

# CANADIAN AGRICULTURAL ENGINEERING



The Journal of the Canadian Society of Agricultural Engineering

## CONTENTS:

THESE THINGS SHALL BE – <i>F. H. Theakston</i>	1
SOME NEEDS AND OPPORTUNITIES IN AGRICULTURAL ENGINEERING RESEARCH – <i>F. A. Stinson</i>	2
ESTIMATION OF YOUNG'S MODULUS AND FAILURE STRESSES IN THE HEN'S EGG SHELL – <i>M. A. Tung, L. M. Staley, and J. F. Richards</i>	3
THE RAPID MEASUREMENT OF EGGSHELL STRENGTH – <i>Peter W. Voisey and G. D. Robertson</i>	6
DRYERATION EXPERIENCE WITH GRAIN CORN IN ONTARIO – <i>R. G. Winfield</i>	9
REFRIGERATION OF DAMP GRAIN WITH NATURAL AIR – <i>E. B. Moysey</i>	12
TENSILE PROPERTIES OF ALFALFA STEMS – <i>E. R. Norris and W. K. Bilanski</i>	14
PERFORMANCE PARAMATERS OF TRACTORS EQUIPPED WITH SINGLES, DUALS AND FOUR WHEEL DRIVE – <i>K. W. Domier and O. H. Friesen</i>	16
A LABORATORY SPRAYER – <i>J. L. Thompson, K. S. McKinlay and H. MacDonald</i>	20
POWER REQUIREMENTS FOR AUGERING FERTILIZER AND THE EFFECT OF AUGERING ON FERTILIZER PULVERIZATION – <i>E. H. Wiens</i>	23
IRRIGATION REQUIREMENTS IN SOUTH WESTERN QUEBEC – <i>E. B. Lake</i>	28
ANIMAL RESEARCH INSTITUTE FACILITIES FOR DAIRY CATTLE BREEDING RESEARCH – <i>J. E. Turnbull, C. G. Hickman, and A. J. Lee</i>	32
ANNUAL MEETING HIGHLIGHTS	38

# CANADIAN AGRICULTURAL ENGINEERING

MAY, 1969  
VOLUME 11  
NUMBER 1

## President

**F. H. THEAKSTON**  
University of Guelph,  
Guelph, Ontario

## President-Elect

**M. E. DODDS**  
Canada Agriculture Research Station,  
Swift Current, Saskatchewan

## Past-President

**C. G. E. DOWNING**  
Research Branch, Canada Agriculture,  
Central Experimental Farm,  
Ottawa, Ontario

## Secretary-Treasurer

**K. W. DOMIER**  
University of Manitoba,  
Winnipeg, Manitoba

## Regional Directors

Alberta & British Columbia

## R. L. ROBINSON

Plywood Manufacturers Association of B.C.  
Vancouver, British Columbia

Manitoba & Saskatchewan

## E. T. OATWAY

Manitoba Department of Agriculture,  
Winnipeg, Manitoba

Ontario & Quebec

## J. E. BRUBAKER

Ontario Department of Agriculture & Food,  
School of Agricultural Engineering,  
University of Guelph,  
Guelph, Ontario

Maritimes

## E. D. GILCHRIST

New Brunswick Department of Agriculture,  
Fredericton, New Brunswick

## Subject Matter Directors

## R. S. BROUGHTON

Macdonald College,  
Quebec

## D. E. CLARK

Nova Scotia Agricultural College,  
Truro, Nova Scotia

## M. G. BRITTON

University of Manitoba,  
Winnipeg, Manitoba

## W. R. MILNE

Ontario Hydro,  
Toronto, Ontario

## W. P. LAMPMAN

University of Saskatchewan,  
Saskatoon, Saskatchewan

## Convention Program Coordinator

## F. W. BIGSBY

University of Saskatchewan,  
Saskatoon, Saskatchewan

## Editorial Committee

## D. T. ANDERSON, Chairman

Canada Agriculture Research Station  
Lethbridge, Alberta

## M. E. DODDS

Canada Agriculture Research Station,  
Swift Current, Saskatchewan

## F. R. HORE

Research Branch, Canada Agriculture,  
Central Experimental Farm  
Ottawa, Ontario

## E. B. MOYSEY

University of Saskatchewan  
Saskatoon, Saskatchewan

## E. L. WATSON

University of British Columbia,  
Vancouver, British Columbia

# THESE THINGS SHALL BE

by

F. H. Theakston

Member C.S.A.E.

These things shall be: a loftier race  
Than 'eer the world hath known, shall rise,  
With flame of freedom in their souls  
And light of knowledge in their eyes.

These words by John Addington Symonds seem to be rather appropriate for a young society like the Canadian Society of Agricultural Engineering at this stage in our development. They are especially pertinent at this time of year when young men are launching their careers in a profession which holds so many challenges before them. So often history sets the pattern and deeds of the past supply the strength of a group of dedicated men. Today the world is opening opportunities which must, of necessity, move all of us out of a complacent atmosphere to explore the future with a vigour and enthusiasm supplemented with knowledge unprecedented at any time since the founding of our land.

It seems incongruous that with our intellectual capabilities few outstanding achievements are evident, and yet it is quite apparent that Agricultural Engineers but have to reach just a little further.

It is always interesting to the writer to meet with educators, extension personnel, industrialists, researchers and administrators on any occasion, since objectives are nearly always the same. However, there seems to be a lack of cohesiveness in fulfilling the objectives and it is high time for a breakthrough in several areas.

It is true that in retrospect one can be quite pleased and perhaps proud of the accomplishments in the field and on the farmstead, and this is evident in the great increase in power that has changed the complete complexion of the agricultural industry. The farm machines are excellent, materials handling equipment and structures are constantly being updated, water resource and soil engineering is making noteworthy contributions in many spheres. Some of the most outstanding developments have surely been in reclamation programs in the West and the East, and Agricultural Engineers have been in the forefront, though unfortunately not given just or due recognition. With these continuing efforts it is perhaps quite safe to make predictions for the future which are bound to come to pass if faith in our profession is maintained by those now intimately concerned and that faith be carried to those not now quite so intimately involved.

The first prediction is already being fulfilled since our population can be forecast to double in the next two decades. With a population of 40 to 50 million it is to be expected that agricultural production will have to increase, not necessarily through increase in the number of farms, but through increased efficiency which has only had a scratched surface to date. Efficiency should be the engineers byword and will be as new techniques are introduced by better training methods to the young people of the nation. The question is often asked, "Will technicians find a place in Agricultural Engineering?" The answer must certainly be positive in this world of technical application. Coupled with this must evolve a system of adult education far superior to that known now, since retraining of Agricultural Engineers in industry and in universities is a natural outgrowth of a fast developing nation. Agricultural colleges have a definite responsibility in establishing programs for those engineers caught in an ever changing educational atmosphere.

Consulting engineers in agriculture are a rarity in Canada, and yet there is obviously a need for experts in the major areas of our profession. There is no need for experts "outside the pale" to be called in on consultation when our Society abounds in ability and experience. Let it be known when and where expertise is to be found and let us support the specialist to the advantage of the profession. It is not an unreal prediction to visualize at least one strong consultant in each province supporting the present excellent extension service provided by well qualified Agricultural Engineers.

It is not out of reason to insist on the acceptance of Agricultural Engineers on government task forces for both national and international problems, and indeed it seems highly relevant to transmit major problem areas to government levels rather than wait for problems to become national issues. This can and will be done if we become unified in our approach to problems within our capabilities. The National

*continued on page 27*

Central Office Address: Suite 907, 151 Slater Street, Ottawa 4, Ontario

Subscription Rate: \$4.00 (four dollars) per annum

Published Semi-Annually (May and November)

# ANNUAL MEETING HIGHLIGHTS

The annual meeting and convention of the Canadian Society of Agricultural Engineering will feature three prominent Canadian Agricultural Engineers in a symposium on the subject, Agricultural Engineering in Developing Countries. The convention is scheduled for August 24 to 28 on the beautiful Greystone Campus of the University of Saskatchewan, Saskatoon. The meetings, to be held jointly with the 49th annual meeting and convention of the Agricultural Institute of Canada, will also feature some 38 technical papers and a joint session with the Canadian Society of Agronomy on field plot equipment for research.

Symposium speakers will discuss the topic, Agricultural Engineering in Developing Countries — Present Status — Prime Needs.

Mr. G. N. (Grant) Denike, Chief, Architectural and Engineering Section, Research Branch, Canada Agri-

culture, Ottawa, made a special study of, and will discuss needs, in East Africa.

Mr. T. L. (Lionel) Coulthard, Agricultural Engineering Department, University of British Columbia, has visited several developing areas but will report specifically on needs in West Africa. Lionel spent a year at the University of Accra in Ghana and will report in some detail on needs in that country.

Mr. J. E. (Jim) Beamish, Chief, Water Development Service, PFRA, Regina, was a member of a special task force that made a study of problems in India. Jim has visited other developing areas and is well qualified to discuss India's problems and needs in the field of agricultural engineering.

The C.S.A.E. program committee has assembled a series of technical papers that will have something of

interest for all engineers and for many agriculturists. Organized into six sessions, some running concurrently, the technical paper sessions are woven into the general program of the A.I.C. to provide variety and interest. Wives and families have not been forgotten. A special ladies' program has been planned which will be highlighted by the annual banquet.

The joint C.S.A.E.-C.S.A. demonstration and discussion of plot research equipment will be of special interest to research personnel. Equipment will be on display from several major research institutions in Eastern and Western Canada. Dr. F. W. (Floyd) Bigsby, C.S.A.E. Program Coordinator, extends a special invitation to all Canadian Agricultural Engineers to participate in the C.S.A.E. program and to attend the plenary sessions of the A.I.C., which will feature the theme, Mobilizing Canada's Agricultural Resources.

## IRRIGATION REQUIREMENTS . . .

*continued from page 31*

3. Holmes, R. M. and Robertson, G. W. Application of the Relationship Between Actual and Potential Evapotranspiration in Dry Land Agriculture. Trans. A.S.A.E., Vol. 6, No. 1, pp. 65-67, 1963.
4. Lake, E. B. Soil Moisture Deficits and Surpluses in South Western Quebec. M.Sc. Thesis, Dept. of Agricultural Engineering, McGill University, 1968.
5. Lake, E. B. and Broughton, R. S. Probability Plots of Irrigation Requirements in South Western Quebec. Pub. No. 100, Dept. of Agricultural Engineering, Macdonald College, Que., 1969.
6. Marlatt, W. E. The Interactions of Microclimate, Plant Cover, and Soil Moisture Content Affecting Evapotranspiration Rates. Atmospheric Sciences Technical Paper No. 23, Colorado State University, Fort Collins, 1961.
7. Penman, H. L. Meteorology and Agriculture. General Survey of Meteorology and Agriculture and an Account of the Physics of Irrigation Control. Quarterly Jour. Royal Met. Soc., Vol. 75, No. 325, 1949.

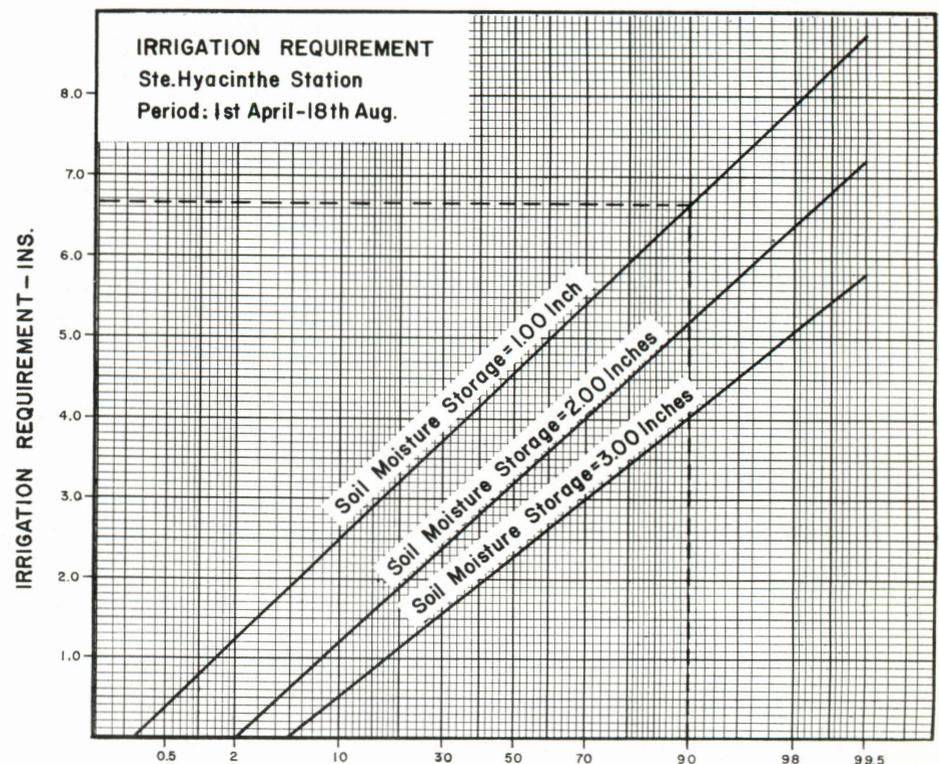


Figure 4. Probability that irrigation requirement will not be exceeded — %.

# EDITORIAL POLICY

Papers for publication in the Journal, *Canadian Agricultural Engineering* must be of an engineering nature with direct or potential application in an agricultural field and fit into one of the following classifications:—

1. A scientific paper based on research conducted by the author or authors.

2. A technical paper based on development, design, testing or analysis of machines, equipment, structures, processes, practices, etc. carried out by the author or authors.

3. A general paper on:—

- (a) Education relative to curricula, philosophy or trends in science and engineering education in general and agricultural engineering in particular.
- (b) A report of a survey or investigation on some phase of research or research methods, on extension or extension methods.

Articles of a promotional or descriptive nature of a type normally published in the *Farm Press* or *Popular Trade* magazines are not acceptable.

## EDITORIAL PROCEDURE

1. The Editorial Committee will evaluate papers presented at the National meetings or prepared expressly for the journal and advise on their suitability.

2. The Committee may use one or more reviewers to assess suitably and other detail regarding publication in *Canadian Agricultural Engineering*. Comments will be kept in confidence and the committee will submit criticisms, suggestion and comments to the authors. The Review will insure that:—

- (a) A research paper does represent a piece of research carried to a well defined stage of advancement and that the conclusions are adequately supported by the experimental results.
- (b) A technical paper presents a clear, concise and factual outline and interpretation of the development, design, test or analysis under consideration, and that it is a contribution in the field of agricultural engineering.

(c) A general paper on education, research or extension is pertinent to major changes in curricula, research or extension or to forward looking developments in these areas.

3. Papers must be clear, concise and written in the impersonal tense. Three copies of the manuscript are required by Editorial Committee. They should be typed, double spaced with margins not less than 1¼ inches. (Manuscript paper with numbered lines is preferable if available).

4. Papers submitted for publication must be originals and must not have been published elsewhere or copy-righted.

5. The title of the paper should be centred in page and all words capitalized.

6. Name and address of authors—if single author centre under the title. If two or more authors, space equally under title. Use lower case letters except first letter of major words. Do not use abbreviations. If author is a member of Society, designate as Member C.S.A.E.

7. Major divisions—Centre in the page and all words in capital letters.

Sub-divisions—Left hand margin in lower case letters except first letter of major words.

Sub-sub-divisions—Left-hand margin all in lower case and underlined.

8. Technical and detail information should be included in only one fashion—either by description, by graph, by table, etc.

9. One or more illustrations are desirable. They must be clearly identified on the back in pencil and must be either black and white lined drawings for charts, graphs, plans, etc., or glossy black and white prints approximately 5 x 7 inches for other types of illustrations.

10. Tables—Tables should be designated at top of table by table number and title, all in capital letters. All headings and other information in table in lower case letters. Check table columns for proper units and for clarity.

11. Figures—Designate figure number at bottom of figure or chart with title in lower case letters. All ordinates on graphs or other information in capital letters or numbers.

12. Paragraph numbering—Where paragraphs are numbered, designate by large numerals. Sub-paragraphs designate by lower case alphabet in brackets.

13. Reference to table or figure in the text should be spelled out in lower case rather than abbreviated, e.g. figure 1.

14. Abbreviations—Do not abbreviate in the text single words such as inches, feet, etc., unless it is the normal method of dimensioning, lumber for instance 2 in x 4 in. However, typical phrases should be abbreviated, e.g. rpm., cps., hp., pto. They should always be designated in lower case without periods. Normally numbers less than 10 should be spelled out, e.g. six.

15. Equations—Equations should be numbered on the right-hand margin in line with the centre of the equation and in large numbers. Use capitals for symbols as much as possible and lower case letters for subscripts or superscripts. All symbols should be defined.

16. References—References should be listed at the end alphabetically by author surname. All information in reference should be lower case with first letter of major words capitalized. Include the source of the reference, volume and page if applicable and year. When referring to references in the manuscript designate by reference number capital size in brackets.

17. Papers published in the Journal may be quoted in whole or in part provided that credit is given to the author and to the journal.

18. The C.S.A.E. is not responsible for opinions expressed in the papers published. Such opinions are the responsibility of the author.

19. The Committee may publish abstracts of papers published in other media or technical reports or research reports available from authors or other sources. It may also publish interesting and important news items of members or developments in agricultural engineering.





**The Canadian Society of  
Agricultural Engineering**

SOUTHERN PRINTING CO. LTD.  
LETHBRIDGE, ALBERTA, CANADA