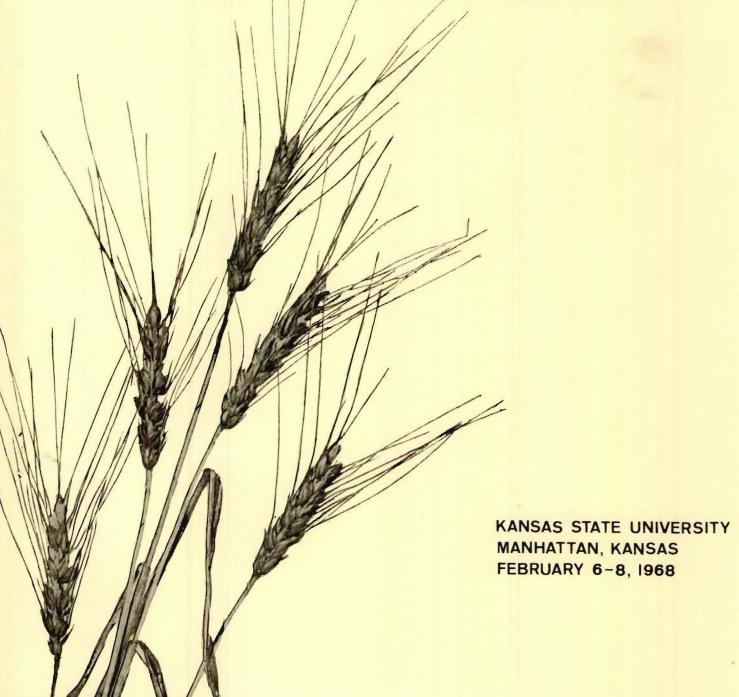
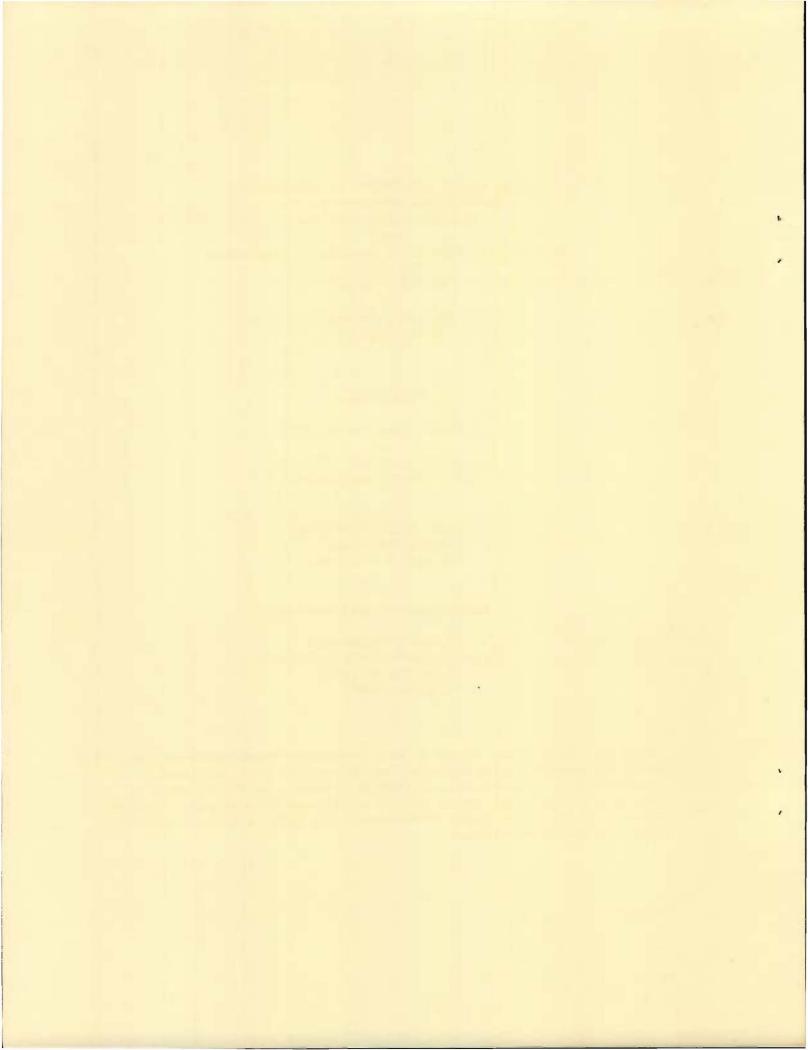
PROCEEDINGS...

ELEVENTH HARD RED WINTER and ELEVENTH HARD RED SPRING

joint wheat workers conference





UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
Crops Research Division
and
Agricultural Experiment Stations, Cooperating
in the
Hard Red Winter
and
Hard Red Spring
Wheat Regions

PROCEEDINGS

ELEVENTH HARD RED WINTER and ELEVENTH HARD RED SPRING WHEAT WORKERS CONFERENCE

Kansas State University Manhattan, Kansas February 6 - 8, 1968

Report not for publication1/

Agronomy Department
Agricultural Experiment Station
Lincoln, Nebraska
June, 1968

1/This is a conference report of the cooperative investigations containing data, the interpretation of which may be modified with additional interpretation. Therefore, publication, display, or distribution of data or any statements herein should not be made without prior written approval of the Crops Research Division, ARS, USDA, and the cooperating agency or agencies concerned.

τ.

SEPTEMBERS.

BUCCOURT BASE PER WEGGE BASE THANKER BASE REQ CREED THANKER WELLES CORRESSES

Hanser Stat. Columnity Manhaetga, Fursk Fobsoury A. B. 1968

Agenescopility sell son stopped

i estat kongi Singga pada gi Pilanga kanga k Kanga ka Kanga kanga

A.This is a conferrable report of the economiative at vestigation, each option of the description interpretation of which may be undulified which additions, fate of recipions of a solic policy policy of a solic policy of the description of the action of

FOREWORD

This was a joint conference of wheat workers in the hard red winter and hard red spring wheat regions. Workers from the Western Region, the Eastern Soft Wheat Region, Canada, Mexico, and Argentina also participated. The conference involved researchers from state and federal agencies and the private sector of the wheat industry.

The conference was jointly sponsored by the Hard Red Winter and the Hard Red Spring Wheat Improvement Committees. Both of these committees, as well as the National Wheat Improvement Committee, met during the conference. Also meeting prior to the conference was the North American Leaf Rust Research Workers Committee.

Abstracts or full texts of most of the presentations are contained herein. No attempt has been made to include the many ideas and comments voiced during the informal floor discussions. Since such informal discussions were encouraged rather than lengthy formal presentations, the material contained in this report does not adequately reflect the full treatment of the conference topics.

Appreciation is expressed to B. C. Curtis, F. H. McNeal, K. A. Lucken and J. W. Schmidt for their leadership in organizing the main conference topics "Barriers to the Improvement of Wheat" and "Hybrid Wheat". A word of thanks is due also to the local arrangements committee at Kansas State University under the chairmanship of E. G. Heyne.

V. A. Johnson and K. L. Lebsock Regional Wheat Improvement Leaders, Hard Winter and Hard Spring Wheat Regions, respectively

2021491203

This was a joint conference of, wheat workers in the heel of winter and hard ned spring wheat regions. Horkers from the Western Segion, the Estimation Monte Viller Region, Sandin, Mexico, and Argentium also participated. The conference Lavelved researchers from state and the private scater of the cheer industry.

the conference was jointly speasoned by the Brid Red Mater and the Lard Red Mater and the Lard Red Spring Waret improvement Constitues. Soil of these constitues, as the Mational Wasat improvement Committee, not during the conference. Also meeting prior to the conference was the Morta-American Leaf Bust Masearch Morkers Committees. ..

Abstracts or full toxus of most of the presentations are contained burden. No atreast has been made to include the many blead soft comments voiced during the informal floor discussions. Since such informal discussions were encouraged rather than longity formal presentations, the maturial contained in this seport does not adequately reflect the full treatment of the confequence topics.

Appreciation is expressed to 8. C. Cartio, F. W. McMcck, X. 4. Lucker and d. W. Schaidt for their leadership in organizing the main conference topics "Barriors to the improvement of Twhit" and 'hybrid iheat'. A word of thanks is der also to the local attangements topmitree of Karsas State University under the vertermanning of S. C. Seyro, .

V. A. Johnson and K. L. Jepsook. Negional Woot improvement heldors. Arro Winters and Pand Spring Wheer. Regions, respectively.

and HARD RED SPRING JOINT WHEAT WORKERS CONFERENCE RENCE

Manhattan, Kansas

February 6 - 8, 1968

rrogram
Morning, February 6
Williams Auditorium
E. G. Heyne, presiding Program

gen Segen in de la companya de la c La companya de la co		the second	Page
WelcomeBarriers to the Improvement of Wheat B. C. Curtis, Discussion Moderator	Ė	• Smith	
How should breeding systems be revised to develop varieties with maximum grain yields?		• Borlang	8
Using male-sterility to aid in locating sources of high yield genes			24
Breeding for yield in wheat	D. R	• Knott	25
Is lack of equipment a problem in wheat improvement?		. Wilson les Hayward	26 28
Use of equipment to expand a wheat breed- ing program	W. L	. Nelson	29
Vacuum operated space seeder	N. D	. Williams	31
Is breeding for milling and baking quality an impediment to improvements in other areas?		and the second s	32
Barriers to the Improvement of wheat			33
Wheat quality considerations in breeding programs and the use of early generation screening tests to improve program efficiency			
efficiency	N. E	allegas . Borlaug . Krull	36

Afternoon, February 6 Williams Auditorium

Barriers to the Improvement of Wheat (continued) F. H. McNeal, Discussion Moderator

\$7 44 1,	•		
90 gm 088 088 1	7.73		Page
Does the lack of knowledge of genotype-	1A.	e model e e	
environmental relationship hinder wheat			
environmental relationship hinder wheat improvement?	67 . m 1.	Donton	44
Tublo Acmetic:	· K. I	A Addison	
हिनेता _र हे - वे ए	xoind	Ackins	46
•			
		E. Borlaug	48
atte in the first of the second of the secon		•	
The use of regression analyses to measure general adaptation in wheat succession analyses to measure the general adaptation in wheat successions and successions analyses to measure the general adaptation in wheat successions analyses to measure the general adaptation in wheat successions analyses to measure the general adaptation in wheat successions analyses to measure the general adaptation in wheat successions analyses to measure the general adaptation in wheat successions analyses to measure the general adaptation in wheat successions and successions are successions and successions and successions and successions are successions and successions and successions are successions are successions and successions are successions are successions and successions are successions and successions are successions and successions are successions are successions and successions are successions and successions are successions are successions and successions are successions are successions are successions and successions are successio	أنفونست تين	i a	
general adaptation in wheat	V. /	. Johnson	
State and Thirthe	S. I	. Shafer and	
Surpragad and	J. W	V. Schmidt	50
Performance of tall and semi-dwarf spring			
fertilization under dryland and irri-	come fore some system of	ing dad gaerder e wilder e geberright were by what he age	ee Comro. God
and durum wheats at 5 rates of nitrogen fertilization under dryland and irrigated conditions	H COTTON	Company and	ূৰ্ <u>-</u>
masion Moderntor	~\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Tio Tie	51
Protein in wheat - who wants it? bashow se	4.13.4	d breedday ava	duch _e amit
Protein in wheat - who wants it:	. L. 1 357-15 103	. Reitz juwaninging	ງນໄ∌ທີ່ຍົ່ນ
Yield and protein content	ومناسون	and one of these areas in the second and of the second are	felisiv
Yield and protein content	R. J	. Baker	54
Relationships between grain nitrogen and plant development	h.kg.	nit vtriltana-	drug which
Relationships between grain nitrogen and	rangan d	himin vetil to	SA TATE SA ETA
plant development	F. H	. McNeal	55
All the state of the second of	. Tr. Garte	area e in Alberta de P	Action B
Can we breed higher protein in wheat?	V. A	. Johnson	
et in die Marie der Green in	P. J	. Mattern and J. Schmidt	and the Control of the
CORTAL A CONTRACTOR OF THE	J. W	. Schmidt	56.
24 Company of the Property			(\$4.41 / A 104.)
Genetic and environmental control of nitrat	e		
reductase in wheat and its influence in increase protein production	,		and the second
increase protein production	L. I	· Croy and	<i>P.C.</i> 3 O ∼3⊊ • • •
The state of the s	E. L	. Smith	57
Increasing the protein content of hard	Y9 ÇES	म ८०० वर भेरतेचा ५	Proposition of
red wheats	D. W	. Sunderman	58
villand nulleac	Uns .	galilio relega	เป็น คนนี้นี้ 🔝
The effect of increasing the number of	917977	นอสร้ายประชาสมเด็	សង្គាធិ៍ ស្រ
characters under selection on expected		مدانيين شعمهديمين فالوبيوان الجاري	1 1 1 1 2 1 1 1 1 H
constituted and for other characters	R C	: Cilmore	61
genetic gain for other characters		e chief bid or	. ខ្ _ែ មស់លើក្រុង
Studies on quantity and quality of wheat	೯ <u>೪</u> ೦ ಕ್ಷ	ing ogsidigen.	வர் தேவின
Studies on quantity and quality of wheat protein	K. E	· neiner	03 .
monron a	aş, ciris	ni <u>-01</u> 8 <u>1</u> 825 -	110796226
Wheat diseases and quality	K. F	. Finney	194 194
		,	
Can amino acid ratios be altered? How?	_ =	•-	,
Will quality suffer?	R. C	. Hoseney	65

5				
				Page
en e				
Protein content in wheat	E.	G.	Heyne	67
Protein, fertilization, year and baking				
absorption	W.	c.	Shuey	68
Incine differences in the Hould Wheat			· · · · · · · · · · · · · · · · · · ·	
Lysine differences in the World Wheat Collection	D	T	Mattern	
COTTECTION	D.	Δ.	Whited	
and weak the control of the control	V.:	Α.	Johnson and	
			Schmidt	70
and the first the		. 1	10 10 CH2+1	
What is the importance of the race concept an non-specific, generalized and horizontal re sistance versus specific, specialized and	ıd :−			
vertical resistance, as related to disease and insect resistance?				70
· · · · · · · · · · · · · · · · · · ·	. E	L.	Snarp	12
What is the importance of the race concept				
to wheat breeding?	L	E. :	Browder	74
ALC: Commence of the second				
Report of the Sixth Conference of the North American Wheat Leaf Rust Research Workers				
Committee	L.	E.	Browder	76
	. 4		And Adams of the State of the S	٠.
Breeding for resistance to barley yellow-dwar	f			
virus in wheat				70
and the control of t The control of the control of	`.J •	K.	Thysel1	/8
Seedling and adult plant resistance to stem	•	: .		
rust	n.	·R.	Knott	82
William and the second of the		•••		:.
Ouantitative levels of resistance to stripe				
rust	W.	K.	Pope	83
galatina kan di malamatan				•
Photosynthetic and yield responses of Gaines	tro ^{ch}	:	43°	· . ·
and Hadden wheats to infection by Septoria		_	1.	
nodorum	Α.	L.	Scharen	84
Inheritance of stem rust resistance in severa				
usrieties of wheat	T.	T :	Cough and	
varieties of wheat	N.	D.	Williams	85
		-		
Reaction of certain wheat varieties and				,
selections to leaf rust - Oklahoma, 1967	Η.	C.	Young, Jr.	
the state of the s				
	J.	Μ.	Prescott and	
and the state of t	L.	L.	Singleton	89
Are our varieties of oats too resistant to				
disease?	: J _	Μ.	Poeh1man	. 9.8
	-•.	•		, ,
Inheritance of blue aleurone and purple peri-				
carp in hexaploid wheat	F.	E.	Bolton and	
	В.	c.	Curtis	99

```
*
                                                                                                                         Morning, February 7
                                                           words to Little Theater, K-State Union Carries with a
                                                                                                                  D. G. Wells, presiding
                                                                                                                                  Secretary Secretary products and asknowled
                                                            to the control of the
 55.5
                                                                                          K. A. Lucken, Discussion Moderator
                                                                                                                                       - mean bloom the the seasons the except
                                                    The the state of the second of
                                                         to color in the
   Genetic male sterility in hexaploid wheat - L. W. Briggle
                                                                                                                                                                                                                                                                    100
                                                    Maderial II B
  Pollen restoration from the World Wheat
           Collection -----K. B. Porter and with all additional and the classification and the classif
                                                                                                      with Edinoria of her TwoG. Wright a Flip by 102 a
                                                                                                                    bus too chainegs inisinger against Connects
  Male fertility restoration problems in Satelinia as possible sor inviting
   Thybrid wheat
                                                                                                                                                                                K. A. Lucken 107
                                                                                                                        मिला है है जर विकृष्ण विद्यार की एक वारत देवताला
  Genetics of fertility restoration in various - head send include of
          male sterile cytoplasms ----- P. Menge
                                                                                                                   dirow and to so E.v.R. a Ausemus and to stone
                                                                                                                   er-product the enses W. J. H. J. Althansson . Faul 108 4
                                                  Collections in a commence was a superior or many and the sixth
  Environmental effect on male fertility
          Vilua it work were more processed and administration P. C. Villiagues it will
  Environmental effects on male sterility
          and male fertility restoration ----- G. Vazquez
                                                                                                                    while of commale of amoin theb, bee garlie b
 Environmental effects on fertility
          restoration in wheat ----- E. L. Smith and
                                                                                                                    enings as a subsew. McCuistion av allient.
                                                                  BANGO IN THE CONTRACTOR OF THE SECTION OF THE SECTI
 Problems involved in the transfer of fertility
         restoring genes into lines of common wheateMr AloUriche with 113 100
                                                                                                               Action of Almotherian an aleast follows with
 Summary of wheat hybrid performance trials
         in Kansas ----- R. W. Livers 114
                                                                                                      age, was at completed that note to computation
Heterosis of yield and seed weight in 44 spring the database to the database to
     wheat crosses in 1965 and 1967 ---- C. L. Lay and
                                                                                                                                                                            D. G. Wells
                                                                                                                                      have related ser heads mindred to believe
The prospects forehybrid wheat Mini . hardistill - read last co town was
        Saskatchewan ---- D. R. Knott
                                   Harry Commence of the Contract
Combining ability studies in durum wheat -- J. N. Widner and
                                                                                                                                                                           K. L. Lebsock
                                                                                                                        on analytisms had name to see any more of
Methods of evaluating combining ability --- E. L. Smith
                                                                                                                                                                          W. O. McIlrath and
                                                                                                             Apply of good fact Charles Clover to In soci 123 to be
                                          cornection at the Replication of the comment of the Replication and the contraction and
                                                        21 35 W 34
```

Afternoon, February 7 Little Theater, K-State Union H. C. Young, Jr., presiding

Hybrid Seed Production J. W. Schmidt, Discussion Moderator

J. W. Schmidt, Discussion Moderator	Page
Pollen production and pollen shedding of spring and durum wheats L. R. Joppa F. H. McNeal and M. A. Berg	125
The effect of temperature and relative humidity on the viability of hard red winter wheat pollen R. E. Watkins	126
Pollen dispersal E. G. Heyne	127
Maximizing cross pollination D. G. Glenn	128
Minimum seeding rates in winter wheat Arthur Klatt	129
Improved seeding practices for hybrid wheat- F. C. Stickler	130
Systemic and nonmercurial fungicides in relation to hybrid wheat E. D. Hansing	131
Hybrid Winterhardiness Nursery V. A. Johnson	132
Winterhardiness in hybrid wheat J. M. Poehlman	134
Morning, February 8 Little Theater, K-State Union Regional Programs K. L. Lebsock and V. A. Johnson, presiding	Page
Hard Red Winter Wheat Regional Nurseries	135
· ·	133
Toward a world plant germ plasm record system C. F. Konzak	136
Resolutions	138
Participants	140

aitánneis, seireann 17 Filithe Disastat, Mestatta istra F. O. W. M. syn. Jr., prest tag

ighetid Sala hroduction J. W. Sahmidh, Visconston Budarator

	Polisa prodocetos aid pullua shaditan of
	នាស្លាស់ ម៉ា ១០០០ មានការការការការការការការបានស្រាស់ ប្រែក្រុង ប្រុស្ធិ៍ ប្រែក្រុង ប្រុស្ធិ៍ ប្រុស្ធិ៍ ប្រុស្ធិ ស្រែក ខេត្តទីស្លា (អ៊ុ ស្ត្រី)
. 11	The state of the s
	The effect of temposeture and relative of the collective of bard values.
	wheter when police commencement and the delice
	MERCHELLE AND
₹	The defendance of the property of the manuscript of the property of the proper
ta to a second s	Hinisum seeding rates in Winner Whest Archis Klatts -
ń.K.j.	Sammayed seeding processes for hybrid weekt of, V. Smichhor
en en la	Ayerale and nonmercertal longs ideally
<u>.</u> , <u>l</u>	Harid Wint hardings Norsery W. A. Johash
. : :	Wisterbordiaese in appris theat
	hoteling, Formusiy 8 hotele Thereis, K-Seato Endon Reginal Propens K. hotelk wil V. A. Jennson, graciding
AN A	
(, 4.3	trong out there there is beginned bressfiles serial bressfiles
Ŕ.	Backer winds plant geing land, binder a branch Connor of Line of the control of the control of the control of
· · · · · · ·	the second of
Car	and the second of the second o

HOW SHOULD BREEDING SYSTEMS BE REVISED TO A CANADA THE DEVELOP VARIETIES WITH MAXIMUM GRAIN YIELDS?

the control of the co

en de la caldidata de la la mém é**norman de debortaug**ada desa mindre la gara El caldado de la caldida de

It is my contention that progress in the development of higher yielding wheat varieties is being slowed primarily by the extreme conservatism of most wheat breeders, coupled with the status quo attitudes of the grain and milling industries.

Most wheat breeders have become slaves to their own narrowly based gene pools. They have, with but few exceptions, shortsightedly organized their programs in such a way that they have given disproportionate emphasis at the expense of yield to the following two aspects of varietal improvement:

- 1. Improvement in disease and insect resistance.
- 2. Maintaining status quo (good or acceptable) milling and baking quality, while improvements are being made in disease and insect resistance.

Perhaps somewhere between 70 and 80 percent of the entire wheat breeding effort in the U.S.A. and Canada in the past 30 years has been devoted primarily to developing new varieties with better resistance to diseases (especially to the rusts and smuts) and to insects (Hessian fly and sawfly).

Course of the left of the first and consisting to the consisting of the consisting of the consistency of the

As new races of rust, for example, have appeared rendering a formerly acceptable commercial variety, such as Thatcher, susceptible, new sources of resistance have been found and crossed into it. Subsequently, Thatcher has been used as the recurrent parent in long backcross programs so as to assure that both the phenotype of Thatcher and its milling and baking quality was recovered in the progeny. Unfortunately this ultra conservative system, which is advantageous and almost foolproof from both a plant pathology and cereal chemistry point of view has been disastrous when viewed from the standpoint of improvements in grain yield and agronomic type. As production costs mount and yields remain stagnant the farmer is stuck in a cost-price squeeze.

Increasing Grain Yield Climas agreemed a resemble to be publication of the control of the contro

One of the first lessons which we learn in genetics is that maximum levels of heterosis are obtained when we cross genetically distinct parents. This principle we promptly ignore in our breeding programs in self-pollinated plants. It has been our experience that wheat crosses that give high yielding F_1 progeny are also likely to produce high yielding lines in advanced generations that will exceed the grain yield of either parent.

the comment will be to be a first and comment of a software beautiful and comment with the comment of the comme

It is our contention that a crossing program designed to increase grain yieldeincwheatsshouldginvolvergasta agreem wor

- 1. Crossing of unlike outstanding parental types within the spring wheat groups (that is, between the best commercial variety in one zone of operation and the best varieties from aggressive spring wheat breeding programs in other parts of the world).
- the my contention that progress in the development of higher and progress in the development. 2nd cast render this paragraphy of the cast render the mark paragraphy and willing industries.

 The grain and milling industries.
- Some wheat varieties with the utstanding parental winter wheat surface to the same

Breeding for the Simultaneous Improvements in Grain Yield, Improved Agronomic Type, Wider Adaptation, Better Disease Resistance and Improved Quality

The Mexican program uses a broad approach in its wheat breeding effort. (It prescribes to both making many diverse crosses and growing large F2 and F3 populations of each cross. It contends that progress in breeding lags because of lack of variability in segregating populations. It also contends that too many of the world's wheat breeding programs are currently oversophisticated and that "the worshipping of gadgets and computers" have replaced common sense and a sense of urgency. Living and working with the wheat plants has become outmoded and old-fashioned. Physical works sweat, sum, dust, and mud are to be avoided and are considered undignified for a scientist. Excuses of high labor costs are too often used as an excuse to justify small poorly oriented breeding programs age sand escape to a scientist.

The Mexican program is a proponent of variability and large segregating populations. It advocates the critical choice of environments
under which to select segregating populations. It also advocates the
use of the proper screening tests for grain yield, (potential),
agronomic type, disease resistance and quality in early generations

(F2. F3 and F2). When these procedures are followed it contends that
it is possible to simultaneously make improvements in grain yield,
agronomic type, breadth of adaptation, disease resistance and milling

To obtain and maintain adequate variability in the program it makes and grows more than 1,500 F₁ crosses each year (two seasons).

These crosses represent combinations between the best Mexican varieties and lines, and the most promising wheats selected from aggressive programs in other parts of the world. The crosses are not made blindly but with considerable knowledge concerning important heritable characters, including quality of each of the parents. Nevertheless, more than half of the new crosses are discarded in the F₁ (plant) generation.

All F_2 populations that are sown each year, generally from 500 to 750, are grown at two locations in Mexico, as well as at two locations

in Argentina, India and Pakistan. A minimum of 2,000 plants is grown in each F, population at each location, when seed permits.

Every effort is made to continuously modify, reincorporate and increase variability into the breeding program. Frequently double crosses are made between the most outstanding but only remotely related F_1 crosses. New crosses are also constantly being made between outstanding F_3 and F_4 plants from different crosses, and between these outstanding plants and the best advanced lines and commercial varieties. This type of recurrent reselection combined with vigorous recrossing, and employing adequate screening tests in early segregating generations, keeps the Mexican program dynamic and has prevented its stagnation.

The Use of the International Spring Wheat Yield Nursery to Select Parents for Increasing Grain Yield

In recent years it has become increasingly clear that certain spring wheat varieties have outstanding yielding ability under a wide range of climatic, soil, moisture, and disease conditions. (1,2,3,4,5,6,7,8,) The data from the Third Cooperative International Spring Wheat Yield Nursery — which is your data — is summarized in a preliminary manner in the attached tables. From these data it is clear that some varieties such as: 1)Pitic 62, 2)Lerma Rojo 64, 3)Penjamo 62, 4)Nainari 60, 5)Crespo 63, 6)Huelquen, and 7)Triple Dirk, are high yielding at many locations, both when grown on fertilized and non-fertilized soil, and under irrigated and non-irrigated conditions.

Several of the newer high yielding Mexican varieties (Table 1 and Table 2A, B and C), i.e. 8156 (from Penjamo "S" x Gabo 55); INIA 66 and Noroeste (both derived from Sonora 64A x Lerma Rojo 64A); CIANO (from Pitic-Chris x Sonora 64); Tobari 66 (from Sonora 64A x Tezanos Pintos Precoz); and Jaral 66/ from Sonora 64 X (Tezanos Pintos Precoz x Nainari) /, were derived from crosses involving the aforementioned high yielding parents. All of the latter are distinct improvements in industrial quality, disease resistance and agronomic type over the former group.

Some of these varieties, as well as other newer experimental lines, are as good in milling and baking characteristics as the best U.S.A. and Canadian hard red spring wheat varieties. This improvement indicated clearly that simultaneous improvements can be made in yield, adaptation, agronomic type, disease resistance and quality if we organize our programs properly, and implement them vigorously.

I maintain we all remain too conservative in our breeding programs. Our yearly advancements in increasing world grain yields via genetics on a per capita basis, is less than the population growth. We are losing ground! Most of the current increases in grain yield that the U.S. farmer is exploiting - to stay in business and not go bankrupt with the current deflated prices - comes from improvements in cultural practices, i.e. fertilizer, better weed control, and better manipulation of soil moisture - not from higher yielding varieties. When are we going to change this? It appears to me that the time is late!

Literature Cited

- 1. Borlaug, N. E., Ortega, J., and Garcia, A. (compiled by) Preliminary report of the results of the first (1) cooperative inter-American spring wheat yield nursery grown during 1960-61. International Center for Maize and Wheat Improvement Miscellaneous Report No. 1. Spring 1964. Mexico, D. F.
- 2. Borlaug, N. E., Ortega, J., and Rodriguez, R. (compiled by). Preliminary report of the second (2) inter-American spring wheat yield nursery grown during 1961-62. International Center for Maize and Wheat Improvement Miscellaneous Report No. 2. Spring 1964, Mexico, D. F.
- 3. Borlaug, N. E., Ortega, J., and Rodriguez, R. (compiled by) Preliminary report of the third (3) inter-American spring wheat yield nursery grown during 1962-63. International Center for Maize and Wheat Improvement Miscellaneous Report No. 3. Spring 1964. Mexico, D. F.
 - 4. Borlaug, N. E., Ortega, J., and Rodriguez R. (compiled by) Preliminary report of the results of the first (1) cooperative Near East-American spring wheat yield nursery. International Center for Maize and Wheat Improvement Miscellaneous Report No. 4. Spring 1964. Mexico, D. F.

we a relate validation of this gradual parameters with a rejetion of the

5. Borlaug, N. E., Ortega, J., and Rodriguez, R. (compiled by) Preliminary report of the second (2) cooperative Near East-American wheat yield nursery grown during 1962-63. International Center for Maize and Wheat Improvement Miscellaneous Report No. 5. Spring 1964.

energy occurs (Present for a 1) Learne doing the all Productions (Planticular Color

- 6. Krull, C. F., Narvaez, I., Borlaug, N. E., Ortega, J., Vasquez, G., Rodriguez, R., and Meza, C. Results of the Third Near East-American spring wheat yield nursery, 1963-65. International Malze and Wheat Improvement Center Research Bulletin No. 5. November 1966.

 Mexico, D. F.
 - 7. Krull, D. F., Narvaez, T., Borlaug, N. E., Ortega, J., Vasquez, G., Rodriguez, R., and Meza, C. Results of the Fourth (4) Inter-American spring wheat yield nursery, 1963-64. International Maize and Wheat Improvement Center Research Bulletin No. 7, March, 1967. Mexico, D. F.

ំទ្រស់ ក្រុម ទីស្នាំ ស្នាំ ប្រណៈ មាន ១០០០ ខណ្ឌ ១០០ សង្សារ ប្រសាវ។

8. Krull, C. F., Borlaug, N. E., Meza, C., and Narvaez, L. Results of the first (1) international spring wheat yield nursery, 1964-65.

International Maize and Wheat Improvement Center Research Bulletin (in press).

THE POLICE CONTROL OF SEA IN ESTREET CONTROL CONTRIBUTE OF AN EXPLOSIVE NOTES OF A CONTROL OF A

Preliminary summary table of the Third International Spring Wheat Yield Nursery, 1966-67. Regional mean yield in kilos per hectare and rank.

TABLE 1.--INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTER (CIMMYT)

THDL	E TINIERNATIONAL				N.Amer		Africa		Asia	,
Var.			36 sta.		14 sta		10 sta		12 sta	,
No.	Variety or strain	Origin					yield	rank	yield	rank
$\frac{32}{32}$	Pitic 62	Mex.	3600	1	3977	1	3242	2	3872	2
7	Lerma Rojo 64A	Mex.	3532	2	3657	9	3138	4	4126	ī
24	Pjsib x Gb55(red)	Mex.	3459	3	3663	- 8	3410	1	3707	3
37	Inia 66	Mex.	3412	4.	3843		3044	6	3696	4
21	Penjamo 62	Mex.	3323	5	3721	5			3541	5
28	Pjsib x Gb55(w)	Mex.	3305	<u>6 G</u>	3810	3	2959	7	3467	9.
12	Nainari 60	Mex.	3265	7	3759		2725	16	3506	7
1	Nar sib ² x Pj sib	Chile	3162	8	3596	13	2798		3474	8
49	Tobari 66	Mex.	3116	ု့ ရှိ	3704	6	2770	13 ·	3177	16
40	Noroeste 66	Mex.	3112	10	3682	7	3090	5	3512	6
36	Crespo 63	Col.	3110	11	3623	10	2768	14	3147	20
	Napo 63	Co1.	3089	12	3438	15	2684	20	3432	10
2	Huelquen	Chile	3086	13	3605	11	2542	30	3298	13
19	Triple Dirk	Aust.	3066	14	3161	21	2812	10	3160	18
22	Bajio 66	Mex.	3064	15	3433	16	2607	24	3409	12
42	Pl62-Chris sibxS64	Mex.	3028	16	3599	12	2598	26	3272	14
41	Roque 66	Mex.	3008	17	3564	14	2681	21	3053	24
14	Sonora 64	,	2893	18	3188	19	2794	12	3061	23
23	C-306	Mex. India	3871	19	2927	28	2607	25	3418	11
38	Jaral 66	Mex.	2850	20	3343	· 17	2524	33	2952	29
46	Nariño 59	Col.	2837	21	2296	49	2388	39	3002	25
35	Tacuari	Arg.	2833	22	3108	22	2458	35	3132	22 22
33	Yaqui 50	Mex.	2819	23	2900	29	2584	27	3239	15
25	NP 881	India	2805	24	3243	18	2552	29. 29.	2907	35
29	Pakistan 5725	Pak.	2769	25	2748	41	2927	9	3139	21
$\frac{25}{15}$	C-271	Pak.	2762	26	2873		2701	18	3168	17
18	Carazinho	Brazil	2745	27 27	2809	35	2425	37	3160	19
9	Giza 150	Egypt	2735	28	3046	25	2702	17	2765	40
45	Centrifen	Chile	2729	29	3044	26 ^{/4}	2650	22	2868	39
6	Mendos	Aust.	2726	30	2762	40	2936		2869	38
30	Tiba 63	Col.	2724	31	2975	27	2573	28	2952	30
27	Bonza 63	Col.	2716	32	3106	23	2437	36	2818	42
26	Giza 144	Egypt	2704	33	3172	20	2526	32	2631	44
13	Bonza 55	Col.		34:	3072	24		. 43	2922	33
	NP 832	India	2690	35	2849	32	2647		2998	26
<u>10</u> 5	NP 824	India	2674	36	2866	31	2528		2993	27
43	Gaboto	Arg.	2662	37	2834	33	2407	38	2966	28
34	Gabo	Aust.	2627	38	2815	34	2748	15	2647	43
17	Crim	U.S.A.		39	2795	38	2326	40	2 893	3 7
39	NP 880	India	2588	40	2738	42	2694	19	2761	41
3	C-273	Pak.	2568	41	2807	36	2288	42	2905	36
20	C-591	India	2559	42	2796	37	2212	44	2924	32
44	Klein PetisoxRaf.	Arg.	2549	43	2655	43	2291	41	2922	34
16	C-518	India	2519	44	2526	47	2469	34	2927	31
11	Chris	U.S.A.	2445	45	2790	39	2117	45	2561	45
48	ElGaucho	Arg.	2264	46	2633	45	1706	46	2515	46
8	Justin	U.S.A.	2024	47	2563	46	1513	48	2153	47
31	Selkirk	Canada		48	2637	44	1627	.47	1919	48
47	Thatcher	U.S.A.			2335	49	919	49	1699	
	Station mean yield	8 1 2 1	2824		3124		2564	*	3054	

TABLE 1. ((continued) warmed incution (while brief to their weeners you at a livery

-		Serie Bruss is	<u>. 1000 1</u>	911. 30	1147. 1	Jack 1	o en le	waita e i	5-67.	367
	(1960)	alor de gra			Mexico		U.S.A.		N. Ame	
Var	1 Alexander 1				irrig.*				_	
	Variety or strai				yield		yield	rank		- rank
32	Pitic 62		_{::} 3600;;	ur <mark>l</mark> bā	3166	18	.6271 _{j a}	y 1 7	4408	,∞6
7	Lerma Rojo 64A		3532	2 0	3342	13	5239	10	4101	14
24	Pjsib x Gb55(red		3459			16	5556ე	6	4142	13
37	Inia 66			દ 4 - હ		·2	4637	30	4522	. · 3
21	Penjamo 62		∆;3323	<u>), 5 🤸</u>	3974	4.	5635	4 ,	4638	<u>r:1</u>
28	Pjs1b x Gb55(w)			3 6 5		12	6014	-3. 2 √ 26	4456	_4
12	Nainari 60					14	547.2		4180	11
1	Nar sib2 x Pj sil	Chile $_{\odot}$		S 8 7	4051	,:.3 ,,	4994	17	4428	ુ5
49	Tobari 66		3116	9	3819	. 5	5233	11	4385	_j 7
40	Noroeste 66	Mex.		10	3788		5054	14	4295	. 8
36	Crespo 63	Col.		,11 °	3,448	11.	4763	24	3974	15
2	Napo 63	Col.		12	3760		5 030	15	4232	10
4	Huelquen	Chile	8 (2)8 18	13 0	2785	26	5605	5	3911	17
19	Triple Dirk	Aust.		14	2040	41	4899	20	3184	38
22	Bajio 66	Mex.	3064	15	3774	7	4962	19	4249	9
42	P162-Chris sibxS6	4 Mex.		16	4318	1,	5026	16	4601	.2
41	Roque 66	Mex.		17	3674	9	4885 -	21	4158	12
14	Sonora 64	Mex.		18	3203	15	4625	31	3772	19
23	C-306	India	2871	19	2505	29	4877	22	3454	29
38	Jaral 66	Mex.	2850	20	3470		4622	32	3931	16
46	Nariño 59	Col.		21 0	3122		4462	37 ₈₈ 3	3658	20
35	Tacuari	Arg.		22	2251		5158 ~	13	3414	31
33	Yaqui 50			23	2249	X 1 74 (5)	4641	38	3206	36
25	NP 881	India 👝		24 e	3039		4976	18 ₀₆	3813	18
29	Pakistan 5725	Pak 🥫		25	3052		4042	48	3448	30
15	C-271 75.05	Pak 8		26 $_{\odot}$			4361 ₀₅	39	3614	21
18	Carazinho		2745	27 28	7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		4540	34	2869	45
9 45	Giza 150		2735	28	2315		5199	12 Official	3468	28
	Centrifen, Cons	Chile o	2729	29	3122	3.7.2.1.15	4111	46 _{CEL}	3517	43
<u>.6</u> 30	Mendos			30	2377		4199	44	3104	41
30 27	Tiba 63		2724	31 32	2878 2698	77737	4461 4638	38 29— ec	3511 3474 —	25 26
26	Bonza 63		2716	32 33		1 7 5 1	4036 5739			24
13	Giza 144			33 34	2455	940	4803	3 23 ∷	3513 3394	32
	Bonza 55		2691	34	2433 2270	24 7 7	4003 5475			22
<u>10</u> 5	NP 832 NP 824			35 36	2279 2255	<i>37.</i> 25	5475 5364		3558 3499	<u>22</u> 27
43					2074-	35 //d	3304 4670: ***		3112	40
34				/ . € m.15	2207		4570 4522		3133	39
17	୍ୟୁଟ୍ରିକ ଜିନ୍ନ ଅନ୍ତିକ			38 39	2187	39	4 <i>5</i> 22 4682	26	31.85	37.
39	د الأن المساف المستمالات <u>نات المسا</u> فة المسافة المسافية	بدلا براقة بينا		40	2920		4049 4049		3371	34
3					2852			45	3385	33
20	C-273 C-591	India	2550	2	2512		4549	33 US	3327 -	-35
44	Klein PetisoxRaf.	Arg.	2549	3	2009	43			2930	44
16	A 510	India		44	2402	30	3468		3028	42
11	Chris DANC		2445	15			4484		2995	43
48	El Gaucho			6	1878			40	2862	46
8	Ingtin	11 S A		17				۲.	3 - 1 - 1	48
31	Selkirk			8					2721	47
47	Thatcher		1664 4	9				42	2271	49
	Station mean yield		2824		001/	(4804		361,3.	V 1
			- 			42.4			CONTRACTOR OF THE PERSON AND ADDRESS OF THE PERSON ADDRESS OF THE PERSON AND ADDRESS OF THE PERSON ADDRESS OF THE PERSON AND ADDRESS OF THE PERSON ADDRESS OF THE PERSON ADDRESS OF THE PERSON ADDRESS OF THE PERSON ADDRESS OF TH	

^{*}Included Toluca summer station through error (seriously damaged by flooding).

TABLE 1. (continued)

	·								37 4	
T7		Ü		* ATT	U.S.A		Canada		N. Ame	
Var.		A-4-4	36 st			ed 5sta				
No. 32	Variety or strain Pitic 62	Origin	3600	rank 1		rank	3778	rank	3546	rank 1
7		Mex.	•		3361	1	3187	7	3212	5
24	Lerma Rojo 64A	Mex.	3532 3459	2 3	3233 3185	5	3181	8	3183	6
24 37	Pjsib x Gb 55(red) Inia 66	Mex.	3412	3 4	3177	7.	3145	9	3163	7
21	Penjamo 62	Mex.	3323	5	2562	25	3108	10	2.804	15
28	Pjsib x Gb 55(w)	Mex.	3305	6	3116	8:	3222	4	3163	8
12	Nainari 60	Mex.	3265	7 ∴	3306	3	3376	3	3337	. 2
1	Nar sib ² xPj sib	Chile	3162	8	2687	18	2857	22	2763	17
49	Tobari 66	Mex.	3116	9	2973	12	3083	12	3022	11
40	•	Mex.	3112	10	3008	10	3190	6	3089	10
36	Crespo 63	Col.	3110	11	3321	2	3207	5	3271	4
2	Napo 63	Col.	3089	12	2690	17	2817	25	2746	21
4	Huelquen	Chile	3086	13	3055	9	3604	2	3299	3
19	Triple Dirk	Aust.	3066	14	3249	4	2996	15	3137	9
22	Bajio 66	Mex.	3064	15(1)	2262	39	3060	13	2617	25
42	P162-Chris sibxS64	Mex.	3028	16	2432	33	2802	26	2596	27
41	Roque 66	Mex.	3008	17	2867	13	3099	11	2970	12
14	Sonora 64	Mex.	2893	18	2473	32	2766	27	2603	- 26
23	C-306	India	2871	19	2279	37	2522		2400	39
38	Jaral 66	Mex.	2850	20	2613	22	2931	17	2754	18
46	Narino 59	Col.	2837	21	3007	$\frac{\overline{22}}{11}$	2823	24	2933	13
35	Tacuari	Arg.	2833	22	2727	16	2894	19	2801	16
33	Yaqui 50	Mex.	2819	23	2568	23	2633	31	2594	28
25	NP 881	India	2805	24	2562	26	2937	16	2673	23
29	Pakistan 5725	Pak.	2769	25	2040	45	2056	49	2047	47
<u> </u>	C-271	Pak.	2762	26	2003	46	2290	43	2131	46
18 :	Carazinho	Brazil	2745		2501	31	3056	14	2748	20
9	Giza 150	Egypt	2735	28	2622	20	2627	32	2624	24
45	Centrifen	Chile	2729	29	2798	14	2284	44	2570	30
6	Mendos	Aust	2726	30	2242	40	2643	30	2420	36
30	Tiba 63	Col.	2724	31	2364	34	2531	37	2438	35
27	Bonza 63	Col.	2716	32	2620	21	2887	19	2738	22
26	Giza 144	Egypt	2704	33	2792	15	2880	21	2831	14
13	Bonza 55	Col.	2691	34	2662	19	2862	22	2750	19
10	NP 832	India	2690	35	1794	49	2570		2139	45
5	NP 824	India	2674	36	1890		2663	29	2233	44
43	Gaboto	Arg.	2662		2568		2541		2556	31
34	Gabo	Aust.	2627	38	2173		2899		2496	33
17	Crim	U.S.A.	2589	39	2279	38	2560		- '	37
39	NP 880	India	2588	40	2071	44	2148		2105	48
3		Pak.	2568	41	2233	41	2223	46	2229	43
20	C-591	India	2559	42	2165	43	2388		2264	42
44	Klein PetisoxRaf.	Arg.	2549	43	2305	36	2474	40	2380	41
L6 .	C-518	India	2519	44	1899	47	2181	47	2024	49
11 :	Chris	U.S.A.	2445		2514	29	2673	28	2585	29
48	ElGaucho	Arg.	2264	46	2503	30	2278	45	2403	38
	Justin	U.S.A.	2024	47	2530	28	2434	41	2487	34
31	Selkirk	Canada		.48.	2536	27	2573	33	2553	32
47	Thatcher	U.S.A.	1664	49~	2306	35	2514	ີ 39	2398	40
	Station mean yield		2824		2594		2785		2678	

TABLE 2-A

Preliminary report of the Third International Spring Wheat Yield Nursery 1966-67. Locations and mean yield in kilos per hectare. International Maize and Wheat Improvement Center (CIMMYT).

No. strain	DOR			irrig.)	(irr	ig.)	<u> </u>		(rainfe		
		: San :		CLANO			:St. Paul				
3 20 m 3 2 1 1 2 4 4 4 1		:Martin:	2 2 S	esta e	Utah	Idaho		Forks		Alaska	Calif.
							.:		N.D.		100
1 Nar sib ² x Pj sil		2844	4955	4355	4266	5721	2107	2361	2385	2240	4344
2 Napo 63		2811	4300	3988	4647	5412	2320		2787	2209	3849
3 C-273	3437	2 2 2 3 4 5 5 5 5 5 5 5	4133	2611	4034	4336	1513		1905	1881	4281
4 Huelquen	4066	2322	3977	2055	5033	6176	2422	2397	4170	1957	4330
5 NP 824	4905	1011	3444	2311	4860	5869	1038	935	1007	1978	4491
6 Mendos	728	1644	2722	2766	4574	3815	1418	1906	2385	1882	361-7
7 Lerma Rojo 64A	1351	2095	3266	4666	4869	5610	2390	3004	4173	1920	4677
8 Justin	3973	1533	2255		_ 3649	4386	1933	2394	. 2961	1928	3336
9 Giza 150	833	1722	3222	2000	5246	5152	1743	1840	2553	2106	4869
10 NI 832		1261	3511	2066	5164	5786	776		1103	2150	4143
11 Chris	1752	1894	2444	1617	3993	4975	1981	2633	2925	1470	3560
12 Nainari 60	2289	2155	3811	3988	_{cu} 5377 👝 ,	5567	3086	3128	3510	20.77	4731
13 Bonza 55		1483	3877	2004	° 4188 °	5418	1721	2582	2718	1908	4379
14 Sonora 64	327	1455	3322	4833	4679	4570	2019	2273	2405	1554	4112
15 C-2/1	4553	761	5044	3544	4620	4103	916	1378	1453	1539	4727
16° C-518	3850	483	3933	2789	3340	4596	945	1102	1577	1852	4018
17 Crim	130	1694	2689	2178	3962	5402	2284	2614	2955	1886	4292
18 Carazinho	839		2378	2033	4238	4842	2266	1935	3194	1520	3591
19 Triple Dirk	450	1322	1744	3055	4847	4950	2073	2927	4197	2303	4647
20 C-591	3294	305	4177	3055	4307	4790	1252	1704	2050	1820	4001
21 Penjamo 62	1654	3655	3789	4477	5400	5870	2426	2828	2958	1203	3395
22 Bajio 66	1617	2078	4200	5044	4284	5639	2483	2019	2572	1445	2793
23 C-306	3671	983	3200	3333	5037	4716	1404	1773	1848	1947	4425
24 Pj sib x Gb55(r		1878	3555	4166	5073	6038	2327	2897	3632	2018	5052
25 NP 881	2943	2261	3900	2955	4651	5300	2530	2859	2934	1529	100
26 Giza 144	1425	1433	2944	1711	5618	5861	2017	1979	2940	2535	4491
27 Bonza 63	4677	2239	3822	2033	4134	5142	1734	2030	3194	2821	3319
28 Pj sib x Gb55(w		2478	3977	3800	5409	6618	2134	2515	3279	2146	5506
29 Pakistan 5725	3319	500	4900	3755	4456	3628	1121	938	1766	2203	4170
30 Ti.ba 63	4745	2933	3400	2300	4297	4625	606	2491	2933 	1882	3907

_
$\boldsymbol{\sigma}$

41 Roque 66 2567 1678 5488 3855 4638 5132 2749 2494 3450 1764 38 42 PI162-Chris sib x S64 2153 3455 5155 4344 4547 5505 2715 2711 2560 1093 30 43 Gaboto 2801 922 3011 2289 3922 2017 2751 2751 3006 1668 33 44 Klein PetisoxRaf.1339 1672 2344 2011 4099 4523 2005 2298 2491 1229 35	
Sta. Catali- Martin na Catali- Martin na Catali- Martin na Catali- Martin N.D. Catali- Minn. N.D. Catali- N.D. Ca	
Catali Martin na Utah Idaho Minn. Forks ton, Alaska Cal Minn. N.D. 31 Selkirk 3233 1528 2789 800 3975 4514 2052 2564 2782 2067 323 2749 2496 2926 3407 3949 1908 463 37 2749 2496 2751 2751 2751 3096 1668 339 275 2711 2560 1093 306 445 284 284 285 284 235 236 236 2488 225 4022 2500 4524 4758 2184 2050 2833 2170 355 2468 225 4022 2504 2955 4892 4151 1411 1803 1108 2150 438 357 2367 2461 3329 1868 366 256 2431 2122 2438 5877 2367 2461 3329 1868 366 266 266 266 266 266 266 267 2844 2855 4892 4151 2122 2438 2867 2461 3329 1868 366 2844 4877 2622 4937 4588 2763 2963 3717 2419 477 278 278 278 278 278 278 278 278 278 2	
na Minn. N.D. 31 Selkirk 3233 1528 2789 800 3975 4514 2052 2564 2782 2067 323 32 Pitic 62 4950 1755 3711 4033 6272 6269 2926 3407 3949 1908 461 33 Yaqui 50 2468 225 4022 2500 4524 4758 2184 2050 2833 2170 357 34 Gabo 586 1122 2544 2955 4892 4151 1411 1803 1108 2150 433 35 Tacuari 3992 320 4311 2122 4438 5877 2367 2461 3329 1868 360 36 Crespo 63 4960 2844 4877 2622 4937 4588 2763 2963 3717 2419 476 37 Inia 66 2061 2736 5244 5355 4370 4904 3016 2478 3050	s
31 Selkirk 3233 1528 2789 800 3975 4514 2052 2564 2782 2067 323 21 1526 2 4950 1755 3711 4033 6272 6269 2926 3407 3949 1908 461 33 Yaqui 50 2468 225 4022 2500 4524 4758 2184 2050 2833 2170 353 4 Gabo 586 1122 2544 2955 4892 4151 1411 1803 1108 2150 433 155 Tacuari 3992 320 4311 2122 4438 5877 2367 2461 3329 1868 360 1868 360 360 2844 4877 2622 4937 4588 2763 2963 3717 2419 474 375 1nia 66 2061 2736 5244 5355 4370 4904 3016 2496 3485 2010 483 184 2345 4033 4033 4033 4837 3016 2478 3050 1324 313 19 NP 880 3042 2272 3677 2811 3902 4195 1795 2064 2223 800 344 18 Roque 66 1320 2622 4488 4255 4574 5535 3260 2552 3350 1743 411 18 Roque 66 2567 1678 5488 3855 4638 5132 2749 2494 3450 1764 384 18 Roque 66 2801 922 3011 2289 3922 2017 2751 2751 3006 1668 334 44 Klein PetisoxRaf.1339 1672 2344 2011 4099 4523 2005 2298 2491 1229 355	f.
32 Pitic 62 4950 1755 3711 4033 6272 6269 2926 3407 3949 1908 460 33 Yaqui 50 2468 225 4022 2500 4524 4758 2184 2050 2833 2170 353	
33 Yaqui 50	,
34 Gabo 586 1122 2544 2955 4892 4151 1411 1803 1108 2150 4393 35 Tacuari 3992 320 4311 2122 4438 5877 2367 2461 3329 1868 366 36 Crespo 63 4960 2844 4877 2622 4937 4588 2763 2963 3717 2419 477 37 Inia 66 2061 2736 5244 5355 4370 4904 3016 2496 3485 2010 483 38 Jaral 66 3184 2345 4033 4033 4033 4837 3016 2478 3050 1324 319 39 NP 880 3042 2272 3677 2811 3902 4195 1795 2064 2223 800 344 40 Norceste 66 1320 2622 4488 4255 4574 5535 3260 2552 3350 1743 41 41 Roque 66 2567 1678 5488 3855 4638 5132 2749 2494 3450 1764 38 42 PI162-Chris	j
35 Tacuari 3992 320 4311 2122 4438 5877 2367 2461 3329 1868 360 36 Crespo 63 4960 2844 4877 2622 4937 4588 2763 2963 3717 2419 474 37 Inia 66 2061 2736 5244 5355 4370 4904 3016 2496 3485 2010 48 38 Jaral 66 3184 2345 4033 4033 4033 4837 3016 2478 3050 1324 31 39 NP 880 3042 2272 3677 2811 3902 4195 1795 2064 2223 800 34 40 Noroeste 66 1320 2622 4488 4255 4574 5535 3260 2552 3350 1743 41 41 Roque 66 2567 1678 5488 3855 4638 5132 2749 2494 3450 1764 38 43 Gaboto 2801 922 3011 2289 3922 2017 2751 2751 3006 1668 33 44 Klein PetisoxRaf.1339 1672 2344 2011 4099 4523 2005 <t< td=""><td>7</td></t<>	7
36 Crespo 63 4960 2844 4877 2622 4937 4588 2763 2963 3717 2419 476 37 Inia 66 2061 2736 5244 5355 4370 4904 3016 2496 3485 2010 48 38 Jaral 66 3184 2345 4033 4033 4837 3016 2478 3050 1324 319 39 NP 880 3042 2272 3677 2811 3902 4195 1795 2064 2223 800 34 40 Norceste 66 1320 2622 4488 4255 4574 5535 3260 2552 3350 1743 41 41 Roque 66 2567 1678 5488 3855 4638 5132 2749 2494 3450 1764 38 42 PI162-Chris 3455 5155 4344 4547 5505 2715 2711 2560 1093 30 43 Gaboto 2801 922 301	3
37 Inia 66)
38 Jaral 66 3184 2345 4033 4033 4033 4837 3016 2478 3050 1324 319 39 NP 880 3042 2272 3677 2811 3902 4195 1795 2064 2223 800 344 40 Norceste 66 1320 2622 4488 4255 4574 5535 3260 2552 3350 1743 41 41 Roque 66 2567 1678 5488 3855 4638 5132 2749 2494 3450 1764 38 42 PI162-Chris sib x S64 2153 3455 5155 4344 4547 5505 2715 2711 2560 1093 30 43 Gaboto 2801 922 3011 2289 3922 2017 2751 2751 3006 1668 33 44 Klein PetisoxRaf.1339 1672 2344 2011 4099 4523 2005 2298 2491 1229 35	+
39 NP 880 3042 2272 3677 2811 3902 4195 1795 2064 2223 800 344 40 Noroeste 66 1320 2622 4488 4255 4574 5535 3260 2552 3350 1743 41 41 Roque 66 2567 1678 5488 3855 4638 5132 2749 2494 3450 1764 38 42 PI162-Chris	3
40 Norceste 66 1320 2622 4488 4255 4574 5535 3260 2552 3350 1743 41 41 Roque 66 2567 1678 5488 3855 4638 5132 2749 2494 3450 1764 38 42 PI162-Chris 3455 5155 4344 4547 5505 2715 2711 2560 1093 30 43 Gaboto 2801 922 3011 2289 3922 2017 2751 2751 3006 1668 33 44 Klein PetisoxRaf.1339 1672 2344 2011 4099 4523 2005 2298 2491 1229 35)
41 Roque 66 2567 1678 5488 3855 4638 5132 2749 2494 3450 1764 38 42 PI162-Chris sib x S64 2153 3455 5155 4344 4547 5505 2715 2711 2560 1093 30 43 Gaboto 2801 922 3011 2289 3922 2017 2751 2751 3006 1668 33 44 Klein PetisoxRaf.1339 1672 2344 2011 4099 4523 2005 2298 2491 1229 35	5 ,
42 PI162-Chris sib x S64 2153 3455 5155 4344 4547 5505 2715 2711 2560 1093 30 43 Gaboto 2801 922 3011 2289 3922 2017 2751 2751 3006 1668 33 44 Klein PetisoxRaf.1339 1672 2344 2011 4099 4523 2005 2298 2491 1229 35	4
sib x 864 2153 3455 5155 4344 4547 5505 2715 2711 2560 1093 30 43 Gaboto 2801 922 3011 2289 3922 2017 2751 2751 3006 1668 33 44 Klein PetisoxRaf.1339 1672 2344 2011 4099 4523 2005 2298 2491 1229 35	5.
43 Gaboto 2801 922 3011 2289 3922 2017 2751 2751 3006 1668 334 44 Klein PetisoxRaf.1339 1672 2344 2011 4099 4523 2005 2298 2491 1229 35	
44 Klein PetisoxRaf.1339 1672 2344 2011 4099 4523 2005 2298 2491 1229 35	
	2
45 Centrifen 3807 2033 4233 3099 3765 4457 2751 2835 2320 2311 37	
46 Narino 59 5059 3355 3222 2789 3600 5324 3274 2723 3016 2200 38	25
47 Thatcher 845 1289 1211 267 3786 4803 1662 2416 2112 2598 27	0
48 El Gaucho 1543 678 3322 1633 3888 4790 2440 2502 2748 1517 33	0
49 Tobari 66 4128 2403 5588 3466 4670 5796 2770 2416 3623 2014 40	1
50 Klein Rendidor* 2147 106 2022 867 4828 4596 1702 3003 33	7
Station mean yield 2755 1745 3646 2939 4526 5098 2085 2278 2748 1893 39	3

^{*} local varieties have been substituted.

(Continued)

(continued from page 16) TABLE 2-A

Var. Va No.	ariety or strain	ECUA- DOR	(rain	MEXICO	(irrig.)	(ir	rig.)	`	U. S.	A. (rain	fed)	
	- Netterbier	Sta. Catali-	San	CIAB	CIANO		Aberdeen, Idaho	St. Paul Minn.	Grand Forks Minn.	Cassel-		
Irrig. Fertil Date s	de or rainfed izer applied eeded	3058 M = 1	19 ⁰ N 2675 ^M rain NP June9	20 ⁰ N 1765 ^M 1rrig NP	. irrig. NP Dec.5	41°45 1350 ^M trrig. N May7	45°56N 1320 ^M 1rrig. N	450N 294 ^M rain 0	45°N 294 ^M rain NPK Apr. 25		61°N 60 ^M rain NPK Mayl2	38 ⁰ N 16 ^M ; rain 0 and Jan = 28
Other Other Area h Conver	es stem rust leaf rust stripe rust diseases factors arvested sion factor	+ + + + + + + + + + + + + + + + + + +	1 -	1.5m ²	3011 5011 5344 4374 [ts.67]	mildw. crusti 1249m ² 2,269	0.15 0.75 2215 	1.49m2 2.269	set: set: set: gophers 2.97m2 1.133	stater shatter dry&cold 3,2m2 1,025	1371 1373 1373 1373 2.45m2 1.389	weather 2.97m ² 1.133
10 E- 20 E-	100 20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	25.25 66.42 68.5 68.5 68.6 68.6 68.6 68.6 68.6 68.6	250 250 250 250 250 250 250 250	7789 7011 7011 7011 7011 3711	\$600 \$400 \$400 \$400 \$400 \$400 \$400 \$400	3775 6270 5226 5326 5762 6762 6237	6269 6277 6277 6277 6269	3076 0063 0013 0016 0006 0003	2496 2496 2497 2497 2496 2496	27.02 27.03 20.30 13.40 27.17 36.30	2007 2007 2179 2150 2150 2417 2410	\$2.8 03.8 03.6 \$3.0 \$3.0 \$3.0 \$3.0 \$3.0 \$3.0 \$3.0 \$3.0
igi Madalan a	rulsijā Naskijā is	2018-1 20	र् (क्षाप्तका) है। गायका जै गायका है। स्टिन्स			5)1944 - 21303 - (234)	THE COURSE OF TH	ym asurr		্বার্থ ক্রার্থ ক্রান্থ্য ক্রায় স (ইংগ্রেক্ট্র	topological National	09341 200 <u>4</u> 03

TABLE 2B--Preliminary Report of the Third International Spring Wheat Yield Nursery 1966-67. Locations yield in kilos per hectare.

INTERNATIONAL MAIZ	E AND	WHEAT	IMPROV	EMENT (
1. * 1942 - \$1.21 - 1.42	القام والمتاري	CANADA	,		, S.	AFRI	CA
The state of the s		111		Mac-			Rivier-
Var. Variety or	Sas-	May Arti	Winni	-donal	d ller	i- ten-	- son-
No. strain ka					bosch	burg	derend
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	:						
1 Nar sib ² xPj sib	3009	1483	3705	3232	1645	4684	2446
2 Napo 63	2940	1263	3950	3115	1307		2360
3 C-273	2550	1183	2417	2740	662	4621	980
4 Huelquen			. 9	3347	1785		2216
5 NP 824	2839	1461	2511		802	4382	1600
		1458	3078	3325	1127	4374	2406
		1626		3258	2002	5503	2511
8 Justin					1447	2889	2246
9 Giza 150	2599	1576	3388	3946	677	4805	2623
10 NP 832	2520	1425	2450	3901	697	4287	1761
11 Chris	2986	1550	3520	2637	1520	3383	2360
12 Nainari 60	3582	1482	4525	3916	1138	4837	2944
13 Bonza 55	2930	1573	3727	3216	1474	3799	2204
14 Sonora 64	2658	1204	3813	3387	1562	6004	1490
15 C-271	2494	1341.	2091	3242	291	4556	13,75
16 C-518	2476	1541	2137	2569	289	4838	702
17 Crim	2580	1612	3430	2620		4147	2726
	3617	1445	3761	3401	888	3892	3513
19 Triple Dirk	2835	1594	3833	3720	1606	4245	3882
20 C-591	2503	1353	2456	3240	604	4454	947
21 Penjamo 62	2948	1840	4364	3278	1419	5314	2733
22 Bajio 66	2948	1344	4283	3663		5672	1868
23 C-306	2418		2811	3609	665	4343	493
24 Pj sibxGb55(red)	3229	1665	4150	3680	1187	5105	3047
	2823	1544				4327	1982
26 Giza 144	2385	The second of the confidence of the contract o	3479	4174		4112	1548
	2621	e e	3738	3395		وهنده خداد	2118
28 Pj sibxGb55(w)	2730			3831	7.	4950	3204
	2908	1523	2088	1706		4 4 6	403
	1970	1268		3815			1669
31 Selkirk	2494	1293	3330	7300	1405		
32 Pitic 62	.333T	1157 1871	2765	2002	1//I	740T	201.0
33 Yaqui 50	2012				1203	5266	2160
35 Tacuari	2772	1594	2410	39/0	799	2200 4020	2240
36 Crespo 63	2055	17/0	4222	3043	1832	4218	
37 This 66	2205	1612	4232	3103	1706	4210 5557	2069 2011
38 Taxal 66	2616	1917	4037	3801	1/2/	6730 6730	1064
37 Inia 66 38 Jaral 66 39 NP 80	- 20±0 - 175Ω	141/	2056	3001	1668	マルンU :: ムタム1	2034
AU Noroceto 66	2067 E	1727 1	. / OM 2 / J	2555	1987	5027	2523
41 Roque66	3091	1720	4228	3355	1575	5175	1498
42 Pi62 Chris sibxS64	2683	1098	3763	3662	1805	4964	2543
43 Gaboto	2451	1264	3199	3252		3806	
44 Klein Petiso x Raf.	2159	1258	3908		1104		
45 Centrifen	2133	1079	3446	2478	970	4596	3122

(Continued)

CANADA Mac Ste Ruis	n.	AFRI CA	115-15- 175-15- 5. 4			DA	CANA				a moral sales meets. N
No. Strain katoon Regina Peg Col. bosch burg 46 Narino 59 2371 1633 3267 4020 1664 3995 48 E1 Gaucho 2630 1014 2346 3123 619 2841 49 Tobart 66 2528 1731 4595 3476 1772 4852 50 Klein Rendidor 2503 964 3450 222 3601 360	Rivi	Rus-	te- I	S	Mac-			ELON-F	12/57		where it is the state of the state of
46 Narino 59 47 Thatcher 48 El Gaucho 48 El Gaucho 49 Tobart 66 50 Klein Remiddor 2503 964 3450 222 3601; Average A	- 80	– ten-	TTen-	Τđ	~dona	winni		~5as~~	entransfer service	ery-or	Var. Vari
46 Narino 59 47 That cher 47 That cher 48 El Caucho 49 Tobart 66 48 El Caucho 2630 1014 2346 3123 619 2841 49 Tobart 66 50 Klein Remiddor 2503 964 3450 222 3601 Average 2782.32 1441 3548 3371 1265 4488 Latitude 520N 505N 505N 455N 33056'S 2598 Aliitude 509M 565M 225M 28M 90M 1230M Irrig or rainfed Fertilizer applied 0 NP NHP NPR NHP NPR Date seeded 5715 5/24 5/19 5/5 12/29 6/2 Lodging 1	dere	burg	bosch	1. 1	Co	peg	egina	toon R	ka	rain	No. st
48 El Gaucho 49 Tobari 66 50 Klein Rendidor 2503 964 34595 3476 1772 4852 50 Klein Rendidor 2503 964 3450 222 3601 Average 72782:32 1441 3548 3371 1265 4488 Latitude 52°N 50°N 50°N 45°N 33°56'S 2598 Altitude 509M 565M 225M 28M 90M 1230M Irrig, or rainfed Fertilizer applied 76 NP N+P NPK NPK NP NP Date seeded 76 17 5/24 5/19 5/5 12/29 6/2 Lodging Diesase: stem rust 1 late - ++ 1 late - +- 1 late 2 lat	1989	3995	664	10	4020	3267	1633	2371	ABTIOD	59	46 Narino
48 El Gaucho 49 Tobari 66 50 Klein Rendidor 2503 964 34595 3476 1772 4852 50 Klein Rendidor 2503 964 3450 222 3601 Average 72782:32 1441 3548 3371 1265 4488 Latitude 52°N 50°N 50°N 45°N 33°56'S 2598 Altitude 509M 565M 225M 28M 90M 1230M Irrig, or rainfed Fertilizer applied 76 NP N+P NPK NPK NP NP Date seeded 76 17 5/24 5/19 5/5 12/29 6/2 Lodging Diesase: stem rust 1 late - ++ 1 late - +- 1 late 2 lat	3212	1936	.348 1	1	2948	3135	1331	2641	3.13.3	r	47 Thatche
Average	2075	2841	619 2	(3123	2346	1014	2630		ho	48 El Gauc
Average	2364	4852	772 4	1.1	3476	4595	1731	2528	SESE	66	49 Tobari
Average 2782.32 1441 3548 3371 1265 4488 Latitude 52°N 50°N 50°N 45°N 33°56'S 2598 Altitude 509M 565M 225M 28M 90M 1230M Irrig, or rainfed rain rain rain irrig, trugs. Fertilizer applied 0 NP N+F NPK N+P N	2676	3601	777			- 345A \	. Uhz.	- 2503C	e to the state of	endi dor	50 Klein R
Date seeded		A			-	10.00	10.5		 12.33 \ \ \ \ \ 	5 6363	SDK 1.55114
Date seeded	2256	4488	.265 a/4	13	3371	3548	1441	782.32	13/2		Average
Part	8 8	154 1				2809	. با ۱۵۵	1105		7377	
Part	34°S	25°S	o56'S	33	45°N	50°N	50°N	520N	1 1 1 1 2 E & F	.	Latitude
Part	.150M	L230M	OM 1	9(28M	225M	565M	509M	SCRE	3 - CP 35	Altitude
Part	rain	trrig.	rig. i	irı	rain	rain S	rain	rain	1 ପ୍ରଥିଷ	rainfed	Irrig. or
Leaf rust	N)	N	4 P 😘	Ŋ⊣	NPK	N-P	NP	$\exists \mathbf{n} \in \mathbb{N}$	24	ann'i le	Fertilizer
leaf rust	5/11	3/2 41	2/29 6	12	5/5	5/19	5/24	5/17	TOLE	d	Date seede
Leaf rust Late - + + +	9 5 £	leti all	0	C	· +	→ 2007、	+ €€5	i t ore	1507		Lodging
Stripe rust	ji 🛶 .	+ #10 (5.)	ttia 🧺	44		late :		4 4 7769	s të 🐬 🦠	tem rus	Disease: s
Stripe rust	4 -4).	- uggergi	+ 2:	4	-	late .	£3763	1 7 3 (5)	t Lie	eaf rus	1.
Other problems	e 🕶 j	a n ono.	0 🐇 🔾 🥫	(-	0ે ેડે	زيارا ف	Flot	ust -	tripe r	st
Other problems Vidry drouth Area harvested Conversion factor 1.814 1.111	sept	4300	-	-	pow.	2015		saw-	2934	ase	Other dise
Table 2-B NO		233	T I (-frejeriden, og								
Table 2-B MO	j = j^^	iphæd .	- a		_	≟ ₹ 8\$	irouth	dry o	10 92°	lems	Other probl
Table 2-B MO	3m ²	3m ² . (6)	3m4 3	$0m^2$	1.70	1.51m	2.98m ²	86m ² 2	-334 T -	sted	Area harves
Table 2-B MO	1.111	111	.111 1	4 1.	1.984	2.203	111	814 1	ı.	factor	Conversion
NO) (1/4)	300-5							ام القرائل المادية الم المادية المادية المادي	141g	angles of the state of the first plant to the state of t
Rocco BIA EGYPT SUDAN OF Rabat Sidt Sakha Ed Kashmel Girba Damer No. Strain	. 15.	aning	v O lon	er angen e n	to an	6795	(840)			0.0.1	Table 2-B
Var. Variety or Rabat Mesri Sakha Damer Ed Kashmel Girba Damer No. Strain 3 A B B A B A B A B A B A B A B A B A B A	7 S.S.		එඡ			33405	LY-	MO-	E # 97	1848	C33 5700
Var. Variety or Mesri Damer A B 1 Nar sib 2 pt sib 2478 4895 1577 1722 589 304 2 Napo 63 1711 4184 1577 2150 750 259 3 C-273 2422 3636 1755 1128 868 522 4 Huelquen 2877 3251 2178 1728 609 597 5 NP 824 2088 3621 2261 1755 720 650 6 Mendos 3477 4206 2533 2261 1085 743 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	EGYPT	d0E-1	UDAN	SU		EGYPT	BIA	RÓCCO	nobe	್ತಿ	영화 - 최고원화 -
Var. Variety or No. Strain 1 Nar sib xPj sib 2478 4895 1577 1722 589 304 259 3 C-273 2422 3636 1755 1128 868 522 4 Huerquen 2877 3251 2178 1728 609 597 5 NP 824 2088 3621 2261 1755 720 650 6 Mendos 3477 4206 2533 2261 1085 743 2178 1 128 868 2270 3703 3233 2083 1118 693 8 Justin 1244 2177 1378 2122 87 28 9 Giza 150 2466 3362 1550 1527 1313 753 10 NP 832 2411 4606 2589 1688 892 582 1 Chris 2000 2916 2005 1150 711 431 2 Nainari 60 1989 3962 2244 1672 960 628 5 3 Bonza 55 2366 4176 1565 1467 763 383 3 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 5 C-271 2422 5287 2583 1389 682 6855 5 C-271 2422 5287 2583 1389 682 682 6855 5 C-271 2422 5287 2583 1389 682 682 682 682 682 6855 5	Giza	irba	hmel G	ash	Ed K	Sakha	Sidt	Rabat	15.36	ARLL	eddin oldadii
No. Strain 1 Nar sib^2xPj sib 2478	4 25.	ire da	1.	•	Damer	1 (CBP	Mesri	108	000	ety or	Var. Varie
1 Nar sib xPj sib 2478	250	B	A ANT	Ã	. ,	2333	08 63	3479	43 (J.)	ln EV	Vo. Strai
3 C-273 4 Huerquen 2877 3251 2178 1728 609 597 5 NP 824 2088 3621 2261 1755 720 650 6 Mendos 3477 4206 2533 2261 1085 743 8 Justin 1244 2177 1378 2122 87 28 9 Giza 150 2466 3362 1550 1527 1313 753 10 NP832 2411 4606 2589 1688 892 582 1 Chris 2000 2916 2916 2005 1150 711 431 2 Nainari 60 1989 3962 2244 1672 960 628 3 Bonza 55 2366 4176 1565 1467 763 383 4 Sonora 64 2222 4058 1472 1794 655 292 5 C-271 2422 5287 2583 1389 682 685 6 C-518 1539 4554 1883 1255 1071 803	6483	304	589 👸	5	1722	15.77	4895	2478	RAGE	xPj sil	1 Nar sib2
3 C-273 4 Huerquen 2877 3251 2178 1728 609 597 5 NP 824 2088 3621 2261 1755 720 650 6 Mendos 3477 4206 2533 2261 1085 743 8 Justin 1244 2177 1378 2122 87 28 9 Giza 150 2466 3362 1550 1527 1313 753 10 NP832 2411 4606 2589 1688 892 582 1 Chris 2000 2916 2916 2005 1150 711 431 2 Nainari 60 1989 3962 2244 1672 960 628 3 Bonza 55 2366 4176 1565 1467 763 383 4 Sonora 64 2222 4058 1472 1794 655 292 5 C-271 2422 5287 2583 1389 682 685 6 C-518 1539 4554 1883 1255 1071 803	~ ~~~	259	7500xd	(.) 7	2150	15775	4184	1711	TEST.	2.5.1	2 Napo 63
4 Huelquen	57 <u>8</u> 8	522			1100	17550	2626	2233	2015	583	ິ3 ∩_273°
6 Mendos 3477 4206 2533 2261 1085 743 743 7 Lerma Rojo 64A 2700 3703 3233 2083 1118 693 8 Justin 1244 2177 1378 2122 87 28 150 NP832 2411 4606 2589 1688 892 582 11 Chris 2000 2916 2005 1150 711 431 42 Nainari 60 1989 3962 2244 1672 960 628 5 13 Bonza 55 2366 4176 1565 1467 763 383 14 Sonora 64 2222 4058 1472 1794 655 292 15 C-271 2422 5287 2583 1389 682 8855 5 16 C-518 1539 4554 1883 1255 1071 803 5 7 Crim	5788 4661		86 ,8 c s ±		TTZR	エルバングット			4,14,20		
6 Mendos 3477 4206 2533 2261 1085 743 7 Lerma Rojo 64A 2700 3703 3233 2083 1118 693 8 Justin 1244 2177 1378 2122 87 28 9 Giza 150 2466 3362 1550 1527 1313 753 10 NP832 2411 4606 2589 1688 892 582 1 Chris 2000 2916 2005 1150 711 4431 2 Nainari 60 1989 3962 2244 1672 960 628 5 3 Bonza 55 2366 4176 1565 1467 763 383 4 Sonora 64 2222 4058 1472 1794 655 292 5 C-271 2422 5287 2583 1389 682 8855 5 6 C-518 1539 4554 1883 1255 1071 8803 7 Crim	4661 4511	597:14	609 🗈	ି <u>ଓ</u> ର	1728	2178	3251	2877	C.F.	17451	4 Huelquer
7 Lerma Rojo 64A 2700 3703 3233 2083 1118 693 8 1244 2177 1378 2122 87 28 9 Giza 150 2466 3362 1550 1527 1313 753 10 NP832 2411 4606 2589 1688 892 582 11 Chris 2000 2916 2005 1150 711 4431 2 Nainari 60 1989 3962 2244 1672 960 628 5 3 Bonza 55 2366 4176 1565 1467 763 383 4 Sonora 64 2222 4058 1472 1794 655 292 5 C-271 2422 5287 2583 1389 682 8855 5 6 C-518 1539 4554 1883 1255 1071 883 7 Crim	4661 4511	597:14	609 🗈	ંડે8 6 7	1728 1728 1755	2178: 2261	3251 3621	2877 2088	<u>cide</u> 2065	17451	4 Hue Iquer 5 NP 824
8 Justin 1244 2177 1378 2122 87 28 9 Giza 150 A2 2466 3362 1550 1527 1313 753 10 NP832 2411 4606 2589 1688 892 582 11 Chris 2000 2916 2005 1150 711 431 42 Nainari 60 1989 3962 2244 1672 960 628 5 1467 763 383 14 Sonora 64 2222 4058 1472 1794 655 292 15 C-271 2422 5287 2583 1389 682 8855 5 16 C-518 1539 4554 1883 1255 1071 803 17 Crim	4661 4511 <u>5677</u>	59.7 650	609 🤌 720 🔙	6 7	1728 1755 2261	2178 2261 2533	3251 3621 4206	2877 2088 3477	<u>Clar</u> 3ans Usia	1001 1001	4 Huelquer 5 NP 824 6 Mendos
9 Giza 150 2466 3362 1550 1527 1313 753 10 NP832 2411 4606 2589 1688 892 582 11 Chris 2000 2916 2005 1150 711 431 42 12 Nainari 60 1989 3962 2244 1672 960 628 513 Bonza 55 2366 4176 1565 1467 763 383 44 Sonora 64 2222 4058 1472 1794 655 292 15 C-271 2422 5287 2583 1389 682 6855 516 C-518 1539 4554 1883 1255 1071 803 57 Crim	4661 4511 5677 5338	650 743	609 ⊝ 720 <u>√</u> 085≲∂	6 7 10	1728 1755 2261	2178 2261 2533	3251 3621 4206	2877 2088 3477	<u>Clar</u> 3ans Usia	1001 1001	4 Huelquer 5 NP 824 6 Mendos
10 NP832 2411 4606 2589 1688 892 582 11 Chris 2000 2916 2005 1150 711 431 4 12 Nainari 60 1989 3962 2244 1672 960 628 3 Bonza 55 2366 4176 1565 1467 763 383 4 Sonora 64 2222 4058 1472 1794 655 292 15 C-271 2422 5287 2583 1389 682 685 6 C-518 1539 4554 1883 1255 1071 6803 7 Crim 3172 4184 1894 383 310 210	4661 4511 5677 5338 6694	59.7 650 743 693	609 50 720 <u>23</u> 085 57 11877 (6 7 10 11	1728 1755 2261 2083	2178 1 2261 2 2533 2 3233	3 <u>251</u> 3621 4206 3703	2877 2088 3477 2700	236 2363 0834 5030	1 6 6 4 A	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro
11 Chris 2000 2916 2005 1150 711 2431 4 12 Nainari 60 3962 2244 1672 960 628 5 13 Bonza 55 2366 4176 1565 1467 763 383 4 14 Sonora 64 2222 4058 1472 1794 655 292 15 C-271 2422 5287 2583 1389 682 3855 5 16 C-518 202 3172 4184 1894 383 310 210 3	4661 4511 5677 5338 6694 1450	59.7 650 743 693	609 (3) 720 <u>33</u> 085 (3) 118 (3) (87	6 7 10 11	1728 1755 2261 2083 2122	21781 2261 25338 3233 13788	3251 3621 4206 3703 2177	2877 2088 3477 2700 1244	230 2300 0800 5000 0800	ojo 64A	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro 8 Justin
12 Nainari 60 1989 3962 2244 1672 960 628 5 13 Bonza 55 2366 4176 1565 1467 763 383 5 14 Sonora 64 2222 4058 1472 1794 655 292 5 15 C-271 2242 5287 2583 1389 682 3855 5 16 C-518 23 172 4184 1894 383 310 210 3	4661 4511 5677 5338 6694 1450 5922	59.7 650 7.43 693 28 753	609 63 720 <u>33</u> 085 53 118 62 (87 313 13	10 11 13	1728 1755 2261 2083 2122 1527	2178 (2261 (2533 (3233 (1378 (1550 (3251 3621 4206 3703 2177 3362	2877 2088 3477 2700 1244 2466	\$200 \$200 \$200 \$200 \$200 \$200) \\(\)(\)	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro 8 Justin 9 Giza 150
13 Bonza 55 24 2366 4176 1565 1467 763 383 4 14 Sonora 64 2222 4058 1472 1794 655 2292 1 15 C-271 2422 5287 2583 1389 682 2855 5 16 C-518 25 3172 4184 1883 1255 1071 2803 1 17 Crim 2 2 3172 4184 1894 383 310 210	4661 4511 5677 5338 6694 1450 5922 5005	59.7 650 743 693 28 753 582	609 (3) 720 (2) 085 (3) 118 (3) 87 313 (1) 892 (3)	6 7 10 11 13	1728 1755 2261 2083 2122 1527	2178 1 2261 2 2533 5 3233 1 378 8 1550 1 2589 2	3251 3621 4206 3703 2177 3362 4606	2877 2088 3477 2700 1244 2466 2411	2065 2065 2002 2002 2043 2693	1 001 0 001 0 000 0 000 000 0 000 0	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro 8 Justin 9 Giza 150 10 NP832
4 Sonora 64 2222 4058 1472 1794 655 292 15 C-271 2422 5287 2583 1389 682 3855 16 C-518 281 281 281 281 281 281 281 281 281 2	4661 4511 5677 5338 6694 1450 5922 5005 4088	59.7 650 743 693 28 753 582 431	609 (3) 720 (3) 785 (3) 118 (7) (4) 87 313 (1) 892 (7)	6 7 10 11 13 8 7	1728 1755 2261 2083 2122 1527 1688 1150	2178 1 2261 2 2533 2 3233 1 1378 2 1550 1 2589 2 2005 2	3251 3621 4206 3703 2177 3362 4606 2916	2877 2088 3477 2700 1244 2466 2411	2843 2843 2843 2843 3893 3107) \(\frac{1}{1} \) \(\frac{1} \) \(\frac{1}{1} \) \(\frac{1} \) \(\frac{1}{1} \) \(\frac{1}{1} \) \(\frac{1} \) \(\fr	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro 8 Justin 9 Giza 150 10 NP832
15 C-271	4661 4511 5677 5338 6694 1450 5922 5005 4088 5288	59.7 4 650 2 743 6 693 6 28 7 753 5 582 5	609 (0) 720 (2) 085 (0) 118 (7) 87 313 (1) 392 (1) 711 (2)	6 7 10 11 13 8 7 9	1728 1755 2261 2083 2122 1527 1688 1150 1672	2178 2261 2533 3233 1378 1550 2589 2005 2244 2	3251 3621 4206 3703 2177 3362 4606 2916 3962	2877 2088 3477 2700 1244 2466 2411 2000	2843 2843 3843 3843 3843 3843 3843	001 010 64A	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro 8 Justin 9 Giza 150 10 NP832 1 Chris 2 Nainari
16 C-518	4661 4511 5677 5338 6694 1450 5922 5005 4088 5288 3344	59.7 650 743 693 28 753 582 431 628 383	609 (3) 720 (2) 785 (3) 118 (7) 87 313 (1) 892 (3) 711 (3) 960 (3) 763	6 7 10 11 13 8 7 9	1728 1755 2261 2083 2122 1527 1688 1150 1672 1467	2178 2261 2533 3233 1378 1550 2589 2005 2244 1565 1565 1	3251 3621 4206 3703 2177 3362 4606 2916 3962 4176	2877 2088 3477 2700 1244 2466 2411 2000 1989	2965 2965 2002 2002 2843 3843 3843 3843 2344	0064A 0664A 0664 0664 0664	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro 8 Justin 9 Giza 150 10 NP832 1 Chris 2 Nainari 3 Bonza 55
77 Critto 665 S78 (3172 [4184]) 1894 (1 383 310 -210 [3	4661 4511 5677 5338 6694 1450 5922 5005 4088 5288 3344 7155	59.7 650 743 693 28 753 582 431 628 383 292	609 (3) 720 (3) 720 (3) 711 (3) 711 (3) 763 (3) 755 5 5 5	6 7 10 11 13 8 7 9 7	1728 1755 2261 2083 2122 1527 1688 1150 1672 1467 1794	2178 1 2261 2 2533 2 3233 2 1378 2 1550 2 2589 2 2005 2 2244 2 1565 1 1472 2	3251 3621 4206 3703 2177 3362 4606 2916 3962 4176 4058	2877 2088 3477 2700 1244 2466 2411 2000 1989 2366 2222	2843 2843 2843 2843 2843 3103 3103	1001 1001 1004 000 000 000 000 000 1	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro 8 Justin 9 Giza 150 10 NP832 1 Chris 2 Nainari 3 Bonza 55 4 Sonora 6
8 Carazinho 14 1765 1016 13666 2111 731 - 749 - 473 4	4661 4511 5677 5338 6694 1450 5922 5005 4088 3344 7155 5164	59.7 650 743 693 28 753 582 431 628 383 292 855	609 (3) 720 (4) 085 (3) 118 (7) 87 313 (1) 892 (3) 711 (3) 960 (3) 655 (3) 655 (3)	6 7 10 11 13 8 7 9 7 6	1728 1755 2261 2083 2122 1527 1688 1150 1672 1467 1794 1389	2178 1 2261 9 2533 8 3233 8 1378 8 1550 9 2589 9 2005 8 2244 9 1565 1 1472 9 2583 8	3251 3621 4206 3703 2177 3362 4606 2916 3962 4176 4058 5287	2877 2088 3477 2700 1244 2466 2411 2000 1989 2366 2222 2422	2187 2005 2000 2000 3000 3800 3800 2000 2000	1001 1001 1001 1006 1006 1001 1006 1006	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro 8 Justin 9 Giza 150 10 NP832 1 Chris 2 Nainari 3 Bonza 55 4 Sonora 6 5 C-271
	4661 4511 5677 5338 6694 1450 5922 5005 4088 5288 3344 7155 5164 5577	59.7 650 743 693 693 753 582 431 431 628 383 292 855 5	609 (a) 720 (a) 720 (a) 720 (a) 720 (a) 721 (a) 721 (a) 721 (a) 721 (a) 721 (a) 721 (a)	13 8 7 6 6	1728 1755 2261 2083 2122 1527 1688 1150 1672 1467 1794 1389	21781 22619 25336 3233 13786 1550 2589 20056 22446 15651 14720 25836 18830	3251 3621 4206 3703 2177 3362 4606 2916 3962 4176 4058 5287 4554	2877 2088 3477 2700 1244 2466 2411 2000 1989 2366 2222 2422	1843 3843 3843 3883 3883 3883 3883 2883 2	1001 1001 1001 1001 1001 1001 1001 100	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro 8 Justin 9 Giza 150 10 NP832 1 Chris 2 Nainari 3 Bonza 55 4 Sonora 6 5 C-271 6 C-518
19 Triple Dirk 3622 4443 1928 767 1140 565 4	4661 4511 5677 5338 6694 1450 5922 5005 4088 3344 7155 5164 5577	59.7 650 743 69.3 75.3 582 431 628 383 292 85.5 803	609 (1) 720 (2) 720 (2) 720 (2) 721 (2) 721 (2) 721 (2) 731 (2) 731 (2) 741 (2) 741 (2) 741 (2) 741 (2)	6 7 10 11 13 8 7 9 7 6 6	1728 1755 2261 2083 2122 1527 1688 1150 1672 1467 1794 1389 1255	2178 1 2261 9 2533 6 3233 1378 6 1550 1 2589 9 2005 6 2244 6 1565 1 1472 9 2583 6 1883 9 1894 6	3251 3621 4206 3703 2177 3362 4606 2916 3962 4176 4058 5287 4554 4184	2877 2088 3477 2700 1244 2466 2411 2000 1989 2366 2222 2422 1539 3172	1843 3843 3843 3883 3883 3883 3883 3883	1001 1001 1001 1001 1001 1001 1001 100	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro 8 Justin 9 Giza 150 10 NP832 1 Chris 2 Nainari 3 Bonza 55 4 Sonora 6 5 C-271 6 C-518
0 C-591 1222 4176 1855 1339 1168 805	4661 4511 5677 5338 6694 1450 5922 5005 4088 5288 3344 7155 5164 5577 3905 4861	59.7 650 743 693 28 753 582 431 628 383 292 855 580 210 3473	609 (3) 720 (2) 785 (3) 118 (7) 87 313 (1) 892 (3) 711 (3) 60 (3) 655 (3) 655 (3) 651 (3) 610 (2) 749 (4)	6 7 10 11 13 8 7 9 7 6 6 6 7 10 3 3	1728 1755 2261 2083 2122 1527 1688 1150 1672 1467 1794 1389 1255 383	2178 2261 2533 233 233 2589 2005 2244 21565 2583 21883 21894 22111 2	3251 3621 4206 3703 2177 3362 4606 2916 3962 4176 4058 4554 4184 3606	2877 2088 3477 2700 1244 2466 2411 2000 1989 2366 2222 2422 1539 3172 1911	1810 2000 2000 2000 3893 3403 3403 2000 2000 2000 2000 2000 200	60 44 60 44 60 44 60 64 60 64	4 Huelquer 5 NP 824 6 Mendos 7 Lerma Ro 8 Justin 9 Giza 150 0 NP832 1 Chris 2 Nainari 3 Bonza 55 4 Sonora 6 5 C-271 6 C-518 7 Crim 8 Carazinh

MO- LY- ROCCO BIA EGYPT SUDAN EGYPT
Name
Var. Variety or No. Mesri Action Damer Action B 21 Penjamo 62 2511 4606 2594 1833 1057 700 7243 22 Bajio 66 1955 4332 806 1678 604 249 7432 23 C-306 2778 4591 2355 1561 1575 948 4816 24 Pj sib x Gb55(red) 4022 4969 2305 1222 1090 557 8377 25 NP 881 2578 4776 2239 1183 414 563 4905 26 Giza 144 2900 3740 2028 1217 1172 789 5233 27 Bonza 63 2433 5021 1839 1128 750 392 4249 28 Pj sib x Gb55(w) 3600 3628 2650 1267 1269 513 5549 29 Pakistan 5725 1722 5295 2049 1827 1378 609 7583 30 Tiba 63 1989
No. strain 21 Penjamo 62 2511 4606 2594 1833 1057 700 7243 22 Bajio 66 1955 4332 806 1678 604 249 7432 23 C-306 2778 4591 2355 1561 1575 948 4816 24 Pj sib x Gb55(red) 4022 4969 2305 1222 1090 557 8377 25 NP 881 2578 4776 2239 1183 414 563 4905 26 Giza 144 2900 3740 2028 1217 1172 789 5233 27 Bonza 63 2433 5021 1839 1128 750 392 4249 28 Pj sib x Gb55(w) 3600 3628 2650 1267 1269 513 5549 29 Pakistan 5725 1722 5295 2049 1827 1378 609 7583 30 Tiba 63 1989 4310 2239 1839 993 483 5011 31 Selkirk 2389 2947 1305 211 183 2283 32 Pitic 62 2689 5650 3283 1728 858 307 6149 33 Yaqui 50 2500 4028 2922 1111 985 406 4600 34 Gabo 2911 4710 2055 2005 1080 603 3933 35 Tacuari 2466 3288 2122 1255 821 524 4272 36 Crespo 63 3177 4339 2533 1633 1076 637 4427 37 Inīa 66 2555 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
21 Penjamo 62
22 Bajio 66
23 C-306
24 Pj sib x Gb55(red) 4022 4969 2305 1222 1090 557 8377 25 NP 881 2578 4776 2239 1183 414 563 4905 26 Giza 144 2900 3740 2028 1217 1172 789 5233 27 Bonza 63 2433 5021 1839 1128 750 392 4249 28 Pj sib x Gb55(w) 3600 3628 2650 1267 1269 513 5549 29 Pakistan 5725 1722 5295 2049 1827 1378 609 7583 30 Tiba 63 1989 4310 2239 1839 993 483 5011 31 Selkirk 2389 2947 1305 211 183 — 2283 32 Pitic 62 2689 5650 3283 1728 858 307 6149 33 Yaqui 50 2500 4028 2922 1111 985 406 4600 34 Gabo 2911 4710 2055 2005 1080 603 3933 35 Tacuari 2466 3288 2122 1255 821 524 4272 36 Crespo 63 3177 4339 2533 1633 1076 637 4427 37 Inla 66 2555 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 4539 1172 1483 434 268 7394 42 P162 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
25 NP 881
26 Giza 144 2900 3740 2028 1217 1172 789 5233 27 Bonza 63 2433 5021 1839 1128 750 392 4249 28 Pj sib x Gb55(w) 3600 3628 2650 1267 1269 513 5549 29 Pakistan 5725 1722 5295 2049 1827 1378 609 7583 30 Tiba 63 1989 4310 2239 1839 993 483 5011 31 Selkirk 2389 2947 1305 211 183 — 2283 32 Pitic 62 2689 5650 3283 1728 858 307 6149 33 Yaqui 50 2500 4028 2922 1111 985 406 4600 34 Gabo 2911 4710 2055 2005 1080 603 3933 35 Tacuari 2466 3288 2122 1255 821 524 4272 36 Crespo 63 3177 4339 2533 1633 1076 637 4427 37 Inīa 66 2555 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
28 Pj sib x Gb55(w) 3600 3628 2650 1267 1269 513 5549 29 Pakistan 5725 1722 5295 2049 1827 1378 609 7583 30 Tiba 63 1989 4310 2239 1839 993 483 5011 31 Selkirk 2389 2947 1305 211 183 2283 32 Pitic 62 2689 5650 3283 1728 858 307 6149 33 Yaqui 50 2500 4028 2922 1111 985 406 4600 34 Gabo 2911 4710 2055 2005 1080 603 3933 35 Tacuari 2466 3288 2122 1255 821 524 4272 36 Crespo 63 3177 4339 2533 1633 1076 637 4427 37 Inla 66 2555 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
28 Pj sib x Gb55(w) 3600 3628 2650 1267 1269 513 5549 29 Pakistan 5725 1722 5295 2049 1827 1378 609 7583 30 Tiba 63 1989 4310 2239 1839 993 483 5011 31 Selkirk 2389 2947 1305 211 183 2283 32 Pitic 62 2689 5650 3283 1728 858 307 6149 33 Yaqui 50 2500 4028 2922 1111 985 406 4600 34 Gabo 2911 4710 2055 2005 1080 603 3933 35 Tacuari 2466 3288 2122 1255 821 524 4272 36 Crespo 63 3177 4339 2533 1633 1076 637 4427 37 Inla 66 2555 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
29 Pakistan 5725
30 Tiba 63
31 Selkirk 2389 2947 1305 211 183 2283 32 Pitic 62 2689 5650 3283 1728 858 307 6149 33 Yaqui 50 2500 4028 2922 1111 985 406 4600 34 Gabo 2911 4710 2055 2005 1080 603 3933 35 Tacuari 2466 3288 2122 1255 821 524 4272 36 Crespo 63 3177 4339 2533 1633 1076 637 4427 37 Inia 66 2555 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
32 Pitic 62 2689 5650 3283 1728 858 307 6149 33 Yaqui 50 2500 4028 2922 1111 985 406 4600 34 Gabo 2911 4710 2055 2005 1080 603 3933 35 Tacuari 2466 3288 2122 1255 821 524 4272 36 Crespo 63 3177 4339 2533 1633 1076 637 4427 37 Inia 66 2555 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
33 Yaqui 50
34 Gabo 2911 4710 2055 2005 1080 603 3933 35 Tacuari 2466 3288 2122 1255 821 524 4272 36 Crespo 63 3177 4339 2533 1633 1076 637 4427 37 Inia 66 2555 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 P162 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
35 Tacuari 2466 3288 2122 1255 821 524 4272 36 Crespo 63 3177 4339 2533 1633 1076 637 4427 37 Inia 66 2555 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
36 Crespo 63 3177 4339 2533 1633 1076 637 4427 37 Inla 66 2555 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
37 Inla 66 2555 4147 2055 1894 688 407 6122 38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
38 Jaral 66 2255 4147 1228 1355 422 144 6472 39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf. 2011 2503 2038 1472 851 157 4566
39 NP 880 2855 4517 2716 1350 1235 629 4666 40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf.2011 2503 2038 1472 851 157 4566
40 Noroeste 66 2311 4295 3622 1805 1345 287 6600 41 Roque 66 2166 4539 1172 1483 434 268 7394 42 P162 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf.2011 2503 2038 1472 851 157 4566
41 Roque 66 2166 4539 1172 1483 434 268 7394 42 Pi62 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf.2011 2503 2038 1472 851 157 4566
42 P162 Chris sibxS64 2889 4139 850 367 739 238 6655 43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf.2011 2503 2038 1472 851 157 4566
43 Gaboto 2433 3192 2072 1900 702 482 4033 44 Klein Petiso x Raf.2011 2503 2038 1472 851 157 4566
44 Klein Petiso x Raf.2011 2503 2038 1472 851 157 4566
45 Gentrifen 1655 3991 2783 1400 336 80 5888
46 Narino 59 2466 4413 2472 1100 957 358 3744
47 Thatcher 1489 903 861 67 62 0 644
48 E1 Gaucho 1878 3391 1883 105 145 98 2939
49 Tobari 66 2722 3880 2072 1833 951 342 5916
50 Klein Rendidor 2278 2607 2387 1189 0 5594
AMERICAN SERVICE SERVICES AND
Average 2419 3998 2074 1382 808 447 5139
Latitude 340N 320N 310N 17035'N 150N 150N 310N
Altitude 25M 25M 21M 353M 440M 440M 21M
Irrig. or rainfed rain irrig irrig irrig irrig irrig irrig.
Fertilizer applied NPK NP N+P N NP O N+P
Date seeded 11/28 11/10 11/20 12/6 12/1 12/9 11/30
Lodging the transfer of the tr
Disease: stem rust - + 0 +
leaf rust - ++ ++ +-
stripe rust - + +
Other disease - mild
Other problems - shat, birds weeds sown seas.
1997年,1997年,北京,郑建林(李松俊、李松俊),夏林(夏禄本 Out)。(1997年),1997年
Area harvested $3m^2$ 2.25 m^2 $3m^2$ $3m^2$ $3m^2$ $3m^2$ $3m^2$ $3m^2$

TABLE 2-C--Preliminary Yield Information from the Third International Spring Wheat Yield Nursery for 1966-67. International Maize and Wheat Improvement Center (CIMMYT)

1000	garaa kemeg	ent Center (CIMM	CV	i.	TAD TO
:	1, 30, 10, 10, 10, 10, 10, 10, 10, 10, 10, 1	TURKEY			JOR- IS-
Var.	Variety or				
		pazari hir	Syn-	Beirut Tel Amara	
1 No	Strain	b 3777 2222	3677	2047 2604	
2 114	po 63	3455 2189	0.2077	2127 2726	•
	273 0001	2644 1311	200330 200330	3137 3736	478 5999
	273	2755 2178	~ 40±1	2004 2494	11924 3463
S MD	824	2600 1567	2411	2220 2006	1122 0/33
	ndos		2666	2227 2410	1790 2072
		1244° 1032° 2478			1789 3940
O T-	lada Teret	10000 2 20000	2200	- 3324W 3094 - 6000 3090	1507 0129
0 04	za 150 50 50 50 50 50 50 50 50 50 50 50 50 5	2477\\\ 1011\\	7399	24092 2022	1211 4593
בט ע	za 130	2300 1488	TOVO	2474 2003	
LO NP	-32 -4-	2522 1199	3000	2349 3116	
TT (U)	TIS	7255 TTAA	エフング	2571 2202	18223 4593
LZ Na:	THALT OU	144465 18220	3333	12/1 3/03	2555 5258
17 PO1	ris inari 60 nza 55 nora 64	2311 2133 3678 1589	3000	2509 2422	1733 4895 311 5253
L4 501	nora o4	3078 1389	21/0	4094 4911 10017 0411	2155 5888
	518 ² (32)	3355 1261	2000		1711 n 4796
.7 Cr:		2778 1372 2478 1955	4200	2034 2083	14800 184316
· / C.			7000	2072 2070	2289 5476
o Cai	razinho iple Dirk	0781 3988\21811	4909	2304 3244 23050 3468	
7 4 4	Thio nair	· · · · · · · · · · · · · · · · · · ·	32117	2859 3494	1844 4846
0 C-	391	2733 1550	2711-1	2634×3010	
T Let	njamo 62 jio 66	2777 1278 2711 1661	3411	2626 3844	522da6917
z baj		2977 2100	3033	2020 3044	942VHD347 カンスパンロライン
.3 U-3	000	d) 3633 1966	2444	2272 1000°	21/1400 4/00 :+470~∧14/04
5 NP	STDXCDOD (LG	2400 1766	2000	2427 2400	1611 1: 5139
	OOT	2044 1150	2/6/	2426 1055	1778si 3417
7 70-	ra 144 nza 63	2044 1130	20118	2925 2400	
0 02	sibxGb55(w)	29770 2166	2021	2751 2466	733da5844
o ri	diuxGUJJ(W)	2489 - 1467	1233	2717 2516	#1#16/5356
	oa 63		2478		478 4383
	kirk				3744 9 V 2413
	ic 62				
2 Var	MASSANDOLL W	3566 2144	2707	3175 3616 3262 3422	1111:1::5360
T cor	6000 HONS	MC 61678 8679	1667	3204 2150	19002820
6 Cre	end 63	2077 - 2011	31 80	2729 2883	1322 : 2760
7 7-4	8/86	1 2 2 2 2 1 2 2 2 2 1	3222	2507 3733	700 7409
R Tar	a1 "66 -	2055 1617	2300	2776 2883	211 - 6209
9 NP	880	2722 1355	2710	1279 3305	1911 e 5509
) Nor	oeste 66°	4244+2266	2721	2842 3433	1489 7486
l Ron	ne. 66	2611 1080	2622	2609 2366	233 6179
2 P16	2-Ch.sibws64	3444 2044	3011	2417 3100	389 6816
3 Gah	of698 17/38	2899 1780	2700-	2681 2389	2355 5329
4 K1e	in Pet Er Re	f. 3044 1605	2944	2018 2916	778 5423
5 Cen	trifen 28	3477 2166 2977 2011 2822 2389 2055 1617 2722 1355 4244 2266 2611 1989 3444 2044 2899 1789 4. 3044 1605 2055 1789	2687	2576 2694	1067 6333
			77		

TARLE.	2-C (continued)

							
mata Medicina di Salah dan Salah	7 10 43	40.70	CY-	7		JOR-	
	**	RKEY	PRUS		MON	DAN	RAEL
Var. Variety or	Ada-	Eskise-	Syn-	Beiru	t Tel	Deir	Beit
No. strain	pazari	hir	grassi		Amara		
46 Narino 59	3633	2122	2678	2242	2439	489	5103
47 Thatcher	2089	1239	1244	2371	1816	444	1906
48 El Gaucho	2089	1978	2187	2212	1989	1744	4720
49 Tobari 66	2700	1650	25,78	2801	2794	1389	7079
50 Klein Rendidor				2801	3122	611	5353
				War all and a second participation of		i kimas	V 35
Station mean yie	1d 2942	1775	2677	2619	2838	1318	5203
	S. fast X	V 1 1 2		.	ing page and in		A A Let root
Latitude	40°N	36045	N3506'	N3 3º50	N330N	32012	N 32 ⁰ N
Altitude	33M	789M	50M	995M	950M	-70M	28M
Irrig. or rainfed	rain	rain	rain	rain	rain	irrig.	rain
Fertilizer applied	NPK		N+P	NP	NPK	5 O	NP
Date seeded	12/2	3/23	11 - 1	11/8	12/12	11/23	12/3
Lodging	788 t 1	+	t		t	+	+
Diseases: stem rust	, t	cult.	⊕ 1€5		++	j. do veri	-
leaf rust	44	+	# :	i	++	++	++
Stripe ru	st +	++-		ŀ	++) +	+
Other disease	TA - 1	:, :'., .– ;	mild.	-	- 3		_
Other problems	1 · · · · · · · · · · · · · · · · · · ·	shat	weeds	-	- 1	birds	-
Area harvested		3m ²	3m ²	2m ²	3m ²	$3m^2$	3m ²
Conversion factor					*3		1.111
* Data not used bec					• <u>**</u> **	. 1	

* Data not used becau	se or severe b	rrd dama	ge.		<u>:</u>
TABLE 2-C	SA S				
TABLE 2-C		SAUDI		PAKIS-	
	IRAN	ARABIA	IRAQ	TAN	INDIA
Var. Variety or	Gorgan Ahwaz	Dirab		Lyallpur	
No. strain			1,652	ny si na i	Biheer
1 Nar sib ² xPj sib	2622 4788	1189	3738	5136	1778
2 Napo 63	3422 4922	836	3665	∵4753 🖖	1889
3 C-273	3533 4255	2284	3142	3676	1722
4 Huelquen	3277 5922	1315	3017	3263	2444
5 NP 824	2966 5288	1868	3427	3683	1833
6 Mendos	2678 4722	1119	3862	2662	2666
7 Lerma Rojo 64A	3444 6011	1223	4405	5026	3277
8 Justin	2433 3266	954	2581	X	333
9 Giza 150	2744 5488	1261	3625	2486	2444
10 NP 832	2966 5332	1591	3692	3680	2222
11 Chris	2933 3844	1237	2781	3021	2499
12 Nainari 60	3233 6011	1617	3661	4564	3277
13 Bonza 55	3066 4255	1780	4018	2675	1944
14 Sonora 64	2889 5033	713	3315	4913	1667
15 C-271	285,5 5011	1462	4413	3638	1555
16 C-518	3033 5388	21.39	3130	2964	1944
17 Crim	2911 4666	1480	4026	2406	2333
18 Carazinho	3119 4788	1420	2621	2711	2444
19 Triple Dirk	3255 4788	1578	4026	3523	3555
20 C-591	3333 4822	1773	3625	3553	1944

(Continued)

	n Ahwaz	Dirab		TAN	INDIA
3044	u in 1		Baohdadi		
3044				Eyallpur	
2280		\$5 \$250) Caroo	Called Services and Control of the C	10 42	
0100 2289	7444	ି 688		4074	3499
2000	25077			4267	2222
1689 6555	5577	2298	,	୍ଷ୍ୟ ଅନ୍ତ	2389
red) ⁸ 4133 108 3344	3388	1232	5142	4504	2889
3344	4844	1042	3352		2333
2633 2855	3222	702A	3121 (2774) or	2668	2833
() 2777	5277	2302		4645	2389 2000
(w) 3777 50 1 3044	25500	1325	4254	945.81	2050
2929°	MATO2	1079	3857	4217	1555
2066	3066		3156	o. Trenti	833
4177	5977		4127	3507	3333
მ∖ა≟ 2822	4688			3387	2222
2433	4911	1581	3825	3517	3110
2789	4766	1607 3g		2762	2778
3189	5166	2316		3679	2722
3900	4788	766		5593	3666
2722	4133	797		4236	1778
		1405	3440		2222
mS 3811		1055	2909	4394	2666
2966		1240		3745	2333
864 (Sep 2833)			3599	4530	1944
2622	4644	1628	3953	2625	2333
Raf. 3266		1443	3017 5	3428	2333
J. 2522	3477	1324	2529	3585	2111
3166	4311	1270	3546	3298	2222
2589		্ _ু 560	2195 ₅₁	√ ਤਰਦੋਂ :	167
2499	3611	1350	3315	2346	1889
88 30 77 8	8 5411 J	1619	2664	3413 4848	2333
or 3155	204755 s	1271		4848	2666
5 2284	3 425.	35€	0450	3685	
Atera 303 /	CO4/34	376	3658 args	3685	2272
230	27.000	7.7407		So 112 5	250501
36051'N 50M d irrig,	20M	N 240N	-3 3oN	3103'N 213M	25059 1
1 110023	TOZON A	3/UM	irrig.	irrig.	165M
led lact 0	Right 4	TELTE.	o o	N+b	irrig. NPK
12/24	848 4	N 11/28	12/5	43776	12/18
	843 <u> </u>		12/3	11/16	0
A VERI A	t a	***	_	ata <u>r</u> il	-
Coc C All C	1980a 1980			rates Si	+
tust H	833 + 3	NAC _	<u> </u>	ែលផ្សើ (ថ	-
	LV2 +	2.5	_ 1:07 is	, धव ् टे रेड	-
	- cold	frost	and the second second second second		birds
3m2	5 3m 2 ₩	3m ²	3.6m ²	3m2	3m ²
r 0557 6	005	1,111	.926	1.6	1.111
To the second	0 / F 1	TC	ប្រជន	KOTAT AT	
	TAP TE		, waiti e	Region (1)	
and the second of the second	and the first of the second second		and and the second an	arst A.J.	
•	98 3m2 3 9r 0:1.111	08 3m 2 3m 2 0 2 3m 2 0 2 1.1111 0 0 7 1.1111	or 1.111 36 3m 2 3m2 3m2 or 1.111 12.111	3m ² 3m ² 3.6m ² 3.6m ² 3.6m ² 926	3m ² 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7

USING MALE-STERILITY TO AID IN LOCATING SOURCES OF HIGH YIELD GENES

(Abstract)

R. W. Livers

and the report of the second

Techniques to aid in discovering parental wheat stocks which can contribute genes for increasing yields would be useful in any program of breeding improved varieties or hybrids. Performance of potential parent varieties themselves has been the best guide in choosing which parents to use. Now that male-sterile and fertility-restoring varieties are becoming available, we can begin to consider additional information from field performance of F_1 hybrids as a guide in evaluation of parental stocks. Furthermore, this gives us a means of detecting good yield potential in varieties which themselves are not adapted in an area. For example, Tascosa is not hardy enough to give good yields in central Kansas. However, data from F_1 hybrids suggests that Tascosa is a promising donor of yield genes in crosses with adapted Kansas varieties.

Elita de la compansión de

We have now the opportunity to grow F_1 's between adapted and non-adapted wheats in the field. Crosses can be made in the greenhouse by pollinating adapted male-steriles with selected exotic strains. Growing F_1 's in the field might reveal some F_1 's of exceptional vigor, but these F_1 's would usually be male-sterile or nearly so.

CONTRACTOR OF THE

We can carry this idea one step farther. Suppose we cross a group of exotics on Bison male sterile in the greenhouse in sufficient quantity to grow F_1 plots in the field. Inter-plant these F_1 field plots (in an isolated area) with a fertility-restoring pollinator such as Cheyenne restorer. Assuming the F_1 's to be sterile the seed production from them after pollination by Cheyenne restorer would form the basis for a yield trial. On trial would be a series of 3-way crosses: (exotics x Bison) x Cheyenne. Genetically these would be 50% Cheyenne, 25% Bison and 25% exotic. A three-way cross with high performance would suggest that the particular exotic involved is contributing something useful to yield. We would be seeing the effects of different exotic donors in a uniform genetic background, the 75% contribution of adapted varieties.

a silvana vena a filo e la la filo en la grafa care la filo para la sur para la care della

us proper de escolo en la compaño de la fina de la compaño de la compaño de la compaño de la partida de la comp O de la compaño de la comp De la compaño de la compaño

and the second of the second o

en tourist la la carrière de la car La carrière types de la carrière de

Andreit American estár a contrata de talencia de la

The same of the state of the same of the same

RELATION OF THE THORIEST CHARACTER GLAMA OF METAL AT RELAM TELEVISOR FOR YIELD IN WHEAT Of the national

_ _ _

D. R. Knott

In Canada we seem to have a particularly difficult time combining high yield with high milling and baking quality. Both are complex in inheritance and are difficult to measure until fairly advanced generations when material is reasonably homozygous although early generation testing shows some promise. Under normal breeding procedures, by the time testing is started the number of lines has been reduced to the point where the chance that one will be both high yielding and high quality is relatively low. To get around this we are trying a system as follows:

- the sign has a library gardeness? For analysis a co-saving eligning requisitable perspects of a term to make a **l**ibra**Make a crossiin athe greenhouse in the sfall** is singular action

has no de mon finise empérares give give de la rist de la central limien. L'iche

- in the greenhouse in the spring and the spring and
 - 3. Grow the F₂ population in the field during the summer and select for the more heritable characteristics such as theight, maturity, plant type and disease resistance.

isitéri.v elembé saggia citra acasa di comporti de le

- and not seed the control of the seeds from each F2 plant and plant very thickly in the greenhouse in the fall (the number of seeds taken from one plant depends on the population desired.)
- and plant in the greenhouse in the spring. The bound beauties
- 6. Grow F₅ rows in the field. If desired frequent checks can be planted and yield measured. An initial protein analysis can be done on the seed.
 - 7. A preliminary yield test is then run on a fair number of faires the following year.

The material will not always be completely uniform but further purification can be done on the promising lines.

Much of the difficulty in breeding for yield could be overcome if we could develop an accurate method for measuring the yield potential of early generation material, particularly F_2 plants. Some years ago we tested the effectiveness of visual selection in F_2 plants spaced a foot apart each way. Yields were tested in the F_3 and the regression of F_3 plot yields on F_2 plant yields calculated. "Good" F_2 plants did give higher yielding F_3 's than "poor" F_2 plants did, but the F_3 ranges were not greatly different. The regression values varied considerably but were mostly positive. For several crosses the F_3 plot yields increased about 1 gm. (on a mean of about 250 gms.) - not a very useful amount.

Recent tests with various foreign varieties on the Canadian prairies have indicated that considerably higher yields are possible. Whether high quality wheats with the same high yield potential can be produced is an open question at the moment.

THE REPORT OF THE PROPERTY OF

netropo se a malenda escar los localestas escar los estados en los estados en estados en estados en el estados Escapações de la estada estado en entra en entre en **(Abstract**) está estado de teneros estados estados en estad

of this granter as a late because of the strain areas of

e en en massi su la companie la la colosia de la color de la color de la color de la coloria de la coloria de l

J. A. Wilson

Carter Borre Mit

Probably most breeders working with wheat observe some weaknesses in their procedures that could be corrected or alleviated provided the "proper equipment" were available. The deficiencies may be in the slowness of hand operations or inefficiencies in the equipment being used. Equipment utilized in a temporary manner sometimes becomes a permanent feature of a procedure. Recurrent improvement of technic through adapting improved equipment should be the philosophy of progressive wheat breeding programs. No one should feel that they have the ultimate in equipment, but rather seek the best available with an open-mind towards change.

Early generation improvement methods should yield useful information even though simplicity and speed are emphasized; yet, in later generations methodology must give more emphasis to accuracy. Generally, it is difficult to obtain both, and a compromise is inevitable.

on a tanona to graph when a tender of a community

The need for acquiring equipment must be determined by "cost-effectiveness-analyses". A new piece of equipment may do the same job more efficiently than 20 men or an out-of-date implement, and thereby, be economically justifiable. If the new equipment is only slightly better, it should be analyzed as to the number of years of savings required to pay back the extra or original investment. If its "payout" time is 10 years or more, it may be a poor investment, especially of the expected life of the equipment is not long.

Recognizing the possibilities for improvement of equipment in a procedure is the $b^i g$ step in making advancement in technic. The more obvious simple needs have already been recognized and dealt with, but the more complex problems have been overlooked or ignored.

With the advent of hybrid wheat breeding, bagging equipment and procedures are required. Many procedures have been tried, but no superior bagging method has been evolved for management of a large field crossing program.

Small samples used in early generation quality analyses require cleaning. The large numbers associated with this type of program requires efficient cleaning equipment that is not now available. Also, seeding procedures are made more efficient by thorough cleaning of seed before planting.

Processing of head and plant selections through threshing to packeting is largely done by hand methods. Automatic equipment that thresh, treat and packet small head samples could be of great help in the breeding effort. New machinery must be developed to achieve this objective.

Seeding rate for nursery yield plots is largely determined by weight or weight based on seed number. Seeding on the basis of seed number would be more accurate, but some sort of seed counter which operates faster than the conventional types should be developed in order to count out all the seed required for each nursery plot in the yield trial.

mostly .5 .t

Nursery seeders that space-plant could be valuable in breeding programs geared to plant selection or mass selection in bulk populations. Some progress has been made with field-size planting equipment, but effort should be made in developing a practical nursery seeder.

Promising self-cleaning combines for both field and nursery plots are now available from Austria (PAM 150) and West Germany (Hege Plot Combine). However, a smaller size is still needed for combining single rows from among discard rows a supplement as a supplement to The Wheat Newsletter published every 3rd year as a supplement to The Wheat Newsletter could be useful as a source of compiled information on new wheat breeding innovations.

is ty geormative agreevenant methode stoud vield treid interention aven ansays wingdaudity and speed are emphasized, yet, in come generalises nathematogy much give mark emphasis, to requir to taily, they ordered to obtain both, and a congressive is inevigable.

The mase for acquiring equipment was the determined by "course of equipment was and do the teacher of equipment will be teacher of eactive as a teacher of equipment with the action of the course of

idenogaizing the postibilities for its coverent of solver taken of moderations on the coverence of the cover

Tick ik, idvent es kybrid wheat hreesing, bugging variousport and conference which have been accessable to the second conference with a second conference been evolved for image particular and conference the second conference between the conference conference between the conference conference and conference between the conference conference conference and conference confer

tind i mongles upod in evily goneration chaits solved to be the transfer of th

in secretary of head and plant catestana approximation of the constant of the constant of the constant packed and the constant of the constant

IS LACK OF EQUIPMENT A PROBLEM IN WHEAT IMPROVEMENT?

(Abstract)

408 1211 July 130 14

indicated in the Article State of Asserts of the Committee of State of Articles and the Articles of the Articles

Charles Hayward

Nurseries of commercial programs are becoming quite large and in most areas reliable labor is difficult to obtain. Of necessity, much of the plant breeder's time is devoted to routine tasks when it could more profitably be utilized in research areas and/or in handling more material.

Improved versions of present plot and laboratory equipment plus new more efficient types of equipment are needed.

The wheat breeder has a distinct need for quality equipment and tests which will allow him to evaluate materials at an early generation on small amounts of seed. This equipment and tests must give reliable and repeatable results which will be accepted by other plant breeders, cereal chemists, millers and bakers.

AND THE PROPERTY OF THE PARTY O

(b) A first the constant of presentations of a source of a continuent place of the expension of a constant of a

STATUSE OF EQUIPMENT: TO EXPAND WHEAT BREEDING PROGRAM

Walter L. Nelson

- bangweii -- frand

The wheat breeding program at Washington State University is dependent upon our ability to handle large populations from many crosses of diverse genetic backgrounds To get maximum exposure to disease and climatic hazards, wone or more plantings of early generation lines are seeded at as many as eight, locations. Each nursery site includes about 700 of these lines planted in duplicate, and in addition one or more plantings of late generation materials for yield data under that specific disease and climatic environment. Each of these locations involves 1 to 4 acres of land, and thousands of individual plots varying in size from one row 8' long to 4-row plots up to 40 ft. long. Seeding conditions vary from ideal to extreme, often requiring deep seeding to a depth of six to eight inches. Distance to sites varies from 50 to 250 miles with some sites requiring as many as four trips to include date of seeding trials. These sites are in addition to our ten regular locations for regional and state yield nurseries, the large populations of breeding material at the Pullman and Lind, and the special nurseries for the extension service.

The key to this program is two special planters, three specially equipped trucks, and cultivating and spraying equipment adapted to plot work. One eight-row planter was built and developed by Dr. O. A. Vogel. Using the same planter head, another 4-row deep furrow planter with adjustable row width was built at the Dry Land Research Unit. Each 4-row head of these planters has the capacity to seed 1000 to 3000 rows per hour depending upon row length. Each plot can be a separate row or any combination of rows. Seed is put up and stored in plastic boxes ready for planting whenever seeding conditions are favorable for study of the particular disease or environmental response, and can be planted by either planter. At two locations in 1967, two plantings were made with each planter.

Weed control is accomplished with a special 8-row roto tiller cultivator for the 8-row plantings and also with small roto-spade type garden tractors for grassy weeds. Spray application of Bromoxinil during the fall and early spring has been very effective for broad leaf weeds, especially those hard to kill with 2,4-D. These applications are put on by small sprayers designed for fast and efficient plot application.

The mechanization of harvest has not been adequately solved. The Dry Land Research Unit has used a plot combine for ten years. It has been satisfactory for the harvest of 4-row yield plots, but is limited to about 300 plots per day. Dr. O. A. Vogel is working on a harvester that should add materially to the efficiency of plot harvest.

Through the use of highly mobile special equipment at Washington State University, we have been able to screen very large populations of breeding materials under natural disease and environmental conditions in the field. At the present time a uniform set of entries was planted at locations permitting screening under natural infections of snow mold (Typhula and Fusarium), Urocystis flag smut, Cerosporella root rot, Fusarium root rot, and Cephalosporium blight disease. Next year one or more plantings will be made in Ophiobolus infected soils. Close cooperation with the plant pathologists is maintained for obtaining desirable new breeding materials, evaluations of segregating generations, and to increase, improve or develop disease epidemics.

One of the most rewarding benefits from this program is the discovery of new sources of resistance and or new levels of tolerance to some diseases from crosses made for other purposes. To mention some, our flag smut nursery revealed high resistance to Wanser, much better than either parent. Some of the new short strawed varieties show good levels of tolerance to root rot, when both parents were highly susceptible. The variety McCall was released after tests in snow mold nurseries indicated better tolerance than an equally high yeilding sister selection Wanser. This is the bonus we get from exposing the uniform sets of populations to many different disease and climatic conditions.

The success of the wheat breeding program at Washington State University is the result of close cooperation among State and Federal personnel in Agronomy, Plant Pathology and in the Wheat Quality Laboratory. Equally important is the support of the wheat industry of the state which has financed much of the cost of the new equipment and puts about \$100,000 into the wheat research program each year.

(a) The control of the second of the control of

In the problem of the control of the problem of the second of the control of the co

avan japa ku kutu juli kuti ili vaetaan lin odki aaska nefte laabin kutika.

orogenidend voi dairamis se**vacuum:Operated spāce sēeder** (adi võigevate - anal astroop agrad gram asamas om miso robod ovati ox "viikvovi it a mode

eccir of found a public of active of will tame in a fact of the rest of eccir of found a public generator restricting arbitract to be made sow the company of the sound public sound of the company of the company vacuum operated Seeder suitable for seeding wheat

-area introductiving bor according to rush a setup aistrop of guitas of Ro

kernels individually has been constructed. Four seeder units were mounted on the lift system of a small 4-wheel tractor. The vacuum operated seed selectors are similar to a prototype developed by I. C. Sweetman in New Zealand.

The seed selector reel consists of a 2-inch diameter steel shaft with eight holes drilled radially to accommadate Luer-loc hypodermic needle adaptors. Hypodermic needles of a suitable guage were shortened to about 1/4-inch so that the distance from the tip of the needle to the shaft is a standard length. The selector reel shaft was drilled axially to accommodate a brass vacuum head of 1 1/2-inch diameter. The vacuum head was drilled axially for vacuum and pressure connections to a groove around the circumference of the vacuum head. The groove was blocked on each side of the pressure connection. The selector reel revolves around the stationary vacuum head. A kernel becomes attached to each needle by vacuum as it revolves through a seed hopper. Each kernel is ejected from the needle into a seed tube as the needle passes over the pressurized section of the vacuum-pressure groove.

The seed selector mechanism was mounted on a flexible type corn planter unit available commercially. The seed selector is driven from a combination press, drive, and guage wheel. Seed spacing can be regulated and varied in a wide range by varying the sprocket combinations of the drive system.

A rotary type vacuum pump driven from the fan shaft of the tractor is used to supply vacuum. Exhaust from the vacuum pump supplies positive pressure for ejecting kernels from the needles and for cleaning the needles.

The precision of plant spacing obtained with the seeder is not perfect, and occasional doubles and misses occur. Precision of spacing is affected by the amount of vacuum, guage of needle, cleanliness of seed, and position of the seed hopper. With clean seed and proper adjustment, the precision of plant spacing is adequate for most purposes.

IS BREEDING FOR MILLING AND BAKING QUALITY AN IMPEDIMENT TO IMPROVEMENTS IN OTHER AREAS?

E. G. Heyne

13 to 10 m

is a firm to the control of the cont

the field to the second at the control

We can say that nearly all characteristics of applant species being used for economic use are or have barriers in relation to other characters in the improvement of the species by breeding. In fact that is the task at hand for the plant breeder to overcome and should be viewed as a challenge. We cannot consider any one character without consideration of other characters.

In plant breeding programs we are not interested in the status quo even though we use procedures that do not effectively allow us to transgress from the present model of the species under cultivation in a local area. A minimum objective can be stated as: The new cultivar should be equal or nearly so in all important characteristics to the one it is to replace and exceed the old cultivar in one or more important characteristics.

Charles as the control of the rest of the second

As we need to consider the whole species there is bound to be some interference of one character with another. For example, to be of practical value, a cultivar bred for high yield must also have a stiff or strong stalk. Some compensation for both characters may be necessary if the total objective is to be reached, and it rarely is the first time so another attempt will need to be made. Thus breeding becomes a step-wise manner of achieving the goal.

of professional for the continue to the passent of the contraction of the contraction of the contraction of the

Wheat is used primarily for food and has many qualities for this purpose; it stores easily and for long periods, it can be used in a number of different ways and is a relatively nutritious plant food with above average protein content in relation to other cereal foods.

Quality, in its broad sense, should have the number one priority for the breeding objectives of wheat for the Great Plains. With proper equipment and large enough populations breeding for high quality does not offer any more impediments to wheat breeding objectives than other characters in relation to its importance.

A safeguard to breeding any species is to insist on an integrated program where all the characteristics are carefully evaluated in relation to the whole. We should avoid one-level, one-idea approaches to wheat breeding. The idea of impediments can be mind-made stumbling-blocks and I believe that with proper genetic engineering we can develop a better wheat plant in relation to all important factors of the species.

YTT BARRIERS TO THE IMPROVEMENT OF WHEATS YOU THE STREET OF STREET OF THE STREET OF TH

L. D. Sibbitt

E. G. Rema

Is breeding for milling and baking quality a barrier to wheat improvement? Possibly yes anto a degree of However, as we sunderstand, there is not shortage of wheat in the world, but there is a shortage of quality wheat. At the recent? C.Q.C. Wheat Quality Conference, held in Minneapolis, Dr. Gilles presented a paper entitled "Wheat Quality - A.Vital Factor in Marketing Upper Midwest Bread Wheat and Durum". Most of the text is relevant to this question, But, of course, time does not permit another presentation of this timely article, however, I would like to quote a few pertinent sentences taken from it which are as follows:

so transgrees from the pre-ent wo del of the spitcies under beitificates "The traditional markets for hard red spring wheat and durum produced in the Upper Great Plains region of the United States have been the domestic markets of the United states", and "Inasmuch as per capita consumption of wheat in the U.S. has remained relatively constant for a number of years, the potential to sell increasing quantities of wheatalies primarily in the export markets. "A "In most of the countries of Western Europe, the vitreous shigh protein common wheats and durum wheat have acceptable quality for pasta products cannot be produced: " Because the consumers in the Common Market countries prefer pasta products made from semolina 1t would seem very realistic that a substantial market for durum wheats will exist in Western Europe" 30The importance of spring wheat quality in the export markets appears very significant, particularly when one considers current market trends in Europe where increased local production is a rising deterrent to TU.S. exports: One observes that during the current marketing year, exports of hard red winter wheat are down about 50% or In the same period, however, the exports of hard red spring in the European markets have increased by about 35,000 tons over the previous year. It is the feeling of many that this is due primarily stolether fact that the quality of the hard red spring wheat currently being delivered to the European markets has desirable quality characteristics "Throughout the world, wheats produced in the Upper-Great-Plains regions of North America are prized for the quality and quantity of their proteins" "In my opinion, one of the quickest ways for the Upper Great Plains region has a to lose its wheat market will be to lose sight of the need for quality".

The little will be a little of the little of the little weeks or of the weeks or of the second or of the second or of the second of the little weeks of the little of the

a transfer of the recipies innothings him of motoring mindering another as refer

بالصف

Other Barriers

Lack of exchange of material and information on the part of plant breeders with each other and with the cereal technologists.

- a. Potential new HRS wheat varieties from other states which have shown promise from a quality standpoint in preliminary tests should be in N. D. station Field Plots for at least two years (ND produces over 50% of the U.S. spring wheat crop).
 - b. Proper quality conclusions cannot be formulated on the basis of one year's test.
 - c. A situation might arise if a neighboring state were to release a variety and we (in the area where it would be grown to the greatest extent) would not have sufficient information to either recommend or reject it.
 - d. The Uniform Regional Nurseries are very desirable plots. But they are still Nurseries. We would like to see plots where we could get about 5 lbs. of wheat for milling, baking, physical dough and biochemical tests.

Lack of Personnel and lack of Equipment.

- a. These two usually go hand in hand both are necessary for an expanded research program.
- b. New modern equipment.
- c. Updating old equipment.
- d. Newer processing techniques in quality evaluation.
- e. Need for trained people knowledgeable in Cereal Chemistry and Technology (more jobs than trained people at present time).

Lack of a good single determination for quality.

- a. Studies should be made to see if such a test can be devised.
- b. All laboratory tests will tell something about quality but none so far will give an adequate and reliable measure of overall quality.
- c. Possibly examine these tests:
 - 1. Flour Disk Reflectance as a measure of Breadmaking Quality (R. M. Johnson)
 - 2. Pelshinke Test (modification to suit HRS wheats)

ระสมพัชธ์ ชอสสด

Early generation testing on a "go" or "no go" basis.

Analy to true out to mailiantain ben is and to agminist to seminate to well as Might be tied in with preceding Item. do to did we exerce to

Potentjal nev.**bezu edejdym serubesorg gnistika** st.**d** sofeth bave, store promise from a quality standpoint in jos likingry

c. Recognition of the fact that to be effective; quality control decisions must be firm. (Get rid of the dogs)

Use of Fertilizer and Irrigation Plots
where the common contentions at those requirements of temperature and temperature and the common contentions and the common contentions are the common contentions.

a. Can we reduce the number of years of testing if, during one year, we tested under fertilizer conditions or

intodefirifation candino a solution of the continuous c

The Cadica Regions Dursertes are vary destributed at the Cadical Addition of the Cadical Cadical Education of the Cadical Cadi

lick of Personnol and Lack of Mondaner.

- a. These two unually so hind so hadd both or mandr say dor so ampanied racion the program.
 - har bedath equipments
 - rs. Updertag old equipment.
 - andfolgetiles yoursely as a coplandopa galon works arrest the
 - c. Need for stained people knowledgeable to do due Chédialis.

 sol Ledmology (norm john that réduel née, le chippeness.

 com

. wallery not colsimilarised signal bong o to in i

- concrete of not be distributed to be able to be able to be considered.
- b. All lober that posts will bell something cheme contain los e come of interior posts of adequate and estimical extension of posts of a contains and contains and contains.
- a. Poer bly v nashalved energy i. Flore visit Schietziagel as a medamine elleten riskaling spaning 'A. Folden and Schietziagel 'A. Ivishindis Teat (Ledictrate se sett MRS selents)

WHEAT QUALITY CONSIDERATIONS IN BREEDING PROGRAMS AND THE
USE OF EARLY GENERATION SCREENING TESTS TO IMPROVE
PROGRAM EFFICIENCY

Evangelina Villegas, Norman E. Borlaug and Charles F. Krull

It is our contention that breeding for good milling and baking quality need not necessarily impede progress in the development of higher yeilding varieties.

It has already been pointed out that in the Mexican program concurrent improvements are being made in developing higher yielding, broadly adapted varieties with improved agronomic type, improved disease resistance and improved milling and baking quality. Neverthe-less, in the vast majority of the wheat breeding programs in the Americas such concurrent improvement is not being accomplished. Improvements in grain yields have lagged. The result has been that the wheat breeder too often unjustly blames the cereal chemist for setting quality standards he cannot attain while simultaneously increasing grain yields and improving other important characteristics. Too often breeders have resorted to the use of long backcross programs, to avoid problems with quality, but by so doing they have simultaneously greatly reduced the possibility of increasing grain yield.

Although we feel that the breeders are in part justified in their criticism of the inflexibility in grain quality standards, as explained in the following paragraphs, we nevertheless feel that many of the quality problems encountered by wheat breeders can be circumvented if an adequate series of early generation screening tests for quality are employed.

Before going into an explanation of some of the screening tests for quality that have been used successfully in the Mexican program, we wish to call attention to some of the overall considerations that influence wheat grain quality and wheat's present and possible future position in competition with other cereal grains in both the domestic and the international markets.

Certain factors affecting grain quality have been at work in the past which have provided a definite advantage quality-wise and market-wise to wheats from certain regions and countries. We feel that this "status quo advantage" is about to be broken because of breakthroughs in genetic improvement. If the heretofore "privileged regions" (quality-wise), such as the Northern Spring Wheat Regions of the U.S.A. and Canada, remain complacent, they will lose their unique market advantage.

State and the state of the stat

Viewing the cereal grain markets broadly, everyone working in wheat research, wheat production, wheat utilization and wheat handling and industrialization, should be increasingly concerned about wheat's position in the future. Increasing competition from other cereal grains in international markets is almost certainly forthcoming.

The discovery of the Opaque 2 gene which greatly improves the nutritional value of corn, posses one threat and challenge. What are we doing about improving the nutritional value of wheat through genetic manipulation? Very little is being done up to the present time. Is the effort adequate?

Recent research breakthroughs such as the development of high yielding, broadly adapted semi-dwarf rice varieties IR 8, (bred by the International Rice Research Institute) will calso bring wheat under greater competition in the grain markets of the world, what are we doing about this? Unless we increase yields and maintain, or better yet improve wheat quality, wheat will price itself out of its fair share of the expanding world grain markets within the next two decades.

What are we as wheat scientists going to do about these challenges in the next two decades and the bearing the constant of the second trade who is guille produced as a final constant of the constant of the

Competition between Different Wheat Chasses in Domestic and International Markets; and between Wheat and Other Cereals

The hard red spring wheat regions of the U.S.A. and Canada have traditionally occupied a favored positional the domestic and international wheat markets of the world. Their favored position has been attained because of:

1. The outstandingly good protein quality of the principal commercial varieties and add and for own deposits.

The varieties Red Fife, Marquis, That cher and their derivatives were bred and selected for their excellent milling and baking quality. The unusual combination of strong well-balanced (extensible) spluten strength has been their outstanding feature. This genetic superiority has been maintained for the past forty years by effective breeding programs.

The control of the distance of the control of the c

This important advantage is the result of the interaction of climate and soil conditions under which the Northern Hard Red Spring Wheat Market class has been grown. Scientists up to the present have contributed nothing to this advantage. In the future, however, the high protein advantage of northern spring wheats will come under increasing pressure and competition both in domestic and international markets as the result of increased grain protein content in wheats from other regions and other exporting countriess and advantage of the responsibility of the seased grain protein content in wheats

In recent years it has been shown that the Frondoza or Atlas 66 high protein gene can increase grain protein content by 2 percent. This action is independent of grain yield. The incorporation of this gene into high yielding Hard Red Winter Wheat varieties will make this winter wheat region more competitive with wheats produced in the hard spring wheat region.

រំលើលថា កិច្ចការ៉ាយ យក្សី ក្រស៊ីប៉ុន្តាម ប្រសាធន៍ ខ្លាំងក្រសួងនៅ ប្រធានធ្វើ ប្រសាធន៍ ប្រធានធ្វើ ប្រធានប្រធានប្ ក្រសួន សេសស្នាស់ សេស៊ីស្លាស់ សេស សេសសាស្រី នៅ សង្គារ៉ាប់ពេល ពិសាធន៍ សេសសាស្រីប៉ុន្តា ប្រធានប្រធានប្រធានប្រធានប Aggressive agronomic research in the winter wheat region, which is currently largely lacking, designed to determine the best timing, rates, kinds and methods of nitrogenous fertilizer application will probably contribute to further increasing grain protein content in the foreseeable future. Progress through this approach will further erode the grain protein content advantage of the hard red spring wheat class.

1941, many last poor last and taxaeth language into benefit quill

The protein quality (especially strength) advantages of spring wheats over winters will shrink in the future, as breeding programs in the hard red winter wheat region increase their effort to correct protein quality defects. This effort is already underway in a number of breeding programs, both hybrid and conventional. The gluten strength of Mexican spring wheat varieties Jaral 66, Tobari 66, INIA 66, CIANO 67, and an especially promising line from the cross II22429, (Tezanos Pintos Precoz-Sonora 64A) (Lerma Rojo 64A x Tezanos Pintos Precoz-Andes dwarf) are already being incorporated into hard winter wheats in a number of different U.S. breeding programs.

Eventually the genes controlling high levels of grain protein and better protein baking quality (strength) will both be incorporated into high yielding hard winter wheat varieties. When such varieties are grown under proper fertilization they will be fully competitive market wise-with the hard red spring wheats.

We have reasons to believe that improvements in gluten (protein) strength will be forthcoming soon in French winter wheats. Similar improvements, through breeding, are under way to improve the protein quality of eastern European and Russian winter wheats.

Another change that will be forthcoming to further complicate the export position of Canadian and U.S. Hard Red Spring Wheats relates to the development of high yielding semi-dwarf hard white spring wheat varieties. No such variety exists at present.

Hard white wheats with strong gluten are preferred by all wheat consuming countries from Morocco to India. They are especially desirable for use in Chapattis in the Middle East countries. Currently the development of semi-dwarf, hard white varieties is well advanced in the Mexican, Indian and Pakistan breeding programs.

All of the forementioned predicted changes from breeding and agronomic research efforts already underway in the U.S.A. and in other countries will indirectly exert pressure on the current economic advantages of hard red spring wheats in the world markets. This is no time for the hard red spring wheat programs of the U.S.A. and Canada to be satisfied with "status quo quality and grain yield".

The Use of Early Generation Screening Tests for Wheat Quality in Breeding Programs

Screening tests are simple tests that can be made rapidly and in large numbers on the small grain samples from individual plants to eliminate undesirable and worthless materials from a breeding program. They are not tests which are to be used for choosing the line that is to be multiplied as a new commercial variety.

The final choice of a superior line which is to be released as a new commercial variety must always be made by a series of well controlled milling and baking performance tests. In such performance tests, the promising new advanced lines are carefully compared to the best commercial varieties to determine their suitability for specific consumer product (i.e. pan type bread, pastries) crackers, etc.)

The purpose and proper application of these two very different types of tests inbreeding programs is frequently confused by both cereal chemists and plantubreeders. Animal live grounds above the confused which can be a constant and set of

Breeding programs which restrict quality testing to the milling and baking performance tests, however, greatly reduce their efficiency, since such tests cannot generally be made before the F5 and F6 endosperm generation. This means that many inferior, worthless lines are carried forward in the program for a minimum of two years. This is a waste of time, energy and money:

Five years ago, after two years of exploratory evaluation, a series of early generation screening tests for quality was adapted for use in the Mexican program. These tests combined with the standard milling and baking tests in the advanced generations have been highly effective in improving the quality of the new wheats currently emerging from the Mexican program. The newer varieties INIA 66, Tobari 66, CIANO 67, Azteca 67 and Bajio 67 and many other even more promising lines in final stages of evaluation, are products of these methods.

The quality tests currently being used by the Mexican program differ primarily from those in use by other programs in North America in the way the plant materials are handled in the early segregating generations.

The preliminary screening tests for quality, are conducted on grain from individual plants in the F3 and F4 endosperm generations. Secondary screening tests are added in the F5 endosperm generation. The secondary screening tests complemented by standard milling and baking tests are used on F6 and succeeding generations.

The type of test that can be used in preliminary screening is governed by the size of the grain sample and the number of individual plants that can be analyzed in the two to three week period between the harvest of the winter generation and replanting of the summer nursery. All preliminary screening tests must be conducted on an individual plant basis. Under our conditions each plant produces from 5 to 20 grams of seed. Three grams of sample are currently used in the preliminary screening tests. The remainder is used for replanting. From 5,000 to 7,000 individual plants are evaluated at each of two locations in each generation. Approximately 300 plants are evaluated each day. Generally 65 to 75 percent of the individual plants that are analyzed are discarded.

In the secondary screening tests between 300 to 500 of the most promising lines are evaluated each generation. Approximately 30 samples can be analyzed each day. Three hundred grams of sample are needed for these series of tests.

Only those samples showing good promise in the secondary screening tests and in the final milling and baking performance tests are indicated in Table #1.

The Implementation of Quality Tests in the Mexican Breeding Program

Quality evaluations are not only used on lines under development in the breeding program but also for classifying the quality characteristics of each potential parent. This is used as a guide in planning the new crosses that are to be made each season.

In early segregating generations of crosses — the F_3 and F_4 endosperm generation — the preliminary screening tests are used exclusively. In these tests major emphasis is given to grain classification tests and to Pelshenke values (Table #1). The grain tests eliminate all lines that have poor kernel characteristics, which are likely to result in low grain test weight, high flour ash and low flour yield. The grain tests evaluate samples for grain size, plumpness, texture, vitriousness and color.

The Pelshenke test is used in the preliminary screening tests as a crude measure of gluten strength. It will separate weak wheats from strong wheats. It will not distinguish however, the strong "bucky" types from the well balanced strong types.

Mexico generally grows soft wheats, hard wheats and durum wheats in adjacent fields. There is no regional or geographic separation of wheat production by market classes. It is therefore absolutely necessary to use the preliminary tests - both grain and Pelshenke tests to identify the different market classes. The plants (lines) under study as potential soft wheat varieties must have large soft textured kernels and weak elastic gluten characterized by low Pelshenke values (i.e. 30 to 45 minutes like Lerma Rojo 64). The plants that are saved for the potential development of hard wheat varieties must by contrast have high Pelshenke values (120 to 180 minutes like Sonora 64 or INIA 66) plump, hard textured and medium sized kernels that are readily distinguishable from the soft wheats.

Distinguishable kernel types associated with corresponding gluten types are absolutely necessary to avoid mixing between soft and hard wheats in marketing.

Occasionally in outstanding crosses, involving a soft and a hard wheat parent plants in the ${\rm F_3}$ endosperm generation with intermediate Pelshenke values (i.e. 70 to 100 minutes) are kept. Such plants are generally heterozygous for both grain type and gluten type. They will segregate in the next generation into both soft and hard wheat types.

The secondary screening test which is considered by us to be of a greatest value for identifying outstandingly promising soft and hard wheats is the Alveogram test. The Alveogram "W value" is a general measure of gluten strength. Wheats with W values above 400 are considered strong wheats, whereas wheats with less than 250 are considered soft wheats.

Paly those supplies seading give propies to the normally or carefully

Table #1. Quality Tests Employed and Properties Studied by Mexican Wheat Program in Different Endosperm Generations

The Text open stien of finitury Texts in the leaful and the series and the series of Preliminary Secondary Performance To make the transfer of the said Screening tale but Screening bear milling & when I gain only a section of Tests of Language Tests of the Baking Tests incomes copsises that type on telepade pade page. The of the of the of the content of 310 ff4 the touch he F5 hanks years ut F6 . To delike besmute disej gradene koresta (est e ett esti och erdise tedlig test A & Grain Properties: air ; of nevity at attackyme reque suces a vali world 1. Plumpness stand Xisay X-d . (It sid XI) sometime site of For the 2 , Size by the second $\hat{\mathbf{x}}$ by $\hat{\mathbf{x}}$ because $\hat{\mathbf{x}}$ because one one where where will resture well well the result diship to result diship to the result of the rate crainals symplear grain sing plyanguas , indicate sing colors X 5. Vitreousness X X X 6. Test Weight X se Seb7. seProtein various Legisland bour ai Xeaa oxeadares ass X emply disposed and the sit , disposite points to observe week a Boschemical and to od falment meet son file if the mean great much " water types dien die will belended strong types!" Physical Properties consilit Pelshenke (wheat sook as a avery vilor our onexal was a traineal fermentation) on at each . which incompose or casseld the thirteen are treated the state of the carried process and the transfer of the second of the seco than the 2 distribute protein dod, - seem version is a version of visite x and ventra inuAlveogramie sit . . 2000. is navier tenseli in els vaitanoù ut security of Tests and the cartestage and a per literator of the a effect of ma) dw value of horizons, inches madely example x and from the x will born, and laby pygovalue" Lab older amount coldex or ox. We said the x. W. descripted of Mixogram detrov weeds found by trace X avol X all landes of X 5. Sedimentation as more (131 os Cal) as X av w x ave and a par X and ers នេះ 🖫 ក្រោយក្នុង Beach ការប្រាស់ ស្រុក ស្រែកបានក្នុង សេចប្រើ ក្រោយក្នុង 🛣 C Milling & Baking . Bakode the and small address track with on Performance Test 1. Demining the luminones anguitomes addrawing according The supproperties of home to grassoom gions here, and register will apertalist of ancert to They 2. Water Absorption X The Baking Test lovel server guillus later et willered seed X or in the second of the contraction and second and second second in the contraction of th 1/ Tests performed whenever line is first cut in bulk; in most cases this is in the F6 endosperm generation. However, in outstanding lines, after best plants have been selected individually, row is cut in F4 endosperm generation. and the states for their thirty outer county by prescriptions in a literature. one Typigan et en gosydd eith oaren eargearda ond yd 2769an bene

្នាល់ ការស្នើ គ្នាសំពីទៀត សំខាន់មានជាជាការប្រើបុគ្គការជាការប្រជាជាការប្រជាជាការប្រជាជាការប្រជាជាការប្រជាជាការប ការការប្រជាជាក់ ស្រាស់ សុខ ស្រាស់ សាល់ស្រាស់ ការប្រជាជាការប្រជាជាការប្រជាជាការប្រជាជាការប្រជាជាការប្រជាជាការប្

医受象链链的 医细胞 集线 线 拉拉斯夫

The Alveogram "P/G value" is the ratio between measured dough tenacity (P) and extensibility (G). The P/G and W values can be used as a guide to selecting wheats with well balanced gluten strength and extensibility in both soft and hard wheats. Wheats either soft or hard - which possess good balance will have P/G values approximating 1/100 of the W value. Wheats with P/G values higher than 1/100 are "bucky".

The P/G and W Alveogram values, supplemented by mixogram scores and sedimentation values determine which lines are worthy of evaluation in the standard milling and baking performance tests.

The correlations between various tests - both preliminary and secondary screening tests and milling and baking quality tests - together with the multiple regression of loaf volume (with bromate) on 4 independent variables for a group of 25 wheats varying from weak to strong gluten are shown in Table #2.

The data show that the Pelshenke value, which is the measure of gluten strength used in the preliminary screening test, is highly correlated with the Alveograms "W value", which is the principal secondary screening test used for judging gluten quality. It is also highly associated with mixing time, sedimentation, mixogram and protein. The Alveogram W value is in turn highly correlated with loaf volume (non-bromated). The correlation (relationship) between Pelshenke value and loaf volume as used in the Mexican program is therefore an indirect one via the Alveogram W value.

It is evident from the data in Table #2 that the sedimentation value is both directly and highly correlated with loaf volume. Therefore it could also be used successfully as a preliminary screening test. We, however, prefer to use the Pelshenke test as the preliminary screening test since it both lends itself better to small grain samples and permits the analysis of from 3 to 4 times more samples that can be evaluated in a given period of time with the sedimentation test.

The multiple regression involving loaf volume with bromate and the four independent variables indicated in Table #2 accounts for 78.1% of the variability for loaf volume. That is by combining only alveograph (both P/G and W) with mixogram and water absorption, we can predict loaf volume on the basis of the preliminary tests.

After five years of employing the aforementioned preliminary and secondary screening tests for quality we are convinced that these tests greatly increase the efficiency of our breeding program. They alone are not used for selecting the lines that will be released as commercial varieties. Standard milling and baking tests are used to make this final choice.

In the light of these data and results why are preliminary and secondary screening tests not employed by most plant breeders and cereal chemists?

Table 2.—Correlations between various tests for milling and baking quality and the multiple regression of loaf volume with bromate on 4 independent variables for a group of 25 wheats varying from weak to strong gluten.

17 300		The first and the second	A-4 / A 4 19 19			
					Feb. 8.1 1.25	
	Cor	relations (r);	a E E Da T			그 동생 등에 보는 그는 사람들이 되었다. 그 사람들이 되었다. 그리고 함께 하는 그는 사람들이 되었다.
	: : : : : : : : : : : : : : : : : : :	Smys			11 17 18 18 18 18 18 18 18 18 18 18 18 18 18	
		最高点想				
ئە	r is ble ble	4 3 3 0 E	ા જેવું જેલે કે કહ્ય			
		LM 5 0 45	- 4 4 6 5 5 E			
그 - 기를 기를	ក្រុម្មាធិ		er en kan iste dat de kan		$r_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r$	Multiple regression
√ Ø		Har G				
ا منظم المراجع المراجع المراجع المراجع المراج	: 3. 왕빛 유	- Tag 4 4 8 6		្រិប្រសិត្តស្នើក្នឹ		Dependent variables
T I		- 후 이 네 ~ 카프 ~ ~			1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	Loaf yolume with Bro3
	Go V G 😕	ૻ	11			781 - 781
Anny A			A-0 = 10		ા ં છું છે.	Constant term=-158:131
8. F		ને કે કે કે કે ક	- .5 . 5 . 33 . 1 . 1 . 1	7	္ ပ	4 "independent" variables
		S			- 5 등 달	Partial
45. 72	5 H D 4 B -					
<u> </u>	강성 회 # # 1	<u>d</u> d	O X	HIS SECTION AS A	်ီ မွ	
	The same that the same of the		H 3 3 H 3	SS STATE	ാ≊് ഫ്	coef.(b) d.f.=n-k-1=20
발 등 경기		Se but his first				(not significant)
Protein, Udy	្នប្ដឹក្	. 20	22 .27	40 2 .26 .21	.2419	-56,6592 -6.010**
P/G, micro		.52** .05		29 .45* .63**	.59**	1.0622 6.110**
II miner	プログログログロック	.16 60**	1,000	59** .84** .68**		-23.6822 -8.930**
W, micro	المناف المعافظ والمراف مؤاه المما	*** P1	4. 4. 4.	64** .71**		(not significant)
Mixogram		. 33				
Sedimentation	J. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	.18 57**	.31	367*		(not significant)
Pelshenke		.02 .27	.15 66**			15 (not significant)
Mixing time	, s , j , j , 4- ,	.14 333	.00 1 7 9 - 4			15.6639 2.834*
H ₂ O absorption		.12 .03		<u> </u>	- P _ \$ 3 3 1	(not significant)
Loaf volume, no		.31		그 봤지 않는 선생 등 등 등		
TOUT NOTHING, 110	, pro3			化双苯基甲基基基基基基		

^{* =} Significant at the 5% level

^{** =} Significant at the 1% level

DOES THE LACK OF KNOWLEDGE OF GENOTYPE-ENVIRONMENTAL RELATIONSHIP HINDER WHEAT IMPROVEMENT?

Abstract)

(Abstract)

(Some of the first of

K. B. Porter

This is a simple question with a complex answer. We might answer it with a simple yes or no, but the answer lies in just what do we know about genotype-environment relationships? I suspect we know more about genotype than we know about environment and more about each as separate identities than their relationship. Our failure to adequately define and our inability to place precise limits on environments adds to the complexity. We all are concerned with environments within an environment. Dryland and irrigation production in a single area represent two distinct environments within an environment while we all are familiar with year to year environmental variation at a given location. Not only are we unable to predict our local environment more than a short span of days in the future, we can't be too sure of changes in the Earth's climate. Just recently meterologists reported that, since 1950, the average temperature of the earth has declined to the cold level of 1900 and forecast shorter summers because of air-pollution. On the other hand, weather control research may eventually permit us "to do something about the weather". Environments are not constant. Temperatures, humidity, light intensity, wind, rainfall, length of growing season and other climatic factors are variable, uncontrollable and not precisely predictable. However, soil type, soil fertility and with irrigation even soil moisture to a degree are stable, controllable, and predictable. Rate, date and plant spacing, and other cultural practices which could be included as integral parts of environment, may alter genotypic responses.

What kind of a wheat plant do we want? Isn't it one or many genotypes, sufficiently flexible to make a maximum response to favorable uncontrollable components of environment, insensitive to unfavorable components but with sufficient genotypic or phenotypic specialization to make maximum response to controlled high level production factors? Can we breed wheats with both general and specific adaptation? Pawnee, Scout, and spring wheats from Mexico suggest we can, within limits, do this. But must we rely on the empirical evaluation of genotypes over a wide range of environments or do we have enough knowledge to use more sophisticated methods? If so I should be able to answer such questions as:

- 1. Can we develop winter wheats for August seeding and grazing and maintain the grain potential of genotypes specifically adapted to October seeding and grain production?
- 2. Can we develop winter wheats sufficiently hardy for the extreme winters that have a maximum potential in years when survival is of no concern?

- 3. Can we select for resistance under heavy rust infection and maintain yield potential in the absence of rust or do we fail to see the wheats because of all the rust spores?
- 4. What is the relationship between photo-period insensitivity, growth habit, winter hardiness and temperature response?

There are a lot of questions we could ask ourselves!

Vavilor described the potential of the wheat plant quite well. First he said, "Although wheat in general appears to be a plant with varieties which are comparatively specialized, nevertheless, in many ecological types there is observed a high degree of ecological plasticity", and secondly, "For the final improvement of wheat great and decisive significance rests in the planned use of the world diversity of wheat".

To state the question somewhat differently, "Does the lack of knowledge of genotype-environmental relationships prevent us from making planned use of this ecological plasticity and diversity in wheat improvement?" or was gain told and is solded by payment and calleged for completionals state and the construction of the construction was about leasening of dract via all engages in the come and of their beo and the second contract and the contract of in the case for the second control of the book control of the control of the control Survived Summer because of the paid ories. The end offer bone, and the who were a transfer to but a contract village may a few decreases command weakling to the professional along page and been adjusted. The third to we high lacametry vind, earnfull, lagua of groving Alexan ond waiter citaratia fuctura ara majbelia, tucombarliciti und pol procingipa Mittable. Rarrage, and type, soit feathless on with configurate sang Ara pendidikang is padisto ora esagob a or exclance liber savi laronia, rodec inc., paroce imit, ben adolo, earl . sidodulo gues problem in rithing restaurables helicinai en Lless limby escibilists Land and the Societa state of the Control

The symmetry of the start of the symmetry of t

- granding and goldens are the velocity that it describes a respect of the following proposed of the first and the following proposed of the first and the fir
- In Can we devote, wanter whomis antificiently agree buy the earth about the earth about the earth about survivers that the carth about survivers that of the carth about survivers the of the catangle.

47.4.7.4.3.4.4

DOES OUR LACK OF KNOWLEDGE ON GENOTYPE-ENVIRONMENT RELATIONS HINDER WHEAT IMPROVEMENT?

(Abstract)

I. M. Atkins

I would simply like to raise the point and ask the question; Are we growing the best type of wheat plant for our environment? Could a more efficient type of plant be found or developed? I do not know the answers but will cite a few examples where changes have brought better yields.

Carleton, when he introduced the durum wheats, was sure that they would find a place in Kansas - but they did not. Kansas grew spring wheats, durum wheats, soft wheats and all were unsatisfactory. Even though Kansas is now the number one wheat state, as late as 1889 a bulletin was published by the Kansas Experiment Station on "Arguments for and against growing wheat in Kansas".

The introduction of the hard red winter wheats into Kansas by Mennonite settlers solved the immediate problem in Kansas and in the Southwest and established wheat as a successful crop. Today we essentially are growing the same type of plant that was introduced in the 1870's. Could this be improved in some way to make it even more successful, at least for specific areas?

Orville Vogel led the way for most of us, and has been more successful than most of us, in thinking of a different type of plant for the commercial wheat crop. This new type of plant has now also been unusually successful in Mexico and from there to other neartropical areas.

A very striking example can be cited in rice. Texas grows more rice acreage than any state, yet light conditions along the Texas Coast are much poorer than in California and Arkansas. For many years average yields in Texas were the poorest in the United States. With horse drawn machinery, rice average yields in 1920 were only 1,530 pounds per acre. With mechanization and increased fertilizers the yield had risen to 2,400 pounds in 1950. A team effort of research people at our Rice Research Center at Beaumont from 1950 to 1967 have laid the groundwork, extension people have carried the word; and an educated, high type of farmer has brought average yields to 2,400 in 1960, to 4,000 in 1965 and in the past year to 5,004 pounds per acre. Texas yields in 1967 were 27% over 1966 and greater than those of Japan and other intensively cultivated areas.

TO EXTREM TO EACH TO THE TOP DESCRIPTION TO THE TOP TO

How has this been brought about? A steady stream of improved varieties which have solved many of the hazards of production; plus the most efficient fertilization, weed control, insecticides, fungicides, cultural methods, etc. Plant breeders produced first improved standard varieties. The rice plant approaches a perennial in habit. By producing very early varieties, plant breeders now have adapted types that can be harvested in July, flooded and fertilized and a second crop harvest in October. They are now changing the plant type to one with erect narrow leaves which do not shade each other and therefore more efficiently utilize the sunlight. They are also "taking apart the leaves" so to speak to find which color of leaf is more efficient in manufacturing plant food.

Maybe we should take a look at our wheat plant? He is seen the second of the second of

្រៅ ប្រជាជាស្មានប្រជាជា ស ស្ថិត្ត ប្រជាជាសិក្សា ប្រជាជាសិក្សា មានប្រជាជាស្ថិត ប្រជាជាស្ថិត ប្រជាជាស្ថិត ប្រជាជាសិក្សា ប្រាជិសិក្សា ប្រជាជាសិក្សា ប្រជាជាសិក្សា ប្រជាជាសិក្សា ប្រជាជាសិក្សា ប្រជាជាសិក្សា ប្រជាជាសិក្សា ប្រជាជាសិក្សា ប្រជាជាសិក្សា ប្រជាជិសិក្សា ប្រជាជាសិក្សា ប្រជាជាសិក

High Court cond on I had am and select for the condition of the Indian Court of the select of the condition of the select of the

controlled to the control of the control of the conditions of the

DOES OUR LACK OF KNOWLEDGE ON GENOTYPE-ENVIRONMENTAL RELATIONS HINDER WHEAT IMPROVEMENT?

Charles F. Krull and Norman E. Borlaug

As many know, our group does not have much respect for variety X location interactions. Such interactions do exist and can be measured, but we feel that varieties can also be developed that are consistent in their performance.

Such an opinion is not based on a few academic studies, but on experience from moving large numbers of breeding lines between countries as well as from results of the international spring wheat yield trials. There are now data from 10 sets of international yield trials. Of these, 4 trials were carried out in the Americas and 3 in the Near East. More recently these were combined into a world-wide test of which some data are available for three consecutive years. These trials combined represent over 150 yield tests in both hemispheres ranging from 35°S to 61°N., long day and short day conditions, fertilized and unfertilized and irrigated as well as dryland conditions. This undoubtedly represents the largest systematic yield testing of genotypes that has been attempted in any crop.

Varieties have been found that tend to do well throughout the spring wheat regions of the world. Sites in which they do not perform well can usually be explained on the basis of disease susceptibility rather than lack of adaptation. Pitic 62 has been the outstanding example of such varieties, but several other Mexican dwarfs show the same pattern. Pitic 62 not only has had the highest yield average over many sites and years, but is also among the highest yielders at the majority of sites. The consistent high yields of these varieties is further substantiated by the fact that between 12 and 13 million acres of them are being grown on the other side of the world from where they were bred.

Thatcher, Selkirk and other U.S. - Canadian wheats have also been consistent in their yield - they are almost invariably the lowest yielders. Such performance might be expected under short day, irrigated conditions, but these yields have generally been disappointing in even those areas where these varieties are of commercial importance.

It is becoming increasingly clear that varieties that have been bred for optimum conditions - particularly as regards fertilizer use - also tend to be superior under sub-optimum conditions. That is, varieties that do well with heavy fertilization tend to do at least as well as other varieties without fertilizers. Such performance is not unique to the group of spring wheats included in the international yield trials, but seems to be a widespread and often

A CONTROL AND A CONTROL OF THE GOOD OF THE CONTROL OF

misunderstood plant breeding principle that applies to many crops. Examples in other crops would be the new dwarf rice varieties and new high yielding sorghum hybrids that are vastly superior with heavy fertilization and also yield as well as older types without fertilizer. Even in corn improvement where variety X location interactions have received so much attention, new prolific hybrids that were bred for dense populations and intensive management are proving to be superior under a wide range of conditions.

In summary, broadly adapted, high-yielding varieties can, and have been produced in wheat. The consistently high performance over a broad area increases the usefulness of varieties and facilitates the exchange of germplasm between crop breeders. It also indicates that greater efficiency will be achieved with strong cooperative regional and international programs in contrast to local, uncoordinated efforts.

A distribution of the state of the common terms of the contract of the state of the contract o

A Company of a second continuo de sée con los servores de contente en april de la contente del contente de la contente del contente de la contente del la contente de la contente del la contente de la contente del la contente de la contente de la contente d

TRENDED TO THE TRACT OF TREATH TRACTORS TREATED AND AN ARTHUR. TREATED AND ARTHUR. TRACTORS AND ARTHUR. TRACTORS AND ARTHUR. TRACTORS AND ARTHUR. TRACTORS AND ARTHUR.

THE USE OF REGRESSION ANALYSES TO MEASURE GENERAL ADAPTATION IN WHEAT

(Abstract)

v. A. Johnson, S. L. Shafer, and J. W. Schmidt

The general adaptation of twelve hard red winter wheat varieties grown in regional performance nurseries was studied by regression analyses. The yields of individual varieties in relation to nursery mean yield was utilized for computation of linear regression coefficients following the scheme reported by Finlay and Wilkinson in 1963. The regressions permitted comparisons of predicted varietal performance over a range of environments. Statistical analysis of thirty years of regional data by this method was utilized in the study.

The performance characteristics of varieties in the southern regional performance nursery indicated that some varieties are relatively better yielders in austere environments whereas others make their best relative performance in high yielding in more optimal environments. Pawnee and Early Blackbull illustrate the first group and Comanche the second. Some newer varieties fall into a third grouping in which varieties are superior in performance over the entire environmental range. This group includes Scout and possibly Gage and Caddo.

In northern regional trials Yogo appears to be relatively superior to Cheyenne and Warrior when the general yield level is less than sixteen bushels per acre. It is relatively poorer than these varieties in the higher yielding environments. The variety Lancer was superior to all other varieties with which it was compared when the general yield level exceeded twenty-five bushels per acre.

The man control of the second control of the

PERFORMANCE OF TALL AND SEMI-DWARF SPRING AND DURUM WHEATS AT 5 RATES OF NITROGEN FERTILIZATION UNDER DRYLAND AND IRRIGATED CONDITIONS

(Abstract)

TABLE WE WENT TO CO

Vanrat Sompaew and D. G. Wells

Chris was compared with two red seeded semi-dwarfs from Mexico and Leeds was compared with two durum semi-dwarfs at 0, 30, 60, 90 and 120# of N per acre at a constant level of 40# of P per acre on dryland and 110# of P per acre under irrigation. Seeding rate was 48# per acre in 3 row plots with rows one foot apart and 8 feet long. Fertilizer was broadcast and plowed under. The original level of fertility at Brookings on the dryland site was very high. Foliage diseases were controlled with Manzate D and green bugs with an insecticide. The traits measured were seeds per head, heads with seed, fertility, lodging, percent protein, weight of 200 seeds, seed yield, straw yield and plant height. Stands of seedlings were determined. Stands were irregular due to lower germination of some entries. A late frost at Brookings reduced stands of 2 of the semi-dwarfs. Stands represented seeding rates of about 22 to 33 lbs. per acre.

The test at Brookings, seeded April 4, received no rain for 60 days so the plants were stunted, tall and semi-dwarfs differing by about 6". Chris tillered more than the semi-dwarfs but Leeds did not. Seeds per head were similar (26 to 28) for all entries. Penjamo 62 excelled in seed size. Yields of the semi-dwarfs and Chris were similar. Penjamo 62 and Chris averaged 29 bushels per acre. One of the durum semi-dwarfs SDI6617 increased in yield with rates of N, exceeding Leeds by 20% at 120# per acre of N due to more heads bearing seed. The semi-dwarfs were lower in protein than the tall varieties.

The test at Redfield, seeded May 8, was irrigated twice in July. The semi-dwarfs were 12" to 15" shorter than the tall checks. No serious lodging occurred. Seeds per head across N rates ranged from 28 to 35. Penjamo 62 averaged 28% more grain yield over all N rates because of having larger seeds and more seeds per head than Chris while having fewer heads with seed. Mean squares for grain yield for varieties and varieties x rates were not significant for the durums while the rates mean square was significant. However, at the 120# rate of nitrogen, the semi-dwarf SDI6617, (Y+54-N104 xLD357)Tc2, outyielded Leeds 71 to 58 bushels per acre due to more heads and more seeds per head. The durums averaged less yield than Leeds over all rates of N. Protein levels, increasing with N rates, were 1 to 2% lower for the red seeded semi-dwarfs than Chris but were similar for the 3 durums.

PROTEIN IN WHEAT - WHO WANTS IT?

Louis P. Reitz

The major cereals provide over 40 million tons of protein annually to human beings. Wheat contributes one-fifth of the total world supply of protein or nearly as much as all animal products combined.

In many countries wheat constitutes 70% or more of the diet and the protein balance is not maintained. This is especially critical for young children. Any increase in the amount of total protein or of the most limiting essential amino acids (lysine and theonine) would be an automatic means for improvement of cereal diets. While the estimated cost for chemical supplementation is low (24 to 93¢ per year per child for lysine), it is obvious that it would be more desirable and more effective to direct nature to make the change than for man to do it.

About one billion people in the world have a diet high in content of high quality protein. Do these people represent a market for high protein wheat? The answer is far from clear. However, we can look at the U.S. position in two ways although neither is free from compounding effects: a) the range in protein desired for various wheat products, and 6) the protein premiums paid in the marketplace.

Soft wheats with more protein would meet trade opposition. This is especially true in the eastern states. Where heavy fertilization has contributed to higher levels of protein and where the Atlas wheats have been grown the trade has objected strenuously. In fact, lower protein has been requested and sought at premium prices. Soft wheats occupy about 20% of the U.S. acreage.

Hard red spring and durum wheats are grown on 20% of the U.S. acreage and provide some of our highest protein grain. The hard red winter and hard white wheats, grown on 60% of our acreage, are, in general, marginal in protein for desired processing.

From 1949 to 1966 the average protein in Kansas wheat was just over 12%. The highest year showed an average of 14.1% (1956) and the lowest was 10.7% (1961). In North Dakota, the average is about $2\ 1/2\%$ higher.

During the last three crop years the premium schedule for government loan rates has been 3¢ per bushel for each percent of protein above 12 with a maximum of 18¢ premium per bushel. This is backed up by open market bidding although the actual premium varies greatly from time to time. In Minneapolis the average premium each year from 1960 to 1965 ranged from 6 to 17¢ per bushel for 15% protein DNS over the base price. Montana spring wheat of 14% protein showed a premium every year during a 22-year period at Great Falls; 16% protein wheat had a premium ranging in amount from 1/20 to 1/2

the base price. At Kansas City, No. 1 Hard of 13% protein was 17, 4 and 5¢ above the base price during a month in the fall of 1965, 1966 and 1967.

BEAR LA HELD

There are many inconsistencies in price premiums. Local millers may have too much protein in the wheat most readily available to them and will pay no premium at all. I have heard of cases where low protein wheat for bread flour was given the higher local price. Many buyers, especially foreign buyers, specify "ordinary" protein and hope for the best. They complain nevertheless when the grain is below their idea of what they really need. a foregoing to grow the fact that is the mixed first of a real content of the content of the

Historically, economically, and for best nutrition a positive approach to the protein problem seems entirely valid. The only exception is for specialty goods where low protein is required for the production of acceptable products by present technology. If more efficient production is to be achieved, a more effective mechanism for converting nitrogen fertilizer and soil nutrients into grain is needed. There is a great challenge and a real opportunity to:

- 1 Breed wheats with higher protein and good yield.
- 2 Breed wheats with improved amino acid ratios but go an preserve wheat's unique gluten and the state of th
 - 3 Breed wheats with more efficient photometabolism.
 - 4 Devise management systems to increase the efficiency - voj , cof mitrogen use a kara me nizvova salo uli ama la se come

the sould a material of these without markets on a first and a factor

of the expect north to high place up at the text of his color, or The second of th

of the feet take the twenty of their are all and the other or the probability of word one will be a little of literate which the way in which we work here were a one in configurations for 20, 100 to a superior personal maneral respective being season and the con-

eg falle il bite espandi at fast tog ognesic sofa vertica etti i est

on the first of the first of the control of the first of t The first of the first o

. Po service stanto religiore presidente esta esta esta esta esta en la composición de la composición de la comp

I see a contract of the property of the property of the contract of the contra

t distribuir en la republica des la réce destruira de figuralisada en la societa de por la cale de la recepció La récepción de la filma de la recepción de la and the second of the second o international programmer of the second of the programmer and the contract of the second of the secon 表现的 医二氯化甲基甲基 医外腹腔 医精囊性衰弱性 海绵麻醉性 医重量物的 医生物性皮肤 医皮肤性皮肤

and the first of t

- Andrew Ell M. I and M. Helse of Sine of Sine

ing the second of the second o

5 - Protect plants from nutrient-robbing effects of lett of the a microbes and diseases. The terror of the some for the form of the control of the

and the country of the country of the state of the country of the នាក់ពេល នេះក្រៅពី នេះដែល ស្ត្រីនេះការនោះក្រៅនេះ តែពីនេះអេចទើក កស់ពីនៃ រង្គាជា សេសីនកា នេះរដ្ឋសាធិក្សាកំនុង សុ

YIELD AND PROTEIN CONTENT

(Abstract)

R. J. Baker

It is generally conceded that there is a negative relationship between yield and protein content in wheat. Existing information would indicate that, while part of this negative relationship is due to the nature of the wheat plant, part is due to the repulsion linkage of genes for high protein with those for high yield. In fact, a negative genetic correlation should be expected when a high yielding variety is crossed with a high protein variety in hopes of producing a line which is high in both.

Computer simulation of a ten locus model in which nine additive genes were controlling yield and one additive gene was controlling protein showedthat, even with linkage intensities of 30 percent between loci, substantial improvement of both traits is unlikely. It is suggested that more effort on breaking up linkage blocks and concentrating on the gradual improvement of both protein and yield would help overcome the problems posed repulsion linkages.

and the second of the second o

RELATIONSHIPS BETWEEN GRAIN NITROGEN AND PLANT DEVELOPMENT

(Abstract)

F. H. McNeal

We have sampled various plant parts of several spring wheat varieties for nitrogen content over a 2-year period. As maturity approaches the nitrogen in stems, leaves, and head chaff decreases, indicating translocation to the developing kernels. Percentages of total nitrogen in top growth that is translocated to kernels has varied from a low of 56.3% in C.I. 13636 to a high of 76.6% in Thatcher. The year, location and variety seem to influence translocation.

In 1966 we obtained r values at an irrigated and a dryland location of 0.89 and 0.92 respectively, for grain nitrogen content vs. the total weight of tops (Table 1). We also obtained r values of 0.88 and 0.93 between grain nitrogen percent and the grain to straw ratio.

A regression equation was developed and used to predict the grain nitrogen content of 7 varieties studies. An r value of 0.91 was obtained by correlating the predicted values with those actually obtained.

The amount of top growth is one of the keys to nitrogen content. A large amount of top growth with a small grain yield will usually result in grain with a high nitrogen content, assuming nitrogen availability. On the other hand, a grain yield that approaches the straw yield will usually be lower in nitrogen content.

Table 1. Correlation coefficients at two Montana locations in 1966.

Variable	Irrigation	Dry1and	
Consis N sentent solth	r	r	
Grain N content with total top weight	0.89**	0.92**	
Grain N percent with grain to straw ratio	0.88**	0.93**	

^{**} Significant at P = .01.

CAN WE BREED HIGHER PROTEIN IN WHEAT?

(Abstract)

V. A. Johnson, P. J. Mattern, and J. W. Schmidt

Cooperative research by the Agricultural Research Service and the Nebraska Agricultural Experiment Station has demonstrated the feasibility of breeding higher protein hard winter wheat. We have utilized Atlas 66 as a high protein source in crosses with hard wheats from which a number of experimental lines have been selected that possess 2-4 percent more protein in their grain than hard winter wheat varieties. These protein increases could be achieved without reduction in grain yield.

Our high protein selections possess several, but not all, of the specific quality and agronomic traits necessary in commercial varieties. We believe that high protein is compatible with acceptable milling and baking quality and that commercially acceptable high proein hard winter varieties can and will be developed.

The high protein trait from Atlas 66 is closely associated with adult leaf rust resistance. With few exceptions, high protein selections from Atlas 66 crosses with Comanche and Wichita also possessed the leaf rust resistance of the Atlas 66 parent. Other investigators have made similar observations.

We have been unable to demonstrate that differential nitrogen uptake by the plant is involved in high grain protein. Significant differences in the plant nitrogen content of varieties have been demonstrated but in no case were such differences related to the protein of the grain. We conclude that high grain protein in the Atlas 66 derived lines results mainly from more efficient and more complete translocation of nitrogen from the plant to its grain during kernel development. The superiority in grain nitrogen content of the Atlas 66-derived lines could be measured from the early stages of kernel development.

We have been able to reduce significantly the protein content of the grain of varieties by removal of all leaf blades at heading time. The protein content of the high protein lines was more sharply reduced than the lower protein varieties by leaf removal. This suggests a possible phynologic contribution of the leaf rust resistance of Atlas 66 in addition to the probable genetic linkage with a high protein gene.

Amino acid analyses of the grain from high protein Atlas 66 x Comanche lines revealed substantial differences in the level of lysine, methionine, and threonine. Some lines possessed as much or more lysine and methionine than Comanche; others were lower in these two amino acids. Threonine was more frequently deficient in the lines than lysine or methionine. It does not appear that the high protein trait need be associated with a less favorable balance of essential amino acids.

GENETIC AND ENVIRONMENTAL CONTROL OF NITRATE REDUCTASE IN WHEAT AND ITS INFLUENCE ON INCREASED PROTEIN PRODUCTION

(Abstract) - Server of a file of the server of the server

Li. I. Croy and E. L. Smith

In view of the current interest in world protein production and the long-time interest in higher wheat protein, we believe it is important to vigorously study the nitrogen reduction system in wheat. We believe that study of this biochemical system in the plant should help us better understand and increase protein production of wheat.

Research to date indicates that there is a good correlation between the Nitrate Reductase activity (NR) and protein production in wheat. Also increasing the level of N available to the wheat plant is conducive to higher NR levels and higher grain protein. Increased temperature above an optimum reduces NR activity and a variety interaction with temperature has been observed. The inheritance of NR in corn appears to be simple, probably controlled by two gene pairs.

We propose to conduct further search to identify wheat genotypes having high NR levels and high protein levels. Also genetic studies will be conducted to determine the inheritance of NR in wheat. We will continue studies on the effect of timing and levels of nitrogen fertilizer application on NR and grain protein. Environmental effects, especially temperature and moisture levels, will be evaluated further for their effects on NR and grain protein production.

The second of th

and the gradual of the file of the state of the second contraction and the second and the second

The second of the second of

The second of th

and the second of the control of the second of the second

The state of the second of the

MANAGER OF THE REAL PROPERTY OF THE STATE OF

green and the second control of the second being been green the second and the second second second second second

The particular of the first for the particular and the second of the sec

and the control of th

INCREASING THE PROTEIN CONTENT OF HARD RED WHEATS

D. W. Sunderman

the superior of a least two entires with the real degrees the transmission of the

Developing wheats with increased protein content has been a minor aim of plant breeders for many years. The average protein content has been raised slightly while the yields of varieties have increased considerably.

Reasons for the small increase in protein content are as follows:

- 1. The heritability of protein content is very low making selection for high protein in early generations rather unreliable.
 - 2. Varieties with high protein content (Atlas 66 and 50) had many undestrable quality characteristics, some associated with protein, making selection rather difficult.
 - 3. High protein content is highly correlated with large loaf volume. Varieties exhibiting exceptionally large volume often have inferior bread grain and texture and are discarded, since these characteristics are generally considered more important than protein count.
 - 4. Protein content is the least important factor considered when releasing a new variety. If the variety protein content is equal to that of current varieties, it is acceptable.
 - 5. Maintaining quality of varieties at the present level, while increasing yield, and disease resistance have been the primary objectives of plant breeders.

Although protein content of new spring wheat varieties has not increased, most of them produce more pounds of protein per acre as shown by their performance in the 1967 International Spring Wheat Yield Nursery grown under irrigation at Aberdeen, Idaho (Table 1). Thatcher and Selkirk, though not appreciably different in protein content produced less total protein per acre than Chris, Crim, ND 824 and NP832.

The performance of these varieties has not been tested under conditions of adequate moisture and limited protein. Tests will be started in 1968 to determine if the yield-protein relationship will remain the same when available nitrogen is limited.

D. W. Sunderman

Table 2 shows protein-yeild-quality relationship of commercial Idaho winter wheat varieties and three high protein Idaho, selections. Under irrigation with adequate nitrogen, the selections had a higher yeild, protein content and total protein than Tendoy. On dryland, where nitrogen was a limiting factor, yield of selections with the higher protein contents was lower, and only one of the selections produced more total protein than Tendoy.

Questions which must be answered before a concerted effort is made to increase wheat protein content of dryland varieties grown in Idaho are:

- l. In low moisture areas where applied fertilizers reduced yields and test weights, should a variety be developed which would use available nitrogen more rapidly than present varieties?
- tend some die hale farmon vische st leatuon mittorg die fig. 1.

 sector swell as high protein wheat yield as well as head of warieties requiring less nitrogen when nitrogen with an is a limiting factor?

 the same of the farmon with a figure sector of the same with a sector of the same of the same with a sector of the same of
 - 6. Protoin contain in the Geast important factor considerate when all asing a new warists. In Education, another content is equal to that of current varietisms, it is a copeable.
 - 5. Mainthoning quality of variaties at the present level, while idereduing yield, and disease registered have been the primary objectives or plant breaders.

Although proceds boutdat of new upring webar variation has not increased, most of them produced were pounds of protein per across that the by their particulance in the 1967 Invernational Spring Wheet Yealt Mossery group under irrigation archberdeen, idaho (Palio 1), that the and Schirt, though not appreciably different in produce Joseffir produced loss total produced than Enris. Other 10 824 and Neffic.

Tag performance of these viriaties has not been teated under conditions of adequate modéfine and limited project. Trais will be crarued in 1968 to defermine if the yield-procein relationable will related the same when availed in piccopan in limited.

, 60

Peak.
min.

4.3

4.5

5.5

yield

67.8 69.2 69.1 69.9

Table 1. Yield and quality obtained on varieties grown at Aberdeen, Idaho, on irrigated land fertilized with 100 pounds of nitrogen.

The to the term of			J. 1	15	·		্ 🐃 🧷 Mix	- 97	, n	*			
Тe	st wt. Yield	Prote	<u>in</u>	Flour	e ::	Peak :	ing	bough1	Leaf	Bre	ad cha	racteristics	s1/
Variety 1b	s/bu bu/A	% 1bs	/A Sed	. yield	Abs.	min.	M.T. time	type	volume	Ext.	Grain	Texture Co	olor
	The state of the s	ريانية المراجعة المر المراجعة المراجعة ا	p :				: 4 B	*				÷ .	
Thatcher 61	L.1 71.3	16.8 7	19 42	୍ଟି72୍	65	4.0	100		9 . b				
Selkirk 59	.8 67.0	17.0 6	83 48	69	64	5.0	40 7 1.4	4 6.	840	5	7	7 🖯 🤴	5
Austin 60	65.1	17.5 6	83 60	69	66	6.5	80 1.4	4 6	790	5	8	8	5
Chris 61	73.8	17.0 7	53 50	69	66	5.5	60 1.	5 6	815	·5	8	8	5
Crim 60	80.2	17.4 8	37 54 ₅	-71	6.7	55	60 1.9	9 6	800	5	7	7 🐣	5
ND 824 63	3.1 87.1	17.0 8	88 58	69	67	8.0	20 2.	6 9	840	5	7	7	5
NP 832 62	2.5 .85.9	17.0 8	76 55	68	66	8.0	40 2.	6 9∉	745	5	7	7	5

1/ Higher number indicates better quality.

Table 2. Yield and quality data obtained on winter wheat grown under irrigation at Aberdeen for 2 years and on dryland at Tetonia in 1967.

Cal. or Test wt. Yield Protein Flour Peak

Variety	C.I. or Cross no.	Test wt. 1bs/bu	Yield bu/A	Protein % lbs/A	Sed
Irrigated			<u></u> §		
Itana x Atlas 66	A589A-133	62.2	73.8	15.3 673	47
				15.0 676	46
Td 3x 7Lee 2x Cns x Au	A615-5-1	63.1 👸 🤚	76.1	14.7 671	55
Tendoy	CI 13426	61.9	70.6	13.9 589	44
Dryland					5) 1- y-
Itana x Atlas 66	A589A-133	62.6	48.2	13.1 379	.,
	-135	62.5	50.8	13.0 396	
Td 3x 7Lee 2x Cns x Au	A615-5-1	62.7	52.9	13.5 428	
Tendoy	CI 13426	63.1	59.4	11.7 417	
Itana 65	CI 13846	62.4	56.3	11.5 388	

THE EFFECT OF INCREASING THE NUMBER OF CHARACTERS UNDER SELECTION ON EXPECTED GENETIC GAIN FOR OTHER CHARACTERS

E. C. Gilmore

I would like to say at the outset that ideas expressed in this paper are not original. Most breeders are aware of the implications of increasing the number of characters under selection. I would hope, however, that the example set forth in this paper might lead us to think anew of the relative importance of characters under selection and the consequences of adding new characters to the standard variety acceptability.

Expected genetic gain (G) expressed as a function of heritability and the selection differential is

$$G = H (\overline{P}_{S} - \overline{P})$$

where H, the heritability, is the regression of genotypic value on phenotypic value, and $(P_s - P)$, the selection differential, is the difference between the means of the selections and the population from which they were selected. When truncation selection is practiced for a character having a normal distribution, $(P_s - P)$ equals ko_p where k is a function of the proportion of the population saved, which is frequently called the selection intensity. As the percent of the population saved increases, k decreases and the selection differential decreases, reducing expected genetic gain.

When equal emphasis is placed on selection of n characters which have no genetic correlations and x is the proportion of the population saved, the selection intensity for one character equals $\frac{x}{x}$.

Let us assume that milling and baking quality of a variety can be completely defined by milling percentage, flour ash content, mixing time, loaf volume, and crumb texture. Certainly breeders and cereal chemists wish quality were so easily defined. Let us also limit selection for agronomic characters to yield, test weight, and straw strength, which make a total of eight characters under selection. Let us also assume there are no genetic correlations among these eight characters. If only one out of 100 lines tested is saved, the selection intensity for one character then becomes $\frac{8}{101}$ or 56%. Under the conditions we have described the selections for this character would be a random sample from the upper 56% of the distribution, and the mean of these selections would be .70 standard deviations higher than the mean of the distribution. In comparison, if milling and baking quality were ignored, the mean of the selections would be 1.33 standard deviations higher than the mean of the distribution. The genetic advance for each character would

depend on the heritability of the character and the selection unit used, but the above changes in selection intensity illustrate the fact that addition of characters being selected rapidly makes the mean of the selections for one character approach the mean of the population.

Genetic correlations among characters complicate calculation of the effect of simultaneous selection, and for this discussion it should be sufficient to point out that desirable genetic correlations tend to increase genetic advance and undesirable correlations tend to decrease it.

The question to which we should address ourselves is not "Is selection for milling and baking quality an impediment to improvement in other areas?". It could not be otherwise unless all milling and baking characters had a very high desirable correlation with agronomic characters. Rather, the question is "What are proper relative weights to place on all characters under selection so that the maximum benefit to society may ensue?". That this be done is of paramount importance if wheat improvement is to reach its potential.

in the contract water in the contract of the c

and the first of the first of the second The first of the second of They intered out to be a companied and to spirition are not as a spirit ายที่ทำอาจาร และได้สาราชน์ของสิทธิ์ พอรัสบานโดย สภัยที่ เพื่อที่เกิดพระนำ และ เรียก เมื่อสาร the second temporary are reduced reflect another to the modelities augit are c the commence of the company of the grade of the company of the com

STUDIES ON QUANTITY AND QUALITY OF WHEAT PROTEIN

Politica nelegione como especial esta esta esta especial de la composición de la composición de la composición

and the second of the build beautiful

n program ne rivere e **esectiva pist Heiner** dollar so selstenop soll Jestino providenta ne gifficio eralle interpolitilar alla viscolica soll il estituto politica di ser bisto si il l'interpo galso di ser pera

Random selections of Minn. II-54-30 were made to compare its protein electrophoretic pattern with that of good quality wheats and also to attempt to select a variant within the population that would have acceptable baking quality. Preliminary data suggests that the protein from the original line, when compared electrophoretically with other lines and varieties, differs in one major protein band. It appears that a structural protein is absent in II-54-30. A few selections have been identified as having an unusual level of protein. These selections are presently being evaluated to determine if the increased protein content is associated with an altered electrophoretic pattern. In addition, an M_2 population of Chris that has been treated with ethyl methanesulfonate is being screened for high and low levels of protein. Of the 600 M2 plants examined, 58 have protein values higher than 18%. Sixteen have good seed characteristics and 5 are excellent in this regard. Two were noted as having 20% protein with good seed characteristics. The average protein content for the control population is approximately 15.5%.

WHEAT DISEASES AND QUALITY

THERE IN A COURSE OF THE SEASON SHEET SHEET WELL TO RECTANGE WHICH IN THE SEASON WAS

kan kanan di din din kanan di kanan **K. F., Finney** Kanan pantian kanan din kanan dikan din dan manjaran di kanan di kanan di kanan di kanan di kanan di kanan di k

We have found that soil-borne-mosaic virus, wheat-streak-mosaic virus, and scab are diseases that affect the quantity and quality of wheat protein.

Virus Diseases--Remarks about the two virus diseases pertain to experiments reported by Finney and Sill in Agronomy Journal, 55:476-478, 1963, Fifty-six tests represented several wheat varieties, several locations, and 4 crop years.

Grain samples from wheat plants infected by soil-borne-mosaic or wheat-streak-mosaic virus had milling properties that were inferior to, protein quality and mixing properties that were equal to, and water absorption, protein content, and "as received" loaf volume that were distinctly superior to those of the corresponding controls. Forage samples of winter wheat varieties susceptible to and infected by wheat-streak-mosaic virus were significantly higher (0.1% level) in protein content than those of healthy controls.

Scab--About 15 pounds of scab infected H. R. W. wheat was separated by hand into what appeared to be a 100% scabby sample and a normal or brown sample of wheat. The normal (brown) and scabby wheat samples were present in the original mixture in the ratio of 4 parts of normal (brown) to 1 part of scabby (white).

Proteolytic activity indicated that the brown sample was about 16 days preripe, whereas the scabby (white) sample represented a stage of development of about 22 days preripe. In addition, the scabby wheat contained about twice the water-soluble protein content of the brown wheat. These data for proteolytic activity and watersoluble nitrogen tie in consistently with previous studies of the laboratory concerning the chemical and baking properties of wheat harvested at various stages of maturity. Accordingly it appears that the 100% scabby wheat simply was killed at a sufficiently early stage of maturity (22 days before ripe) before appreciable gluten protein synthesis had occurred, thereby accounting for the inability of the protein in the flour milled from 100% scabby wheat to retain the carbon dioxide produced during fermentation. Previous studies have shown that baking characteristics usually are about normal (compared to ripe samples) as early as 16 days preripe, and above normal 10 to 14 days preripe.

The configuration of the confi

The State of the second second

CAN AMINO ACID RATIOS BE ALTERED? HOW? WILL QUALITY SUFFER?

R. C. Hoseney

I think we can start with a positive statement that yes - the ratio of amino acids in wheat can be altered. Wheat is a biological system, and all biological systems can be altered.

A logical approach to altering the ratio would be to find a wheat with a more desirable amino acid ratio and then use it as a parent in breeding programs. The data, although somewhat limited, suggest that such a wheat may not exist in our present varieties.

The proteins in wheat can be divided into two general classes. the endosperm and non-endosperm proteins. This separation is made when wheat is milled into flour. The endosperm proteins contain about 2.2% compared to the 4.4% lysine in the non-endosperm proteins. Thus, we would have a high-lysine wheat if we significantly raised the percentage of the non-endosperm matter in wheat. However, this likely would lower the milling quality of the wheat and would not give us a more nutritious endosperm. The endosperm proteins also can be divided into 2 groups, namely gluten proteins and waterand salt-soluble proteins. The water and salt-soluble proteins are essentially the same proteins found in the bran, and thus contain about 4.4% lysine. The gluten protein contains only about 1.1% lysine. The gluten proteins can be divided into 2 groups, gliadins and glutenins, but these do not vary much in lysine content. The ratio of water-soluble to gluten protein varies. In general, the percent of water-soluble protein is higher at the lower protein contents. Thus, the lower the protein content of wheat the higher the percentage of lysine. This must be taken into account when searching for a high-lysine variety. នៃបាក ១ជ to days positips; whoreak

A second way to obtain a high-lysine wheat would be to find a mutant that will block the synthesis of one of both of the gluten proteins but permit the synthesis of the water-soluble proteins. This evidently is the mode of action of the two mutants in malze described by Dr. Mertz and coworkers at Purdue. The synthesis of zein, which corresponds to gliadin in wheat, has been tetarded while the synthesis of globulin proteins has been increased.

on the basis of what has been learned from the high-lysine maize and what we know about wheat protein. I think we can postulate some things about a high-lysine wheat obtained in a manner comparable to that for maize. It would have a white, chalky, non-vitreous endosperm, a low test weight (due to a low density kernel), and probably a low yield when considering weight and not bulk. If it was sent to a quality lab for evaluation, the report would read "Considering the protein content, this is one of the poorest varieties we have ever tested". Such mutants probably have occurred, but have not been recognized.

Another type of mutation could change the amino acid make-up within a specific protein. While this type likely does occur, its effect on the overall lysine content of wheat probably would not be significant. For example a change of from 3 to 4 lysine residues per molecule of a gliadin protein (50,000 molecular weight) would only change the lysine content of that protein from 0.8% to 1.1%. Based on such a change, the increase of lysine in the flour would be 0.04%.

The effect of the above changes on quality would depend on whether the emphasis is on baking performance or nutrition. From a nutrition standpoint, the quality would be greatly improved. From the point of view of the baker the quality probably would be poor. We probably would lose the properties that make wheat so uniquely suited for leavened products.

្លុក ប្រធានប្រជាពលរដ្ឋ ប្រធានប្រជាពលរដ្ឋសម្រាជា ប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប ប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្រធានប្

and the state of t

come as bline entine out operate blood to return un else al alsocit estim un else entireladorit estim un estimatorio estimatori estimatorio estimatori estimatori estimatorio estimatori estimatorio e

Is protein content heritable? Yes, protein content is heritable as well as protein quality. The physical properties of high protein wheats generally available for breeding purposes are not satisfactory for hard wheats. Crosses with Atlas 50 and 66 and Kaw indicate that if the population size is sufficient high protein lines with suitable hard wheat milling and baking properties can be obtained. Selections with 1-2 percent more protein than Kaw were isolated that had good milling properties and baking properties that were equal or better than Kaw.

PROTEIN, FERTILIZATION, YEAR, AND BAKING ABSORPTION

W. C. Shuey

There is evidence to show that the protein content of the wheat is inversely proportional to yield for specific selections. This can be partially overcome by fertilization; however, varieties respond differently to additional nitrogen, and the protein synthesized is of different quality.

Table I shows the response of 3 varieties to 3 levels of nitrogen and the effect on wheat protein and baking absorption. Variety A - showed very little response to increased nitrogen in wheat protein content or baking absorption. Variety B - showed an increase in wheat protein content with an initial increase in baking absorption and then a decrease. Variety C - showed an increase in both protein content and absorption with increased amounts of nitrogen. The data show that not only did the varieties respond differently to the amounts of nitrogen applied, but the baking absorption capacity response was different.

Table II shows the response of Variety A to fertilization at 2 locations and 2 crop years. Not only does variety play a role in response, but also year and location. Careful perusal of the data reveals that a variety may respond similar to a different variety grown at one location when it is grown at several locations and in different crop years.

The data presented show that: (1) protein can be increased by breeding (Variety A versus Varieties B and C), (2) amount of nitrogen, location, and crop year can alter the amount of protein, and (3) the composition of the protein must be altered under these conditions since the baking absorption responses were different.

POPONIOSIA DELIMO CEL LA**TABLECI**LTAS PLETENT DEPONET

SAME LOCATION, YEAR, AND METHOD OF APPLICATION

Seasy :	2 hg	
Variety A	Variety B	Variety C
Wht. Bake	Wht. Bake	Wht. Bake

Treatment	Wht. Bake	Wht. Bake	Wht. Bake
i imam ibs. nof: N umbo	e Promabsh daes	Prost Abs.	Prox Abs.
notic secondanier	eld for specific	<u>úr el impolatoro</u>	<u>. 7 </u>
1951 TO BE STORE	word poplassififur	ivi ve moutuve vi	1-33113 31 54.
		19.9 64.4	

100 18.0 70.6 . 11 1 14.4 66.6 m 200 18.2 70.9 15.3 67.0 15.8 68.5

In thems I or applying I to appropriate and stoods I didn't with the real that lifter on the extender and belief evening the expedient "At or Ho Bearonagh on secondora - Antifograph Especie - A political en afrika persakan baresar kalan kerikan persakan mali 🔻 🛂 🏅 egilah k and the resting and the section protecting resident became as I seed - to vite ignal. To hear soon in the distance and address on the contract of t this militariogal from the continuent along the inclusion to the least of the continuent of the contin green for load was blue off augustin to interest been and rogerita lo aracera adi el gia**rabili il** bucasor actroires els ble eppila a, test cina bekiring abeurritika copaciar magamara waa districe

SAME METHOD OF APPLICATION

will be able to a product of the seasons will always if a following the control of the following seasons are a seasons of the following seasons are a season of the control of the following seasons are a season of the control of the following seasons are a season of the control of the following seasons are a season of the control of the following seasons are a season of the control of the following seasons are a season of the control of the following seasons are a season of the control of the cont a year wastany and Location A . Trans y cars to him Location Bi to ப்படு க்கில் 1966 - Crop அடி 1967 - Crop சக்கி 966 - Crop அக்கி 1967 - Crop Treatment Wht. Bake (a Wht. Bake: b Wht. Bake: a Wht. Bake 1bs p of Nee Product Abs. and Product Abs. to Proce Abs. as / Proce Abs. - esser elsa proveillà dà las edutions i leroque

100 mb (s) 18.0 barol 6 mb 15.4s / 67.3s ov 21.0s 570.9 16.8 d 68.2 . 45 (120 2001) | Barri 18.2 13 | 70.9 | 146.6 167.0 20 | 19.1 (17.2 | 17.2 | 166.3 s vandi animam korroliko od i nima rekorij odi 10 mojrtima prog<u>odi</u> (8) t<u>oro</u> clustration of the belief absorbed and recognition were well at the contract of

LYSINE DIFFERENCES IN THE WORLD WHEAT COLLECTION OF THE WORLD WHEA

grand of the sent nation of the (Abstract) of the the the little sections

P. J. Mattern, D. A. Whited, V. A. Johnson, and J. W. Schmidt

Lysine is usually considered the amino acid most likely to be limiting in wheat. If genetic sources with higher lysine contents could be identified it should be possible to make substantial improvements in the nutritional quality of wheat.

LILEN W IS HELD

The Nebraska Experiment Station in cooperation with the Agricultural Research Service is systematically analyzing all of the common wheats in the World Collection maintained by the U.S. Department of Agriculture to identify new sources of high protein and high lysine. The research is being supported by the Agency for International Development, U.S. State Department. More than 2000 wheats from the Collection have been analyzed to date.

Lysine is analyzed in an acid hydrolyzate with an amino acid analyzer which has been modified with four short columns for basic amino acids. Samples are run sequentially in about eight minutes. Protein is determined by the Udy dye-bind method. These samples which show promise are also rechecked for protein by the Kjeldahl procedure.

The correlation of protein with lysine (expressed as percent of dry weight) over the entire range of protein encountered among 2079 wheats was +0.81. However, the correlation of lysine with protein within 2% protein increments is relatively modest - ranging from +0.46 in the 13.0-14.9% protein level to only +0.03 at the 17.0-18.9% protein level. This would indicate that lysine variation within restricted ranges of protein is largely random.

A low negative correlation of -0.48 was obtained when lysine as a percent of protein was correlated with protein. The correlations were even lower when correlations were based on samples within restricted protein ranges.

Our data indicate that level of lysine is influenced by protein level but that protein can account for only a portion of the lysine variation we have encountered. Thus, it would seem that selection for high lysine in wheat may be feasible.

The protein and lysine contents of selected wheats from the World Collection are shown in Table 1. The mean protein content of 2079 wheats from the World Collection was 13.6%. Lysine expressed as percent of protein averaged 3.04%. The lowest lysine encountered was 1.77% in a 14.3% protein wheat from Russia. Seven of the wheats included in Table 1 appear to have promise as possible sources of high lysine. None is abnormally low in protein and two are higher in protein than the average of the 2070 wheats analyzed.

Whether these wheats have promise for breeding higher lysine will depend upon whether their high lysine values are real or only apparent. The effect of environment on lysine level is not known.

We are optimistic that wheats with superior levels of lysine will be found. Improved lysine level combined with high protein would constitute a major step in the improvement of the nutritional value of wheat.

an aline, on the moit energy to the trailer to the bit has

make the cities in a maintainer his of a concerned

Commission as the second of th

Table 1. Protein and lysine content of selected wheats from the World Collection at the basis of the selected wheats from

a talono i regional e regia etalo provvoco oltessen la regionale del primore. Propologio i termo solva per alcherro, e l'illepete qui la differenza escionale.

ο.	ogi oliginiza	protéin <u>l</u> /	ism dry wti	protein
22	Arabia USA	12.1	0.44 0.46	3.66 3.65
667 610 20	USA China Sweden Spain	12.5 13.3 15.1	0.45 0.47 0.52	3.58 3.57 3.44
.180	Sweden Spain USA USA	14.1 13.2	0.47	3,36 (2.11) 3,33×
	g thus upting by light subspicetive to the Poly	The state of the s	mar path arms.	- 1 p d x 3 / A x - 子 さ
(2079	9 samples)	13.6	0.40	3.04
AS A TAR CANADA	The state of the second	表表 医乳腺性病 电速流点	三,指示权制制 计特殊	ফুলাফুর নিব ও লা প্রিটিড
229	ander of the second	S (1) 14 19 19 19 19 19 19 19 19 19 19 19 19 19	0.25	1.77

IN EXPLORATE CHESTOCK HE HAVE TO THE SECOND PARTY NEEDS THE THE SECOND

garan kan arang kerendah pada dan dan kerendada dan beberapa dan berandan berandan dan berandan

one in more than the state of the contract of

The second control of the control of the second control of the second control of the control of

Service of the servic

4.,

^{1/} Dry weight basis.

WHAT IS THE IMPORTANCE OF THE RACE CONCEPT AND NON-SPECIFIC, GENERALIZED AND HORIZONTAL RESISTANCE VS. SPECIFIC SPECIALIZED VERTICAL RESISTANCE, AS RELATED TO DISEASE AND INSECT RESISTANCE?

Single of Edwidth and (Abstract) by i lam only Dispersion of the beginning for

E. L. Sharp

Vertical specialized or specific resistance in a host is directed against some physiologic races of a pathogen but not others. In many cases genes for resistance in the host are known to have counterparts or corresponding genes for virulence in the pathogen. The race concept is founded on this type of resistance. Vertical resistance reduces the initial inoculum. It is relatively easy to work with, usually gives clear cut differences even in the host seedling stage and is often monogenic in inheritance. Vertical resistance has been most often used by plant breeders and has been combined into resistant varieties by a number of pathways including pairs of genes, multiple genes and multilineal varieties.

39745 98**0**

Horizontal, non-specific or generalized resistance operates against all physiologic races and usually results in a moderate degree of resistance. It reduces the infection rate, is probably best exemplified in the resistance of some potato varieties to late blight, but is applicable to other host-pathogen systems. Some attributes of horizontal resistance are difficulty in obtaining infection, reduced sporulation, lengthened incubation period, slow growth of lesions and a shortened infectious period for infected tissue. The genetic nature for this type of resistance is not well known. It is probably polygenic and additive in action and single genes are difficult to identify. Field resistance tends to be horizontal resistance.

Advocates of horizontal resistance view it as a longer lasting resistance and suggest that breeding for vertical resistance may lead to a multitude of races and reduction of horizontal resistance originally present in a plant host population.

At Montana State, considerable study has been directed toward determining the genetic systems of the wheat variety P.I. 178383 which condition resistance to <u>Puccinia striiformis</u> (stripe rust). The results are summarized in Table 1.

Table 1. Summary of stripe rust infection types conditioned by major and minor genes of wheat variety P.I. 178383.

TROPIS PORT SIGNALI SPRIMERANISTA STOUTHER & JEOMAN WÎ, TUVINE (,

No. and type of resistance genes	Mean infect at 15/24 oF.	ion type at 2/18°C
None	(** 12. × 3. × 3. 4	4
one minor	2	3
the minor of bandras		2
three minor and arogo	in de la Paris de la Contra de l La contra de la Cont	gradis Arresta (#1200) Santa Santa (#1200)
one major		
tile pativocae The col	and in the second of the secon	and the control of th
rigagar Ox Estimati (ala.	on this or a second to the second	to the second second second
The major gene is a	pistatic to all minor ge	1esima all'arta
ក្នុង ខេង្ស ខែ ប្រជាជា ស្រី ស្រី នេះ នេះ នេះ	ears eat differencement over	io, engine editroler
formi en limbrom ichiologi		
	ระบับสหา และโดย คำว่า ซะครัฐ "รูส"	
no. [] P.I. 178383 is ne		
rust. One major near	dominant gene conditions	the reaction. In
	or gene, 3 recessive add	
rust reaction can be d	etected. : These minor ger	iés allicondition more
resistance at a higher	temperature profile D	lfferent genotypes of
P. striiformis are bei		
resistance: conditioned		
	twwheatsvarietys(Crest),q	
	conventional amethods cont	
gene from P.I. 178383		
ender bejork om hat dig gemek		
	क्रमण प्रक्रिक है है । स्वतिकार है किस	
The contract of the contract o	ro u imegyice yiki kira uu	di tuman di Sarr
	dal II milk ar heron kty.	

Acceptable in the control of the con

្រក់ទ្រក់ស ទូកាស់ក្រៅបើ ១ ស្មើនស.ស ក្រុមថា ១០១៩៣ ១៤៤ស សេកម្**ល់ស ៤១១៩**៤ សមានម៉ូ**ល់** ប្រ ក្រុមប្រែក្រុម ប៉ុន្តែ ស្រុសសម្រេច សេសម៉េង អូចនៃ ២០ សក្សាស់ស ១ កម្មិស ស្រុសថ្មី អូចនៃប៉ុន្តែ ១៤៤ ស្រុប្រ ការីស្នាប់ថ្ងៃ ក្រុមប្រែស្រុសស្គារ ស្រៀសស្នា ១៥ សនិកម្មានម៉ែក ប្រ**ទេ**ទី ប្រឹក្សាស្នា ប្រែប្រឹក្សាស ប្រែប្រឹក្សា លើ ១៤៤ សម្រេច ស្រុសស្គារ ស្រួសសម្រេច ស្រួសសម្រេច ប្រែក្រុមប្រឹក្សាស

WHAT IS THE IMPORTANCE OF THE RACE CONCEPT TO WHEAT BREEDING?

is a minimum. The constant of the constant of \mathbf{L}_{i} , \mathbf{E}_{i} , $\mathbf{Browder}$, \mathbf{S}_{i} , \mathbf{S}_{i}

The importance of the race concept to wheat breeding is dependent upon the wheat breeders race concept. The concept that race is a stable, hard and fast, ultimate means of classification negates its usefulness completely. But if one understands race as a term to be a flexible, artificial means of categorizing certain combinations of genes for virulence, then the race concept may still be of value. The North American Wheat Leaf Rust Workers' Committee has established that races may be identified equally well on any set of differential host varieties if the information has been published so that others may understand the meaning of race numbers and if the "set" is designated in the race designations. Thus, we may have UN races, NA61 races, NA65 races, and others as well as International Standard races, which are the classic races.

The gene-for-gene relationship is generally accepted to be the basis for pathogenic specialization. As such, this imposes certain limitations and implications on race identification studies. These studies are studies of the parasite race nomenclature and are based on pathogenicity to known host genes for resistance, or known host varieties. Infection-types of host:parasite interaction are observed and information concerning parasite is inferred. The accuracy of inferred information is directly related to accuracy of knowledge of host materials.

The practical use of information concerning pathogenicity to host genes for resistance brings the question of how many genes for resistance can be successfully manipulated in combination in breeding programs.

This is the number of genes for pathogenicity we need to consider and relate to one another in studies of pathogenic specialization. If we use only one gene for resistance only one parasite gene need be followed in a parasite population; if two or more are used, then all the corresponding genes for pathogenicity need to be studied, each independently and in association with one another.

Studies of parasite populations known as race surveys have long been conducted; data obtained were translated into pathogenicity combinations including the entire differential set studied, or races. This treatment tends to obscure information concerning combinations involving less than the whole set, individual virulence gene frequencies and association of pathogenicity to two or few genes for resistance.

and the interest and the single problems the state of the single single

There are three parameters which these studies seek to estimate: 1) virulence frequencies, 2) virulence associations, and 3) virulence distributions. These parameters can best be estimated directly, from original data rather than by extracting them from race data. The numbers of combinations which need to be studied may eventually limit the practicality of assigning race numbers to them at all. This whole area of work in wheat leaf rust work presently is in a state of transition. Some better ways of presenting data need to be found: The wind the same of the same of

I would recommend that we consider pathogenic specialization data in the form which the phenomenon functions in nature--ie genes for host reaction and genes for parasite pathogenicity, and that we use survey data to decide which genes for resistance to use rather than what races to breed against.

Finally, a word of caution, we should never assume to equate adult plant resistance to rust with generalized resistance. Such resistances have proven to be quite specific in several cases.

But the Common Community of the Community of the Area and the Community of The state of the state of

is the control of the Market Anna and a grown are considered by the feet of the residence

(a) A substitution of the state of the st

of Secretary in the control of the control of the first of the control of the con and the state of t

en in her control and make for in the control in a weight of the date of the control in or opposit for the comment was a first make an end of the

วาย (การเกาะ หรู สาทาง การสมาโปการ ตัว เป็นเท้าๆ และ<mark>สำนักงะ</mark>คุณ การการสมาัย (มาก The second of the control of the con and the second section in the second contract of the second contract

en i sante i le mane estre proposar la comunitarie poste en sagén i plane d' La sagencia de conservat en la relación en la sente de la sente de la comunitario de la comunitario en la sent

en 1990 de la complète de la complèt La complète de la co The later than the specific specific and solve the later than the specific field of the specific speci

Syrap and Sy

REPORT OF THE SIXTH CONFERENCE OF THE NORTH AMERICAN WHEAT LEAF RUST RESEARCH WORKERS COMMITTEE

February 4-5, 1968

Manhattan, Kansas

The state of the s

ライビス B Witter Configuration (Application of Application of Appli

The committee and visitors met informally for dinner and discussion on February 4. An agenda was set for the February 5 meeting. The discussion centered around genes which "modify" the effect of other genes, the specific or non-specific nature of such genes and methods of demonstrating their specificity or non-specificity. o de est trades que transpoi del

The committee convened at 8:30 a.m. on February 5. Discussion began concerning principles of applying information of specific host:parasite relationships to disease control and the kinds of host materials which are of value in studying parasite populations. The general categories of host lines having: (1) "Universal Resistance", (2) known single genes for resistance, (3) combinations of known genes for resistance, and (4) genes for adult plant resistance were consider-Increased knowledge of the resistance genotypes of host materials increases the potential value of studying the North American differential set for Puccinia recondita f. spitritici. The decision was made to meld lines containing certain single genes; for resistance from the International Standard Differential varieties with two lines, each having one gene from Exchange ("E" and "L"), and the variety Aniversario (of unknown genotype for resistance) into a North American 1968 (NA68) differential set. A report describing this set and a key for nomenclature of virulence combinations will be published soon. All workers are encouraged to submit host materials for consideration as candidates for the Test Variety program of the NA committee. This may be done by contacting me.

A statistical tool for evaluating association of parasite genes for virulence and derivation of information about genotype of the host lines from data obtained in surveys was discussed as well as the potential value of virulence association data in choice of specific resistances for disease control. Improvements in methodology and equipment used in making surveys so as to provide better data more efficiently were discussed. tivoscop katusky o sta piłydła i cza avagog centra la stancest

rama of sibling of or a rapidal tobelower Practicular than the

Dr. E. G. Heyne met with the committee to discuss nomenclature of genes for specific leaf rust resistance in wheat and the symbolization of host:parasite genotype interactions. The committee resolved to recognize Dr. Heyne as a "clearing-house" for the assignment of gene numbers in the LR series. All workers are urged to contact him before publishing new numbers for genes for leaf rust resistance. The need for designating "intangible" genes temporarily in some cases is recognized. Symbols other than numbers should be used in these cases. A uniform means of designating host genes and alleles was deemed beneficial and such a designation system was agreed upon. A slightly different system from that previously used was developed to accommodate expanding use of automatic data processing equipment.

The group then toured the Wheat Leaf Rust Laboratory and observed some equipment recently developed for use in making surveys of pathogenic potential.

The committee then reconvened in conference to discuss the value and use of non-specificity in rust control. Possible mechanisms and the measurement including early testing of non-specificity were the chief topics considered.

The deposit of cultures of P. recondita f. sp. tritici in the Plant Rust Collection of the American Type Culture Collection was considered and deemed of great importance to future scientists for comparisons as well as providing reserves of today's working cultures and voucher cultures for published research. All rust workers are encouraged to make use of this collection. Cultures may be deposited as "Restricted" and "Red Label" cultures where their distribution is carefully controlled to avoid escape of dangerous cultures.

The later of the first trait and the forest party that the section of the section

aver the chartery lair two will be what is included any engine

Some of the previous work of the NA Committee has been published three papers:

- 1. A COMMITTEE OF NORTH AMERICAN WHEAT LEAF RUST RESEARCH WORKERS. 1959. A proposed modification of the system of wheat leaf rust race identification and nomenclature. Plant Disease Reptr. 43:613-615.
- 2. A COMMITTEE OF NORTH AMERICAN WHEAT LEAF RUST RESEARCH WORKERS. 1961. The North American 1961 set of supplemental differential wheat varieties for leaf rust race identification. Plant Disease Reptr. 45:444-446.
- 3. Young, H. C. Jr., and L. E. Browder. 1965. The North American 1965 set of supplemental differential wheat varieties for identification of races of <u>Puccinia recondita</u> f. sp. <u>tritici</u>. Plant Disease Reptr. 49:308-311.

Reprints of these papers are available through the secretary.

్ కార్ములు కార్మం చూరితోందు. కొండి కార్ట్ కొండాన్ని అక్కార్స్ క్రార్ట్ కార్స్ కొట్టి కార్ట్ మంజర్స్ కార్మం కార్మం కారణకు కొండి ప్రభాస్తున్నానుకోంటా మార్క్ మండ్ కోస్ట్ కార్స్ కోస్ట్ కార్స్ కార్క్ కార్క్ ఉన్నాయి. కొంటేమాటుకోన్ అంట్నిమాణునికే కార్మ్ త్రిట్లో కేంద్రం కోర్ట్ కార్స్ కార్స్ కార్స్ కార్స్

The engineering amount of thems that the applicantions are even, who is

Committee members present at the sixth conference were W. Q. Loegering, Chairman; D. J. Samborski; J. F. Schafer; H. C. Young, Jr.; and L. E. Browder, Secretary.

BREEDING FOR RESISTANCE TO BARLEY YELLOW DWARF VIRUS IN WHEAT

(Abstract)

Paul J. Fitzgerald and J. R. Thysell

Barley yellow dwarf studies at Brookings are directed toward locating useful sources of tolerance or resistance to the BYDV in wheat, the development of resistant breeding lines, and the study of the inheritance of resistance to the virus. Concurrent with these efforts have been several special studies to determine factors affecting symptom development and the effect of the virus on yield and quality. A special study is in progress to measure the effects of aphid number and plant age on the response of individual plants to infection with the BYDV.

Compared to the contract of th

Screening of lines for resistance began in a modest way in 1963 in the greenhouse. The program has expanded to include field comparisons for all final evaluations. Evaluations in the greenhouse based solely on foliar symptoms have not been effective in identifying the most resistant or tolerant lines as measured by field performance. Comparisons between control and inoculated plants at or near maturity with regard to head size, height, and general vigor have been useful in identifying sources of tolerance. More than a dozen lines tested in 1964 greenhouse trials were considered to have some potential as parental material. An additional 14 lines were selected from a screening trial in field plots in 1965. Subsequent tests have reduced the number of promising lines, but crosses have been made involving many of these BYDV-tolerant lines and some of the current hard red spring wheat varieties. Some of the crosses have produced progenies that survived testing as F_2 plants in the greenhouse, as F_3 lines in field plots, and as F_4 lines in a replicated yield trial in 1967. The yield trial also included several selections from the Rockefeller-Mexican Program. Summarized results are presented in Table 1. The performance of some of these lines is encouraging when compared to the 60-75% tolerance reported by H. C. Smith from the best New Zealand wheats. The disturbing note is that Crim and Chris have shown much poorer performance in several previous trials in other years. Additional testing will be required to determine the level of tolerance the lines will exhibit under different environmental stresses.

A different approach to breeding for resistance to the BYDV has been undertaken by utilizing adapted varieties that have complimenting reactions to infection with BYDV with regard to their yield components. Two hard red spring wheats in the 1965 BYD trials were selected because of the following reactions:

	Kernel	s/head	1000-kerne	el_weight - g
Variety	Control	Inoculated	Control	Inoculated
Minn **-54-30	26.7	26.3	30.17	27.86
ND 456	28.5	17.5	28.14	28.09

the second state of the second

These varieties were crossed and their progeny was advanced to the F₂ generation before testing. Parental lines and the F₃ progeny were heavily infested in the seedling stage with viruliferous Rhopalosiphum padi aphids. Approximately 100 primary tillers from each parent and 500 from the F3 progeny were harvested from infested and control plots for individual head analysis! Preliminary analyses suggest a close approximation to a normal distribution curve. A partial summary of these data is presented in Table 2. The more critical analysis in 1967 indicates that the parental 11ines:d1d*not:respond=1n=the manner as 1n=the 1965∀trial*from which they were selected? It is encouraging, however, that several lines from the progeny exceed the mean of the progeny control for seed number and seed weight. If differences observed are heritable rather than chance variation or escape of infection, prospects seem good that BYDV-tolerant lines may be developed from adapted The stranger of the stranger o

is the judicialists of the programme average and include the till of the The control of the co graphic trader, all species dies rough transporterations and ascillation violable become ្នាក់ Company () ចំណុំ ស្នើ ស្នែក្រោយនៅសំខាងក្នុង នេះបានទៀប ស្ត្រីបានសៀមមាន ប្រែក្រោយ on programment consist water for the beautions & Indianapus, elevated seesing service In the contract of the contract of the entraction of the first contract of the first being producted , also para erold occessor entire exito come train als entreed frequintes in the 1992 and the companies of the second of the companies of the second of the companies of parent of volume and the different for a very entered the two servers and the two borgher tweet that areeppeaded. But the little Maly for LANG Historian on the first of the control of engage to the section of the section of the confidence of the section of the sec specime Alban was a contract of Sono we was not also as as we prove the party of an The world of the examplements and the energial of the angles of postaring and the ្សាក្រ ស្រុកស្ពី ស្រែក្រ ស្លាស់ ស្រែក ស្រែក ស្រែក ស្រែក ស្រាក់ ស្រែស ប្រ ស្រាស់ ស្រែក ស្រែក ស្រែក ស្រែក ស្រែក on pitos koskonis must nanstantav ažkunau Sebbeidu muir ik taj slušy on the state of the between and are to be more than the statement of the transfer of the region of the formal performance is to respect to be associated as a second contract the contract to the thought a get twenty do not a district the significant of some is the first entitle The compains a contraction was set of the first a street policies with a street policy and the set of the contraction and the contraction are the อง การเกล้า และการกราก การเมอง ค.ศ. ตาริตสิชาการเกมโดเทา (โหลากระชายมี) และ สินตรงสืบเหตุ สมราช จ and the state of the set and the state of the part of the grant feature. carence a fermaneaves and authorized lighter like tomic sol-

ម ម៉ាន់ នៅក្នុង មាន ខាងមានមាននេះ។ មេម៉ា អ្នក់ទី ២០០០ បាន ១០០០០០០ ខាងមានទី១០ ម៉ាន់។ ម៉ាន់។ មានប្រជាជាប្រជាជាប្រ មានទៅឃើញនេះ ១០០០០ នៃបាន ទេស នៃបានក្នុង ២០១៤៤៤ ប្រធានប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប មានថា ១៩៤៩ ប្រធានប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រ កុម្បាល ១៤៤៤៤ ជាប្រជាជាប្រាជាប្រជាជាប្រធាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រាជាប្រជាជាប្រធាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រជាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាបាប្រធាជាប្រធាជាប្រធាជាប្រធាជាបាបប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រាជិត បាបប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាបាប្រធាជាប្រធាជាប្រធិសាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជាប្រធាជា

TORINGE TO THE SECOND STATE OF THE SECOND SE

Table 1. Performance of selected spring selections inoculated with barley yellow dwarf virus in field plots at Brookings, S.D. 1967.

	. ;			: :
Selection	Yield in Control	bushels/acre Inoculated	Percent control	Standard error <u>l</u> / (adjusted t)
From Brookin	ngs Program			
6526A-23	34.2	29.6	86.5	NS.
Crim	38.8	32.2	83.0	NS
Chris	30.6	24.8	81.2	NS
6516A-13	38.4	30.6	79.7	<u></u> ns
6516D-12	30.2	24.0	79.5	, ns
524A-20	33.8	26.2	77.5	*
6529A-22	30.6	23.4	76.5	NS
6524A-22	36.0	27.2	75.6	* * * * * * * * * * * * * * * * * * *
6531A-24	34.6	25.8	74.6	. NS
6516D(SB)	33.2	24.6	74.1	**
From RF-Mex	ican Program	• • • • • • • • • • • • • • • • • • •		
S4027 S3981	30.4 26.0	33.2 24.0	109.9 92.3	ns Ns
Mex 30	30.4	27.6	90.8	NS.
S3987	25.6	22.8	·	NS
T ₂ PP-An64	24.0	21.2	88.3	, NS
Penjamo	30.6	26.4	86.3	NS

^{1/ * =} Treatment means are different at the .05 level of significance.
 NS = No significant difference between treatment means.

Table 2.--Partial summary of individual head analyses from hard red spring wheat parental and F₃ progeny plants infested with viruliferous aphids.

Variety		Number	of ker	nels	W	eight of kern	els		mean of c	ontrol
and Generation	Treatment	Total heads	Range	Mean	Total heads	•	Mean g	No. of kernels	Weight of kernels-g	
Minn.II-54-30	Control	87	17-51	33.1	87	0.451-1.750	1.066	41	36	33
P ₁	Inoculated		2-49	25.7	84	0.050-1.600	0.624	12	3	3
ND456	Control	86	21-46	33.7	86	0.701-1.700	1.313	46	40	35
P 2.	Inoculated	78	4~38	20.1	78	0.101-1.500	0.551	5	2	2 5
6651A	Control	463	14-68	36.4	456	0.140-3.570	1.261	194	226	151
(P ₁ XP ₂) F ₃	Inoculated		1-56	25.0	481	0.019-1.711		29	21	9
								,	1 12 200	*

SEEDLING AND ADULT PLANT RESISTANCE TO STEM RUST

D. R. Knott

. 2 35 7 14 P.

OTAMEATERS IN REPEAL OF THE SECOND OF THE SE

I have tended to be skeptical about the importance of adult resistance, partly because there have been so few good studies that tested both seedling and adult plant resistance. Hope and H44 are considered to be good examples of varieties having adult plant and perhaps horizontal resistance, but many studies on them were done only in the field. I began a study of these two varieties because I was interested both in their genes for resistance and the relationship of the genes to adult plant resistance.

and the contraction of the contraction of the contraction of the contraction of Backcrosses of both varieties to Marquis were studies. For seedling resistance to race 56 each variety had a single dominant gene on chromosome 2B (XIII). A line carrying only this gene, Sr 1, Sr 1 proved to condition moderate resistance. However, a second gene, Sr. 2, was clearly segregating. Alone it provided moderate resistance to race 56. Only families segregating for both Sr 1 and side Sr. 2 hadeplants that were as resistant as Hope and H-44. The gene in second Sr/2; had; no; detectable affect in seedlings. However, at the seeding stage also it was found that only families segregating for both Sr 1 and Sr 2 contained plants as resistant as the parent. Thus - and in seedlings Sr 2 modifies the resistance conditioned by Sr 1 while at the adult plant stage the two genes act independently but their effects are additive. As east wild be growned without outs as dispent Copyrgue to Asia dament, it has on a caspara which a

Both varieties also carry a recessive gene that conditions good resistance to race 15B-IL. Its location has not yet been determined.

Theoresults show conclusively that Hope and H-44 do have adult plant resistance. Lit is inherited in a normal fashion and it is reasonable to assume that there is a corresponding gene for virulence in the pathogen. The rather broad resistance of these two varieties is probably due to the number of genes that they carry at least three genes in addition to genes they obtained from Marquis.

QUANTATIVE LEVELS OF RESISTANCE TO STRIPE RUST

退退 输尿 微性性的 计一、影动 工事人 机人物造成效。

(Abstract)

ared pagardo berg the second of Wi KirPopeserosad Vilago Juana. They

The first the spread out of the many of the refer of Carnellan word of

to a related state approved appropriate or an appeared to top out the constant of

Wheat selections and populations as observed under stripe rust (puccinia striiformis) at Moscow, Idaho since 1960 show many combinations where crosses of susceptible or moderately resistant wheats produce segregates more resistant than the best parent. These genes act by dosage, are relatively ineffective alone, but produce additive increments of resistance in most, but not all non-alielic recombinations.

The five varieties Cheyenne (res.), Hussar (res.), Idaid (res.), Commanche (Int.) and white club (sus.) will produce additive resistance in all combinations by two's. The highly susceptible Lembi 62 functions as a missing ingredient with moderately resistant bolden producing highly resistant derivatives that persisted further F₁ plants in 1967 with additionally resistant derivatives of the Idaid x Omar combination.

Many highly resistant varieties are multigene such as Hohenheimer whose resistance could not be maintained in a fast backcross to the fully susceptible Lemli. In contrast in a backcross of resistant Cheyenne to Hohenheimer, it has been easy to maintain a higher than Cheyenne level of resistance by maintaining presumably only a part of the Hohenheimer resistance.

All highly resistant wheats including those with very dominant genes have had more than one genes for resistance. Dominant and recessive resistance have been distinguished only by segregation patterns and not by phenotype.

r <u>artelláss is porced</u>te vales communicativos es genera laborado a laborado en la composições en communicacion de La laborado situado esporta la collectiva es com posse albas pobações proportados en communicaciones en commun

Chewin a of

WARREST AND THE MORDING NAMES OF

PHOTO SYNTHETIC AND YIELD RESPONSES OF GAINES AND HADDEN WHEATS TO INFECTION BY SEPTORIA NODORUM.

 $r(\cdot)$ grand 1 and they are to alread ($ext{Abstract}$) r^{op} by Syck result $c \in \mathbb{R}^{n}$ Cuttotiem and instance has no A. L. Scharen : own medicates while s endant pourse plike est form the room to block of bostoness year on the very di But such that the organism is seen to the bostoness were one polices for Photosynthesis, measured as CO2 absorption, was measured in Meads and flag leaves of Gaines and Hadden wheats. The effect of infection by Septoria nodorum on rates of photosynthesis was determined daily for 2 weeks after inoculation at the flowering stage. Yield was measured and related to disease symptoms and photosynthesis. Heads and flag leaves of Gaines absorbed CO2 at an average rate of 5.98 mg per hour during the test period. Severe infection reduced photosynthesis by 46% and yield by 57%. Heads and flag leaves of Hadden absorbed CO2 at an average rate of 2.62 mg per hour. Moderate infection reduced photosynthesis 3000 by 14% and yield by 23% houd of our releasing books as how -కార్మిక్ ట్రింగ్ క్రింగ్ ప్రైవేగ్స్ కై కెర్ట్స్ క్రింగ్ స్ట్రిక్ కి కింగ్ సిన్స్ కింగ్ కింగ్ కింగ్ కెర్ట్స్ క High rate of photosynthesis are characteristic of high yielding varieties. Changes in photosynthetic ability of varieties when infected by S. nodorum were correlated with the seed yield of those varieties. Measurement of photo-pair synthetic ability may be useful in selecting lines with high yielding potential in breeding programs. Maintenance of photosynthetic ability, and consequently yielding ability, in spite of infection by a pathogen may be helpful in selecting lines with resistance or tolerance to certain diseases. tidad chipecias has acceived in concentrated in the

From crishes of T. serious squarely (Vill , North 12) in . Mart 181, factor for and for the . Mart 181, factor for . and for with it specially the . Only 181. State of the . Three, deren and for large range of the . Three, deren and the large range of the . I have a starpe of the first the continue of the . I have a for the continue . Same continue of the continue of the . I have the first for the continue of the . I have a continue of the . The .

⁽d) Fig. and in a graborally adminished a case many decident to refer when the the line for agein Adjudent. Her A. A. Berer Mr. Hourela March, and the Delegan Archivence.

INHERITANCE OF STEM RUST RESISTANCE IN SEVERAL VARIETIES OF WHEAT

F. J. Gough and N. D. Williams a/ A A D. Williams a

We have worked at Fargo, North Dakota on the culture (genotype)specific form of resistance of <u>Triticum</u> to <u>Puccinia graminis</u> f. sp.
tritici Eriks. & E. Henn. Culture 111-SS2 of race 111, the most
widely avirulent race known, was used as the standard test culture.
In every variety previously studied as many, and usually more, genes
for resistance were indicated by the use of culture 111-SS2 than had
been indicated by the use of a more widely virulent culture. However, culture 111-SS2 did not indicate all of the genes for resistance
which some varieties possessed. For example, <u>Sr 5</u> and a gene in <u>T</u>.
dicoccum Schubl. 'Khapli', believed to be <u>Sr 14</u>, were not discernible
with the use of culture 111-SS2.

Objectives of the program were: a) to demonstrate the presence or absence of a gene-for-gene relationship, b) to develop a series of wheat lines, each monogenic for a different gene for resistance, to be used to differentiate cultures of P. graminis f. sp. tritici and as sources of resistance in breeding programs, and c) to select tester cultures of P. graminis f. sp. tritici which would differentiate genotypes of wheat varieties, selections, and hybrids. Ideally, the cultures would have different single genes for avirulence each corresponding to a different gene in the series of monogenic wheat lines.

The first objective has been accomplished. The second will never be to our full satisfaction since almost all varieties are resistant to culture 111-SS2, and because new sources of resistance useful in breeding programs occasionally become available. The third objective has received no concentrated effort.

From crosses of <u>T. aestivum ssp. vulgare</u> (Vill., Host) Mac Key 'Marquis', 'Reliance', and 'Kota' with <u>T. aestivum ssp. compactum</u> (Host) Mac Key 'Little Club', three, three, and four lines, respectively, were isolated. Each line was believed to have a single gene for resistance. Subsequent crosses of each line with Little Club confirmed that all except one derived from Kota (Kt-A) had a single gene for resistance. Kt-A had two genes for resistance. The derived lines were intercrossed and those from Marquis and Reliance were crossed with lines having the genes for resistance from substitution lines Hope 1D, Red Egyptian 2B, and Thatcher 2B. The lines

a/ The authors gratefully acknowledge the many contributions to this work by the late Dr. Mario Rondon, Dr. L. A. Berg, Mr. Hossein Kaveh, and Mr. Melvern Anderson.

And the state of t

A to the discount of the control of the control

State of the state

derived from the substitution lines were developed by Dr. W. Q. Loegering. Relationships among the genes for resistance are shown in Table 1.

Several varieties of T. durum Desf., two of T. dicoccum, and one selection of T. timopheevi Zhuk. were crossed with T. durum 'Marrocos 9623'. Subsequent segregating generations were tested to determine the number of genes which conditioned resistance culture 111-SS2, and to isolate lines with single genes for resistance (Table 2). The most apparent feature of the data in Table 2 is the number of times that three genes for resistance were indicated by culture 111-SS2. One possible explanation is that the culture had three genes for avirulence which corresponded to three loci in the host varieties. However, this hypothesis weakened by the data obtained from Marquis, Reliance, and Kota which indicated that these three varieties may possess as many as six non-allelic genes for resistance.

en filosoficio e personale de la companya de la co En companya de la co En companya de la companya del companya de la companya de la companya del companya de la companya del la com

North and high English was in most of the contain and the straight of the stra

and and the translation of the properties and manifold (1.12) to be one it.

1. The content of t

Table 1. The relation of genes for resistance to culture 111-SS2 of Puccinia graminis f. sp. tritici in lines derived from Marquis and Reliance to those in Kota and in lines derived from substitution lines Hope 1D, Red Egyptian 2B, and Thatcher 2B.

and the contract of the state of the country of the contract o	posiowa da Balli 20-11-11-12-11-11-11-11-11-11-11-11-11-11-
	Gene relationship Control of the con
Supplied and service was as as as	t rout to space strate state
and the state of the state of the state of	Marifi sauti a marka kanangai bi A
Mq-A, R1-A, Kt-B, and Hope 1D	
	ार्थकार अ रह म ज़र्बन करें हेल्दी रूप्तर ह
	Single gene, probably linked with
्या भू तकार अस्त सामान्य स्थलित है कर उन्हार स्थलित है	Wymanian arm
	aleca Tol seeing v. red foreber . p
R1-B and Thatcher 2B	Single gene in common, Sr 16
Mq-C and R1-C	Single gene in common, not linked with or allelic to genes in other derived lines
Kt-A	Two genes, one may be the same as the one in Mq-C and Rl-C. Neither gene allelic to Sr 9a nor the gene in Hope 1D. The cross between Kt-A and Rl-B not obtained.
Kt-C	Single gene, not linked with or allelic to genes in other derived lines
Kt-D	Single gene, cross not obtained with R1-B, not linked with or allelic to genes in other derived lines

a/ Mq-A, Mq-B, and Mq-C were derived from Marquis. R1-A, R1-B, and R1-C were derived from Reliance. Kt-A, Kt-B, Kt-C and Kt-D were derived from Kota.

Table 2. The number of genes in durum, emmer, and timopheevi wheats which condition resistance to culture 111-SS2 of Puccinia graminis f. sp. tritici.

T. duı	rum		*** 18 Y	July 1 mole	នេះ	2 D
		and the second of the second				* /* *
	TCHE -			5 5 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	. 1	* 1 1 1 1 1 m
1.00		- 11 y i			3,	rage to the
(C. I. 7805	d .,	o Alberta (1965) Originalis and Salar		្សាស្ត្រ ក្រុម ខេត្ត	Visit er
	. I. OLJO	Tarifoliosa (1964)			3 1 200 - 1, 200 - 2	,
·	rnmilto	១៦៨៦ ៩៩៦	។ ប្រាស់ស្ន	o per que	3.	
· · · · · · · · · · · · · · · · · · ·	uudanka*	នៅ។ ជាអំពីសាស្រា			والأراج والمساور المواسات	
	dinduma		D. Wigney.	s. oinid	3	10 31/FT
	. 1. 94/U	£7 6 ga			.3	WE THE W
	opelmar ^a	00	a in the police The contract		3 3 va to sijuo	
\$	St 464 ^b	e de la companya de La companya de la co	ena di mperior		. 3	
1	remez pre	tod	, , , , , , , , , , , , , , , , , , ,		3 5 10 40 00	ing blaker. Profesiona
	remez rijo				2	
	ក្នុងមេ ១១៤	or or and the	mand) v		Haranger Co.	-EPA
<u>I. dic</u>	coccum				er ger Japan	
ĸ	Khapli ^a	on the DATA	ជីប់បារ៉ាស្មិត ។	atti osto oli t	© 5 (b) ing	is again
		era, gilaya	i. Holos por	**.	1 + 2 modi	lfiers
** * * *		rational street	TOTAL BULL CO.	1. 7. 1. 14 1.	धारः । । । इत्यस	1-1

a Selected single gene lines intercrossed and crossed with susceptible <u>T. durum</u> 'Marrocos 9623'.

b Single gene lines selected from F_4 and backcross- F_3 .

c F_2 and backcross- F_1 tested.

d Cross made but segregating generations not tested.

REACTION OF CERTAIN WHEAT VARIETIES AND SELECTIONS TO LEAF RUST - OKLAHOMA, 1967

the thirty of the state of the state of the state of

H. C. Young, Jr., T. A. Kucharek, J. M. Prescott and L. L. Singleton

Seeding reaction tests of 82 wheat varieties and selections plus 30 differential varieties and selections were made with 21 isolates of <u>Puccinia recondita</u> f sp <u>tritici</u> during February and March, 1967. The tests were made in the greenhouse at approximately 20°C. The tests with individual cultures were not made concurrently and, therefore, a certain amount of variation in reaction was expected due to light and temperature fluctuations. In all cases, the number of plants with off-type reactions was noted. Those varieties or selections with off-type reactions were considered mixed or segregating for reaction to one or more cultures. Approximately 15 to 20 seedlings were tested with each culture and the reaction listed was the reaction expressed by the majority of plants. If a variety or selection was segregating, a false reaction might have been indicated with such a small number of plants.

The response of most of these same varieties and selections to leaf rust in the field also was recorded. No artificial inoculations were made on the field plantings.

These data have been assembled and distributed with the thought that they would be of interest to other pathologists and breeders concerned with leaf rust problem in wheat.

en de la companya de la co

Since the section of the section will be any an in the late of the

politica de la sacretação forma de porta do altimada sou estra que

The second of the second of

and the transfer when the beautiful to the state of the s

Entry Variety		C.I. o	r Source	2-1	IA65-	•	5	-NA65	5 –	•		6	-NA65	<u></u>	<i>i</i> •	
No. or Cross		Sel. No	o	9	27_	27	3	19	19	27	3	19	19	25	27	28
1. MA /1		4898	LR INT	0,	0-01	01	4	4	4	4	4	4	4	4	4	4
2. CI	٠.	3756	DIFF	-	0'-1	7	0'-2	0'-1	0'-2	0'-2	X	2-4	X	3-4	2-4	Х
3. BV	$(\gamma_{i,j},\ldots,\gamma_{i,j})$	3778	11	0' -	0'-2	0'-2	0'-1	0'-1	0'-2	X	4	4	3-4	4	4	3-
4. WST		3780	$\mathbf{m}_{s} \leftarrow \lambda_{s}$	Ó'	0'-1	0.4	0'-1	0'-1	0'-1	0'-2	0'-2	0'	0'-1	0'-1	01.	01.
5. LS		3779	†I	01	0'-2	0 1-2	0 1	0'-1	0'-1	0'-2	3-4	4	3-4	3-4	4	3-
6. MI		3332	11	4	4	4	4	4:	4	4	4	4	4	4	4	4
7. HS		4843	11-	2-4	3-4	3-4	3-4	3-4	4	3-4	4	4	X/	4	3-4	4
8. DO		3384	11	4	4	4	4	4	4	4	3-4	4	4	4	4	4
9. DLR		13373	NA SUP	0'-1	2-4	2-4	0'-2	2-4	3-4	2-4	0'-3	4	3-4	2-4	2-4	2-
lO. LEE	. 1	12488	DIFF	3-4	3-4	2-4		0.1 - 2	0'-2	4	2		0'-2	2-4	2-4	3-
L1. WBN		12992	JI	0'	0'	0'	0'	0-0'	0.1	0'	0'	O,	O'	0'	0'	0
L2. SVL	•	12595	J1	0'	3–4 ⁻	4	4	4	4	4	4	4	4	0'	4	4
13. ECH		12635	ĴŤ.	0'	-		0'-1	7	0'		0'-1	.7	0'	0'	0'-2	**
L4. ARS		13228	NA UR	0'	0'	0'	0'	0'	0' .	0-0'	, o	0'	0'	0-0'	0'	0,
L5. AG		13523	-11	0'-2	-		0'-1	- 4	0'-2	-	0'	0'-2	- T.	0'	0,	0"
L6. AIV		12578	11	0'-2	-		0'-2	-	-	-		•	0'-2	2-3	0'-2	2-:
L7. LCO	•	14047	11	0'	0'-1	-	0'-1	-	~	0'-2	-	-	-	0'	0'	0.
l8. TF		13483	n 	0'		0-0'	0-0'		0-0'	0-0'	0-0'	0-0'	0-0'	0-0'	0-0'	0
.9. WK	•	13659	11	0'	0'-2	-		0-0'	0'		0'-1	-	-	0'	0'	Ġ.
20. WD2		13628	NA TV	0'	0-01	-	0-0		0'-1	•	0'	0'-1		0'	0'	0.
21. WBN2		14018	,11	0'	0'	0.1	0-0.		0'	0-0'	0-0'	0	0'	0-0'	4.F	01
22. WK2		14049	-11	0'	0'	0'		0-0'	0'	0'-2		0'-1		0'-1	•	Ç.
23. L.R.		13651	**	0'	X	0'			0'-3		3-4	3–4	3-4	0'-4	•	4
24. LANI		14021	"	0'-1			0'-1	-	-	0'-1	-			0'-2		0.
25. LF		14022	***	0'	-	0'-2	-			0'-2		0'	0'	0'	0'	0.
6. ANEX		14020	11	0'		0'-3		0'	0'	0'-1	- ,	0'	0'	0'	0'	Ò.
7. FREX	١.	14019	11	0'	0'	0'-1	-		-	0'	0'	0'	0'	0'	0'	0.
8. WTR	٠.	12110	OK TV	4	4	3-4		0'-2	•	X	4	3-4	0'-2	4	4	3-
9. WSL 0. TP		13090 14154	.,	2-4. 0'	.3-4 . 0'	2-4 0'-1	3-4	2-4	2-4 0'	2-4 0-0'	4	2-4 0'	X,	2-4	3-4	Ö,

Entr	y Variety	C.T. or	Source	2-1	VA65-			5-NA65	<u></u>				5-NA6!	5-	 -	
No.	or Cross	Sel. No		9	27	27	3	19	<u>19</u>	27	3	19	19	<u>25</u> .	27	28
	KR/HF		OK TV	0'		0'	01	0'	01	0'	0'		0'	0'	0'	01
	SWI/TF	13853	H	0'	•	0.1		0-01	0.4	0-0'	-	0-0		0-0'	•.	0-01
	I.B.J/TF	S60R7919		01	0-0'	0-0	0-01	0-0'	o'	0-0'	0-0'	0-0'	0-0'	0-0	0-0'	0-01
34.	The state of the s		CK	4	4	4	4	4	4	4	4	4	4	4	4	4
35.	ne*	12517	11.	3-4	.4	4	0'-2	X	X	X-4	4	X	X	4	4	4
36.	77 eg en - 1	11952	11	3-4	4	4	4	4 :	4	4	4	4	3-4	4	4	4
37.	i resu	12132	ii .	3-4	4	4	4	4	4	4	3-4	4	4	4	4	4
38.		12518	l)	4	4	3-4	4	4	4	4'	4	4	4	4	4	4
	T*SP/A*E2/PN	13020	# 1.	0.	0'-1	0'-2	0'-1	0'-1	0'-1	0 *	0,4	01	0'-2	0.4	0.1	0'-1
	MQL/20RO2/TM4/T*SP/A*	* 10 to 10 t	} ^{##}	0'-1	2-4	0.1	0'-1	012	0'-2	0'-1	0'	0'-1	0'-1	01	O'T	0'-1
	KV2/FZ/HG3/W38/WBS2/1		IND	0.4	01	Θ_{μ}	0 *	0-0	0.	0.,	0 '	0.1	0.4	0,4	0 1.	01
100	2/HOPE/HS5/ARS	11-4		Ę .	100	Or,	* 4 *			, ·			() = () +	$G = \mathbb{C}_{+}$	1,(;	
42.	(UNKNOWN) /2	P5517B5-5-1P-3-1	û	0"-1	X	2-4	0'-2	X	X	X	X	X : 1	0'-1	0''-2	0 -4	X
43.	(UNKNOWN) /2	P5824A1-1-3	**	01	0'	0-0	0-01	0 •	0.4	0-0 '	0-0'	0-0	0"	0-0'	0'	01
44.	WBS/A.B2/AIV	13227	89.	0'-1	0 -2	0	0'-2	01	0'-2	X	0'-1	3	2-3	0 1-2	0,4	0'-3
45.	AIV/2PNC	S62R8530	OK	0 1-2	0 4-1	0.1	0'-2	0'	0'-1	0'-3	0.1	3-4	2-3	0'-1	0,4	2-3
46.	BI/CCH2/ATN	T59C773	TEX	0 '	0'-2	0' -2	0'	0.	0'-3	-	0.	0,1	0 1	01	X	0' -
47.	ATL50/FW1123 2/SUWONS	92/NRN66 S61R8529	fit.	0-0	0-0		0-0'		O'	Õ'	0'	01	0-0	0'	X	0'
48.	PSK	14153	OK	0'	0'	0'-1	0''-1	0,1	0'-1	0,	Ó.	0 1,-2	0'-1	0.1	Õ.	0'-1
49.	MQL/ORO2/PN3/FTN	S61R8538	10 2	0-0	0'	0'-2	0'-2	0'-1	0'-2	0'-1	0'	0'-2	9'-1	01	0	0'-2
50.	BP	PI203084	FOR INT	0'	2-4	X-4	X	0 t d	X-4	X	0'	0'-2	X	Q'	X	01
51.	(ÛNKNOWN) /2	S61R8541	IND	0-0'	0+0'	0-0'	0-0'	_	Ö-0'	Ö'	0-0	0-0	0'-1	0-0'	Ó.	0-0'
52.	2TMP2/T*SP/A*E	\$646395	OK	01	0'-1	0'	0'-2	•	0'	0'	0'		0!-1		O'Y	0'-1
53.	11 11 11 11 11 11 11 11 11 11 11 11 11	S646408	ii	0'-1	-, -	- 7 -		0'-1		- T T	Õ'	73.	0'-2	-	0'-1	0'-1
54.	KAW3/TMP2/T*SP/A*E	S646253	si		0'-1	0'	0'-1	0'	0'-1	0'	0,	0'-1	0'-1		0'	0'-1
55 .	64KRANSADOR	i di	FOR INT	100	2-4	2-4	4	2-4	2-4	X	4	4	4	0'-3	2-4	4
56.	2TMP2/T*SP/A*E	SC60123-9-3-2	OK	7 7	0'-1	-	- A - 7	0'-1	-7. 77	T	0'	7 -	0'-1	- Tu	0'	0'-1
57.			11: 1		0'-1	, -		_	0'-1	Ų I	0'	0'-1	Ψ.	0'	0'	0'-1
58.		S64C1028	10. Earl		0'-2		0'-1		01	0'	0'	Ö'	Ŏ'	0'	0'	0'-2
59.	and the second s	13369	TEX	3-4	4	0'-2	4	2-3	2-4	2–4	2-4	2-4	X	0'-2	X	2-4
	(UNKNOWN)/2	P568B6-2-3P-2	IND	4	4	4	4	4	0'	4:.	X	2-4	X-4	4	4	X -
	(UNKNOWN)/2	P568C3-5	IND	3-4	3-4	4	0'	3–4	4	4	4	4	X	2-4	0'-4	4
62.	(UNKNOWN)/2	P5752A1-1P-2	IND	2-4	4	4	3-4	4	4	4	4	4	X-4	3–4	4	X
	;			• • • • •	a e ige	a * ·							Conti	nued		
													Contl	nued		
•																

Enti	y Variety	C.I.or			NA65-			5-NA65	5				NA65-			
No.	or Cross	Sel.No.		9	27	27	3	19	19_	27	3		19	25	27	28
63.	IVCL (12034)/CMN2/PN3/CCH	K63322	KAN	3-4	2-4	X-4	4	0'	0'	0'-3		0'-2		X	3-4	2-4
64.	51	K63326	11	0'-2	0'-2	0'-2	0'-1	0 ! -2	0'	0'-2	2-4	0'-2	0'-2	0'-4	X	X-4
65.	38MAB0427	PI116015	FOR IN	0'-1	2-4	3-4	4	seg.	4	4	3-4	3-4	2-4	X	4	X
66.	ARGENTINA C9556	PI117490	ts	4	4	4	4	4	4	4	4	4	4	0'-4	4	X
67.	RIETTE/QUALITY	PI225157	11	0'-1	0'-3	0'-2	3-4	X	2-4	0'-2	Y	2-4	X	0'-1	X-4	X
68.	OTT2/SVL/2PN	K62234	KAN	4	X-4	4	2-4	X	X	X	2-4	X-4	X-4	0'-2	0'-4	X-4
		P1113954	FOR IN		4	4	4	4	4	4	-	4	4	-	4	4
70.	TF3/T*SP/S*C2/FW815X2	GA2892	GA	0-0	0-0 *	0-0	0-0	0-0	0-0'	0-0	0-0'	0-0	0-0'	0-0'	0-0'	0-0 '
71.	BC3896/62 3 3 3 3		11	2-4	2-4	2-4	2-4	2-4	3-4	2-4	3-4	3-4	3-4	2-4	-	2-4
72.	DANNE SEL C-129-16	S431	OK	4	43 - 7	4	4	3-4	4	4	.4	4	4	4	4	4
73.	CCH CALL	12517	CK	4 -	4.	4	0 '-1	01	X	X-4	4	X-4	X	4	4	4
74.	SDY	13684	CK	3-4	4	4	3-4	4	4 1	4	4	4	4,	0.4	4.	4,
	SUT	13546	CK	3-4	3-4	4	4	3-4	4:	4	4	2-4	2-4	04	4	2-4
	CDD '	13536	11,	4 ·	3-4	3-4	4:	3-4	3-4	4	4	4	4.	4.	2-4	4
77.	KAW61	12871	11	4	43	2-4	4	4:	2-4	3-4	3-4	4	4	4	3-4	4
78.	PKR	13285	11	3-4	2-4	X-4	0'-1	0,1	0 '	0!-2	4	2-4	X	2-4	4	3-4
79.	DANNE SEL C-145B4	S111	OK	4.	4	. 45	; 4 ≒	4	4: -:	4	4	4	4	4	4	4
30.	DANNE SEL C-146-4	S118	11,	4	4	4,000	4	4	400	4	4	4	4	4	4	4
	DANNE SEL C-141-2	S116	11	4.	4	4:	4	4.	4	4	4	4.	4 ~~	4.	4	4.
	DANNE SEL C-204	S31	11	4	4	4	4	4	4	4	4	4	4	4	4	4
33.	DANNE SEL C-5-134-8	S50	11	3-4	4	4	3-4	4	: 4;	4	4	4	4	4	4	4.
34.	NRN16/CI12500 2/KAW	K63155	11	4:	3-4	3-4	4	2-4	X-4	X :	4	4	4	4	3-4	4
35.	DANNE SEL C-140-E	S307	11	4	4	4	4	3-4	4	4	4	4 .	4	4	4	4
36.	DANNE SEL C-155-2	S157	**	4:	4	4	4	4:	4	4	4	4::	4	4	4:	4
37.	DANNE SEL C-132-8	S286	U,	4	4	4 🛶	4:	4-	4	4	4	3-4	4	4.	4	4
38.	SANDO HYBRID	SS684	11)	4	3-4	4 °	0'-1	0'-1	0'-2	X-4	4	X	X	4	4	3-4
39.	SANDO HYBRID	SS4149	11 Sept. 1	3-4	3-4	4	0'-2	0'	0'-2	X-4	4	0'-2	X	4	3-4	X-4
0.	DANNE SEL C-61-19-1	S1219	11	3-4	4	4	4	4	.4	4	4	4	3-4	4	4	4
	TMP/AG	S646307	11	0 1	0 .	୍ଠ¹	0'-1	0'	0'	0'	0'	0'	0'	0'	0'	0'
	KAW/AG	S646255	11	0-0'	0'-2	0'-1	0'-1	0 '	0!-1	0.	0'	0'	0'-2	0':	O'	0'-2
	DANNE SEL C-170-6	S770	· # Jagar - g	2-4	4	4	4	4	4	4	4	4 ,	4	4	4	4
3:11						• •		- 4 % - 1 √ 6 - 6		•	•.		(Contir	ued -	<u></u> ·

nti	ry \	Variety		C.I.or		2-1	NA65-		5-	-NA65-	-				6-	NA65-	ana .	
ο.	DVDGG C	or Cross		Sel.No	Source	9	27	27	3	19	19	27	3	19	19	25	27	28
4.	OTT/CTI	r2/cch/kaw3/ti	MP :	S648735	OK	4~(4,~;	4 -	4, -2	4	3-4	seg.	4	4	4	0'-4	4	4
5.	I.B.J/(CMN2/TF3/I.B.	J/CMN2/	S648788	* 11	segr	egati	ng	$\{Y_i\}_{i=1}^n$	{·	C	21 2-3		Q.	e de la companya de l		0.	er. G
) '	T*04/T	MP	-	87 STA	.**	-d	•	₹*			÷	₹		-4	3-4			
6.	TOLLE	SEL		· Siking great	FOR INT		3-4	4	4	4	4	4	4	4	3-4	4	4	3-4
7.	TMP64 S	SEL		S65317	OK	4	4	4	4	4	4	<u> 4- y</u>	4	4	4	3-4	4	4
8.	TMP64	SEL SEL	•	13679	11 13	4	4	3–4	4	4	.4	4	4	3-4	.4	4	4	4
9.	I.B.J/	CMN2/TF3/I.B.	J/CMN2/T*O		.!!	3–4	٠4	4	4	3-4	3–4	4	4	3-4	_₹ 3–4	X	.4	.3–4
ਦ - ਛ= '		HT G-TVO-E	4	3307	23 11	\ <u>.</u>	·.	<i>.</i> .	V	3-46	5	.1 1	i,	: <u>.</u>	Ť	sł.	V.	ri.
		HYBRID		SS736	- (**	:4 	4 · ·	3-4		0'-1		X4		X	X,	3–4	4	3-4
1.		CMN2/TF3/I.B.	J/CMN2/T*O	8643966	4.5	0'-1	X.	∜X ∜	X	0'-2	į X	X	X	X	X	,0'-1	2-4	0'-
	4/011/	CTT2/CCH/KAW		S649033			2-4	:X-4	₹ /.	ੁ ∵X~4	7 01 6	x-4	Ÿ.	v /	₹ X-4	7 ⁶	QP V	
		AJA		2514	FOR INT	ં ય 'ે∩'	3-4	2-4	\ .	⊹3-4			्4 -3–4	્ત્ર−4 ⊹3–4	્⊼−4 .⁄.	γ X ⊰X	2-4	X
J.	T C / CDD	P G Even		211	CAN	. ,∪ .;-		0'-2			(0'-1		:₹3 – 4	्उ−4 े3−4	X-4	4	.,∠-4 .li	-4 2_4
T.	7TC/WS	ф		13353	II.)-	0'	· 0 - 2	•	/O'	ે ં ' - ±		ີ -ດ'-1	0'-2			ית	ຸກ ¹ -ຸກ ¹
6.	STE AR	RTCA43	, 2	15815	17	Ç-	4		√0'-2	٠ -	3–4		2-4	0'-2		2	3-4	ŏ'-
7.	6TC/DO	PRICA43	, ,	98,6%	<u></u>	· _	4 :	,	;4 −		4	4	4	3-4	` x -	4	4	4
8.	6TC/M.	Е		, North	CH.	3- 3	4	3-4	. 4	3-4	4	4	4	4	4	4	.4	4
	6TC/CT		•	136.20	(Jt	Ç ⊶ √	X	₹4	~4	4	-4	-4	_c 2-4	×X	.4`	64	.4	4
o.	6TC/EC	H L	5 a	8431 12017	CH.	۲; –	₹4	2-4	୍ଦ!÷1	ୃଠ୍ '	X	$\mathbf{x}^{\mathbf{X}_{i}}$	÷3-4		X	. 4	. 4	4
		HE ECH SONS ?		2737	o !!	ξ _i 	2-4	†2 – 4		0'-3		ਦ 0 ¹ − 3	કે∂0¹−2	ਹ†−2	2-4	2-4	2-4	3-4
	AFRICA			j.	11 11	3 - 0	5 X	ु0 ुं − 2	ʒ 3 ÷4	ូ0∛−2	∃X ∙	X -	2-4	ું4્ર	4	4	4	4
		T/SECT/PROLES			CV.	6-01	0-0,	9-0.	(j~0)	0-U.	÷,;	(-0 ₁	,	(time(s	7-2	,	G~€i.	4.47
	- \$000.0100	7288 77288	3	and the second of the second o	FOR LAT	ş i	Ÿ	\$3	ş.	ź.	;	-, 3"		ti.	11			Ų.
	Market and a		.5		WY:	-1	-1'- 'V	1	\$ 1,k	.:	j.	7.	Çy	7:4:	V* ** - 1	Ų - 3		77 - 177 - 177
		OBINIA Boloman		T3 13723	11	C_{α}^{-1}	O _a rti	0,-1	Ĵ+ot	·	L V	€,÷0-		700	X	J + 7	, · · · jr	Y
	ge Mor	ET CORRE	•	HITITES -	1	₹	*	Ţ.			s ^r	· i	:	i ^r	ŧř	Garage .		, 3
,	.d (1 - ×2√2). •	wi da	h	17,0413	half Illi		2 -4	2 V	•	唐台4:	`.	. 1	·	3.00	13		7	2
	errects.	"我们"。 "你们一个一个一个一个一个一个	ر چېوبرونو ر چېوبرونو	e Politica (Prince) Commissione		: · · · · · · · · · · · · · · · · · · ·	9.44	(i. ~).	ug Jos	u mil e	di.		÷ ,	<i>C</i> -				. · · è
		Cole					5-y				: ·			133	7		3	7
J., J.			The second of the second of the second	11 설립 30년 12 : 11 중국 11 전 1	, G (4) (1) (1)	4 ,	- 3. 		1	Ž.	(d	. 1	?		18		ì	, di
	a transfer and the second	against the	the same											<u>(</u> , −)				

•

Reaction to Leaf Rust Culture

Entry		9-NA	65-			13-N	A65-		Off	1967	Field I	Response		
No.	1	1	1	1	7	7	13	23	Type <u>3</u> /	Ř	S	P		
1.	4	4	4	4	4	4	4	4	0			_	,	
2.	3-4	2-4	3–4	3-4	3-4	4	4	2-4	0 .		-	-		
3.	3-4	2-4	3-4	2-4	3	3-4	3-4	2-4	0	<u>-</u>	-	-		
4.	4	4	4	4	4	4	4 :	3-4	0	-	-	-		
5.	4	4	4	3-4	4	3–4	4	4	0 :	-	-	-		
6.	0'	0'-1	0'-1	0'	3–4	3-4	4	4	0 [£]	-	-	-		
7.	2-4	3-4	4	2-4	2-4	2-4	0'-2	2-4	0	-	-	-		
8.	0'.	0'-1	0'-1	0'	4	4	4	4	0	-	-	.		
9.	0'-1	0'-2	0 -2	0'-3	0'-2	0'-2	0,	2-4	0,	4	tr	100		
10.	0'-1	0'	0'-1	0'-2	0'	0'-2	4	0'	0	-	-			
11.	0'	0'	0-0'	0'	4	4 .	4	4	4	4	tr	100		
12.	0'	0'	0-01	0'	4	3-4	0'	3-4	. 0	-	• ∸	-		
13.	0'-1	0'	0'	0'	0'	0'-1	0'	0-0 *	0-		_			v
14.	0-0'	01	0-0'	0-0'	0'	0'	0-0'	0'	0	0	0	0		94
15.	01	0'-1	0'	0'.	0'-2	0'-2	0'	0'	0	0	0	0		
16.	0'-1	0'-1	01	0'-2	0'-2	0'-2	0 -2	0'-2	0,	4	tr	100		
17.	0'-2	0 -1	0'-1	0'-1	0'-1	0'-1	0'	0 7 -2	0	0;	tr	100		
18.	0-0	0'	0-0'	0-01	0-0	0-0'	0-0	0-0'	0	_	_	-		
19.	0'	0'	0-01	01	0'-2	0'-2	0'	0'-2	20	segr	egating			
20.	0'-2	3–4	3-4	3-4	0'-1	0'-1	3-4	X	3.	4	tr	tr		
21.	0'	0'	0-0'	Ò'	4	4	3–4	4	4 2. •	4	3	100		
22.	0'	0'-1	0-0'	0-0'	0'-1	0'-1	0'-1	0'-2	17	segr	egating			
23.	X	3-4	X	2-4	0'-1	0'-2	0'-2	2-4	0	-	_	· 🚣		
24.	0'	0'	0'-1	0'	01	0'-1	0'-1	0'-2	5	0;	tr	100		
25.	0'	0'-1	0'	0'-1	0'-2	Ô'T	0-0'	0,	0	0	0	0		
26.	0 1	01	0'	0'	.0 *	0'	01	0 '	2.	0;	tr	100		
27.	0.1	0'	0'	. 0	0'-1	01.	01	0.	38	o Î	0	0		
28.	0 *	3-4	3-4	4	0'-2	2-4	4	2-4	0	4	70	100		
29.	0'-2	2-4	3-4	3-4	X	2-4	X	2-4	- 0	4	70	100		
3Q.	01	0'-1	0-0	0-0'	0 1	01	0-0'	01	-0	0	. 0	0		
					. X	•,		,•	•		· ·	•		

try		9-NA6				13-N	A65-		Off	1967	Field R	esponse
,	1/:	1	1	<u> </u>	7	7	13	23	Type3/	R	S	P
31.	0 *	0'	0'-1	0'	0'	0'-1	0,	0'	1	Ó	0	. 0
32.	0-0'	0.1	0.1	0-0 *	0-0'	0-0'	Q.	0.1	0	Ò	0	Ö
33.	0-0'	0-0	O'r.	0,	0-0*	0'	0-0'	0 '	O	0	0	- 0,
34.	4	4	4	4.	4	4	4	3-4	, O	4]	50	100
35.	4 X	4	4	3-4 4	0'	0,1	4	X-4	Ò	4	50	100
36.	4	4	4	4	3–4	4	4	4.	.0	4	70	100
37.	4	4	4	4	4	4	4 4	4	1	4	70	100
38.	4	4	4	4	4	4	4	4	1	4	50	100
39.	0'-2	0'-2	0'	0,	0'-1	0'-1	0.*	0'-1	8	Ó	0,	0'
40.	0 1	0'	0.	0.	0'-1	0'-1	0'	0'-1	41	0;	tr	100
41.	0*.	0-0'	0'-1	0.'-1	0'-1	0-0	0 *	0'-1	· · · 1	Q Î	0	0
42.	X	X	X	0'-1 0'-1	0'	0'-1	0.	0'-2	1	Ö	0	
43.	Q-Ö'	0-01	0-0*	0-0 •	01	0-01	2-4	O'1. ~~	31	Ó Î	0	0
44.	0'-4	0 1	0'-1	0'-2	01	0'-1	0 • –1	0'-2	\2	0;	tr	100
45.	0'-3	0'-1	0'-1	0 '	01	0'-2	2-4	X	្មី	0;	tr	100
46.	0'-2	X	0'-2	0 t O	O [®]	0'-1	Ô.	01-2	4	0;	tr	100
47.	X-4	2-4	2-4	0'-2	0'-1	X	Ó*	0'-1	14		regating	
48.	0.	0'-2	01	0'-1	0'-1	0'-2	O. s.	0'-1	14 2	0;	tr	100
49.	0'-1	0'-2	01	01	0'-2	0'-1	Ö'	0'-2	11	o T	Ô	0
50.	X	X	2-4	0'-1	0'-2	X	Ö-0*	0'-1	∵7	2-4	tr	100
51.	3-4	4 0'-1	2-4	4	4	X	3-4	3–4	`7	4	tr	25
52.	0'	0'-1	0'	0'	0'-1	0'-1	0 1	0'	1	0	0	0
53.	Ŏ ¹	0'-1	0-0'	0 *	0'-1	0'-2	ö'	Ö* <u>≤</u> 1	Ō	Ó	O	0
54.	0'-1	0'-2	0,	o'	0'-2	0'-1	0'-1	0'	0	· 0	0	0
55.	0'-4	Ö†	0'	0,	3-4	4	3-4	4	1	0	0	0
56.	01	0'-1	0-0'	0'	0'-1	0'+1	Ŏ'	0 • [©]	1	; Ö	0	Õ
57.	0'. 0'.	0'-1	0-0	0'	0'-2	0'-1	0'-1	0'-1	.0	0	0	Ŏ
58.	01	0'-2	0'	0'-1	0'-1	0'-1	0'-1	0,4	0	·Õ	Ŏ	Ö
59.	0'-1	0'-1	01	0'-2	2-4	3-4	3–4	2-4	0.	4	5	100
60.	X-4	4	4	0'-4	4	. 4	X	X	$^{\lambda,b}\hat{0}$ \wedge	4	ī	100
61.	X	0'-4	X	X	3-4	4	4	4	o i i j	2-4	3	100
62.	2-4	X	0'	4	X	3-4	2-4	X	2	0	0	0
~ - 7	- -	41.	•	- •						•	•	ntinued

2
С

ntry		9-NA6	5			13-N	A65-		Off	1967	Field	Response
o.	1	1	1	1	7	7	13	23	Type <u>3</u> /	R	S	P
53.	0'	0'-1	0'	0'	0'	X	3-4	X	6	4	1	100
64.	0'-1	01	0'-1	0'-1	0'	X	4	X	14	4	5	100
55.	4	X-4	2-4	X	3-4	4	0'-1	X	6	0;	tr	
66.	3-4	2-4	2-4	2-4	2-4	4	X	3-4	0	۸.	5	100
67.	01	X	1-2	0'-2	X	X	X	X	0	4	5	100
68.	X	0'-1	X	0'-1	4	4	X-4	X	3	0;	tr	100
59.	4	4	_	X	3-4	4	2-4	4	0	4	30	100
70.	0.1	01	01	0'	0-0'	0-0'	0-0	0'	0	0	0	
71.	0'-3	2-4	0'-2	X	X	3-4	X-4	2-4	. 0 :	4	- 30	. 100
72.	3-4	4	4	4	3-4	4	4.	4	· · · 0	, . - .,	-	·
73.	0'-4	4	4	4	01	X	4	X	0		_	· · · · · -
74.	4	3-4	0'-4	4	3-4	4	3-4	4	.0	_		
75.	0'-4	X	4	4	4	4 .	3-4	4	0	_	-	_
76.	4	3-4	4	4	4	4	2-4	4	,O		_	_
77.	2-4	4	4	3-4	4	4 .	4	4	1	_		·
78.	0'-2	3–4	2-4	3-4	0'	X	3-4	2-4	O	-	_	_
79.	3-4	4	4	4	4	4	4	4	2	-	-	_
30.	4	4	4	4	4	4	3-4	4	0	. —	-	-
81.	. 4	. 4	4	4	~4	4	4	4.	O	<u> </u>	-	_
32.	4	4	4	4	4	4	- 3-4	4	1	, –	_	_
33.	3-4	4	4	4	3~4	4	2-4	· 4	0	_	_	-
34.	2-4	4	4	4	4	4	3-4	·- 4	0	_	-	· -
35.	4	4	3-4	4	- 4	4	3-4	. 4	1	, –	_	·
36.	4	4	4	4	4	: 4	. 4	4	0	· -	-	·
37.	4	4	4	4	4	4	. 4	4	. 0	, –	_	-
38.	, X	4	4	4	· 0 *	X	4	X	Q	-	_	· _
39.	0'-4	4	4	4	· 0'	X	4	X-4	8	-	_	· -
0.	4	4	4	- 4	4	4	4	4	0	-	-	_
1.	0'	. 01	0-01	01	0'-1	0'	0'-1	0'	· O	-	-	_
2.	01.	.01	0'-1	0 1	0'-1	∵ 0 *	0-0 *	0 *	0		_	· ·
3.	4	4	4	4	4	4	3-4	4	1 .	· _		

	9-NA65	5	_		13-N	A65-		Off	1967	Field	Response
1	1 :	1	1	7	7 .	13	23	Type <u>3</u> /	R	S	P
4	4	4	4	4	4 👀	4	4	2			
Segrega	ating	AT PERSON S	· · ·	1		N. S.	:	89 🚊			
4	4	4	4	4	4 ·	4 :	4	0	~ .	-	_
4	4	4	4	4	4	4 0	4 🛴	O :		-	
4	4	4	3-4	4	4 🗵	4	4	1		-	
3-4	4	0'-4	4 👯	X-4	3-4	3–4	4 :	1 . ,	- _	-	- <u>-</u>
	4	4	4	0' :	01	3-4	X-4	2	- ken	-	_
	X-4	0'-2	X	\mathbf{X}^{\pm}	X .	0.4	X (4 🕆		-	_
	0'-4	0 * -4	2-4	X-4	1-4	X-4	2-4	0		-	·
	01	0'-1	0-01	0!-1	2-4	X	4:	7 🗟	-	_	-
_ '	4	4	4 ^{(†}	<u>, , , , , , , , , , , , , , , , , , , </u>	4	- 0,59	4.	0 🐒	- ,	-	-
	4	4	3-4	- ":	4 🗟	- *	3-4	0.4		_	. - .
-	01-3	0'-2	2-4	<u>~</u> "	3–4	- } ~ ₹	0.1-2	0	-	-	_
		0'-1	01	<i>≛</i> "	3-4	÷,	3-4	2,	-	-	_
4	3-4	4	2-4	-	4	- : •]	4	0		-	
4	4	4	3-4	<i>2</i> 5	4	- (2-4	0	-	-	•
01	4	4	3–4	<u></u>	X	- 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2-4	2		-	. •
0'-2	2-4	2	2-4	- ≟.	3-4		2-4	0		-	<u> </u>
4	4	4	4	~	2-4	- ₹~₹	3-4	0	-		
•	4 4 3-4 0'-4 X X-4 X 4 4 0'-1 4 0'	1 1 4 4 Segregating 4 4 4 4 4 4 3-4 4 0'-4 4 X X-4 X-4 0'-4 X 0' 4 4 4 4 3-4 0'-3 0'-1 0' 4 3-4 0' 4	Segregating 4	1 1 1 1 1 1 1	1 1 1 1 7 4 4 4 4 4 4 Segregating 4 4 4 4 4 4 4 4 4 4 3-4 4 4 4 4 3-4 4 0'-4 4 X-4 0'-4 4 4 4 0' X X-4 0'-2 X X X-4 0'-4 0'-2 X X X-4 0'-4 0'-4 2-4 X-4 X 0' 0'-1 0-0' 0'-1 4 4 4 4 4 4 4 4 3-4 0'-1 0' 0'-1 0' 4 3-4 - 0' 4 3-4 - 0' 4 3-4 -	1 1 1 1 7 7 4 4 4 4 4 4 4 4 Segregating 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 3-4 4 4 4 4 4 4 3-4 4 0'-4 4 4 4 0' X X-4 0'-2 X X X X-4 0'-4 0'-4 2-4 X-4 1-4 X 0' 0'-1 0-0' 0'-1 2-4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 3-4 0'-1 0' 0'-1 0' 0' 0' 3-4 0'-3 0'-2 2-4 - 3-4 0'-1 0' 0'-1 0' - 3-4 4 4 4 4 3-4 - 4 0' 4 4 3-4 - 4 0' 4 4 3-4 - X 0'-2 2-4 2 2-4 - X-4	1 1 1 1 1 7 7 13 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	1 1 1 1 7 7 13 23 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	1 1 1 1 7 7 7 13 23 Type3/ 4 4 4 4 4 4 4 4 4 4 4 6 6 Segregating 89 4 4 4 4 4 4 4 4 4 4 6 6 4 4 4 4 4 4 4	1 1 1 1 7 7 7 13 23 Type3/ R 4 4 4 4 4 4 4 4 4 4 6 2 Segregating 4 4 4 4 4 4 4 4 4 4 6 0 4 4 4 4 4 4 4 4 4 4 4 1 4 X X-4 0'-2 X X X X X 0' X 4 4 X 0' 0'-4 0'-4 2-4 X-4 1-4 X-4 2-4 0 3-4 0 4 4 4 4 4 4 4 4 4 3-4 0'-3 0'-2 2-4 - 3-4 - 3-4 2-4 0 4 3-4 0'-3 0'-2 2-4 - 3-4 - 2-4 0 4 0'-1 0' 0'-1 0'-1 0' - 3-4 - 2-4 0 4 4 4 4 4 3-4 - 4 - 4 0 0 2 0'-1 0' 0'-1 0'-1 0' - 3-4 - 3-4 0 4 4 4 4 4 3-4 - 4 - 4 0 0 2 0'-2 2-4 2 2-4 - 3-4 - 2-4 0 3-4 0 4 0' -2 2-4 0 3-4 0 4 0' -2 2-4 0 3-4 0 4 0' -2 2-4 0 3-4 0 4 0' -2 2-4 0 3-4 0 4 0' -2 2-4 0 3-4 0 4 0' -2 2-4 0 3-4 0 4 0' -2 2-4 0 3-4 - 2-4 0 4 0' -2 2-4 0 3-4 - 2-4 0 4 0' -2 2-4 2 2-4 - 3-4 - 2-4 0 4 0' -2 2-4 2 2-4 0 3-4 - 2-4 0 4 0' -2 2-4 2 2-4 0 3-4 - 2-4 0 0 4 0' -2 2-4 2 2-4 - 3-4 - 2-4 0 0 4 0' -2 2-4 2 2-4 - 3-4 - 2-4 2 - 2-4 0 0 4 0' -2 2-4 2 2-4 - 3-4 - 2-4 2 - 2-4 0 0 4 0' -2 2-4 2 2-4 - 3-4 - 2-4 2 - 2-4 0 0 4 0' -2 2-4 2 2-4 - 3-4 - 2-4 2 - 2-4 0 0 4 0' -2 2-4 2 2-4 - 3-4 - 2-4 2 - 2-4 0 0 4 0' -2 2-4 2 2-4 - 3-4 - 2-4 2 2-4 2 - 2-4 0 0 4 0' -2 2-4 2 2-4 - 3-4 - 2-4 2 2-4 2 - 2-4 0 0 4 0' -2 2-4 2 2-4 - 3-4 - 2-4 2 2-4 2 - 2-4 0 0 4 0' -2 2-4 2 2-4 - 3-4 - 2-4 2-4 2-4 2 2-4 2 2-4 2 2-4 2 2-4 2 2-4 2 2-4 2 2-4 2 2-4 2 2-4 2 2-4 2-4	1 1 1 1 7 7 7 13 23 Type3/ R S 4 4 4 4 4 4 4 4 4 6 2 Segregating 4 4 4 4 4 4 4 4 4 6 0 4 4 4 4 4 4 4 4 4 6 0 3-4 4 4 4 4 4 4 4 4 4 1 3-4 4 0'-2 X X X X 0' X 4 X X-4 0'-4 0'-4 Z-4 X-4 1-4 X-4 Z-4 0 X 0' 0'-1 0-0' 0'-1 2-4 X 4 7 4 4 4 4 4 6 7 3-4 6 6'-3 0'-2 Z-4 - 3-4 - 3-4 0 3-4 7 4 4 4 4 4 4 4 4 0 0 3-4 6 0'-3 0'-1 0' - 3-4 - 3-4 0 3-4 0'-3 0'-1 0' - 3-4 - 3-4 0 3-4 0'-3 0'-2 2-4 - 3-4 - 3-4 0 0' 4 4 4 3-4 - 4 - 4 0 0' 4 4 4 3-4 - 4 - 4 0 0' 4 4 4 3-4 - 4 - 4 0' 4 4 4 3-4 - 4 - 4 0' 4 4 4 3-4 - 4 - 2-4 0 0' 4 4 4 3-4 - 4 - 2-4 0 0' 4 4 4 3-4 - X - 2-4 0 0' 4 4 4 3-4 - X - 2-4 0 0' 4 4 4 3-4 - X - 2-4 0 0' 4 4 4 3-4 - X - 2-4 0 0' 4 4 4 3-4 - X - 2-4 0 0' 4 4 4 3-4 - X - 2-4 2 0' 4 4 4 3-4 - X - 2-4 2 0' 4 4 4 3-4 - X - 2-4 2 0' 4 4 4 3-4 - X - 2-4 2 0' 4 4 4 3-4 - X - 2-4 2 0' 4 4 4 3-4 - X - 2-4 2 0' 4 4 4 3-4 - X - 2-4 2 0' 4 4 4 3-4 - X - 2-4 2 0' 2-4 2 2-4 - 3-4 - 2-4 2 0' 4 4 4 3-4 - X - 2-4 2 0' 4 4 4 3-4 - X - 2-4 2 0' 4 6 7 8 89 Type3/ R S Type3/ R S Type3/ R S Type3/ R S Type3/ R S 189

Abbreviations used were made according to rules adopted by the National Wheat Improvement Committee as amended by KONZAK. See Agron. J. 52:613, 1960, U.S. Dept. of Agr. Tech. Bull. 1278, p. 131, 1963 and Wheat Newsletter 1965.

^{/2} Variety name or cross unknown to us at this time.

Number of plants with off-type reactions. In general, over 10 plants with off-type reactions indicates the variety or line is segregating for reaction to one or more cultures.

ARE OUR VARIETIES OF OATS TOO RESISTANT TO DISEASE?

J. M. Poehlman

In breeding for resistance to disease, protection may be conferred by (a) single (or complementary) major genes, (b) combinations of several major genes, (c) combinations of minor genes, or (d) combinations of both major and minor genes. It is suggested that resistance to highly specialized diseases. such as crown rust (Puccinia coronata avenae Eriks and B. Henn.) may be short-lived in varieties protected by single or complementary major genes. Warieties which have a moderate or intermediate type of resistance conferred by a group of genes, each of which contributes, if only in a minor way, to the defense of the host plant, may retain their protective qualities over a much longer period. Breeding for the moderate type of resistance thus might give more stability to disease resistance and permit greater concentration on breeding for needed improvements in agronomic qualities. Comparisons of the resistance of the Marion variety with varieties carrying Victoria and Bond resistance genes are cited. Control of the Maria Barrier Services and the Services of the

tanak na maka malawa na katana ang tangga mana ang managa tangga na managa tangga managa managa managa managa The state of the s Contracting the second of the grafia a servicini se servicini di presidente della completa di propriesione di conserva della completa. In lata della completa della completa di conserva di conserva di propriesione di conserva di altra di conserva In la servicini di conserva di conserva

the control of the second of t

and the contract of the contra in the control of the

INHERITANCE OF BLUE ALEURONE AND PURPLE PERICARP IN HEXAPLOID WHEAT

(Abstract)

19. Black of FragaBolton and B. (C. Curtisa) and a second

A study of blue aleurone and purple pericarp characters in hexaploid wheat included cytological observations, gamete transmission studies, genetic analyses, histological observations, and pigment characterizations and the state of the stat

Two blue aleurone lines, Blue (C.I. 12025) and Pugsley's Male Sterile/Blue Baarta (PBB), exhibited significant differences in transmission frequency through the male and female gametes of the chromosomes controlling blue aleurone. PBB exhibited xenia but Blue did not. PBB produced a darker blue seed color than Blue. It was concluded that blue aleurone was controlled by a substituted pair of alien chromosomes in Blue and an alien addition (ditelocentric chromosome) in Pbb. No homology was observed between the alien chromosomes in Blue and in PBB.

for purple pericarp, one of which is dependent on the complementary action of a third gene (S) controlling the purple stem character. Two purple-seeded tetraploid lines, NYL and NY3, were converted to hexaploids by backcrossing to Wichita, C.I. 11952, a common hexaploid variety. NYL contains a single gene for purple pericarp which is the same as the P² in ND2. NY3 contains a third gene (P³) for purple pericarp. The three genes, P¹, P² and P³, are incompletely dominant and show additive gene action. When all three genes are combined in crosses with parents, each of which has purple stem, they segregate independently and the combination of six factors for purple pericarp produces a very dark purple seed. The purple pericarp factors were found to be inherited independently of factors for brown and black glume of the non-purple seeded parent.

The purple pigments are located in the cross cell layer of the pericarp whereas the blue pigments are in the aleurone layer. The red color of common wheat was also present in the testa of both the blue aleurone and purple pericarp parents. The combination of two genes for purple pericarp and a substituted chromosome for the blue aleurone, along with the tannish-red testa produces a bluish-purple to grayish-black seed color. Three distinct seed color lines were developed which are phenotypically different from the common red and white wheats.

The pigments of the aleurone and pericarp producing the blue and purple colors were characterized as anthocyanins, although positive identification of the glycones and aglycones was inconclusive.

GENETIC MALE STERILITY IN HEXAPLOID WHEAT

L. W. Briggle

Seed of a stock segregating for male sterility was obtained from C. A. Suneson who in turn had received it from A. T. Pugsley of Australia. This proved to be a very heterogeneous population for various plant and seed characters when grown in the Beltsville greenhouse during the winter of 1962-63. Several plants were male sterile or partially fertile. Some plants which appeared to be male sterile produced 1 or 2 seeds per spike - presumably selfs. Seed from this latter class (1 or 2 seeds per spike) was saved and the plants grown in the greenhouse in 1963-64.

One vigorous plant from a selfed (?) seed was completely male sterile and produced several spikes. Pollen from 'Chancellor' was sifted over the exposed stigmas and a very good seed set obtained.

 F_1 plants were fertile. The F_2 population segregated for male sterility, but did not fit a logical pattern. Spikes on male sterile F_2 plants were bagged and some pollinated with Chancellor. Those bagged and not pollinated did not set seed.

Backcross plants (from male sterile F_2 plants backcrossed to Chancellor) were fertile, and corresponded to an F_1 generation. The F_2 segregated for male sterility. Each F_2 population was very small (15-20 plants) but about 50 F_2 populations were grown. Male sterile plants numbered from 1 in an F_2 population to 7 in another F_2 . Male sterile F_2 plants were bagged and some backcrossed again to Chancellor. Plants in 8 F_2 families set seed on "male sterile" plants which had been bagged but not pollinated. These families were discarded.

The second backcross population (equivalent to an F_1) was fertile. Again the F_2 segregated. Partially fertile plants occurred in some F_2 families, and very few male sterile plants in others. Still other families had normal 3:1 ratios of fertile to male sterile plants. Again individual F_2 populations were rather small, but many were tested. This procedure was used in preference to growing one or a very few large F_2 's in an attempt to select stable F_2 populations approaching 3:1 segregation patterns for further backcrossing.

Ratios obtained from some second backcross F2 families are as follows:

		Fertile	Sterile
W66-67	33A	49	19
94	33B	17	6
•	33E	18	3
\$1	33G	18	7
11	33M	71	20
11	33P	19	7

Twelve fertile second backcross F₂ plants, chosen at random, were used as male parents in another backcross to Chancellor. Some of the twelve were expected to be heterozygous for the male-sterility gene, so that when used as the male parent one could determine whether the male sterile characteristic was transmitted by male gametes. Male sterile plants did occur in some of the F₂ populations grown. Populations again were small, but segregation ratios were as follows:

e de la companya de La companya de la co	al al gradiente. Al maria de la composición de la compo	<u>Fertile</u>	Silvania Silvania	Sterile
W66-67	34A	14	t was a second	3,
o garanta da santa d Banara da santa da s	34D	- 18		
•	34G	12 12	ng Arthur Silvania. Silvania	4
	34G 34L	12	- 1-4 Bi .	3
	34N	. 8		4
n enemale de la companya de la comp La companya de la co	34P	8 14 8	in de la companya di dia dia dia dia dia dia dia dia dia	5 9 1
	34U	8	and the state of t	9
	34CC	13		1
en e	34EE	12 · 12	er og syr klig	2

These results indicate that a gene (s) for male sterility is involved, rather than cytoplasmic male sterility. The fact that F₁ populations are always fertile and that segregation occurs in F₂ is also indicative of gene male sterility. Male sterility appears to be conditioned by a single recessive gene, but larger populations are needed before definite conclusions can be made.

Chancellor seems to have a compatible genetic background for the male sterile gene to be expressed. A number of third backcross F2 families presently growing in the Beltsville greenhouse have essentially the plant characteristics of Chancellor and I hope will segregate in a 3:1 ratio for fertility and male sterility. Expression of male sterility in the original stock received from Suneson apparently was affected by modifying genes. Perhaps these modifiers have been removed by backcrossing to Chancellor, which in effect is transferring the male sterile gene into a Chancellor line.

Further backcrossing to Chancellor is contemplated, along with rigid selection for stable expression of male sterility. At the same time further genetic studies will be conducted.

6.5

the control to the control to the first of the control to the cont

POLLEN RESTORATION FROM THE WORLD WHEAT COLLECTION

K. P. Porter and T. G. Wright

Restoration from the World Wheat Composite:

Restoration research at the Southwestern Great Plains Research Center has included a search for additional sources of restoration in the World Collection of Common Wheats. Crosses of male-sterile Bison x a composite of the World Wheat Collection (W.W.C.) were made in isolated field crossing blocks in 1964 and 1965. Forty fertile or partially fertile F_1 's were selected from a total of 5000 F_1 's in 1965 and 1966. The fact that 99 percent of the F_1 's set a negligible amount of seed is evidence that seed set on the selected plants resulted from self- rather than from cross-pollination.

Detailed data were not taken on 11 F_1 's selected in 1965. However, the average number of seed produced on open pollinated spikes of their F_2 progeny varied from 15.9 for the least fertile to 32.7 for the most fertile F_2 population. It was obvious the populations segregated for pollen-fertility.

Seed set data were taken on 29 F1's selected in 1966, Table 1.

Table 1. Mean number of tillers and seed set on selected F_1 plants, male-sterile Bixon x World Wheat Collection 1/

Plant character	Mean of 29 plants	Range
Tillers/plt.	20.6	0 64970 2 - 41 - 42
Wt. of seed/plt, gram	15.3	2 - 35
Wt. of seed/spike, gram	.76	.4 - 1.2
No. seed/spike	23.3	11 - 34

^{1/} Fertile or partially fertile plants selected from 2500 F_1 plants in 1966.

Many of the selected plants were highly fertile.

The F_2 populations of the 29 F_1 plants were grown in the field in 1967. About 75 spikes of selected populations and of fertile Bison were bagged prior to flowering. Mean percent seed set on bagged and exposed spikes of each populations are shown in Table 2.

gue i regiĝi la liburi labela ĝas kiĝas kiĝ

Table 2. Mean percent seed set on spikes of F2 populations, malesterile Bison x W.W.C. and on spikes of Bison.

	where it is a first of the second second	
F ₂	Mean Per	cent Seed Set
Row No.	Bagged Spike	s Exposed Spikes

2843	44	81
2852	a ang territoria ang <mark>66</mark> 19. Pad	771 (1) (1) (1) (1) (1) (1) (1) (1) (1) (1
2854	nn mar bhilir n <mark>40</mark> ans	အေးရး သို့ကောင်းကြည်း အော် ကြုံ ပြောင်းသည်။
2858	with $(1,2,1)$ and $(1,2,2,3)$ for 3	rožuski je vetre je u izvoj
2000	Transitoù amadis tiazak oro-	- 変の 1 応した9 版内に 0.00%
000	ತಿಷ್ಣಿತಿಕಿಕ ಟಿ. ಟ್ ಕಿಕ್ಟ್ ಕ∍ಷಚಾಗ್ಯ	これがいえま しんまた ちゅぎ 海海 ほく ちあの田
0070	りゅう いれい シェルー ながいしき リアード (世界) シェースター	記載 - 1 Section and Applied A
2070	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Libra 2001 fil 64 fill filmit
ta ji ta jan kaba ta	ak anggapaken us historiju jib	ระธานสาย อาร์สาสโปล์
	Carried Carried Carried Co.	

Frequency distributions in percent seed set classes of both bagged and exposed spikes for the least and most fertile F2 population and for Bison are shown in Figure 1: Population 2860 was segregating from amber to dark red seed color.

No conclusion was attempted from these data concerning the mode of inheritance of restoration. The data indicate that useful genes

Plants from seed of the most fertile bagged heads are being grown for test crosses in the greenhouse. In addition, eighty of the more fertile of 1000 F₃ head rows (originating from the 11 F₁'s selected in 1965) are being increased and evaluated in the field.

Agricultural and the control of the Seed of a composite from the F_2 and F_3 populations, 1967, are available from J. C. Craddock, Beltsville. Seed of individual populations should be available in 1968. Carry Late Africa Day of the

1.

Lines from Nebraska Lot 1, Dekalb's T. Timopheevi x Marquis3, 'Kansas' (T. Timopheevi x Marquis³) x Bison, fertile F₂, F₃, plants of MS Bison x W.W.C., and Primepi have been intercrossed in several ways in an effort to combine restoration genes from several sources. ويعارضه والمنافية والمنافية

CARREL CAR LANGE LECTURE

Restoration from Hairy Chaffe Types: 1918 1918 1918 1918 1918 1918 1918

72.5

Hairy chaff was a characteristic of some F1's. It appeared that some hairy chaff wheats possessed good restoration genes. A number of hairy chaff types from our W.W.C. were test crossed to male-sterile Bison but only one gave partially fertile F1's. To make a complete search, seed of all hairy chaff types (700) were obtained from J. C. Craddock. To date test crosses of malesterile Lee and single plant selections from 149 hairy chaff spring wheats have been grown.

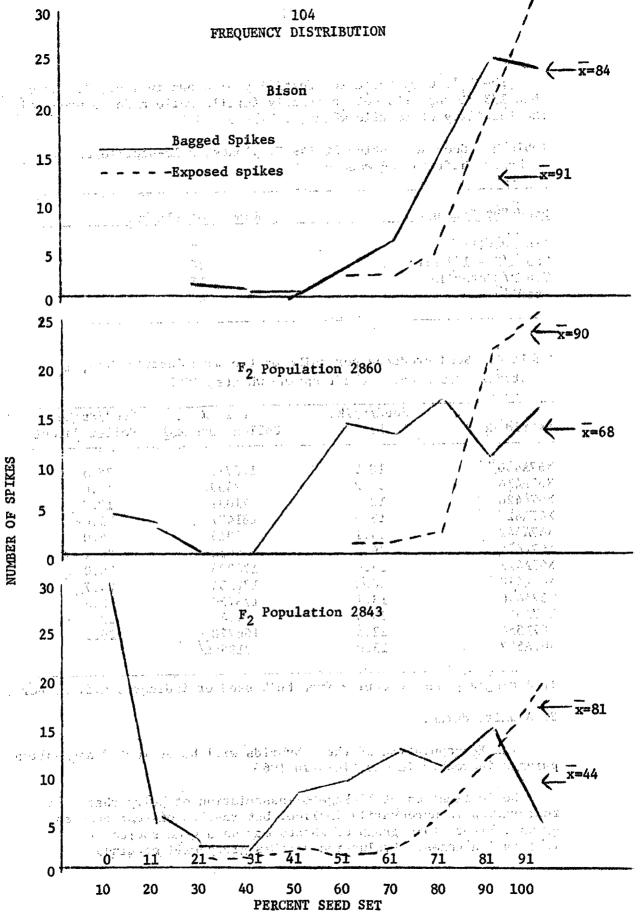


Figure 1. Frequency distributions of bagged and exposed spikes in seed set classes of 2 F₂ populations and Bison grown in field.

Bushland, Texas, 1967.

The F_1 's were rated for fertility as shown in Table 3. More than 1/3 of the F_1 's were partially fertile while a few approached the fertility of fertile wheat, Tables 3 and 4.

Table 3. Seed set rating of 149 F_1 plants, male-sterile Lee x hairy chaff spring wheats.

Seed Set Rating	Number of Plants	
Tip sterile Top 1/3 - 1/2 sterile	13 36	
Top 2/3 sterile Sterile		

Table 4. Seed produced per spike on the more fertile F₁'s, malesterile Lee x hairy chaff spring wheats, 1967.

Hybrid No.	Seed/Spike ^F 1	P.I. No. Pollen Parent <u>1</u> /	Seed/Spike Pollen Parent
x67A406	18.9	178717	28.6
X67A414	26.2	192459	18.6
X67A426	18.9	171031	18.7
X67A429	15.5	181427	13.0
X67A442	16.1	4315	16.0
X67A455.	26.3	4910	24.4
X67A471	25.6	170994	26.0
X67A478	18.8	172534	24.7
X67A496	13.1	178769	12.6
X67A511	23.4	4544	23.6
X67A554	22.5	166778_ ,	26.9
X67A557	15.0	91955 <u>2</u> /	

^{1/} A single plant selection from bulk seed of indicated P.I. number.

2/ A white durum.

The F_2 population of these hybrids will be evaluated and pollen parents increased in the field in 1968.

No implication of linkage or association of hairy chaff and restoration is necessarily implied, but results of test crosses grown indicate this group of wheats may be a good source of restoration genes. Evaluation of this group will continue.

tur uguga kering akan kering di angan mengalang pada di kebagai di basa di kebagai di kebagai di kebagai di ke Pangalang di kebagai kebagai kebagai di dalah sebagai di kebagai di kebagai di kebagai di kebagai di kebagai d Di kebagai kebagai kebagai kebagai di kebagai di kebagai di kebagai di kebagai di kebagai kebagai kebagai kebag THE MENDER OF THE COURT OF THE PROPERTY OF THE COMPANIES.

the apparatual series and above its form the construction of the construction of the construction of

Famous to the control of the said of special teaching for the area of the consistent of a size of en en la companya de la co and the state of t

Restoration from 'Primepi': CONTRACTOR OF ALCOHOLIST OF ST

1262 S

'Primepi', as reported by Oehler and Ingold 1/ appears to have good restoration potential. Results of test crosses grown at Bushland le supports their findings; Table 5. vent de la ville de la la ville

Table 5. Mean seed set on Primepi hybrids grown in greenhouse, overland in the light with the

				"
A	Hybrid and the market			
	or	of	Lateral C	Central
	Parent		Florets	
				Kali Safisii
	Caddo x Primepi	10	o site 830, 3 9 for 1	4.6
	MS Caddo x Primépi			
	Primépi x Caddo			
	MS Tascosa x Primépi	10	81.1°	2.3 ^{333 (b)}
	Caddo	4	77.8	2.0
Contract to the second	Tascosa 👉 🕾 😤	200e + 5		
	Primépi	2	81.0	1.5° (a)

Hundrich Language, des la service de la mountaire de la faire de la language de la composition del composition de la composition del composition de la compo in the profession of the countries of the factors are got accoming to the first the countries of

filter filter of the filter of Augusta from From Astronomy of From Armade Continue of Canagora Continue and Armade from Armade from Armade fr

A CERTIC CONTROL OF A SECURITY OF THE TOTAL CONTROL OF A CONTROL OF A SECURITY OF A

om over the period of and the feather than the second of the contract of the c e no never passeramente e despo di escaparati na quesa en sua cibado la colige agthe work of the first parameter Appearance to be bounded from the first of the cold whole the

^{1/} Oehler, E., and M. Ingold. 1966. New cases of malesterility and new restorer source in T. aestivum. Wheat Information Service No. 22:1-3. en novembre 1960 and 1960 on a Figure 1960 of the program [

MALE-FERTILITY RESTORATION PROBLEMS IN HYBRID WHEAT

S. S. Maan and K. A. Lucken

British at a mesery M. Literal Lastreams! we Salabour as . Decided!

Our hybrid wheat investigations include a search for new and more suitable cytoplasmic male-sterility-fertility restoration systems, and attempts to improve the male-fertility restoration of common wheat with T. timopheevi cytoplasm.

The cytoplasm of <u>T. zhukovskyi</u> has produced male sterile common wheats. Lines with male-fertility restoring factor(s) from <u>T. zhukovskyi</u> appear promising for anther size, anther shape, anther extrusion, and abundance of pollenger.

The cytoplasm of two diploid wheats T. monococcum and T. boeoticum has produced male-sterile durum plants. Lines with male fertility restoring factor(s) from diploid wheats are being tested. One addition line with mst-common wheat + a chromosome pair from T. boeoticum is about 70% fertile.

The possible effect of <u>T</u>. araraticum cytoplasmeonemale-sterility is being investigated.

Studies of the T. timopheevi male sterility-fertility system include chromosomal location of male-fertility restoring genes in several R-lines, and the development of 'single gene' or chromosome substitution lines in the genetic background of the variety Chris. For this a male sterile monosomicaset of the variety Chris is ibeing used. We hope the use of anmale sterile monosomic set and isingle gene' lines will allow study of dose effects of restorer gene (s) i and also the evaluation of individual chromosomes of R- and B-lines for their influence on male-fertility restoration. If dose effects are favorable, increase of restorer gene dose may be possible by the 5B-method (transfer to a homeologous chromosome) or by a system of compensating nullitetras involving ditelocentrics such as: 19" 1A" 1D° 1AL" 1DS" or 19" 1A" 1BO 1AL" 1BS", assuming the gene is on 1AL. On the other hand, if a chromosome arm has an inhibiting effect on the expression of a gene for male-fertility, easy-to-restore compensating nullitetra di-telocentric female lines may be a possibility, such as: 19" 7A" 7DO 7DL" 7AS, if short arm of 7D has an inhibiting influence on male fertility restoration.

If male-fertility promoting or inhibiting effects of individual chromosomes in a R-line or a B-line can be ascertained, then cytogenetic methods can be used to develop desirable chromosome combinations in male and female lines for completely fertile hybrid wheats.

GENETICS OF FERTILITY RESTORATION IN VARIOUS MALE-STERILE CYTOPLASMS

P. Menge, E. R. Ausemus, W. H. Althaus

and part middle

Primepi was a popular variety in France about 20 years ago. It is a descendent of the old variety Bon Fermier which descended from Noe.

We received Primépi during the summer of 1966 with the report that it contained a single dominant gene for complete restoration. Primépi has been crossed with 33 male-sterile spring wheats, most of these are hard red spring wheats from the United States and a few from the Mexican breeding program. The Fi's were planted and observed for fertility in the greenhouse and most of them were found to be as fertile as the standard parent varieties. A duplicate planting was made in the field but, it was planted so late that the data obtained was not reliable.

the tite of course is allowed in the typic

The F_2 's were planted in the greenhouse during the fall of 1967 with fertility readings being taken in January, 1968. We get some sterility in the greenhouse at this time of year due to light conditions, however, the fertility readings on the F_2 's indicated that the restoration was due to a single dominant gene. These are preliminary data based on a small number of plants. This simple type of inheritance agrees with the report of M. Ingold at the Eucarpia meetings held in Switzerland in 1967.

Primépi was crossed with 23 winter wheat male-sterile varieties, 11 hard red, 6 soft red, and 6 foreign varieties. The fertility of the F₁'s of all of these crosses was as good or better than the standard parent varieties when grown in the greenhouse. The anthers and pollen shedding was excellent with the exception of 1 or 2 varieties. Primépi crosses with Scout, Gage, and Kaw male-steriles were the best pollen shedders with good anther extrusion and large anthers. Primépi has given us better restoration of the soft red winter wheats than any of our other restorers.

We will be glad to supply a limited amount of seed from the F_1 or F_2 plants to anyone interested. Address inquiries to Northrup, King & Co., 1500 Jackson St. N.E., Minneapolis, Minnesota 55413, attention Mr. Wm. Althaus.

1960 1.70 E. 108420. MINISTER MEDITARES APREL 1727/9/4 REMEDIANTAL 1.101/2014 1736

ENVIRONMENTAL EFFECT ON MALE FERTILITY RESTORATION

(Abstract)

Carter of the released or good to be with the tree of a Peter Salm

n in the graph of the Bull notioners and grafts in a filter of the character with

The effects of environment on fertility restoration were estimated by uniform yield trials of restored F₁ hybrids at several locations in 1967. Latitude had the most pronounced effect on fertility. Sterility increased when going from south to north. The northern locations are often characterized by cool temperatures, long days and rapid plant development. One or all of these factors may be contributing to the greater sterility levels observed in the hybrids.

This type of uniform trial, utilizing a partial restorer and A-lines of different restoration requirement, offers an effective means of monitoring the sterility level of a region. Locations 200 - 300 miles apart have shown significant differences in restoration requirements in these tests.

A hypothetical model indicating sterility levels by location, and the number of restoration genes required is proposed.

oración de la final de como enclasa fatellas capación en especial de la final de la final de la final de la fin La capación de la final de la

The state of the property of the state of th

and the property of the state o

A CONTROL OF THE CONTRO

ENVIRONMENTAL EFFECTS ON MALE STERILITY AND MALE FERTILITY RESTORATION

(Abstract)

Gregory Vazquez

en en la transportación de la conservación de la conservación de la conservación de la conservación de la cons

Relatively large differences in the number of days to flowering are observed in materials sensitive to day length, whereas nonsensitive materials show only slight variations in flowering when grown in areas of varying day lengths. The variations in the vegetative period seem to be associated with varying levels of restoration of fertility, especially in materials sensitive to day length. There is a general tendency for less restoration of fertility as the number of days to flowering decreases. The high fertility at Ciudad Obregon, Mexico may be due to longer stigma and pollen viability, whereas, this characteristic may be much reduced in areas having short growing seasons such as Casselton, North Dakota.

The environments of Ciudad Obregon, Mexico, Toluca, Mexico and Casselton, North Dakota are somewhat different. The environments of Obregon and Casselton are commonly characterized by having contrasting temperatures and relative humidity, particularly during the flowering period. However, observations conducted during the last few seasons indicate that the average high and low temperatures and relative humidity in Cuidad Obregon and Casselton are very similar, with Toluca being a little cooler and wetter than the other two. Nevertheless, restoration appears to be much easier in Cuidad Obregon than in Casselton with Toluca being somewhat intermediate.

It may be suggested that unless minor climatic differences are responsible for these tremendous variations of levels of restoration observed; there exists the possibilities that these differences may be due to the length of the growing period of day length sensitive materials grown at variable latitudes. There is also the possibility that modifier genes acting differently control these variations. An extensive reciprocal recurrent selection program for restoration within groups and among groups planted at different locations, might eventually unite sufficient modifier genes that are capable of restoring under any set of environmental conditions.

ner in terfore province in exploring a **compre**nding a company of the company of the experience of the company of the company

William Rose

ENVIRONMENTAL EFFECTS ON FERTILITY RESTORATION IN WHEAT.

1. July 19 19 19

JAN 19-81 SEPT BESTREAM WIT

Will district

E. L. Smith and W. L. McCuistion

Variation in fertility restoration resulting from environmental differences is not unique to wheat. This phenomenon has been reported in corn, sorghum, and several other crops. From observations made at the Oklahoma Station it appears that certain meterological conditions during the flowering period account for a considerable amount of the variation observed in percent seed set of restorer lines and crosses being evaluated in our hybrid wheat program. Temperatures in our glass greenhouse have occasionally exceeded 90° F. during the flowering period. Following these periods a sharp increase in percentage of sterile florets has been noted. Rather moderate temperatures and high relative humidity appear to be desirable for maximum expressing of fertility restoration.

In a study just completed at Stillwater, the degree of fertility restoration was noted on restorer material derived from Nebraska 542437 stock. The material was evaluated for two years under the following environments: 1) glass greenhouse, 2) fiberglass greenhouse, and 3) field nursery on the Agronomy farm. The material consisted of 6 Lot 1 and 7 Lot 2 restorer selections and the F₁ hybrids between each of these selections and male sterile Bison.

During this study there was no noticeable environmental effect on the sterile system. Bison ms remained completely sterile in the three environments. There was however, a great deal of variation in fertility restoration of the restorer selections and testcrosses as measured by percent seed set (Tables 1 and 2). There was little association in percent seed set from one location to another. For the glass and fiberglass greenhouses the response in fertility restoration was somewhat similar from one year to the next. However, this was not the case for the material grown in the field.

considering the reaction of all restorer material involved in this study, the fiberglass greenhouse was the most critical environment for measuring fertility restoration and had a fair degree of correlation from one year to the next. Of the three environments, the fiberglass greenhouse appears to be the most suitable for the early phases of restorer line development.

rene e mod l'Éclearrepoles, les frances et l'intelle rappatités, se religion à payancé a méaleré

TABLE 1 .-- CORRELATION COEFFICIENTS (r) OF SEED SET

Location		Lot 1	Lot 2	Checks
	Correlation Betw	ween Years		
1965 vs. 1966	6 Field	0.33	0.35	0.88**
	Glass Ghse.		0,67	0.58*
1965 vs 1966	Fiberglass Ghse.	0.81*	0.76*	0.86**
	CAPPALATIAN KAPI	JEEN LOCAT	lons. 1900	lagoria de la Maria de Carlos
Field vs. Gl	ass Ghse. berglass Ghse.	-0.59 0.34	0.13 0.34	0.64** 0.24
Field vs. Gl. Field vs. Fi Glass Ghse.	ass Ghse.	-0.59 0.34 . 0.30	0.13 0.34 0.52	0.64** 0.24 0.83**

TABLE 2.—PERCENT SEED SET OF 5 MS x R TESTCROSSES IN THREE
ENVIRONMENTS

			Fiberglass	
Testcross	Field	Ghse.		
<u>. Dega (for lights of the first of</u>	one on A grains	value and pro-	gning (
5892 – 25. F_{175. (1993) (1994)}	81.0	91.4	79.0	
5893–2 \sim F $_{f 1}$, which we have $ ho$		55.6	79.6	
5892-7 F ₁		£ 3.84.3		
5892-9 F ₁	67.2	61.1	83.0	
5892-2 F ₁	57.1	55.3	55.9	

PROBLEMS INVOLVED IN TRANSFER OF FERTILITY RESTORING GENES INTO LINES OF COMMON WHEAT

A. B. Carlotte

(Abstract)

Max A. Urich, W. R. Grace & Co.

Selections from the Kansas and Nebraska sources of fertility restoration were used as base material in our program for the development of common wheat lines with fertility restorer genes. The F1 plants of most crosses (restorer selection x common wheat line) showed 60 to 90% fertility as measured by seed set. Large BC1.populations of all crosses were grown in a fiberglass greenhouse during the fall of 1967. In most populations it was impossible to find any plants with over 50% fertility. Some populations were completely sterile. This indicates (1) an extremely sterile environment in our fiberglass greenhouse, (2) the difficulties encountered in a backcross program for fertility restoration, and (3) some type of complex interaction involving Triticum timopheevi cytoplasm, restoration genes, genes from the common wheat recurrent parent. and the environment which causes an apparent breakdown of fertility restoration

Varying degrees of fertility have been noted in two of our male sterile lines after showing good sterility for several generations. This again indicates the complexity of the male sterility - environmental interaction.

and the second of the second o

. (<u>@</u>.)

SUMMARY OF WHEAT HYBRID PERFORMANCE TRIALS IN KANSAS

R. W. Livers for the contract of the contract

A five-year Kansas experiment, which will be completed in 1968, is concerned with field performance of hard red winter wheat hybrids compared with their parents. Data the first year were obtained on eighteen hybrids involving seven parents. In succeeding years there have been 36 hybrids, all possible single-crosses of nine parental varieties. These have been grown in four replications at Hays from hand-crossed seed planted at the rate of forty-five pounds per acre in single-row plots three feet in length bordered on all sides by a full stand of wheat. In addition to this experiment a five-variety diallel trial has been grown since 1965 at Hays, Hutchinson and Manhattan with the same plot arrangement.

There are several questions which are being answered by the information which is accumulating. In the first place, there can be no doubt that there is a substantial amount of hybrid vigor in grain yield when the best available hard red winter wheat varieties are intercrossed. In the four crops to date the average of all hybrids at Hays has been 37 bushels per acre, 32% more than the parent variety average. The best hybrid has averaged about 43 bushels, a 31% advantage over the best variety.

In maturity the hybrids have been close to the midparent value, but with a definite trend toward earliness. They have averaged about 1/2 day earlier than the midparent, suggesting partial dominance of earliness. Earliness has had little or no effect upon yield except in the stem rust year, 1965, when earliness was of some benefit.

Height, seeds per head, seed weight and pounds per bushel are characters which have consistently exceeded the midparent value in hybrids. Sometimes this appears to be a dominance effect from the better parent and sometimes there has been a minor heterotic effect.

There has been striking heterosis for number of heads per plot, straw yield and grain yield. Measured from the midparent values these have been 120%, 126% and 132% respectively. Head number has been strongly and positively associated with yield in three years out of four; and straw yield has been closely related to grain yield in two years but appeared unrelated in the other two years.

Correlations between midparent and hybrid values for yield from 1964 to 1967 have been -.23, .83, .66 and .28. These correlations are not homogeneous, and they suggest that sometimes parent yield is a good predictor of hybrid performance, but that often it is not. Parent-hybrid correlations for some characters including maturity, height, seed weight and bushel weight have been quite high.

From the 1964 and 1965 crops mixogram data were secured. There was close and consistent relationship between hybrids and midparent values for mixing time and mixing tolerance.

Yield data from F₂ populations are available for comparison with F₁'s from the Hays crop of 1966 and 1967. In 1966 yields were very low. The F₁ hybrids exhibited the usual 30% increase, but the F₂'s were almost exactly equal to the parents. In 1967 the yield level was quite high. The average of 36 F₂'s was 7% better than the yield of parent varieties. This compares to an advantage of 35% for the F₁ hybrids. In neither year was any F₂ significantly better than the best variety.

In the hybrid study involving three Kansas locations there has been a moderate amount of interaction between genotypes and stations, and between genotypes and years. However, the consistent performance of hybrids in different sites and years is a more impressive feature of the experiments than occasional interactions. Generally speaking, the two additional stations give data which agrees with Hays data both in degree of heterosis and in superiority of certain hybrid combinations.

Analyses are notivet available at the time of this writing about the time of this writing about

938 0000 A-YEAR RESULTSOWITH WHEAT HYBRIDSOAT HAYS, KANSAS & DAY of the book of the second of the se

```
of a deliberg with mode ones of weeds 1964d w1965 VC 1966 KA1967 AVERAGE of a cells of a common of second was been selected as a cells of the common of the cells and the common of the cells are cells of the cells
```

YIELD OF BEST HYBRID OF TO SELECT TO SELECT SECTION 62.8 1.42.8 *
YIELD OF BEST VARIETY SELECT TO 34.0 06.44.2 V 13.3 6.46.0 61.32.6 **
DIFFERENCE, BUSHELS PER ACRE 11.0 12.9 3.6 16.8 10.2
TO ADVANTAGE OF HYBRID 16.8 500.33% bed 29% 25.27% 16.37% 31%
Given by The Acre 11.0 12.9 2.6 20.27% 16.37% 31%

* Average of hybrid with best 4-year yield performance.

** Average of variety with best 4-year yield performance.

in illege as then training becomed; for engine of the society of acute per plants of the series of the formal formal series of the series of t

unit ຈີ ໄດ້ເປັນ ເປັນ ເປັນເປັນ ປະເທດ ໄດ້ ປະເທດ ໄດ້ ພັດສະ ເປັນ ພັດ ໄດ້ເປັນ ໄດ້ເປັນ ເປັນ ໄດ້ ພັດໝາຍ ໄດ້ ໄດ້ ພັດ ປ ກ່າວ ເປັນເປັນ ການ ເປັນ ເປັນ ປະຊາຊົນ ປະຊາຊົນ ປະຊາຊົນ ປະຊາຊົນ ໄດ້ ໄດ້ ໄດ້ ໄດ້ ປະຊາຊົນ ປະຊາຊົນ

starie i sand file wed the forest party of the entree details in the entree of the sand from the entree of the ent

PERFORMANCE OF HYBRIDS IN PERCENT OF MID-PARENT VALUES

	1964	1965	1966	1967	MEAN
DATE HEADED	99%	97%	100%	88%	96%
HEIGHT	104%	102%	104%	105%	104%
HEADS PER PLOT	109%	126%	124%	122%	120%
SEEDS PER HEAD	105%	101%	101%	104%	103%
SEED WEIGHT					105%
LBS. PER BU.	100%	102%	101%	101%	101%
STRAW YIELD					
GRAIN YIELD	122%	137%	129%	138%	132%
	£. ;			** * .	7

Simple correlations between grain yield and other characters observed in wheat hybrids grown at Hays, Kansas.

	F) 4	1964	1965	1966	1967
DATE HEADED		.07	35*	.21	03
HEIGHT	٠.	.22	34*	.39*	.71**
HEADS PER PLOT	Υ.	.52**	.25	.43**	.78**
SEEDS PER HEAD	Ţ.,	.34*	26	.73**	.50**
SEED WEIGHT		. 24	.62**	.09	.21
LBS. PER BU.		.13	.83**	.49**	.19
STRAW YIELD		.82**	.03	.26	.80**

to a contract to a light statement set some the following and

The state of the s

THE WATER AT THE

NAME OF A STATE OF STATE

41

3-year average yields of 9 parents & 36 wheat hybrids at Hays, Kansas.

15		Tmp ,	Pkr	Sut	Tcs	Cch	0t	Pn Bsn Cnn
÷_**.	Trlumph	on National Control	34.0	33.3	34.1	31.9	35.2	34.9 34.4 36.7
: :	Parker	34.0	* 2° 13 21 3 12	34.8	40.3	34.9	38.1	38.3 37.7 38.4
	Scout	33.3	34.8		43.2	37.7	35.3	38.3 44.7 39.5
-3 ⁻² 53	Tascosa	34.1	40.3	43.2		35.6	38.7	40.3 37.8 39.7
	Concho	31.9	34.9	37.7	35.6		37.1	36.4 31.9 36.5
	Ottawa	35.2	38.1	35.3	38.7	37.1	m <u>ilu</u> i Sufw N	36.7 38.3 36.0
			• •		•	•		 37.7 36.3
	Bison	34.4	37.7	44.7	37.8	31.9	38.3	37.7
	Cheyenne	36.7	38.4	39.5	39.7	36.5	36.0	36.3 38.3
	Average	34.3	37.1	38.4	38.7	35.3	36.9	37.4 37.6 37.7
	Parent	22.0	28.0	32.1	23.5	28.5	29.6	26.9 28.3 27.6
	3 <u>V</u>	75 ₁ ,	Adres as	ů\$((Mar 10 00 d3
	,	rāçr.	77 × ,	ÜĹ				U.A. 803 L.N.E. T
	× 125.	: : : : : : : : : : : : : : : : : : :	ra.	무취일생.	. 			CHARL INGER

55 pt. V.3

HETEROSIS OF YIELD AND SEED WEIGHT IN 44 SPRING WHEAT CROSSES IN 1965 and 1967

C. L. Lay and D. G. Wells

Yield and kernel weights were studied of hand made crosses of 22 spring wheats with Lee and Rushmore in 1965 and 1967. The F_2 generations also were studied in 1967. F_1 and parental seed was produced in the greenhouse and was uniformly plump. F_2 seed came from the field and was plump. A split plot design in 4 replicates was used. In 1965 whole plots were of one row 170 cm long divided into subplots 20 cm long separated by oat hills in 5 cm long spaces. Rows were 31 cm apart. In 1967 two rows were added to a whole plot, one row for each F_2 . Plots were overseeded and thinned to a rate of 30 kg/ha (27#/acre). Diseases were chemically controlled. Rainfall was abundant in 1965. In 1967 there was drouth stress broken by one irrigation and then natural rainfall.

For yield in 1965 and 1967, the F_1 's for Lee crosses in relation to the high parents ranged respectively from -18 to +108% and -14 to +61%. For seed weight in 1965 and 1967, the F_1 's in relation to the high parent ranged respectively from -13 to +10% and -3 to +13%. F_2 yields in relation to the high parents ranged from -36 to +15%. F_2 kernel weights ranged from -9 to +7% in relation to the high parent.

For yield in 1965 and 1967, the F_1 's for Rushmore crosses in relation to the high parents ranged respectively from -19 to +62% and -30 to +23%. For seed weight in 1965 and 1967, the F_1 's in relation to the high parent ranged respectively from -9 to +10% and -7 to +5%. F_2 yields in relation to the high parents ranged from -42% to -9% while seed weights ranged from -7% to +5%.

The 2 testers in hybrids differed significantly only for kernel weight in 1967. For kernel weight in 1965 and yield both years, they were similar. The 22 tested entries differed in GCA for both trials both years. There were SCA differences in yield but not kernel weight in 1965. No SCA differences were found in 1967. Tested lines in both years for both traits were significantly different at the 1% level of P. Testers for both traits were similar in 1965 and significantly different in 1967. Rushmore in 1967 averaged 23% higher in yield than Lee. In 1965 Lee and Rushmore yielded 2021 and 1989 kg/ha. In 1967 the yields were 3296 and 4287 kg/ha respectively.

THE PROPERTY OF A STATE WIND WILL BE A STATEMENT OF THE S

The highest yielding F_1 in 1965 was 66% over Chris, the best commercial variety in the test. In 1967, Canthatch yeilded a little more than Chris. The best F_1 was 36% over Canthatch.

The correlations for 1965 between yields of the two sets of hybrids, of yields of Rushmore and of Lee hybrids with their seed weights and between seed weights of the two sets of crosses were all highly significant. However, there was no significant correlation between yields of the high parents and the hybrids in both series of crosses.

Correlations were not significant between years in the yields of crosses involving kee or Rushmore.

For years in the second of the different terms of the contract of the contract

For minking the hours of and 1967, the Fj to the duchness and the first of the circumstance of the circums

Inserted a Review girmedia and a constitute abjust in the end of a constant for a constant and a constant a constant and a con

THE PROSPECTS FOR HYBRID WHEAT IN SASKATCHEWAN

D. R. Knott

In some earlier work at Saskatoon 7 F_1 hybrids were tested and the maximum increase in yield over the better parent was 11%. The best hybrid also yielded 11% more than Thatcher.

More recently diallel crosses were made among 6 varieties of fairly diverse origin but all basically hard red spring wheats. The varieties were chosen so as to provide a good measure of the inheritance of yield, maturity, rust resistance and quality in F₁ hybrids. Enough seed was produced to test the hybrids in short rows with seeds planted 2 apart. Of the 15 hybrids, the plants of one developed progressive necrosis and died and the plants of a second showed moderate chlorosis. The latter cross was, therefore, eliminated from consideration.

The yield of the 13 remaining hybrids ranged from 4% below to 24% above the better parent. The only two significant increases above the better parent occurred for crosses where the parents had lower yields than expected. The best hybrid was only 6% above the best parent.

In heading the hybrids tended to be nearer to their earlier parent than to their later parent. Hybrids involving the early variety Garnet all headed within a day of Garnet.

The protein content of the hybrids tended to be near or even below that of the lower parent with a couple of exceptions.

Rust resistance behaved as expected.

Committee Control We

and the second second second

The hybrids were tested in F_2 both to see if a useful degree of heterosis was present and also to give a prediction of the degree of heterosis in F_1 . The average yield of the F_2 's was exactly equal to the average of the parents.

Correlations between midparent values and F_1 and F_2 values were highly significant for weight per 1,000 kernels, days to head and height were significant for protein and yield. The yield correlation between the mid-parent F_1 values would have been much better except for the unexpectedly low yields obtained for two of the parents, Garnet and Manitou. This resulted in low mid-parent values. It appears, therefore, that a pretty good idea of F_1 performance can be obtained by looking at the parent values. Estimates of general combining ability were much greater than for specific combining ability.

Our attempts to produce good restorer lines has convinced me that the present genes are not adequate. None of the F_1 's we have tried are fully fertile.

COMBINING ABILITY STUDIES IN DURUM WHEAT

J. N. Widner and K. L. Lebsock

A ten parent diallel was conducted at two locations in North Dakota during 1965. Heterosis percentages ranged from 184% to 81% of the higher yielding parent. The highest yielding hybrid outyielded its higher parent by 30% and the standard variety Wells by 16%.

whom thre was account within vitable with Estimates of general and specific combining ability were obtained by the analysis designated by Griffing as Model I. Method 4. Number of tillers/2 feet, kernels/head, 200 kernel weight, and grain yield all had highly significant mean square values for general combining ability. Only 200 kernel weight had a highly significant mean square value for specific combining ability. The percent general to specific combining ability for these characteristics as calculated from the variance components are as follows: 18 18 18

	is book bygger abbrisd t	Strack GCA Strategy	E to MIXISCATE
	ter o Lauranti vort + lau ori.	ស្រីស្រីស្រីស្រីស្រីស្រីស្រីស្រីស្រីស្រី	rud mili overte siati or
and the state of t	Tillers/2	1 560 42.4 6 300	හාද වෙන්න ්න වි න්ත් වෙන්න්
997636674	Kernels/head,	- 641 ,41.,3 ,935,641	ar resid 10.12 .00 resident es
	200 kernel weight	48.1	្រួញ(29∞5 វឌ្ឍ អស់
	Grain Yield	23.3	24.6

The estimates of general combining ability effects indicate 61-130 to be the highest in general combining ability. This parent was also involved in the crosses that produced the highest yielding hybrid and the highest increase in heterosis above the higher parent.

a ed of bable to blinder oils to this thou newscare off The correlation coefficient (r = .16) between yield of the midparent and the hybrid indicates parental yields do not safely predict the yield of the hybrids. The highest yielding hybrid in this study came from a cross of Langdon and 61-130 which ranked 4th and 9th respectively in yield. The lowest yielding hybrid came from a cross of Wells and 60-45 which ranked 1st and 5th respectively in yield. 200 The transfer of the second of the party of the party of the party of the second of the

James and Sill From the Color of the Color application of the Administration representation of the section of grand for the confirmation is also a transfer on the first management of the second section of the second second The training of the training pair better any and the compare were also sometime. and the state of the production of the second production of the second production of the second policy for the R. Sw. well hardwarf ended two typings govern will not become ந்தது. அவர் ஆ இதைந்துக்கும் ஒரு விரும்கிய விருக்கிற்ற பெருப்படுக்கிற நடி र महीते होता । अनुवेत पुत्र कर्षा कर्मा है अपने स्थान है अपने स्थान है अपने अनुवेद र अपने स्थान compact that too took and the parents was use. The forest of themselved policidos offaçego aci estrace as demo brea va. Des jate bisco and the second s ်ကာ (၁၆၈) (၁၆၈) ကိုက်တွေ့ ရောက် စာခုကျန်းမှု (၁၈၄) ပန်ဆေးကို (၁၈၄) လည်းသည် (၁၈၄) ရန် ကျွန်းများ (၁၈၄) မှန်မြော

owns are promoted to an analysis and analysis are an analysis of the promoted and decid Chaffa falia a first over the as

PARENTAL LINES	PARENTAL YIELD G/PLOT	F ₂ YIELD G/PLOT*	F ₁ YIELD G/PLOT*	ESTIMATES OF GENERAL COMBINING ABILITY EFFECTS
61-130	147 (9)	192 (9)	245	10.6
LEEDS	217 (2)	218 (1)	244	9.9
WELLS	240 (1)	209 (2)	243	8.6
AKMOLINKA	139 (10)	195 (7)	240	5.10 or or
60-120	217 (3)	204 (3)	237	2.6
LANGDON	199 (4)	204 (4)	236	
TEHUACAN	164 (7)	197 (6)	234	-1.7
RAMSEY	178 (6)	192 (10)	233	-2.6
CAPPELLI	157 (8)	197 (5)	229	-6.4
60–45	182 (5)	195 (8)	211	-27.1

^{*} MEAN OF FIVE REPLICATIONS.

METHODS OF EVALUATING COMBINING ABILITY POSSIBLE PROCEDURES

E. L. Smith, W. O. McIlrath, and C. R. Glover

A number of wheat workers have demonstrated that general combining ability variances are more important than specific combining ability variances for yield as well as other agronomic characters. This suggests that we should look first for high general combining ability in our hybrid wheat material. However, specific combining ability effects should not be ignored. In the final analysis we will have to make use of these non-additive effects in selecting parental combinations which give rise to superior hybrids.

A combining ability study involving adapted and foreign varieties was recently conducted at the Oklahoma Station. In this study general combining ability variances for yield were some 12 times greater than specific combining ability variances. For tillers/plant, kernels/plant, 1000 kernel weight, heading date, and plant height, general combining ability variances were also well in excess of specific combining ability variances. However, it is of considerable interest to note that in all characters examined, variances associated with specific combining ability, although relatively small, were statistically significant.

Extrapolating from findings in other crops, we can assume that general combining ability will be relatively more important than specific combining ability in material previously unselected for combining ability. Specific combining ability will become more important in material which has been previously selected for general combining ability. Considering this as well as the nature of the problems encountered in A- and R-line development, the following procedures might be useful in evaluating hybrid wheat material for combining ability.

Preliminary general combining ability estimates should be obtained on varieties and experimental lines before or concurrent with their conversion to A- and R-lines. This can be accomplished through the use of hand-made crosses involving two or three high-performing adapted varieties as testers. Diallel or partial diallel crossing system can also be used. In most programs, preliminary estimates of general combining ability have already been obtained for many commercial varieties and promising lines.

It appears that A-lines can be developed more rapidly than R-lines. Therefore, more A-lines than R-lines will be available, at least initially. With this situation we can employ a partial diallel mating system for a more extensive evaluation of general and specific combining ability effects. With this method (Table 1) four or five R-lines will serve as testers for 10 or so A-lines.

In addition to general combining ability, we will also evaluate for specific effects and search for promising A-line X R-line combinations. As more R-lines become available the model can be reversed so that four or five A-lines are used as testers for a larger number of R-lines.

This type of mating system has been used with sorghum and other crops and appears to be well suited for work with wheat. Also this model provides a means of obtaining additional information on variance components.

Table 1. -- PARTIAL DIALLEL MATING SYSTEM

Note that the second of the second of the

		N ₁ = 1.2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
A-Line	s	R-Li	nes		en en en
	W	X.	Y	Z	
· ·	S			· · · · · · · · · · · · · · · · · · ·	
1 .	W1	X1	¥1	Z1	
 2	W2	X2	Y2	1 / L	
3	⋅ W3	х3			
4	W4		1	1	
5	W5	1			
6	W6	i	1	1	
7	W7			. , 4,	
8	. W8				. ,
. 9	W9				
10	W10	x10	Y10	Z10	,

POLLEN PRODUCTION AND POLLEN SHEDDING AND SHEDING AND SHEDDING AND SHEDDING AND SHEDDING AND SHEDDING AND SHEDING AND SHEDDING AND SHEDDING AND SHEDDING AND SHEDDING AND SHEDING AND SHEDDING AND SHEDI

garafa gerajaga an benja ekonomeia okolomi teknolomi tenden an abetek on Gabstract) medi ili a dikenemen oleh di

en en en de la companion de la

era, spilit i pratici i i gari, a ja tareita i a les apesas la escriptura di ribusa a

The amount of seed set by cytoplasmic male sterile lines of wheat is determined by amount of available pollen, relative flowering date of the male and female lines and area of stigma exposed by the female. The present study was designed to investigate the relative pollen shedding ability of varieties of spring and durum wheats and the relationships between pollen shedding and other varietal characteristics.

and the comparison for a transfer and the

The varieties differed in amount of pollen shed, number of pollen grains/anther, % anthers extruded, tillers/plot, fertile florets/plot, fertile florets/tiller, yield and kernel weight. The amount of pollen shed was positively correlated with % anthers extruded and tillers/plot but negatively correlated with fertile florets/tiller.

Path coefficient analysis indicated % anther extrusion had the largest direct effect on pollen shedding. Pollen shedding ability of a variety can be predicted on the basis of fertile florets/plots pollen grains/anther and % anther extrusion.

THE EFFECT OF TEMPERATURE AND RELATIVE HUMIDITY ON THE VIABILITY OF HARD RED WINTER WHEAT POLLEN

(Abstract)

R. E. Watkins

Three varieties of hard red winter wheat - 'Warrior', 'Wichita', and 'Triumph' - were grown in controlled environment chambers at four temperatures each at three levels of relative humidity to determine the effects of temperatures and humidity on pollen viability and longevity. The temperatures were 65, 75, 85, and 95°F, and the relative humidities were 20, 50 and 80%. Pollen viability was determined through the use of the vital stain, tetrazolium bromide, in a sugar-gelatin mixture.

The results indicate that both temperature and humidity have an important effect on the longevity and viability of wheat pollen. Approximately 15% of the pollen grains were still viable after 40 minutes of exposure at 65°F and 50% relative humidity. While only about 18% were viable after 5 minutes at 95° and 50% humidity. At a constant temperature the pollen longevity was greater at the higher relative humidities. This study indicates that relatively low temperatures and high humidities are necessary for extended longevity of wheat pollen.

ACO GOT FAIRT ACTION OF A GOOD OF AN POLICE DISPERSAL

a To Giard Atherma, and and annion of the marks the

(Abstract)

E. G. Heyne

Pollen dispersion measured by Kramer-Collins spore traps and by glass rods indicated pollen would move at least 200 feet. However, highest seed sets were obtained on the down-wind side of the source and within 10 feet. Temperatures and other environmental conditions were poor for wheat pollination and maximum seed set was only 42%. There appear to be two peaks for pollen dispersion per day sometime in the morning before 11:00 a.m., and again in the afternoon when air temperatures decreased. Very high correlations were obtained between pollen per cubic foot per day and the average seed set per date of exposure.

Wheat cultivars appeared to differ in amount of pollen per anther. In 1966, 12 cultivars varied from about 1300 to 1600 per anther from the middle spikelets.

High the critical to the city to be about the complete with application of a city o

್ಟ್ ಬ್ಯಾಪ್ ಕ್ರಾಪ್ ಕ ಕೃತ್ತಿ ಮಾಡ್ತಿ ಕ್ರಾಪ್ ಕ್ರಾಪ

error are more make terrer, as the superfect of S.M. Burn like are selectively

MAXIMIZING CROSS POLLINATION

(Abstract)

D. E. Glenn

As early as 1965 we expressed confidence that a satisfactory level of cross pollination could be obtained in drill strips up to 16 feet in width, using a ratio of 1 male to 2 females. To date, we have seen nothing to change this opinion. Our data shows that we have obtained 80% cross pollination on a field average basis, though results have sometimes been difficult to duplicate.

Probably the most important factor in obtaining a satisfactory level of cross pollination is the proper timing of the blooming of male and female. Best results have been obtained where the sterile blooms about two days earlier than the pollinator. However, exposing the unfertilized stigmas for several hours or days may create some disease problems. The most serious that we have encountered is the formation of ergot bodies at the more northernly United States locations.

We are attempting to study the amount of isolation required to for Flacrossing fields as Results from 1967 showed insignificant of a levels of crossing at distances of 250 yards to 300 yards from approache pollen source at the large shows a star grape of a lowest and the pollen source at the large shows to a transfer the large star and the pollen source at the large shows the first part beautiful to the source.

MINIMUM SEEDING RATES IN WINTER WHEAT

(Abstract)

Arthur Klatt

One of the basic problems associated with hybrid wheat is the high cost of seed, not only from the farmer's aspect but also the producer. As a possible means of reducing the seed expenditure, a seeding rate study was conducted at Ft. Collins, Colorado in 1967. Two adapted, high yielding varieties, Scout and Lancer, were tested under 4 rates of seeding (3#, 6#, 9#, and 15#/Ac.).

The yields of Scout ranged from 54.7 bu/Ac at the 3 lb/Ac rate up to 71.4 bu/Ac at the 15 lb/Ac rate. Lancer yields ranged from 57.2 bu/Ac at the 3 lb/Ac rate up to 63.1 bu/Ac at the 6 lb/Ac rate. There was no significant difference in yield of Scout at either the 9 or 15 lb/Ac rate; however, the 3 lb and 6 lb/Ac rates were significantly lower in yield. The yield of Lancer did not differ significantly at the 6, 9, or 15 lb/Ac rates, however, the 3 lb/Ac rate again decreased yield. When the grain yields of the two varieties were averaged, no significant difference occurred between the 6, 9, and 15 lb/Ac seeding rates.

This test indicates that maximum or near maximum yields can be maintained at seeding rates that are much lower than the 30 to 50 lb/Ac seeding rates commonly used in this area. Mield component studies showed that the yield levels are maintained at the lower seeding rates mainly by an increased number of tillers per plant and larger head size.

IMPROVED SEEDING PRACTICES FOR HYBRID WHEAT

(Abstract)

F. C. Stickler

There is general agreement that seeding rates will be reduced with hybrids because of higher seed costs. However, it is still not known whether rates will be sufficiently reduced to require new concepts of seed metering and other changes in planting equipment design.

There is much experimental data indicating that the prevailing rates in most localities can be reduced without materially affecting yield. However, there are important "side issues" to the seeding rate question (particularly in the Hard Red Winter and Soft Red Winter areas) that may limit the extent of reduction. These are:

- The stands to compete with weeds.
- 2. Windward water erosion problems arising from incomplete to the trace of ground cover. A tributable of the control of the cover was tributable of the cover of
 - winter. 200 to the wheat during the fall and
 - 4. Delayed maturity of the crop.
 - 5. Less winter survival, presumably because of less material protection.

These are not insurmountable problems, but they are factors to consider in assessing the future needs for planting equipment. Although unit-planters may meet the planting requirements of the plant breeder and/or seedsman, they are not the answer for the commercial wheat grower.

More uniform seed distribution and improved fertilizer application practices may help capitalize on the increased tillering capacity of hybrids.

AMERICA MALABORA (M. 1900). POLICIA E POLITICARE PORTO E PORT

All Comme

SYSTEMIC AND NONMERCURIAL FUNGICIDES IN RELATION TO HYBRID WHEAT

And the state of t

About 70% of the wheat seed in Kansas is now treated with mercurial fungicides before planting. With the eventual change to hybrid wheat little or no seed will be treated with mercurial fungicides. Systemic fungicides likely will be used during development of the hybrids. Vitavax 75, an oxathiin fungicide applied as a seed treatment, will control loose smut, bunt, and some seed rots and seedling blights. Then either nonmercurial fungicides or combinations of them with systemic fungicides will be used for seed distributed to farmers. They are more expensive but also more effective than mercurial fungicides for control of seed rots and seedling blights. Since seed will be more expensive the grower will want to have it treated with the best fungicides so as to obtain maximum stand of plants and yield.

The second of th

ි බඳුන් හැරි දියට පළමු දියට පැකිර සියි. සිදු විද්යාවේ අතර සියි. එම දිය විය විය විය විය විය සියි. අතර අතර දියට පත්තර විදු වැඩි සිදු සියි. සියි. සිද්ධායේ සියි. සිදු සියි. එම දෙන දියට දියට සියි. සියි. සියි. සි අතර විය විය විය සියි. සියි

The standard selection of the selection

HYBRID WINTERHARDINESS NURSERY

V. A. Johnson

The winter survival of 16 winter wheat hybrids was evaluated in replicated rows at six locations in the hard winter wheat region in 1967. Eight of the hybrids were non-restored ms Bison as a common parent. The other eight hybrids involved NB 3547 or TX 1055 as a fertility restorer parent, crossed with A-line versions of winter wheat varieties ranging in winterhardiness from Parker to Omaha.

The second of the second of the second

A STATE OF PARTIES

Differential winterkilling occurred only at Laramie, Wyoming and Brookings, South Dakota. The average winter survival of non-restored hybrids was slightly less than the least hardy parents. Restored hybrids survived somewhat better on the average than either parent at Laramie but were only equal to the least hardy parent at Brookings where the winter was more severe.

Heads were bagged in restored hybrid rows prior to anthesis to permit measurement of degree of restoration. The data appear in Table 1. Restoration was clearly the most complete at Laramie where there was little difference in degree of restoration provided by NB3547 and TX1055. Overall restoration provided by NB3547 was next at Bushland followed by Brookings, Lethbridge, and Mocassin in that order. Restoration provided by TX1055 was approximately half as effective as NB3547 at Bushland and even less so at the other locations.

Table 1.

	% seed set on bagged heads						
Hybrid	:Laramie :Wyoming			:Brooking: :So. Dak.	:Lethbridge	:Mocassir	
					1122002 00	71101100110	
Gage x 3547	100		77	74	74	54	
Scout x 3547	95		75	68	64	57	
Bison x 3547	72		90	67	53	38	
Parker x 3547	79		74	70	38	44	
Omaha x 3547	62		67	51	55	33	
Wichita \times 3547	82		83	69	55	54	
Bison x 1055	64		28	2	2	6	
Wichita x 1055	95		49	3	19	16	

BANGAR WALLENDERSON OF BARME

Grain yields were taken at Mead, Mocassin and Lethbridge where all hybrids survived the winter without loss of stand. Performance of restored hybrids in relation to the parents is shown in Table 2. Less-than-complete restoration at these locations undoubtedly had a depressing effect on the performance of hybrids, although seed set from cross pollination probably lessened the effect.

o en la companya de l Companya de la compa

างกระทั่งได้ ที่ได้ และ เรียง เกียงกับ สังหาการหนึ่งและเรียงกระทุก เกียงนี้ สารรัฐการการ เกาะ โดยการที่เกาะ

Hybri	d jekan	: Hybrid : line) a : Mead	performanc and best pa : Mocass	e as % rent (b in	of parent mean (abovelow line). : Lethbridge	
Scout x	3547	$\frac{123}{122}$	14. 1 38. 91	og tild s erha salt	104	
no se des el como el c	1129 (990) 1547 1960 1547 1960 1961 1961 1961 1961	101 96	102 85	i de la constantia de l	107 92	
Bison x	3547	101 98	100	a be e ngo est tologic	116 111	
Parker x 3547		97 87	.a. 48da <mark>9.7</mark> 88		112 111	
Omaha x	3547	90	9904 - 84 	ministration (111 110	
Wichita	1.4	94 85	50 <u>93</u> 30 <u>83</u>	601 63 83	103 92	
		10 89 V	70 23 23 24 24	23 23 24 24 24	TARES AND	

SUPPRINCIPATION OF STREET

WINTERHARDINESS IN HYBRID WHEAT

make the state of the first of the first temperature of the state of t

J. M. Poehlman

Winterhardiness in wheat is a complex problem with survival depending upon the interaction of the genotype and the environment. Inherent survival will differ with the class of wheat and the variety within the class. Survival will be affected by the minimum temperatures, duration of exposure, moisture content of the soil, alternate freezing and thawing, snow cover, crop residue on the surface, plant spacing, soil fertility and texture, plant and root development, prehardening, disease or insect injury, and other factors. In general the hard winter wheats have greater resistance than the soft winter wheats to low temperature and drought while the soft wheats have the greater resistance to heaving. This is a basic difference in the adaptation of soft wheats to the Eastern U. S. and the hard wheats to the Great Plains.

The inherent hardiness of hybrid wheats will depend upon the inherent hardiness of the parent strains. It would be expected that the low temperature hardiness of a particular hybrid would be intermediate to that of the parent lines. Hardiness, particularly to heaving, might be increased over the midparent by greater seedling vigor and growth in the hybrid line.

and a mender serging of the authorise place meet that has been precised in a property of the property of the control of the property of the control of the c

្រុក ប្រជាពី ស្ត្រី ស្ត្រ ស្ត្រីស្ត្រី ស្ត្រី ស្ត្រី ស្ត្រី ស្ត្រី ស្ត្រី ស្ត្រីស្ត្រី ស្ត្រីស្ត្រី ស្ត្រី ស្ត្រី ស្ត្រី ស្ត្រី ស្ត្រី ស

A STATE OF THE STA

and the state of t

HARD RED WINTER WHEAT REGIONAL PROGRAM

Uniform Quality Series

The purpose and organization of the Uniform Quality Series were discussed. A motion to discontinue the Quality Series after the 1968 crop year was approved. Karl Finney of the Hard Winter Wheat Quality Laboratory will evaluate varieties in the 1968 Quality Series as composites only. Cooperating stations are urged to submit advanced lines and varieties for quality evaluation as "special samples". Five pounds of seed would be adequate for full evaluation of special samples.

to the Boards and duty in tigger of each business apportion deposity.

Southern Regional Performance Nursery of the book once galled so

There were no recommendations for changes in the nursery. Cooperators were urged by the regional leader to ship seed of new entries by parcel post or motor freight. It was pointed out that north-south movement of railway express shipments is very slow. Walter Nelson of the Lind, Washington Station expressed interest in obtaining seed of entries in the southern and northern regional performance nurseries for observation and yield testing at the Lind Station.

Northern Regional Performance Nursery wise of the additional angulous

and Nonchanges are commended some set 3 to the set alied to the second

Uniform Winterhardiness Nursery

It was suggested by the North Dakota cooperators that the northern and southern materials sections of the nursery should be grown at Williston or Dickinson instead of at Fargo where the winterkilling is usually too high for differential ratings. This change will be affected for the 1969 nursery.

ar a Company armedy from the boy of the engine of the profession of

Soil-bornel Mosaic (Nursery & services some cases of malifester and making with

No changes recommended.

Uniform Rust Nursery

Organization and the policy governing the management of the nursery was discussed by R. A. Kilpatrick.

Regional Report

No changes were recommended for the report except the suggestion that data in 1968 be reported in metric as well as English units in anticipation of eventual conversion to the metric system entirely.

C.I.Number Assignments

Cooperators were urged to consider requesting C.I. numbers for regional nursery entries. Numbers are assigned only upon request or at the time of release to growers. If C.I. numbers have not already been assigned, this certainly should be considered by the originator at the time an experimental variety is withdrawn from the nursery. Failure to assign numbers could result in the eventual loss of valuable germ plasm.

Data Retrieval Systems

Computerized retrieval of regional data was discussed by F. H. McNeal. C. F. Konzak discussed a world germ plasm record system.

TOWARD A WORLD PLANT GERM PLASM RECORD SYSTEM

C. F. Konzak

A program to develop an internationally coordinated system adapted to the storage, retrieval and processing of records and data by computers is nearing the stage of initial field action. The studies involved are being conducted by a working group on international standardization in crop research data recording. This working group was established on the recommendation of a group of scientists assembled at IAEA headquarters in Vienna in December, 1965, at the invitation of the Directors General of FAO and IAEA.1/ Since then the working group has investigated the possibilities for standardization of data recording procedures and is developing a model system for records on accessions of food, feed and fiber plants as a part of these investigations.

Studies of a trial system for storage and retrieval of records by computers were successfully completed in February, 1967 by the coordinator and colleagues with the guidance and assistance of other working group members and the IAEA computer staff. Preliminary recommendations on data recording procedures have been extensively reviewed. Development and review of the format for records is now in the process of final review prior to the launching of field tests. As part of the International Biological program, some standardized procedures have been proposed for records on new germ plasm obtained from plant explorations, from induced mutation research and from hybridization or selection programs as well as for records on existing collection of germ plasm being maintained at stations all over the world.

^{1/} Members of the Working Group are: T. T. Chang, Geneticist, International Rice Research Institute, Manila, Philippines; K. W. Finlay, Reader, Waite Agricultural Institute, Glen Osmond, South Australia; E. G. Heyne, Professor of Agronomy, Kansas State University, Manhattan, Kansas, USA; A. F. Kelly, National Institute of Agricultural Botany, Cambridge, U.K.; C. F. Krull, Agronomist, Rockefeller Foundation Programme, Mexico City, Mexico. Advisory members of the Working Group include: S. Borojevic, Institute for Agricultural Research, Novi Sad, Yugoslavia; E. H. Everson, Michigan State University, East Lansing, Michigan, USA: J. MacKey, Department of Genetics and Plant Breeding, Royal Agricultural College of Norway, Vollebekk, Norway; C. A. Watson, Agricultural Experiment Station, College of Agriculture, Montana State University, Bozeman, Montana, USA; and P. R. Jennings, International Rice Research Institute, Manila, Philippines.

IN THE REAL OF SEALTH MINE THE PROPERTY OF SEALTH PARTY.

S. Santa & D.

The organization and integration of internationally standarized records has been proposed by way of a coordinated world plant germ plasm record system. FAO headquarters at Rome is the logical location for the coordinating center and central record file. Wide scale field tests of the proposed system are being planned. Holders of a number of the major world collections of wheat germ plasm stocks will be asked to participate in these tests. The system will also be used in plant exploration and adaptation projects of IBP and in programs coordinated by FAO and FAO/IAEA. A project on a germ plasm record system has been included among the U.S. projects participating in the IBP. and the second of the second s 181 68

In preparation for the planned all out effort on germ plasm registration, U.S. workers could begin to standardize their records in at least three ways that should be compatible with their present work: accession number systems can be established; designations applied to varieties and selections could be made compatible for length (23 spaces) and complete pedigrees for accessions could - be recorded according to the standardized system proposed by Purdy et al. where the transform with the thought beginning to a chair a familie of the control of the appropriate of the property of the property of the control of th ate of the entropy with the second by the first acceptance of the second second second second the ex-tension of the entropy o

no 1 1 level i negli nose i li sessi e promini se ugi lebani i li subse o gi li sessi li casi li casi ကောင်းသည်။ သည်သို့ သောရေးရန် <mark>အိမ်လည်း ကိုကြော်သော်</mark>သည်ကို လောင်းရေး မြောက်သည်။ မြောက်သည်။ မြောက်အာ ကြည်သည်။ ကြောက်သည် သည်သည်းသည်သူ့ရေးကြို့သည်။ သို့မောက် အောင်းကောင်းသည်။ မောက်သည်။ မောက်သည်။ La model de que pareixa en estronou político de la mese de la Control of the following that a character control of the

this part is a second to the second of the second part of the second of and the second of the first terms of the second of the sec The source of the state of the The first of the second contraction of the second s en typen einer grad ogset var de tolkbyreger de retoffen i Mørse trikt and the state of t grand that the state of the sta na karanta ing karanta ng Pangganggan ng Karanta ng Karanta ng Karanta ng Karanta ng Karanta ng Karanta ng Kar Karanta ng (a) The second of the control of

Compressified Cather Complete and December 2

Regional Committee Reports

These were made by K. L. Lebsock, Secretary, Hard Red Spring Wheat Regional Committee, and V. A. Johnson, Secretary, Hard Red Winter Wheat Committee. Germ plasm release policies were discussed at length by the state and federal workers attending the regional programs session.

RESOLUTIONS

The following resolutions were adopted unanimously by the conference participants.

REPORT OF THE SPRING WHEAT RESOLUTIONS COMMITTEE

and the control of the second of the passes. The second of the second of

Be it resolved that the members of the Eleventh Spring Wheat Workers Conference, February, 1968, express their appreciation to the following people and organizations: First, to the local arrangment committee and various Departments of the Kansas State University for arrangements, accomodations, and hospitality; second, to the Chairmen of the various sections for the arrangement of the program; third, to the Kansas State University for their promotional activity, and fourth, to the Hard Red Winter Wheat Conference for their invitation to meet jointly. Be it also resolved that we go on record as favoring future joint conferences. Be it further resolved that we express our appreciation to our neighbors in Canada and Mexico for their participation and interest in our conference. Finally, we wish to thank those representing commercial interests in spring wheat research. We hereby also direct the Secretary of this Conference to express our appreciation by letter to the appropriate leaders of the organizations mentioned and enter these resolutions in the official record of this Conference.

Committee: Norman Williams
John Schmidt

Paul J. Fitzgerald, Chairman n de gagnet de la companya del companya de la companya de la companya del companya de la companya del la companya de la compan

REPORT OF THE RESOLUTIONS COMMITTEE OF THE HARD RED WINTER WHEAT WORKERS:

Be it resolved that the Hard Red Winter Wheat Workers express their appreciation to the administration of Kansas State University, its Conference Coordinator, and the local arrangements committee, especially its chairman, Dr. E. G. Heyne, for the use of their facilities, their excellent planning, and their hospitality as the host of this conference.

Be it further resolved that the Hard Red Winter Wheat Workers express their pleasure in having met jointly with the Hard Red Spring Wheat Workers in a fruitful and successful conference.

Be it further resolved that the Hard Red Winter Wheat Workers express their recognition of the substantial and stimulating contribution of private research workers participating in this conference.

Be it further resolved that the Hard Red Winter Wheat Workers express their appreciation to Dr. E. G. Heyne and Dr. D. R. Knott for their unselfish contribution of time and effort in developing the Wheat Newsletter into an effective means of communication among wheat workers.

The mount had to been to followith bit at annihouse while

The state of the s

and the the grown off and colored

Burned Argent Block Burney Argeny Association

PARTICIPANTS IN ELEVENTH HARD RED WINTER WHEAT CONFERENCE

- Allison, James
 Fannin Drive
 Tulia, Texas
- Althous, William 1500 Jackson St. NE Minneapolis, Minnesota
- Amaya, Alfonso Arnoldo
 Agronomy Department
 North Dakota State Univ.
 Fargo, North Dakota
- Anderson, Melvern
 Agronomy Department
 North Dakota State Univ.
 Fargo, North Dakota
- Anderson, Virgil
 69 18th Street North
 Fargo, North Dakota
- Atkins, I. M.
 Texas A & M University
 College Station, Texas
- Ausemus, Elmer
 1500 Jackson St. NE
 Minneapolis, Minnesota
- Bajwa, Manzur Ahmad 46 Bison Court Fargo, North Dakota
- Baker, R. J. 25 DaFoe Road Winnipeg, Manitoba, Canada
- Bauer, Ken John Deere Horican Works Horicon, Wisconsin
- Beck, Glenn H.

 Kansas State University
 Manhattan, Kansas
- Beckstrom, Kenneth 1225 North 44th Lincoln, Nebraska

- Bequette, Robert 1831 Woodrow Wichita, Kansas
- Berger, George A.

 Dept. of Agronomy
 University of Missouri
 Columbia, Missouri
- Bohnenblust, Kenneth E.
 University of Wyoming
 P.O. Box 3354
 Laramie, Wyoming
 - Bolte, Lerance, ARS, USDA 1959 Lincoln Drive Manhattan, Kansas
 - Brakke, Myron, ARS, USDA
 304 Plant Industry Bldg.
 University of Nebraska
 Lincoln, Nebraska
 - Browder, L. E. ARS, USDA Kansas State University Manhattan, Kansas
 - Buchenau, George
 Plant Pathology Dept.
 South Dakota University
 Brookings, South Dakota
- Borlaug, Norman E.
 Rockefeller Foundation
 Londres 40
 Mexico 6 D F, Mexico
- Calpouzos, Lucas
 Plant Pathology Dept.
 University of Minnesota
 St. Paul, Minnesota
- Campbell, Barry
 Canada Dept. of Agriculture
 Research State, 25 DeFoe Rd.
 Winnipeg, Manitoba, Canada
- Carter, Jack F.
 Agronomy Department
 North Dakota State Univ.
 Fargo, North Dakota

. . .

- Chada, H. L. ARS, USDA Finkner, Ralphaner Entomology Department Oklahoma State University Stillwater, Oklahoma
- destroit if Bil Curtis, Byrd 1909 Osage Street Fort Collins, Colorado
- Croy, Lavoy I. Dept. of Agronomy Oklahoma State Univ. Stillwater, Oklahoma
 - V To Harmoyide Dalton, L. G. Box 788 Plainview, Texas
 - Dewey, Wade G. Plant Science Dept. Utah State University Logan, Utah
 - Dickerson, Ottle J. Kansas State University Manhattan, Kansas
- Pagaraga Dreier, August F. Dept. of Agronomy University of Nebraska Lincoln, Nebraska
- Wingdels I salt Duncan, Gary Drawer - R Leoti, Kansas
 - Dyck, P. L. Canada Dept. of Agr. Research Station, 25 Dafoe 15: 227 1 Winnipeg, Manitoba, Canada
- Contact the state of Echols, Jim 2505 Tulane Drive Fort Collins, Colo.
- Edwards, Lewis H. e intibut la la Dept. of Agronomy ta jedan 14 -Oklahoma State Univ. Stillwater. Oklahoma
 - Farrell, E. P. Grain Science & Industry Kansas State University Manhattan, Kansas

- Route #2 Clovis, New Mexico
- Fitzgerald, Paul J. ARS, USDA Northern Grain Insects Res. Lab Brookings, South Dakota

n satari \$

- Colling Brother Frohberg, Richard C. Agronomy Department North Dakota State Univ. Fargo, North Dakota
- Gallum, Robert, ARS, USDA Rural Route #9, Box 70 W. LaFayette, Indiana

Compressive and Manager's

- Stanford Malagra Gerloff, Eldeon D., ARS, USDA University Station Brookings, South Dakota
- Giles, K. A. Mariy and show Dept. of Cereal Chemistry and Technology Fargo, North Dakota

mental and cont

人。我是一个钱子。

J. Astrolia, A. A.

- Gilmore, Earl C. Texas A & M University College Station, Texas
- Glenn, Dwight has a good 1831 Woodrow Wichita, Kansas
- Posside Tradicine Public Glover, Charles 229 North Knoblock, #244 Stillwater, Oklahoma
- Goertzen, Mrs. & Mr. Kenneth Frontier Hybrids Inc. Box 366 Show U Scott City, Kansas
- Gough, F. J., ARS, USDA Texas A & M University College Station, Texas
- Grabouski, Phile 1601 East "D" North Platte, Nebraska
- BASEMENT PROTECTION Grant, M. N. Bayer ent. Canada Dept. of Agriculture Research Station Lethbridge, Alberta, Canada

- Greenley, Kermit L. Hoover, William Midwest Research Associates Kansas State University 631 West Pacific Box #J Dassel, Minnesota
- Greer, Eldon 913 South Oklahoma Cherokee, Oklahoma
- Greer, Gary 1831 Woodrow Wichita, Kansas
- Gustafson, Carl Texas A & M University College Station, Texas

Carlotte Commence

Burney Commencer

- Hansing, Earl D. Kansas State University Manhattan, Kansas
- Hayden, E. B. Crop Quality Council 828 Midland Bank Bldg. Minneapolis, Minnesota

· 经设置 · 设置 · 设备设置

Hayward, Charles F. W. R. Grace and Co. 2 21 27 RFD #2 Hutchinson, Kansas

£ 1.

Heiner, Robert, ARS, USDA 694 West 6th Rd. B 2 St. Paul, Minnesota

and the second second

- Hess, Delbert C. Acco Seed Box 1630 Plainview, Texas
 - Heyne, E. G. Kansas State University Manhattan, Kansas
 - Holden, Ronald Box 2706 Des Moines, Iowa

Consum 200 in Contract of Cont

Holland, R. F. DeKalb Agric. Assn., Inc. Sycamore Road DeKalb, Illinois

- Manhattan, Kansas
- Hoseney, R. Carl, ARS, USDA Grain Science Kansas State University Manhattan, Kansas
- Hubbard, John D., ARS, USDA Kansas State University Manhattan, Kansas
 - Ilyas, Tunio M. Department of Agronomy North Dakota State University Fargo, North Dakota

Contract Contract

Johnson, John A. Kansas State University Manhattan, Kansas

Later William Control State Control

- Johnson, Virgil A., ARS, USDA Agronomy Department University of Nebraska Lincoln, Nebraska
- Johnston, David 1409 Summit View Drive Fort Collins, Colorado

Jones, Dexter 401 North Michigan Chicago, Illinois

18 1 Sept.

- Joppa, Leonard, ARS, USDA Walster Hall State University Station Fargo, North Dakota
- A Justus, Norman R. .. Columbia, Missouri
- Kaveh ; H. C. C. C. S. 12 Bison Court Fargo, North Dakota And Carlot English second of the
- Keith, George 508 South Broadway Urbana, Illinois eta e espetado. Lugar Anton Sobre

างกับเหล่าสู่หั้ม การหมายเรา เมื่อ

the selection because the letter 1970 that

Kilpatrick, R. ARS, USDA Leisle, Die State

id Klatt, Arth .w .v ewayd 626 Stuart Fort Collins, Colorad

กระหากได้ เ**ดิงสะเห็กเ**ลื Knott, D. B. University of Saskatoon Saskatoon, Canada

Konzak, C. F. Washington State Univ. Pullman, Washington may remain the second of stands

The second of the second and the second

Krull, Charles Londres 40, Mexico 6, D. F. Mexico

egit merben bassa marsil LaFever, Howards and M. Ohio Agr. Research & Dev. Centers of the second Wooster, Ohio สารเสอ เลือดหน้าราชาเทียน

Lancaster. Dean ... 3849 Orchard Lincoln, Nebraska

and a service of the president state. Langenberg, WIlliam, ARS, USDA 304 Plant Industry Bldg. Lincoln, Nebraska

Lawless, John Colby Branch Exp. Sta. Box1488mmma care Colby Kansas

Consideration of the Control of the Control

PALLET & THE RECORD TO LONG THE

Lay, C. Lines come? Agronomy Department Brookings, South Dakota

1906, 536, 500, 500, 200 Liang, George Kansas State University Manhattan, Kansas

a kantasti ikan 1941 kengebah Lebsock, Kenneth, ARS, USDA State University Station Fargo, North Dakota

Leininger, L. N. Miller Seed Company 1540 Cornhusker Highway Lincoln, Nebraska

Plant Industry Station Canada Dept. of Agriculture Beltsville, Maryland Research Station, 25 DaFoe Rd. Winnipeg, Manitoba, Canada

> Livers, Ronald Ft. Hays Branch Exp. Station Havs, Kansas

Loegering, W. Q. Plant Pathology University of Missouri Columbia, Missouri Art Constant

Lucken, Karl North Dakota State University Agronomy Department Fargo, North Dakota

Maan, S. S. S. and J. Stank 1425 North 10th Street Fargo, North Dakota Thursdy vailing the

Mattern, Paul 1420 North 37th Lincoln, Nebraska CONTRACTOR STATE

will the beautiful To follow

McBean, D. S. Canada Agr. Research Station Swift Current Saskatchewan, Canada 24975 - Rija yar noruz ya safoti

McCain, James A. ** Kansas State University Manhattan, Kansas ato cristi a femili

McKenzie, Hugh Canada Dept. of Agriculture Research Station Lethbridge, Alberta, Canada

McNeal, F. H., ARS, USDA Montana State University Bozeman, Montana

The first of the

McVey, Donald V. Coop Rust Lab. University of Minnesota St. Paul, Minnesota Committee with the state of

Menge, Paul Manage 1500 Jackson St. N.E. Minneapolis, Minnesota

- Merkle, O. G., ARS, USDA 303 Bolton College Station Panhandle State College College Station, Texas
- Mills, Richard 1137 North 37th Lincoln, Nebraska
 - Morris, Rosalind Deptartment of Agronomy University of Nebraska Lincoln, Nebraska
 - Nelson, Walter Dryland Research Unit Lind, Washington
- Nestor, Guiller Mochad Cargill S. A. Reconquisto 365 Buenos Aires, Argentina
 - Niernberger, Floyd Ag. Economics KSU Manhattan, Kansas
 - Nordquist, Paul 1505 East D. Street North Platte, Nebraska
 - Olson, R. V. 1947 1987 Agronomy Department Kansas State University Manhattan, Kansas

and the state of t

- Ortega, Jacobo 320 Church Street Salinas, California
- Ortman, Eldon E., ARS, USDA No. Grain Insects Res. Brookings, South Dakota
- Pass, Bill 2127 West University Stillwater, Oklahoma
 - Roberts, Bill J.
 Entomology Department Londres 40,
 Kansas State University Painter, Reginald Kansas State University Manhattan, Kansas
 - Paulsen, Gary M Agronomy Department Kansas State University Manhattan, Kansas

- Peck, Raymond Agr. Exp. Station Goodwell, Oklahoma
- Poehlman, J. M. Department of Agronomy Columbia, Missouri
- Polich, Gerald Kansas State University Manhattan, Kansas
- Pomeranz, Y., ARS, USDA Dept. of Grain Science Kansas State University Manhattan, Kansas
- Pope, Warren K. Department of Plant Science Moscow, Idaho
- Porter, Kenneth B. Texas Agri. Exp. Station Bushland, Texas
- Prescott, Jon M. 393 Highway 8 St. Paul, Minnesota
- Quinby, J. R. Pioneer Sorghum Company Box 788 Plainview, Texas
 - Quinones, Marco A. Plant Science Department Winnipeg, Manitoba, Canada
- Reitz, Louis P., ARS, USDA Plant Industry Station Beltsville, Maryland
- Rinke, Ernest 1500 Jackson Minneapolis, Minnesota
- Mexico 6 D. F. Mexico
- Roberts, Tom C. Kansas Wheat Association 404 Humboldt Manhattan, Kansas

- Robertson, Larry 1300 West Washington Bloomington, Illinois
- Roelfs, A. P., ARS, USDA 306 Ag. Bot. Building St. Paul, Minnesota
 - Romig, R. W., ARS, USDA 308 Ag. Bot. Building St. Paul, Minnesota
- Salm, Peter 2213 1st Avenue North Fargo, North Dakota
- Samborski, D. J. Canada Dept. of Agr. Research Sta., 25 DeFoe Rd. Winnepeg, Manitoba, Canada

grand of the section of the section of

- Schafer, John Kansas State University Manhattan, Kansas
 - Scharen, Albert, ARS, USDA Plant Industry Station Beltsville, Maryland
 - Schmidt, John W. Department of Agronomy University of Nebraska Lincoln, Nebraska
- Sebesta, E. E., ARS, USDA 924 Stanley Stillwater, Oklahoma
 - Shands, Henry DeKalb Agri. Ass., Inc. 1211 Cumberland Ave., Box D West Lafayette, Indiana
- Sharp, E. L. Dept. of Botany and Microbiology Montana State University Bozeman, Montana
- Or to Shellenberger, J. A. Grain Science Kansas State University Moline, Illinois Manhattan, Kansas

- Shogren, M. D., ARS, USDA Funk Bros. Seed Company Secretaria Kansas State University Manhattan, Kansas
 - Shuey, William C., ARS, USDA North Dakota State University Fargo, North Dakota
 - Sibbitt, bleonard garagest. Cereal Technology North Dakota State University Fargo, North Dakota
 - Sill, Webster 1128 Wreath Avenue Manhattan, Kansas
 - Singh, S. P. Rockefeller Foundation Londres 40, Mexico 6 D. F., Mexico
 - Smith, Edward Lancofor of 1725 Linda Lane Stillwater, Oklahoma
 - Smith, Floyd W. Barry 9360 Kansas State University minor Manhattan, Kansas
 - Smith, Rex L. F. J. Commission University of Arkansas y Fayetteville, Arkansas Committee of animal
 - Somsen, Harry W., ARS, USDA Entomology Department Kansas State University Manhattan, Kansas
 - Sorenson, Orlo Kansas State University Manhattan, Kansas
 - Stegmeier, William Garden City Experiment Station Garden City, Kansas
 - Stewart, Vern R. Tolder N. W. Mont & Br. Station Kalispell, Montana carrier by a transfer an
 - Stickler, F. C. Deere and Company 33300 River Drive Companies a companies of the

Stroike, Jim 1812 North 58th Lincoln, Nebraska

Sunderman, Donald, ARS, USDA Box 99 Aberdeen, Idaho

Swinbank, J. C. 2835 North 56th Lincoln, Nebraska

Talaat, Elham H.

Department of Agronomy
Fargo, North Dakota

Taylor, Allen G. 828 Midland Bank Bldg. Minneapolis, Minnesota

Thysell, J. R., ARS, USDA
Northern Grain Insects
Research Lab.
Brookings, South Dakota

Toler, RObert W.
Texas A & M University
College Station, Texas

Tuleen, Neal A.

Texas A & M University

College Station, Texas

Urich, Max A.
RFD #2
Hutchinson, Kansas

Vasquez, Greg 1831 Woodrow Wichita, Kansas

Villegas, Evangelina Londres 40 3er piso Mexico 6 D. F., Mexico

Walberg, M. E.

Box 512

Milwaukee, Wisconsin

Walter, Ted L.

Department of Agronomy
Kansas State University
Manhattan, Kansas

Ward, A. B.
Dept. Grain Science & Ind.
Kansas State University
Manhattan, Kansas

Watkins, Richard E. 1305 Springfield Fort Collins, Colorado

Wells, D. G.
Agronomy Department
Brookings, South Dakota

Whited, Dean North Dakota State University Fargo, North Dakota

Widner, Jimmy
Department of Agronomy
Fargo, North Dakota

Wihrheim, Sven E.
North Dakota University
Fargo, North Dakota

Williams, Norman D., ARS, USDA State University Station Fargo, North Dakota

Wilson, James A.
DeKalb Agr. Assn. Inc.
1831 Woodrow
Wichita, Kansas

Wise, Martin Aberdeen, Idaho

Wood, E. A., Jr., ARS, USDA Oklahoma State University Stillwater, Oklahoma

Yildirim, Metin
311 A North Duncan
Stillwater, Oklahoma

Young, Harry C.
Oklahoma State University
Stillwater, Oklahoma

Zillinsky, Frank J.
Londres 40, Mexico City, Mexico

Zuzens, Didzus 20 Kings Drive Winnipeg, Manitoba, Canada

and the second of the second o

en de la companya de Companya de la companya de la

enter de la proposición Terrespondentes

To see Wildowski, I make and the second of the second of the second

(1) 20 (2011) 1 (1) (1) (1) (1) (1)

Construction of States

in the specific of the specific control of the specifi Agent Constant Straighton

i kata Asa Ba

An year the side of Angle south to the Angle

Contract Contract States

All Sections of the Section (Section 1997).

Sp. Death of the Sp. Sufference of the Cartesian Land Control of the Control

en de la companya de

in the second of the second of

The second secon 19章 克尔尔·福兰克尔 化种类的数据 19章

A STATE OF THE STA

and the state of t

Control (1886) Control of the Artist Control of the The state of the s

al de la companya de la co

to design of the second se

 $\begin{array}{lll} \mathcal{H}^{(1)}(\mathbb{R}^n) & & \mathcal{H}^{(1)}(\mathbb{R}^n) & \mathcal{H}^{(1)}(\mathbb{R}^n) \\ \mathcal{H}^{(1)}(\mathbb{R}^n) & & \mathcal{H}^{(1)}(\mathbb{R}^n) & \mathcal{H}^{(1)}(\mathbb{R}^n) \end{array}$

and the second of the second o

 $\label{eq:constraint} \operatorname{constraint} (x,y) = x + (x,y) + (x,y$ The second section is the second section of the second second second second second second second second second

Manager (2007). growg i take to be because in