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### Physiological Aspects of Crop Yield (Frontmatter)

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# PHYSIOLOGICAL ASPECTS OF CROP YIELD

Proceedings of a symposium sponsored by the University of Nebraska, the American Society of Agronomy, and the Crop Science Society of America, and held at the University of Nebraska, Lincoln, Nebr., January 20-24, 1969. Financial support for the symposium came from The Rockefeller Foundation. Publication assistance was provided through the International Biological Program.

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## FOREWORD

This volume is the outgrowth of an international symposium held at Lincoln, Nebraska, January 20-24, 1969. It was sponsored by the University of Nebraska in cooperation with the American Society of Agronomy and the Crop Science Society of America with partial financing by the Rockefeller Foundation and the International Biological Program.

The symposium planning committee was broadly based and was able to bring specialists from many parts of the world to the conference. Thus, the technical presentations were drawn from outstanding authorities backed up by a clear perspective of social needs. This was a happy combination which contributed greatly to the success of the conference and is shown on the printed pages of this book. Happy, too, is the realization that in this symposium the most basic of inquiry into the physiology of plants is brought to bear on solving problems of the yield of economic plants vital to man's existence, both now and in the long view ahead. Empiricism, successful in past decades will, we are convinced, be augmented and in some cases be replaced by the new understanding of the physiology of yield in plants.

We sometimes hear that research is less enjoyable and rewarding now than formerly, partly because it is so fragmented. The output is so great that no one can keep up with more than a mere fraction of research reports and relating one part with another is often difficult. We believe the symposium presented here in book form has bridged some of these chasms.

There is no reason why science cannot be put to work somewhere to assist man in his eternal quest to control his environment and satisfy his basic needs and ambitions. However, there are many examples of misguided or abortive "advances" which produce short-term or local gains at the risk of much larger long-term losses. Hence, as was brought out at the symposium, a certain level of technology must be evaluated in terms of its cost, its worth, and the goals men hold. The societies which sponsored this undertaking are dedicated to the encouragement of excellent science and to the dissemination of knowledge. We believe this book represents a positive and useful effort toward both.

July 1969

L. P. Reitz, President, CSSA  
W. L. Nelson, President, ASA

## PREFACE

Mounting world population pressures and accompanying malnutrition problems pose grave concerns in the minds of thoughtful men. The nature, scope, and impending gravity of this situation has been ably characterized by Dr. J. J. Harrar, President of the Rockefeller Foundation. In a stimulating address during the symposium, Dr. Harrar identified the two principal approaches toward alleviating malnutrition as (i) increased food production per unit land area and (ii) population control. This symposium was concerned with the first approach.

Despite the considerable genetic sophistication incorporated into current plant breeding techniques, C. M. Donald describes plant breeding approaches as being largely empirical (*Advances in Agronomy*, Vol. 15) because our knowledge and use of yield-related physiological and morphological characters is meager. Crop physiologists and biochemists must continue to provide plant breeders with criteria for tailoring crops to different environments, and plant breeders in turn must recognize and use these criteria in their programs.

Plant production processes must be better understood if maximum economic yields are to be realized and exploited. The competitive advantage of any biologic organism in the field, be it crop plant or pest, is dictated by its relative response to the prevailing environment. Environmental physiology research has scarcely touched on interdependencies amongst and control of the major physiologic processes dictating competitive advantage. Quantitating the environment and plant morphologic characters simultaneously with major physiologic process rates may provide much essential perspective concerning the order of these yield limiting factors. The subsequent exploitation of these yield-related factors will depend on their detailed characterization at cellular and molecular levels.

Life processes, in the final analysis, are the sum total of biochemical reactions at cellular and molecular levels. The manner in which these reactions interrelate dictates the efficiency with which light energy is trapped in the plant, converted to chemical energy, and elaborated into storage products useful to man. A significant, increased rate of progress in breeding for yield will depend on expanded, interrelated advances in disciplines such as environmental physiology, systems analyses, simulation and instrumentation, anatomy and morphology, cell biology, and genetics. This symposium was keyed to reviewing and highlighting selected aspects of knowledge in some of these diverse disciplines in an attempt to bridge some of the gaps between essential field and molecular level research pertaining to higher crop yields.

The Rockefeller Foundation approved a five-year grant in 1966 to the Nebraska Agricultural Experiment Station in support of a research program entitled "The Physiology of Yield and Management of Sorghum in Relation to Genetic Improvement." A sum was included in the grant budget to assist in financing a symposium concerning the application of physiological principles in the improvement of crop yields.

Arrangements were made for the American Society of Agronomy and the Crop Science Society of America to cooperate with the University of Nebraska in sponsoring the symposium. The symposium planning committee members were Drs. F. A. Haskins (chairman), J. M. Daly, Jerry D. Eastin, and C. Y. Sullivan, representing the University of Nebraska and appointed by Dr. H. W. Ottoson, Director of the Nebraska Agricultural Experiment Station; Dr. C. H. M. van Bavel, representing the ASA, appointed by Dr. R. S. Whitney, then President of the ASA; and Dr. R. W. Howell, representing the CSSA, appointed by Dr. A. A. Hanson, then President of the CSSA.

The symposium was held from January 20 to 24, 1969, at the Nebraska Center for Continuing Education, as one of the first events in the Centennial observance of the University of Nebraska. Registration at the symposium totalled approximately 445 persons. A total of 40 states and the District of Columbia in the USA, and 14 countries outside the USA were represented at the conference.

A complete listing of all those who have helped the planning and editorial committees is not feasible. However, the committees do wish to acknowledge publicly the excellent contributions of all speakers, invited discussants, and session chairmen. The names of the speakers and of those invited discussants who elected to submit copy for this volume are shown in the Table of Contents. Two of the invited discussants made excellent verbal presentations but chose not to submit copy for publication. They were Drs. C. B. Tanner, University of Wisconsin, and V. T. Walhood, ARS, USDA. One of the invited discussants, Dr. R. W. Allard, University of California, Davis, was unable to attend the symposium.

Chairmen of the eight half-day sessions were the following: Dr. H. H. Kramer, Purdue University; Dr. D. E. McCloud, University of Florida; Dr. C. H. M. van Bavel, Texas A and M University; Dr. G. E. van Riper, Deere and Company; Drs. R. W. Howell and F. G. Viets, ARS, USDA; and Dr. E. F. Frolik and H. W. Ottoson, University of Nebraska.

The contributions of the following in various phases of planning and conducting the symposium and/or publishing this volume also merit special mention:

Drs. Sterling Wortman and Lewis M. Roberts of the Rockefeller Foundation

Dr. A. B. Ward of the Nebraska Center for Continuing Education

Drs. D. C. Smith and F. L. Patterson, Past-Presidents of the ASA and CSSA, respectively

Drs. W. L. Nelson and L. P. Reitz, Presidents of the ASA and CSSA, respectively

Dr. Matthias Stelly and Mr. R. C. Dinauer of the ASA Hdqtrs. staff

The financial support of the Rockefeller Foundation has already been mentioned. Without it, this symposium would not have been possible. The financial contribution of the International Biological Program toward the publication of this volume also is acknowledged with thanks.

July 1969

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# CONTENTS

FOREWORD . . . . .	v
PREFACE . . . . .	vii
CONTRIBUTORS . . . . .	ix

**1      Systems Analysis of Natural Resources and Crop Production      1**

**MARION CLAWSON**

I. Requirements of Crop Production . . . . .	1
II. Aspects of Natural Resources . . . . .	3
A. Qualities of Nature. . . . .	4
B. Technology . . . . .	4
C. Economics. . . . .	5
D. Goals . . . . .	6
III. Natural Resources and Their Use as Systems . . . . .	8
IV. Some Examples . . . . .	10
A. Water Quality . . . . .	10
B. Large Scale Desalting of Sea Water for Commercial Agriculture . . . . .	11
C. A New Crop Variety . . . . .	13
Literature Cited . . . . .	14

**2      Engineering for Higher Yields      15**

**YOSHIAKI ISHIZUKA**

I. Introduction . . . . .	15
II. Changes in Rice Yield from 1000 A.D. . . . .	15
III. A Blueprint to Obtain 6 Tons/Ha of Brown Rice. . . . .	16
IV. Engineering for Higher Yields . . . . .	18
A. Plant Type. . . . .	18
B. Translocation and Respiration . . . . .	21
C. Techniques of Fertilizer Application . . . . .	22
D. Minor Elements . . . . .	23
E. Soils . . . . .	23

**3      Productivity and the Morphology of Crop Stands:  
Patterns with Leaves      27**

**R. S. LOOMIS and W. A. WILLIAMS**

I. Community Organization . . . . .	28
A. Density of the Vegetative Cover . . . . .	28
B. Horizontal Patterns Among Leaves. . . . .	29
C. Vertical Separation of Leaves . . . . .	31

	D. Vertical Distribution of Leaves and Light Interception . . . . .	32
	E. Foliage Angle . . . . .	33
	F. Stratified Analyses of Foliage Angle . . . . .	34
	G. Light Distribution Models . . . . .	36
	H. Azimuthal Orientations. . . . .	40
	I. Nonleaf Structures. . . . .	41
	II. Relation of Canopy Morphology to Production . . . . .	42
	A. Simulations of Crop Productivity . . . . .	42
	B. Some Experimental Results . . . . .	43
	Acknowledgments . . . . .	45
	Literature Cited . . . . .	45
	Discussion . . . . . DONALD N. BAKER	48
	Discussion . . . . . J. W. TANNER	50
4	Physiological Significance of Internal Water Relations to Crop Yield . . . . .	53
	<p style="text-align: right;">R. O. SLATYER</p>	
	I. Introduction . . . . .	53
	II. Development of Internal Water Deficits. . . . .	54
	III. Effects of Water Deficits on Some Physiological Processes .	56
	A. Water Deficits and Growth Processes . . . . .	57
	B. Water Deficits and Physiological Processes . . . . .	59
	1. Water Deficits and Water Transport. . . . .	60
	2. Water Deficits and Nutrient Uptake . . . . .	60
	C. Water Deficits, Protein Synthesis, and Nitrogen Metabolism . . . . .	61
	D. Water Deficits, Photosynthesis, and Carbohydrate Metabolism . . . . .	66
	IV. Effect of Water Stress on Grain Yield in Cereals . . . . .	71
	A. Water Stress and Inflorescence Development . . . . .	71
	B. Water Stress and Fertilization . . . . .	75
	C. Water Stress and Grain Filling. . . . .	76
	V. Conclusions . . . . .	78
	Acknowledgment . . . . .	79
	Literature Cited . . . . .	79
	Discussion . . . . . PAUL J. KRAMER	84
	Discussion . . . . . J. J. OERTLI	85
5	Light Interception and Radiative Exchange in Crop Stands . . . . .	89
	<p style="text-align: right;">J. L. MONTEITH</p>	
	I. Radiation and Crops . . . . .	89

**CONTENTS**

**xv**

II. Specification of the System. . . . .		90
A. Radiation . . . . .		90
B. Leaves . . . . .		92
1. Geometry . . . . .		92
2. Optics . . . . .		94
III. Measurement of Radiation in Crops . . . . .		95
IV. Theoretical Principles. . . . .		96
A. Random and Nonrandom Foliage . . . . .		96
B. Transmission in Foliage . . . . .		97
C. Translucent Leaves . . . . .		99
D. Incident Flux . . . . .		99
E. Sunlit Area . . . . .		101
F. Longwave Radiation . . . . .		102
V. Measurements. . . . .		102
1. Cotton . . . . .		104
2. Clover . . . . .		104
3. Kale . . . . .		104
4. Maize . . . . .		105
5. Barley . . . . .		105
6. Beans . . . . .		107
7. Rice . . . . .		107
8. Ryegrass . . . . .		107
VI. Conclusions . . . . .		108
Acknowledgments . . . . .		108
Literature Cited . . . . .		109
Discussion	<b>K. J. MC CREE</b>	<b>111</b>
Discussion	<b>J. R. PHILIP</b>	<b>113</b>
<b>6</b>	<b>Gaseous Exchange in Crop Stands</b>	<b>117</b>
	<b>EDGAR LEMON</b>	
I. Problems of Measurement and Understanding . . . . .		117
A. Brief Review of Energy and Momentum Balance Methods of Measuring Gaseous Exchange in Crop Stands . . . . .		118
B. Some Weak Points in the Methods . . . . .		121
1. The Heat Budget . . . . .		121
2. The Momentum Budget . . . . .		121
II. Agronomic Usefulness of Micrometeorological Studies . . . . .		127
A. As a Measuring Tool and the Pursuit of Understanding . . . . .		127
1. Plant Growth . . . . .		127
2. Used as a Tool to Pinpoint Critical Plant- Environmental Interactions . . . . .		129
3. Model Building and Testing . . . . .		134
Literature Cited . . . . .		136
Discussion	<b>O. T. DENMEAD</b>	<b>137</b>
Discussion	<b>PIETER GAASTRA</b>	<b>140</b>

**7 Mechanisms of Translocation of Plant Metabolites 143**

**ORLIN BIDDULPH**

I. Introduction . . . . .	143
II. Anatomy of the Phloem . . . . .	144
III. Loading of the Phloem . . . . .	145
IV. Materials Translocated . . . . .	147
V. Linear Rate of Movement . . . . .	147
VI. Distribution . . . . .	148
VII. Radial Loss from the Phloem . . . . .	149
VIII. Tangential Movement . . . . .	151
IX. Removal from the Phloem . . . . .	155
X. Mechanics of Translocation . . . . .	156
A. Temperature . . . . .	158
B. Inhibitors . . . . .	158
C. Log Pattern . . . . .	159
D. Water Movement . . . . .	159
E. Bidirectional Movement . . . . .	159
XI. Summary . . . . .	161
Literature Cited . . . . .	162

**Discussion ALDEN S. CRAFTS 165**

**Discussion C. A. SWANSON 167**

**8 Metabolic Sinks 169**

**HARRY BEEVERS**

I. The Kinds of Metabolic Sinks . . . . .	169
II. Concentration Gradients and Sinks . . . . .	170
III. Metabolic Reactions in Sinks . . . . .	172
A. Absorption of Sugars . . . . .	172
B. Fate of the Entering Sugar . . . . .	173
C. Accumulation of Sugars and Starch at Sinks . . . . .	174
1. Absorption of Sugars at an Accumulating Sink . . . . .	174
2. Starch Formation . . . . .	175
IV. Interaction Between Source and Sink . . . . .	177
Literature Cited . . . . .	179

**Discussion JOHN B. HANSON 180**

**Discussion GEORGE G. LATIES 182**

**9 Interrelationships Among Photosynthesis, Respiration, and Movement of Carbon in Developing Crops 185**

**VOLKMAR STOY**

I. Interdependence of Photosynthesis and Respiration . . . . .	185
--	-----

A.	Photosynthesis and Respiration in Individual Plants . . . . .	185
B.	Photosynthetic Production and Respiratory Consumption in Plant Communities . . . . .	189
II.	The Influence of Metabolic Sinks on the Rate of Photosynthesis . . . . .	190
A.	Experimental Evidence . . . . .	190
B.	Possible Mechanisms to Explain Sink Action . . . . .	191
III.	Growth and the Distribution of Photosynthetic Products . . . . .	193
A.	The Distribution Pattern . . . . .	193
B.	Regulation of the Flow of Assimilates . . . . .	194
IV.	The Dependence of Yield on Photosynthetic Activity . . . . .	195
V.	Challenges for the Future . . . . .	196
	Literature Cited . . . . .	197
Discussion	DALE N. MOSS	203
Discussion	GILLIAN N. THORNE	205
10	Mechanisms of Carbon Fixation and Associated Physiological Responses	207
	ISRAEL ZELITCH	
I.	Control of Stomatal Aperture by Specific Inhibition of Guard Cell Activity . . . . .	207
A.	Control of Stomatal Opening in Light . . . . .	207
B.	Effect of Inhibitors of Stomatal Opening on the CO <sub>2</sub> Compensation Point . . . . .	208
II.	Differences in Photosynthetic Efficiency Among Species . . . . .	210
A.	The Carboxylation Reactions . . . . .	210
B.	Photorespiration and its Measurement . . . . .	213
C.	The CO <sub>2</sub> Compensation Point . . . . .	215
D.	Net Photosynthesis in Atmospheres Low in Oxygen . . . . .	215
E.	The Glycolate Oxidase Reaction as a Source of CO <sub>2</sub> in Photorespiration . . . . .	216
F.	Increasing Net Photosynthesis by Inhibition of Glycolate Oxidation . . . . .	217
III.	The Relation Between Photorespiration and Net Photosynthesis . . . . .	218
A.	A Sensitive <sup>14</sup> C-Assay of Photorespiration . . . . .	218
B.	Comparison of Turnover of CO <sub>2</sub> to the Quantity Released in CO <sub>2</sub> -Free Air in the Light . . . . .	219
C.	Effect of Genetic Control of Photorespiration on Net Photosynthesis . . . . .	221
	Literature Cited . . . . .	223
Discussion	DOV KOLLER	226
Discussion	T. A. MANSFIELD	231



11	Physiological Responses to Nitrogen in Plants	235
	YOSHIO MURATA	
	I. Introduction . . . . .	235
	II. Nitrogen and Formation of "Yield-Container" . . . . .	235
	A. The Number of Spikelets and Nitrogen . . . . .	235
	B. Effect of Nitrogen Topdressing for Increasing the Capacity of "Yield-Container" . . . . .	237
	C. The Number of Spikelets and LAI . . . . .	237
	D. Fertilization (Pollination) and Nitrogen . . . . .	239
	III. The Amount of "Contents" in Relation to the Capacity for Yield . . . . .	240
	IV. Production of Reserve Substances, Ripening, and Nitrogen . . . . .	241
	A. Accumulation of Organic Substances and Nitrogen . . . . .	241
	B. Ripening and Nitrogen . . . . .	243
	C. Photosynthetic Activity, Respiratory Activity, and Nitrogen . . . . .	244
	D. Root Activity and Photosynthetic Activity . . . . .	246
	V. Dry Matter and Grain Production Under Abundant Nitrogen Supply . . . . .	247
	A. Disruption of Photosynthesis-Respiration Balance . . . . .	247
	B. Influence of Solar Radiation on Nitrogen Effect . . . . .	248
	C. Disturbance of Nitrogen Metabolism . . . . .	249
	D. Decrease of Root Activity . . . . .	250
	E. Translocation and Distribution of Substances and Nitrogen . . . . .	251
	F. Nitrogen Response of Varieties. . . . .	253
	VI. Conclusion . . . . .	255
	Literature Cited . . . . .	256
	Discussion	R. H. HAGEMAN 260
	Discussion	AKIRA TANAKA 262
12	Plant Morphology and Stand Geometry in Relation to Nitrogen	265
	ROBERT F. CHANDLER, JR.	
	I. Introduction . . . . .	265
	II. Morphological Characteristics Associated with Responsiveness to Nitrogen . . . . .	266
	A. Length and Thickness of Culm . . . . .	266
	B. Width, Thickness, Length, and Uprightness of Leaves . . . . .	269
	C. Tillering Capacity . . . . .	272
	D. Panicle Weight. . . . .	276
	E. Grain-Straw Ratio . . . . .	277
	III. Stand Geometry and Nitrogen . . . . .	278
	A. Spacing-Nitrogen-Variety Interactions . . . . .	278
	IV. General Considerations . . . . .	281
	V. Conclusions . . . . .	283

**CONTENTS** **xix**

VI. Acknowledgments . . . . . 284  
Literature Cited . . . . . 285

Discussion PETER R. JENNINGS 286

Discussion WERNER L. NELSON 287

**13 Development, Differentiation, and Yield** **291**

**JOHN HESLOP-HARRISON**

I. Introduction: Features of the Developmental Process  
in Plants . . . . . 291

II. Storage Tissues: Characteristics and Development. . . . . 296

    A. Biological Role of Storage Organs . . . . . 298

    B. Development of Storage Structures . . . . . 299

    C. The Hormonal Factors . . . . . 301

    D. The Nutritional Factors . . . . . 304

III. Growth, Differentiation, and Translocation . . . . . 305

IV. Differentiation and the Components of Yield . . . . . 307

V. The Outlook . . . . . 314

    Literature Cited . . . . . 316

Discussion NORMAN E. GOOD 321

Discussion WALTER E. LOOMIS 324

**14 Cultural Manipulation for Higher Yields** **327**

**WILLIAM G. DUNCAN**

I. Introduction . . . . . 327

II. Intraspecific Competition . . . . . 327

    A. Cooperative Interaction . . . . . 329

    B. Competitive Interaction . . . . . 329

    C. Plant Uniformity and Barrenness . . . . . 330

    D. Planting Patterns . . . . . 332

    E. Tillering . . . . . 333

    F. Leaf Area Index . . . . . 333

III. No-Tillage Planting . . . . . 334

    A. Rooting Patterns . . . . . 335

    B. Future of No-Tillage . . . . . 336

IV. Utilization of the Growing Season . . . . . 337

    A. Ideotypes . . . . . 337

    B. Double Cropping . . . . . 338

V. Future Research . . . . . 338

    Literature Cited . . . . . 339

Discussion HARRY F. CLEMENTS 339

Discussion E. B. TREGUNNA 341

15 Environmental Manipulation for Higher Yields 343

PAUL E. WAGGONER

I. Introduction . . . . .	343
II. The Photosynthesis Simulator . . . . .	344
III. The Running of the Simulators . . . . .	350
IV. The Standard Case. . . . .	355
V. Managing Stomata . . . . .	356
VI. Manipulating Light. . . . .	359
VII. Modifying the Wind . . . . .	362
VIII. Fertilizing with Carbon Dioxide . . . . .	365
IX. Summary . . . . .	369
Literature Cited . . . . .	370

16 Germ Plasm Manipulation of the Future 375

G. F. SPRAGUE

I. The Transfer of Genetic Information . . . . .	376
II. Enzymes and Heterosis . . . . .	378
III. Mineral Nutrition and Genetics. . . . .	382
IV. Plant Design and Biological Efficiency . . . . .	382
V. The Physiological Genetics Approach . . . . .	382
Literature Cited . . . . .	386

Discussion N. F. JENSEN 387

SUBJECT INDEX 391