL 11 RANK  9MEAN        0.00
SØIL  3 RANK 10MEAN      150.00
SØIL  7 RANK 11MEAN      150.00
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MATRIX ØF T FØR CRØP4AND VBLE FERT FØR STRIP 2RANKED

0.00	-0.01	2.16	-3.20	3.44	4.27	16.73	16.73	3.44	-3.20	16.73
0	25	34	13	13	13	12	12	13	13	12
0.00	-0.01	2.39	-3.71	4.01	4.97	19.44	19.44	4.01	-3.71	19.44
0	25	33	12	12	12	11	11	12	12	11
0.00	-0.01	2.39	-8.86	1.33	2.60	21.70	21.70	1.33	-8.86	21.70
0	25	33	21	21	21	20	20	21	21	20
0.00	-0.01	2.39	-8.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	25	33	21	0	0	-1	-1	0	0	-1
0.00	-0.01	2.39	-8.86	0.00	0.00	0.00	0.00	0.00	-0.00	0.00
0	25	33	21	0	0	-1	-1	0	0	-1
0.00	-0.01	2.39	-8.86	0.00	0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-1	0	0	-1
0.00	-0.01	2.39	-8.86	0.00	0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	-1	-2
0.00	-0.01	2.39	-8.86	0.00	0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	-1	-2
0.00	-0.01	2.39	-8.86	0.00	0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	0	-1
0.00	-0.01	2.39	-8.86	0.00	0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	0	-1

MEANS

SØIL	7	RANK 1MEAN		0.00
SØIL	8	RANK 2MEAN		0.00
SØIL	11	RANK 3MEAN		0.00
SØIL	6	RANK 4MEAN		150.00
SØIL	5	RANK 5MEAN		160.00
SØIL	9	RANK 6MEAN		160.00
SØIL	3	RANK 7MEAN		170.45
SØIL	1	RANK 8MEAN		201.43
SØIL	2	RANK 9MEAN		201.54
SØIL	4	RANK 10MEAN		240.00
SØIL	10	RANK 11MEAN		240.00

MATRIX ØF T FØR CRØP5AND VBLE FERT FØR STRIP 2RANKED

0.00	4.92	5.00	21.00	21.00	21.00	21.00	21.00	5.00	21.00	21.00
0	4	4	2	2	2	2	2	3	2	2
0.00	4.92	-1.00	31.00	31.00	31.00	31.00	31.00	-1.00	31.00	31.00
0	4	2	0	0	0	0	0	1	0	0
0.00	4.92	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	4	2	0	0	0	0	0	1	0	0
0.00	4.92	-1.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	4.92	-1.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	4.92	-1.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	4.92	-1.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	4.92	-1.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	4.92	-1.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-1	-1
0.00	4.92	-1.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-1	-2

MEANS

SØIL 4	RANK 1	MEAN	0.00
SØIL 5	RANK 2	MEAN	0.00
SØIL 6	RANK 3	MEAN	0.00
SØIL 7	RANK 4	MEAN	0.00
SØIL 8	RANK 5	MEAN	0.00
SØIL 10	RANK 6	MEAN	0.00
SØIL 11	RANK 7	MEAN	0.00
SØIL 2	RANK 8	MEAN	155.00
SØIL 3	RANK 9	MEAN	160.00
SØIL 9	RANK 10	MEAN	160.00
SØIL 1	RANK 11	MEAN	210.00

MATRIX ØF T FØR CRØPLAND VBLE VALUE FØR STRIP 2RANKED

0.00	1.49	2.57	-0.10	4.23	1.73	15.23	15.23	0.87	0.93	15.23
0	32	31	19	15	17	14	14	16	17	14
0.00	1.49	1.12	-1.34	2.74	0.48	15.91	15.91	-0.28	-0.96	15.91
0	32	33	21	17	19	16	16	18	19	16
0.00	1.49	1.12	-2.20	1.44	-0.41	16.52	16.52	-1.09	-2.50	16.52
0	32	33	20	16	18	15	15	17	18	15
0.00	1.49	1.12	-2.20	3.30	1.59	11.55	11.55	0.86	0.85	11.55
0	32	33	20	4	6	3	3	5	6	3
0.00	1.49	1.12	-2.20	3.30	-1.40	0.00	0.00	-2.00	-7.00	0.00
0	32	33	20	4	2	-1	-1	1	2	-1
0.00	1.49	1.12	-2.20	3.30	-1.40	11.00	11.00	-0.64	-1.30	11.00
0	32	33	20	4	2	1	1	3	4	1
0.00	1.49	1.12	-2.20	3.30	-1.40	11.00	0.00	-10.00	-31.00	0.00
0	32	33	20	4	2	1	-2	0	1	-2
0.00	1.49	1.12	-2.20	3.30	-1.40	11.00	0.00	-10.00	-31.00	0.00
0	32	33	20	4	2	1	-2	0	1	-2
0.00	1.49	1.12	-2.20	3.30	-1.40	11.00	0.00	-10.00	-0.32	10.00
0	32	33	20	4	2	1	-2	0	3	0
0.00	1.49	1.12	-2.20	3.30	-1.40	11.00	0.00	-10.00	-0.32	31.00
0	32	33	20	4	2	1	-2	0	3	1

MEANS

SØIL	7	RANK	1MEAN	0.00
SØIL	8	RANK	2MEAN	0.00
SØIL	11	RANK	3MEAN	0.00
SØIL	5	RANK	4MEAN	36.00
SØIL	3	RANK	5MEAN	39.44
SØIL	6	RANK	6MEAN	41.25
SØIL	2	RANK	7MEAN	43.50
SØIL	9	RANK	8MEAN	45.00
SØIL	10	RANK	9MEAN	46.50
SØIL	1	RANK	10MEAN	49.84
SØIL	4	RANK	11MEAN	50.40

MATRIX ØF T FØR CRØP2AND VBLE VALUE FØR STRIP 2RANKED

0.00	0.34	0.66	0.17	12.16	12.16	12.16	12.16	12.16	12.16	12.16
0	10	9	4	1	1	1	1	1	1	1
0.00	0.34	0.49	-0.14	21.67	21.67	21.67	21.67	21.67	21.67	21.67
0	10	15	10	7	7	7	7	7	7	7
0.00	0.34	0.49	-0.50	19.65	19.65	19.65	19.65	19.65	19.65	19.65
0	10	15	9	6	6	6	6	6	6	6
0.00	0.34	0.49	-0.50	13.00	13.00	13.00	13.00	13.00	13.00	13.00
0	10	15	9	1	1	1	1	1	1	1
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2
0.00	0.34	0.49	-0.50	13.00	0.00	0.00	0.00	0.00	0.00	0.00
0	10	15	9	1	-2	-2	-2	-2	-2	-2

MEANS

SØIL 5	RANK	1MEAN	0.00
SØIL 6	RANK	2MEAN	0.00
SØIL 7	RANK	3MEAN	0.00
SØIL 8	RANK	4MEAN	0.00
SØIL 9	RANK	5MEAN	0.00
SØIL 10	RANK	6MEAN	0.00
SØIL 11	RANK	7MEAN	0.00
SØIL 3	RANK	8MEAN	65.37
SØIL 2	RANK	9MEAN	67.59
SØIL 4	RANK	10MEAN	68.47
SØIL 1	RANK	11MEAN	69.78

MATRIX ØF T FØR CRØP3AND VBLE VALUE FØR STRIP 2RANKED

0.00	0.00	-41.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	-2	-2	-2	-1	-2	-2	-2	-2
0.00	0.00	-41.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	-2	-2	-2	-1	-2	-2	-2	-2
0.00	0.00	-41.00	41.00	41.00	41.00	-4.00	41.00	41.00	41.00	41.00
0	-2	3	3	3	3	4	3	3	3	3
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-2	-2	-2	-2
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-2	-2	-2	-2
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-2	-2	-2	-2
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-1	-1	-1	-1
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-1	-2	-2	-2
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-1	-2	-2	-2
0.00	0.00	-41.00	41.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
0	-2	3	3	-2	-2	-1	-1	-2	-2	-2

MEANS

SØIL	1	RANK	1MEAN	0.00
SØIL	2	RANK	2MEAN	0.00
SØIL	4	RANK	3MEAN	0.00
SØIL	5	RANK	4MEAN	0.00
SØIL	6	RANK	5MEAN	0.00
SØIL	8	RANK	6MEAN	0.00
SØIL	9	RANK	7MEAN	0.00
SØIL	10	RANK	8MEAN	0.00
SØIL	11	RANK	9MEAN	0.00
SØIL	3	RANK	10MEAN	85.28
SØIL	7	RANK	11MEAN	93.60

MATRIX ØF T FØR CRØP4AND VBLE VALUE FØR STRIP 2RANKED

0.00	0.48	0.88	1.01	8.90	-3.72	27.82	27.82	5.74	1.01	27.82
0	25	34	13	13	13	12	12	13	13	12
0.00	0.48	0.29	0.40	9.03	-4.78	29.76	29.76	5.58	0.40	29.76
0	25	33	12	12	12	11	11	12	12	11
0.00	0.48	0.29	0.18	20.15	-11.80	68.09	68.09	12.17	0.18	68.09
0	25	33	21	21	21	20	20	21	21	20
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	0.00	0.00	0.00
0	25	33	21	0	0	-1	-1	0	0	-1
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-1	0	0	-1
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	0.00	0.00	0.00
0	25	33	21	0	0	-1	-1	0	0	-1
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	-1	-2
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	-1	-2
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	0	-1
0.00	0.48	0.29	0.18	0.00	-0.00	0.00	0.00	-0.00	-0.00	0.00
0	25	33	21	0	0	-1	-2	-1	0	-1

MEANS

SØIL	7	RANK 1MEAN	0.00
SØIL	8	RANK 2MEAN	0.00
SØIL	11	RANK 3MEAN	0.00
SØIL	5	RANK 4MEAN	52.20
SØIL	9	RANK 5MEAN	60.90
SØIL	4	RANK 6MEAN	73.95
SØIL	10	RANK 7MEAN	73.95
SØIL	3	RANK 8MEAN	74.15
SØIL	2	RANK 9MEAN	74.95
SØIL	1	RANK 10MEAN	76.75
SØIL	6	RANK 11MEAN	87.00

MATRIX ØF T FØR CRØP5AND VBLE VALUE FØR STRIP 2RANKED

0.00	7.81	11.09	39.00	39.00	39.00	39.00	39.00	11.00	39.00	39.00
0	4	4	2	2	2	2	2	3	2	2
0.00	7.81	1.39	22.33	22.33	22.33	22.33	22.33	-1.00	22.33	22.33
0	4	2	0	0	0	0	0	1	0	0
0.00	7.81	1.39	31.00	31.00	31.00	31.00	31.00	-4.00	31.00	31.00
0	4	2	0	0	0	0	0	1	0	0
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-2	-2
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-1	-1
0.00	7.81	1.39	31.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
0	4	2	0	-2	-2	-2	-2	-1	-1	-2

MEANS

SØIL 4	RANK	1MEAN	0.00
SØIL 5	RANK	2MEAN	0.00
SØIL 6	RANK	3MEAN	0.00
SØIL 7	RANK	4MEAN	0.00
SØIL 8	RANK	5MEAN	0.00
SØIL 10	RANK	6MEAN	0.00
SØIL 11	RANK	7MEAN	0.00
SØIL 3	RANK	8MEAN	50.84
SØIL 2	RANK	9MEAN	54.94
SØIL 9	RANK	10MEAN	57.40
SØIL 1	RANK	11MEAN	79.95

MAP ØF VALUE FØR STRIP 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	34.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	57.	34.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	59.	61.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	59.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70.	0.	55.	0.	34.	59.	59.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61.	56.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	70.	70.	0.	0.	0.	0.	0.	0.	0.	0.	0.
45.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
55.	71.	71.	0.	0.	59.	0.	63.	63.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	87.	0.	0.	59.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
83.	0.	34.	68.	0.	57.	45.	45.	49.	67.	34.	0.	0.	0.	0.	0.	0.	0.	0.	0.
83.	87.	34.	34.	56.	94.	94.	45.	45.	0.	34.	0.	0.	0.	0.	0.	0.	0.	0.	0.
78.	0.	45.	0.	87.	83.	83.	78.	0.	0.	36.	0.	0.	0.	0.	0.	0.	0.	0.	0.

87.	87.	52.	0.	74.	0.	74.	36.	74.	36.	36.	36.	0.	0.	0.	0.	0.	0.	0.	0.
52.	52.	45.	0.	45.	78.	78.	65.	70.	36.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	41.	0.	0.	45.	0.	0.	0.	0.	0.	0.	78.	78.	0.	0.	0.	0.	0.	0.	0.
0.	0.	74.	0.	0.	0.	0.	0.	63.	0.	0.	79.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	45.	70.	0.	36.	74.	74.	79.	79.	79.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	45.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	45.	70.	0.	0.	0.	0.	79.	79.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	45.	45.	45.	0.	87.	87.	45.	83.	0.	83.	0.	0.	0.	0.	0.	0.	0.
0.	68.	61.	74.	45.	0.	0.	87.	45.	78.	45.	45.	0.	0.	0.	0.	0.	0.	0.	0.
0.	68.	61.	0.	68.	0.	0.	82.	45.	45.	45.	87.	0.	0.	0.	0.	0.	0.	0.	0.
0.	68.	61.	0.	68.	0.	82.	0.	45.	0.	45.	87.	0.	0.	0.	0.	0.	0.	0.	0.
0.	68.	65.	65.	70.	0.	0.	0.	0.	0.	79.	87.	0.	0.	0.	0.	0.	0.	0.	0.
0.	20.	0.	0.	0.	36.	36.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	55.	0.	0.	0.	36.	74.	50.	50.	50.	63.	82.	0.	0.	0.	0.	0.	0.	0.	0.

0.	20.	70.	0.	0.	74.	74.	45.	45.	74.	74.	68.	0.	0.	0.	0.	0.	0.	0.	0.
0.	20.	70.	70.	45.	74.	74.	70.	45.	74.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	45.	70.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

01105 MFGØØDCHILD2 060 002MIN 17SEC CØST$010.46 REM. TIME -032MIN 29SEC
002MI 19SEC00900=