

Quality Breeding at Bread Wheat

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Purpose of breeding

- **FARMER**- Yield, Disease tolerant
- **INDUSTRY** – good breed, Pasta , biscuit quality and cheap.
- **USER CUSTOMER** – good test and quality.

Quality factors which have impact on wheat quality

Botanically:

Species(14), , 3 species economically important

Tr. aestivum (Ekmeklik) – 42 Chromosome

Tr. compactum (Topbaş) – 42

Tr. durum (Makarnalık) – 28

Use of different species

Tr. aestivum:

Breed

Hardiness and protein content is different within species.

Tr. compactum:

Resistant to drought, White soft grain,
Low protein, biscuit, Low gluten

Tr. durum:

Mostly spring , Mediterranean and TÜRKkey winter type.

Region ,Climate , Aber colour, Gluten

...Factors Affecting Wheat Quality

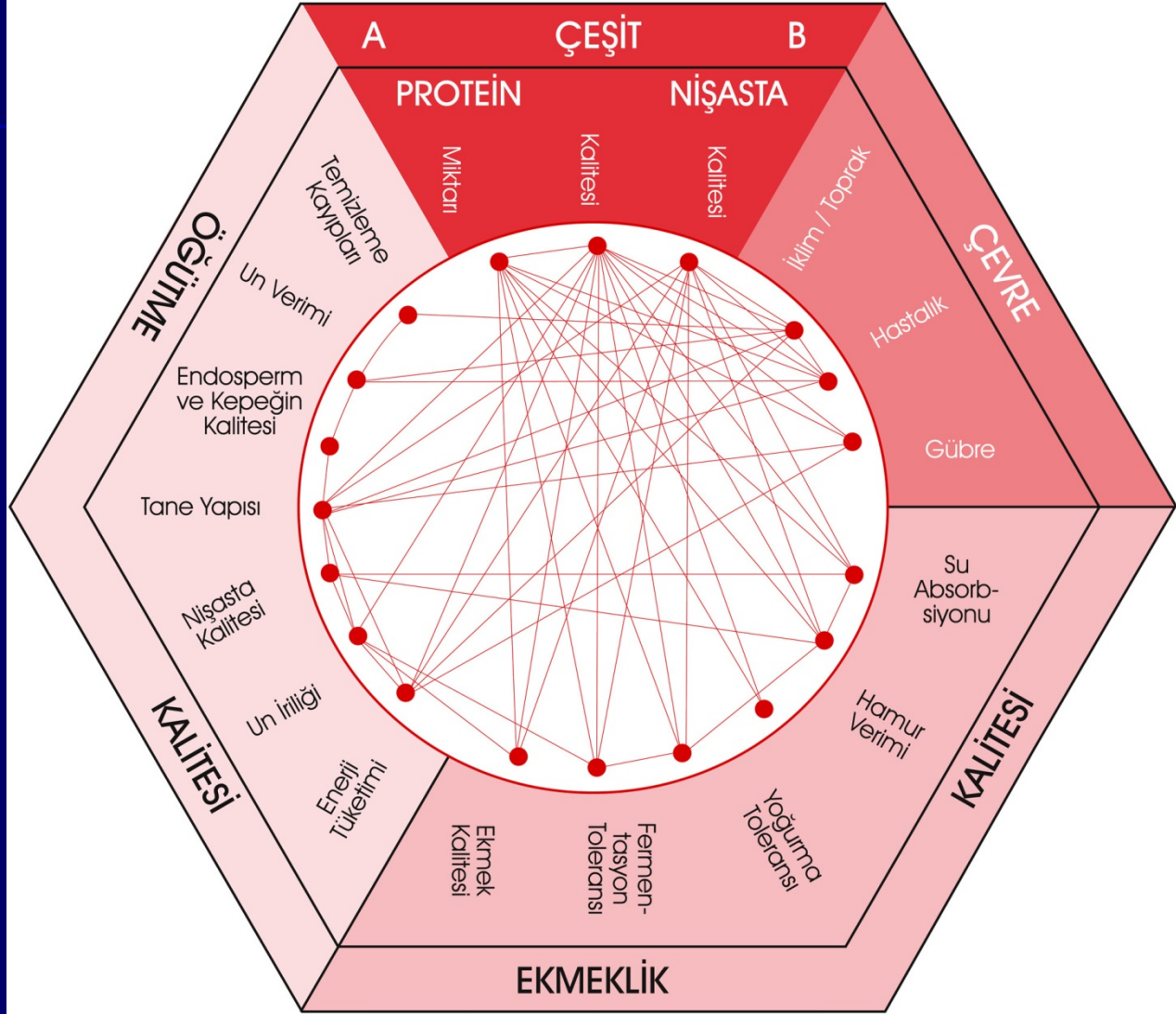
Milling Quality Bread quality

- Protein
 - Starch
 - Amount
 - Broken
 - Environment
 - Grain
 - Hardiness
 - Testa
 - Biggest
 - KÜL
- Protein
 - Amount
 - Quality
 - Gliadine
 - Glutamine
 - Carbohydrate
 - Starch
 - Sugar
 - Lipid
 - Polar
 - Non polar
 - Environment
 - Enzymes
-
- Variety
 - Agronomic practises

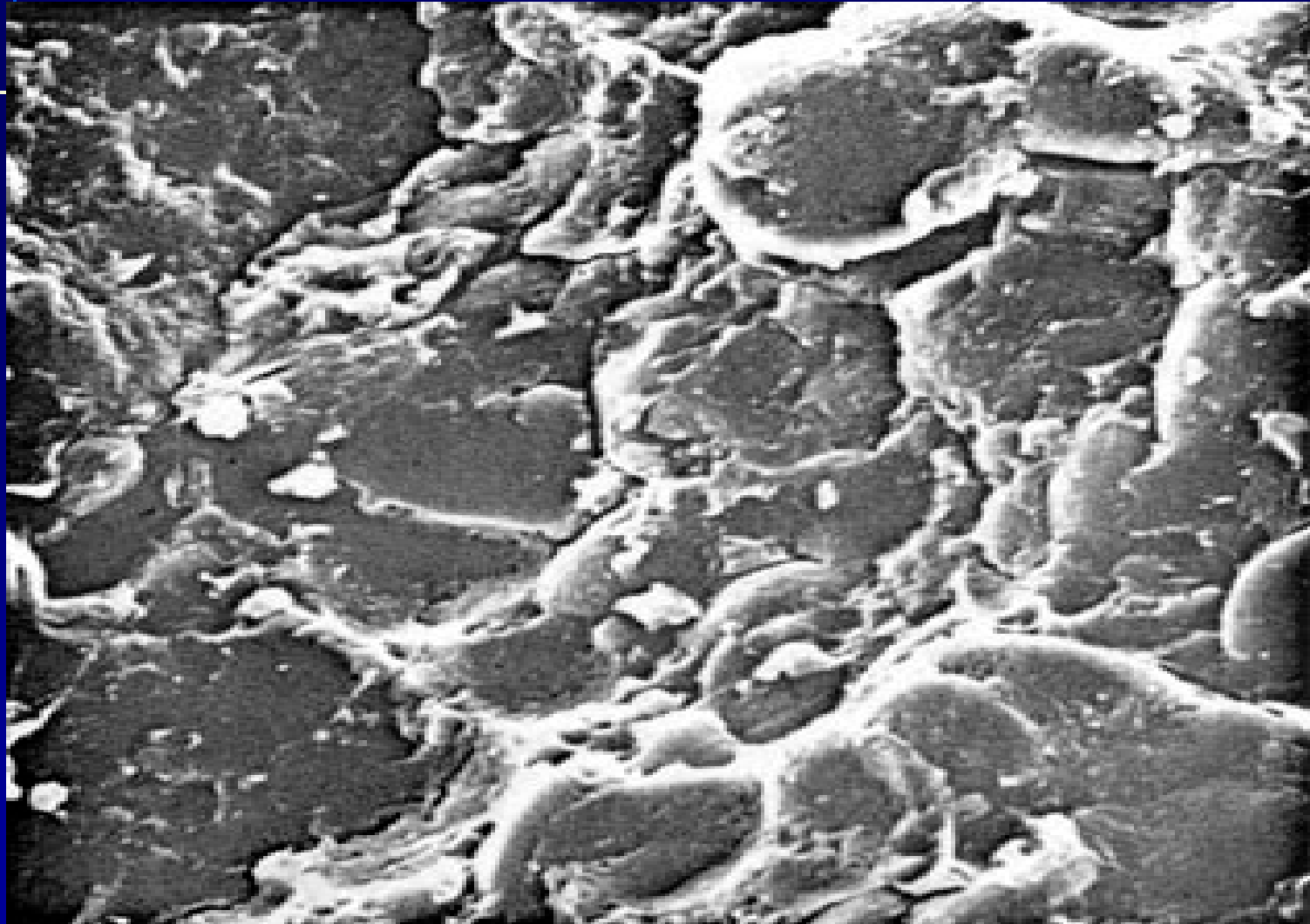
.....Importance of wheat grain composition for breeding

- Different localization of grain quality chemical components within the grain
- Different concentration of chemical components within the grain
- Morphological shape
- Genotype x Environment for quality traits
- Nutrition

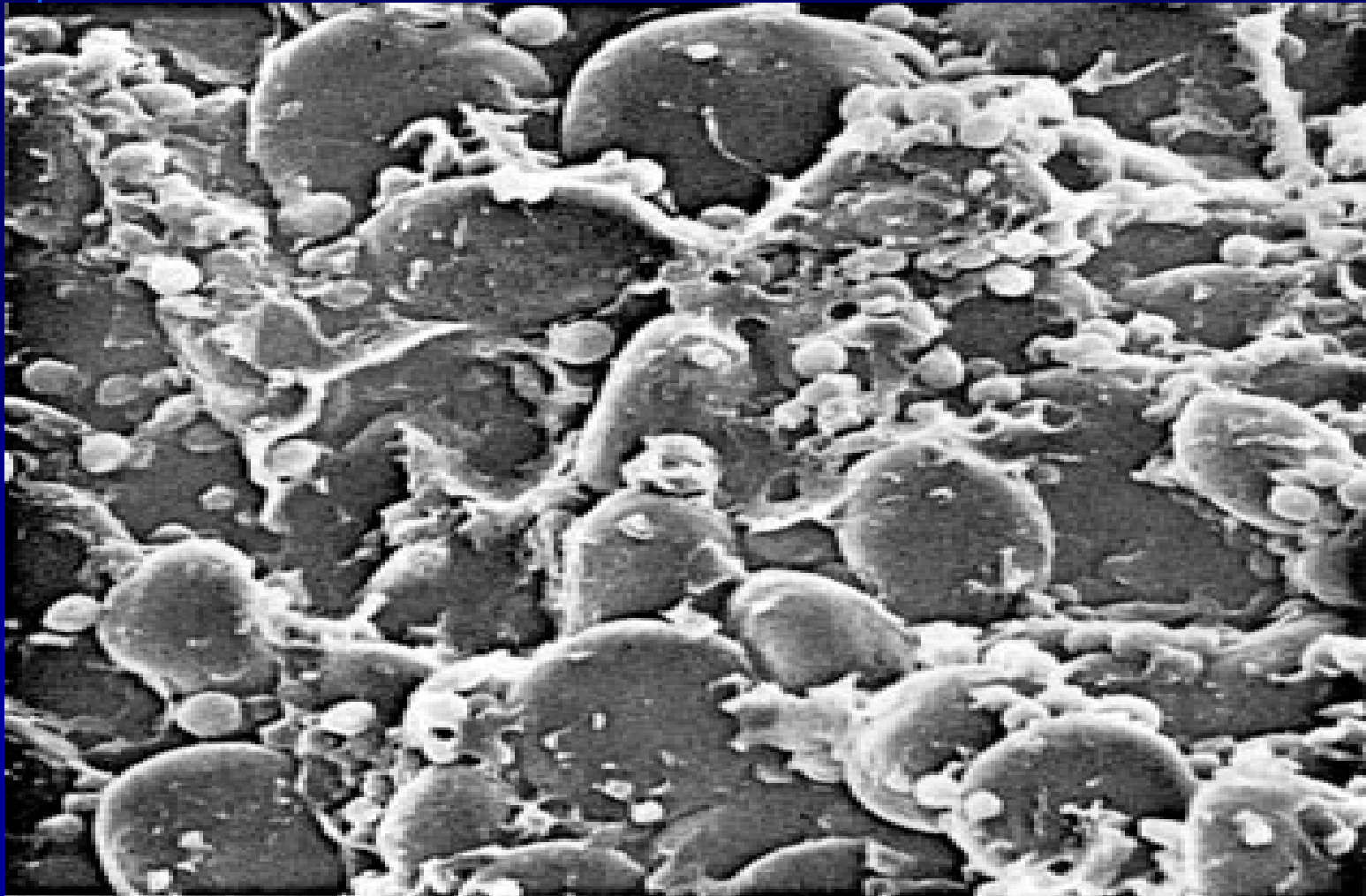
COMPONENT OF GOOD QUALITY



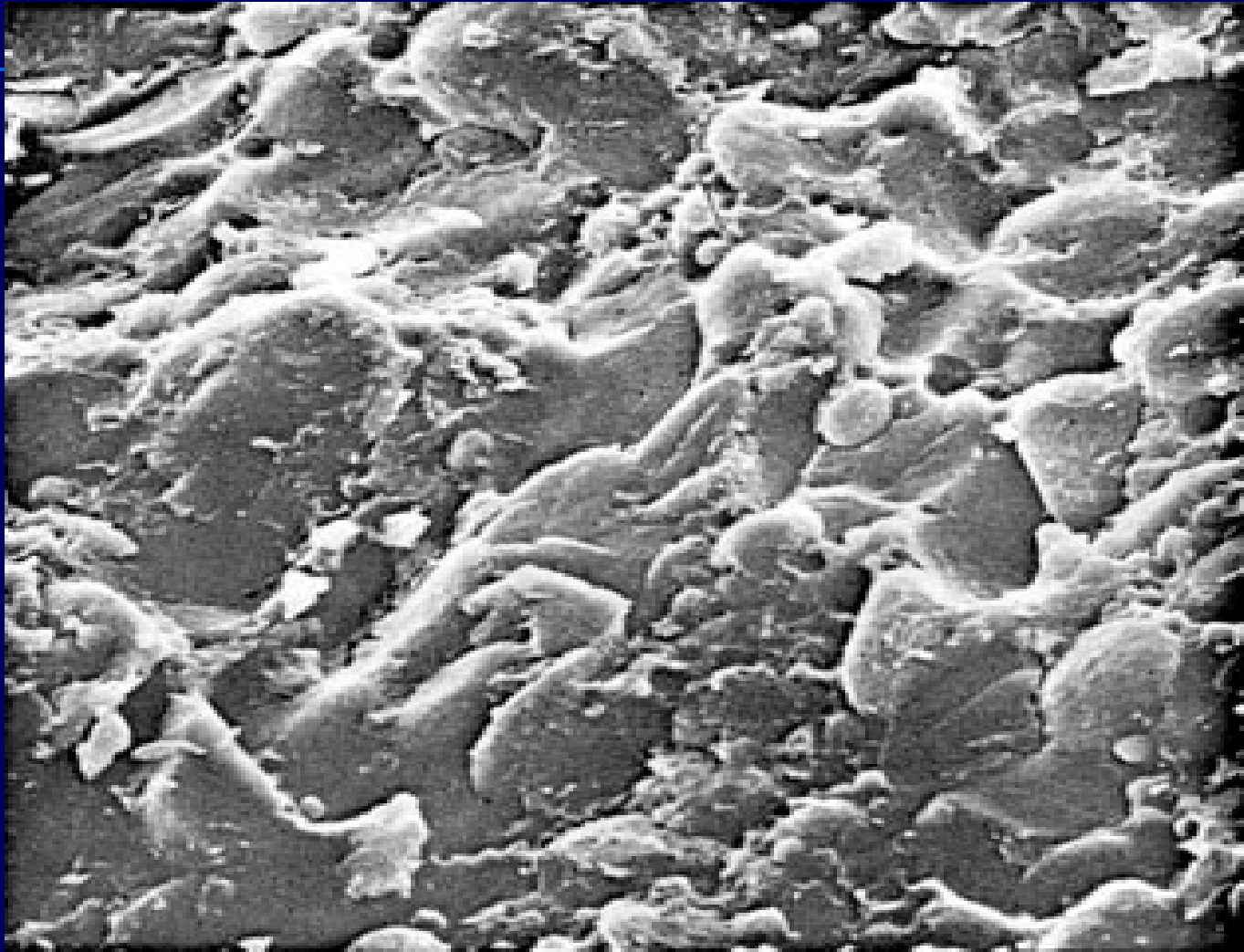
ENDOSPERM OF HARD WHEAT



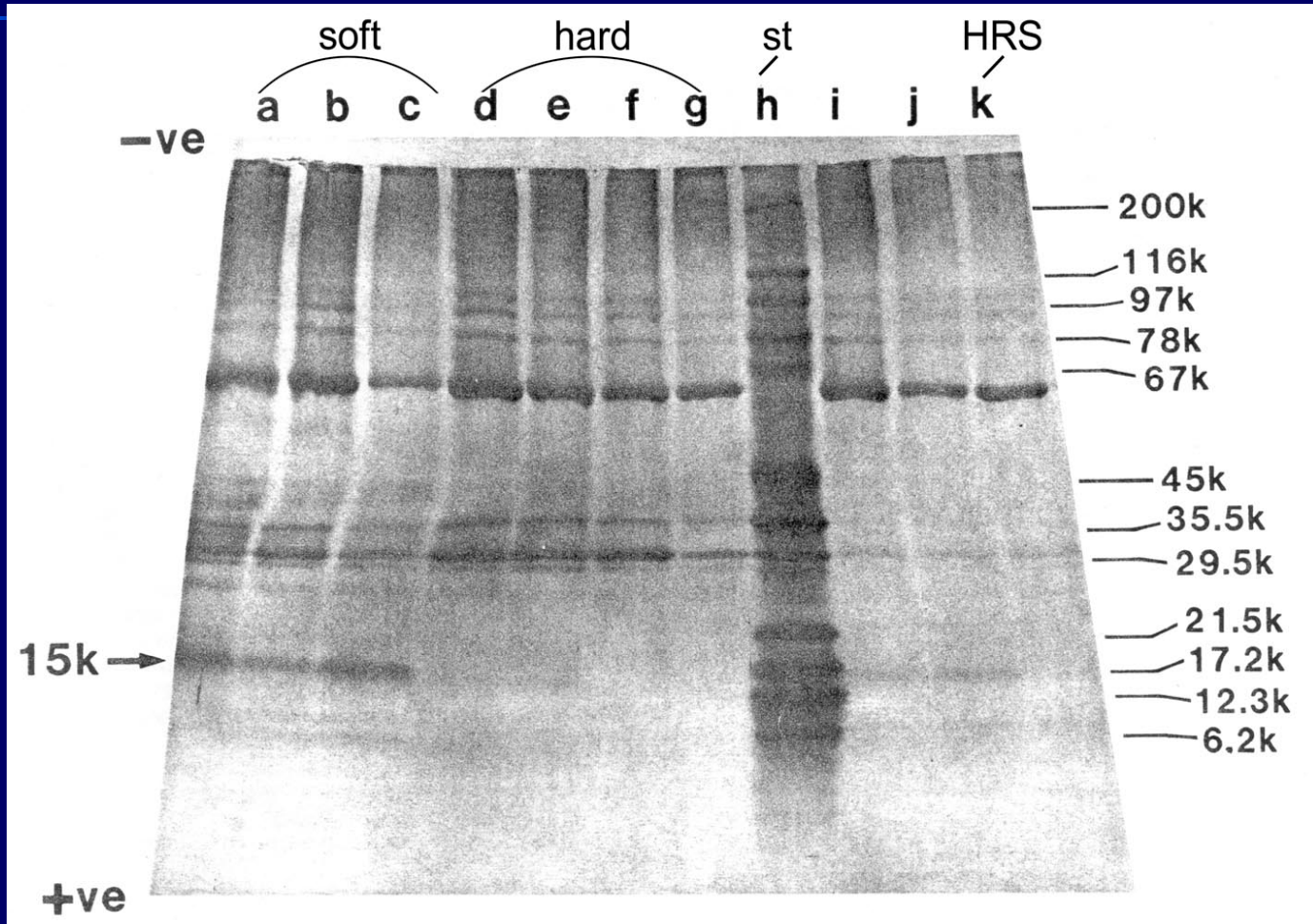
ENDOSPERM OF SOFT WHEAT



DURUM WHEAT ENDOSPERM



SDS-PAGE ELECTROPHORESIS FRIABILIN



GRAIN HARDINESS AND FRIABILIN

FRIABILIN -

Texture of grain

Not only friabilin causes softness

Other factors Starch

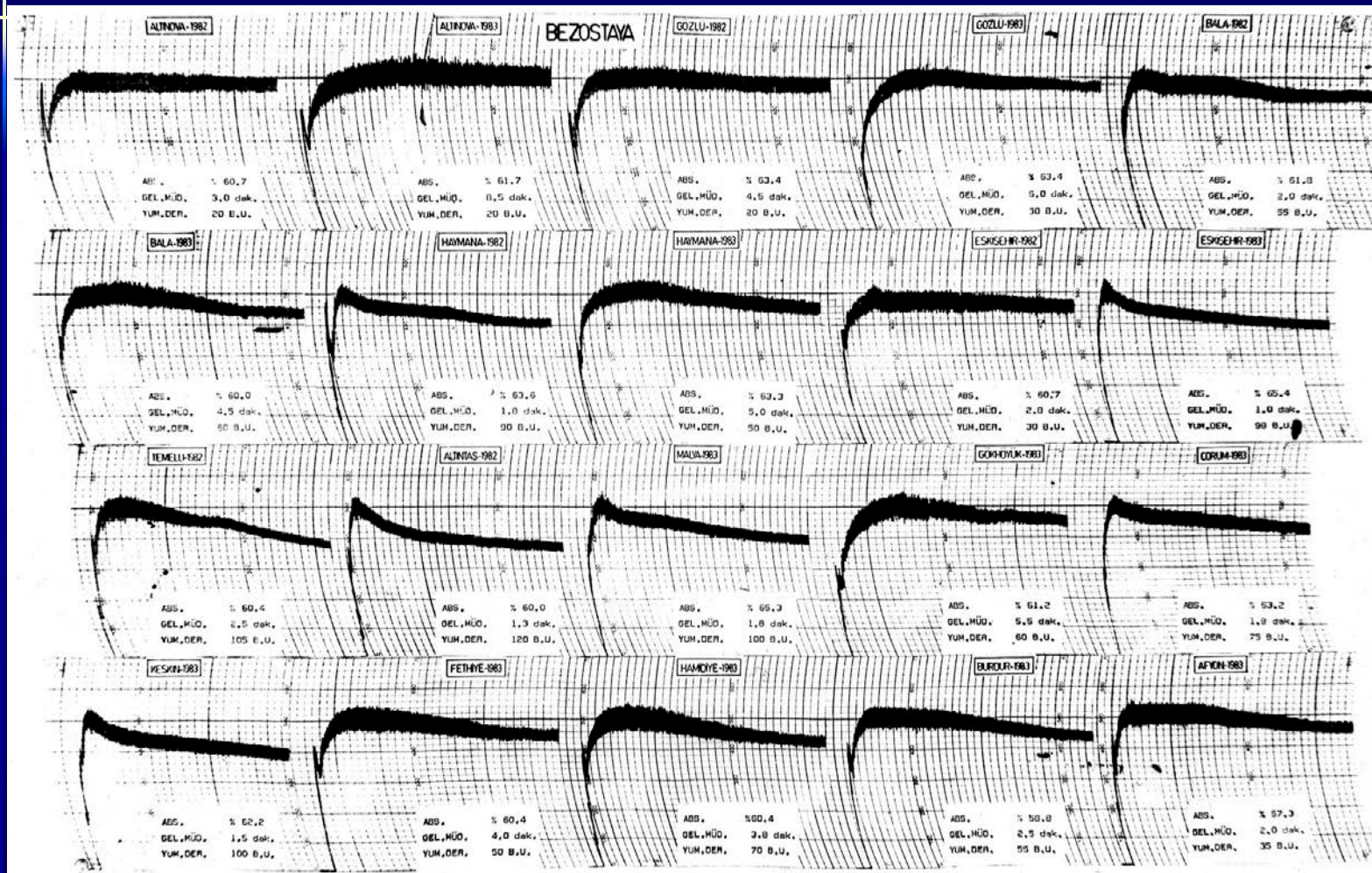
Polar, Non polar, Glico phospholipids

FRIABILIN Interact with

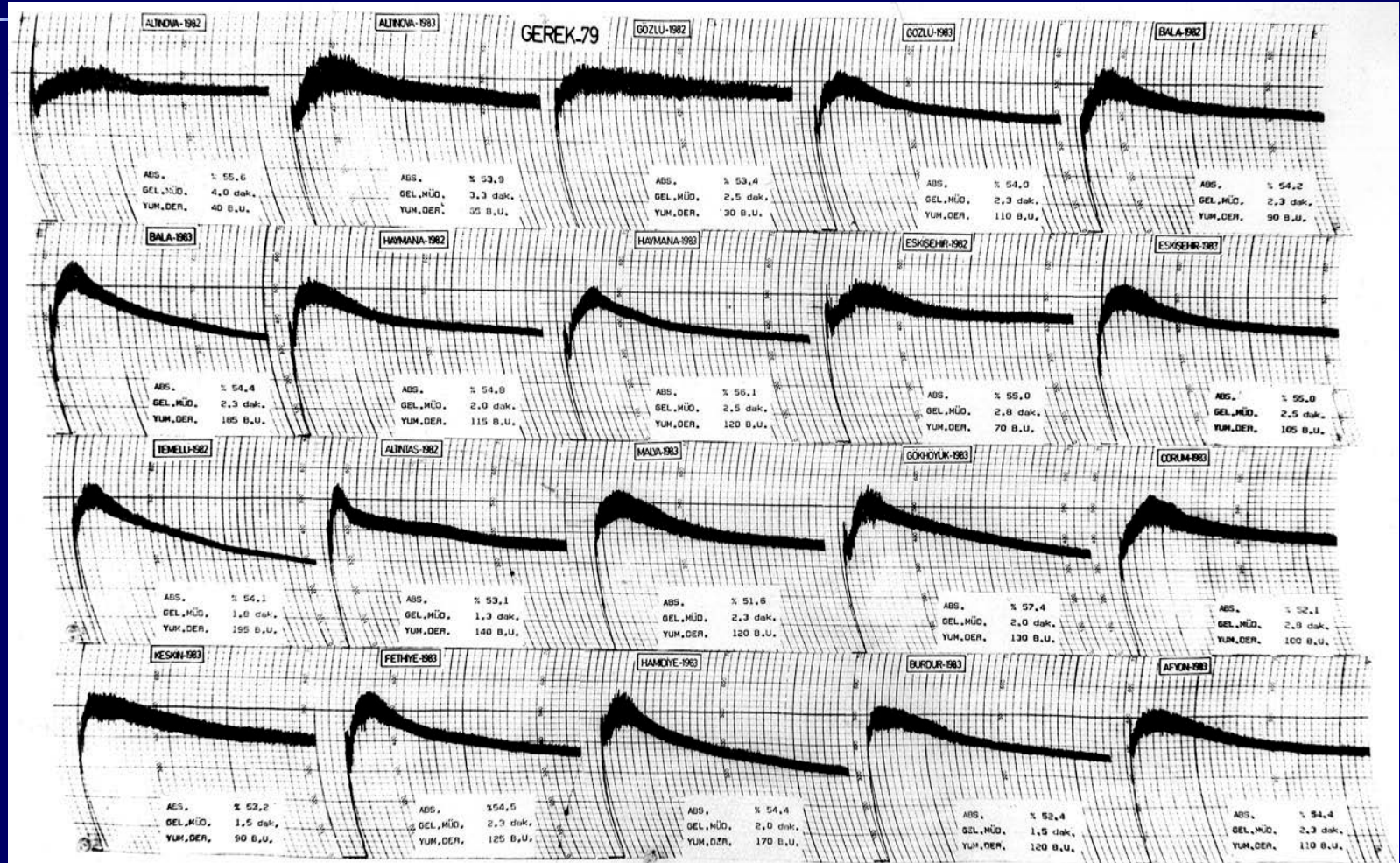
polar lipids – Can use as a marker for softness

these knowledge can be used in breeding for material with different hardness

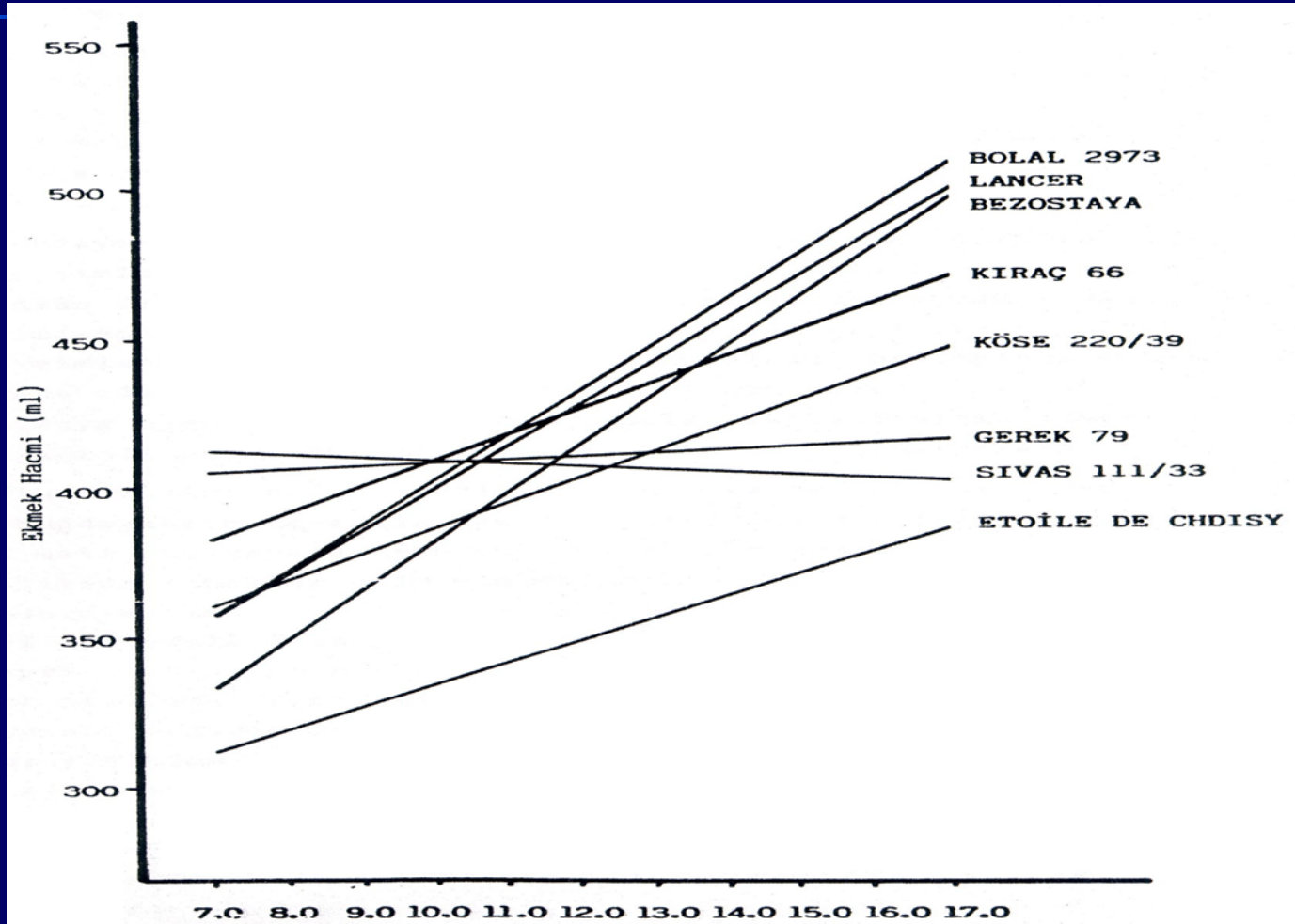
Environment effect on FARINOGRAM (BEZOSTAYA)



EFFECT OF ENVIRONMENT ON FARİNOGRAM (GEREK 79 VARIETY)



INTERACTION BETWEEN BREAD VOLUME AND PROTEIN CONTENT



QUALITY

- Genetic - protein quality
- Environment – protein amount

Heredity of quality

is important

QUALITY FOR DIFFERENT END-USES

- MILLER, BREAD MAKER, PASTA, PRODUCER

etc..

- Breeder, Quality lab/ and Food health
Breeder

- Inheritance of quality traits
- Commercial quality

TARGET OF RESEACH

INHERITANCE OF QUALITY TRAITS

biochemical methods

Protein electrophoresis

Genetic control of proteins/

Genetic correction

INHERITANCE OF QUALITY IS

- Genetic,
- No effect of environment,
- Use of material

COMMERCIAL QUALITY

- Phenotype
- Environmental factors X Heredity
- Grover

QUALITY METHODS AND CORRELATION BETWEEN TRAITS

1. QUALITY , NEGATIVE CORRELATION WITH SOLUBLE PROTEINS
IN ACETIC ACID.

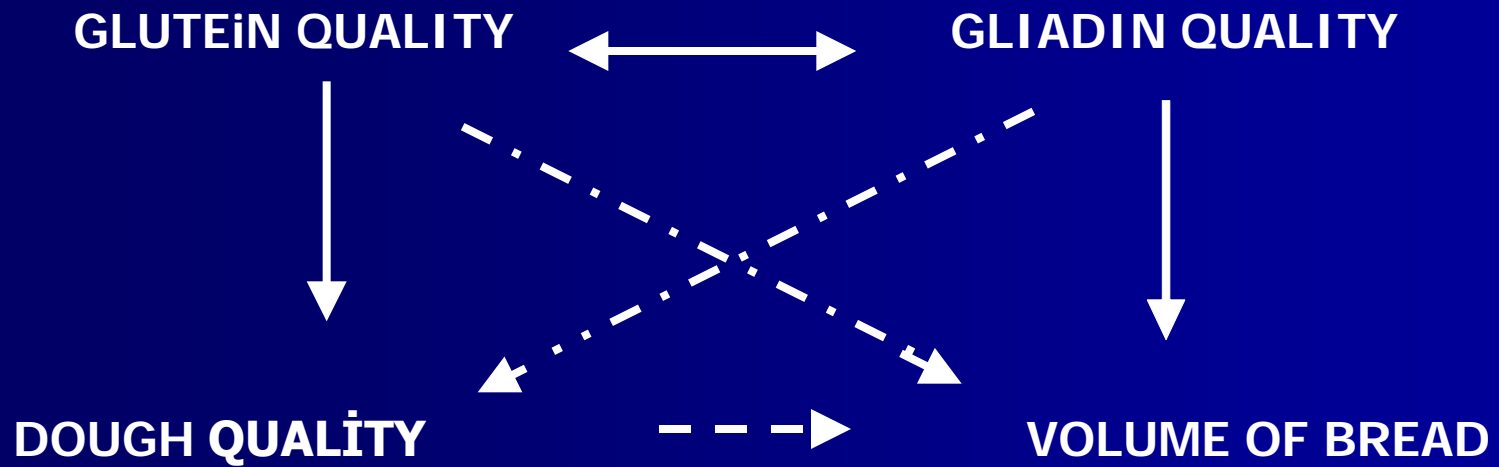
POSITIVE CORRELATION WITH RESIDUAL PROTEIN (NON
SOLUBLE IN ACETIC ACID GLUTENIN) (sds->35)

2. GEL PROTEIN (JP)

- JP: 4-18 mm

- RELATION : ZELENY, ALVEO, JP WITH BREAD QUALITY
- NO RELATION WITH TOTAL QUALITY AND GEL PROTEIN.

RELATION BETWEEN GLUTEN PROTEINS AND DOUGH QUALITY AND BREAD VOLUME,

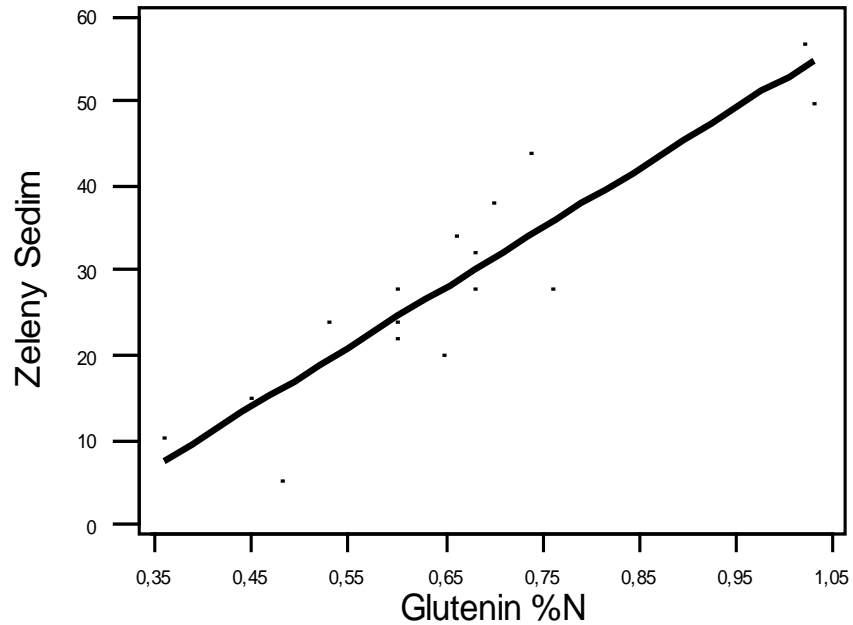


EFFECT OF GLUTEN, GLIADIN AND GLUTENIN PROTEINS ON BREAD QUALITY



(Total protein is % 12.0 all bread); 1 (normal flour),
2 (normal flour + gliadin), 3 (normal flour + glutenin), 4 (normal flour+ gluten)

RELATION ZELNY SEDIMENTATION AND AMOUNT OF GLUTENIN



RELATION GLUTENIN AND BREAD QUALITY

GENETIC CONTROL OF HMW GLUTENIN PROTEINS

GLU- A1, GLU-B1 ve GLU-D1 SUB-UNITS
ON LOCI (LOCALIZED
LONG ARM CROMOZOM 1A 1B 1D)

QUALITY BREEDING

BREEDER, USED TO DISCARD MATERIAL AT EARLY GENERATIONS.

FLOUR PROTEIN, SDS SEDIM. AND HMW- G SUB UNITS KNOWLEDGE

BREEDING FOR SPECIFIC QUALITY

- SPECIFIC PROTEIN CONTENT**
- GLIADIN ELECTROPHOREGRAM**
- PROTEIN SUB-UNIT COMPOSITION**

MUST BE KNOWN BY BREEDER

RELATION QUALITY AND GLIADIN ELECTROFOREGRAM

1. KNEAD AND BREAD QUALITY , SOMALINA –PASTA MACORONI
QUALITY- HAS RELATION SPECIFIC GLIADIN BANDS

2. FUNCTIONAL RELATION BETWEEN GENES
Linkage

Gliadin amounts is low.. (% 1-3 of total proteins) But big effect on dough quality.

SELECTION FOR HIGH QUALITY MATERIAL

1. F3 (or half of grain in F2) 2;7+8;5+10 band combinations or, GLU-1 quality point be 10 select.

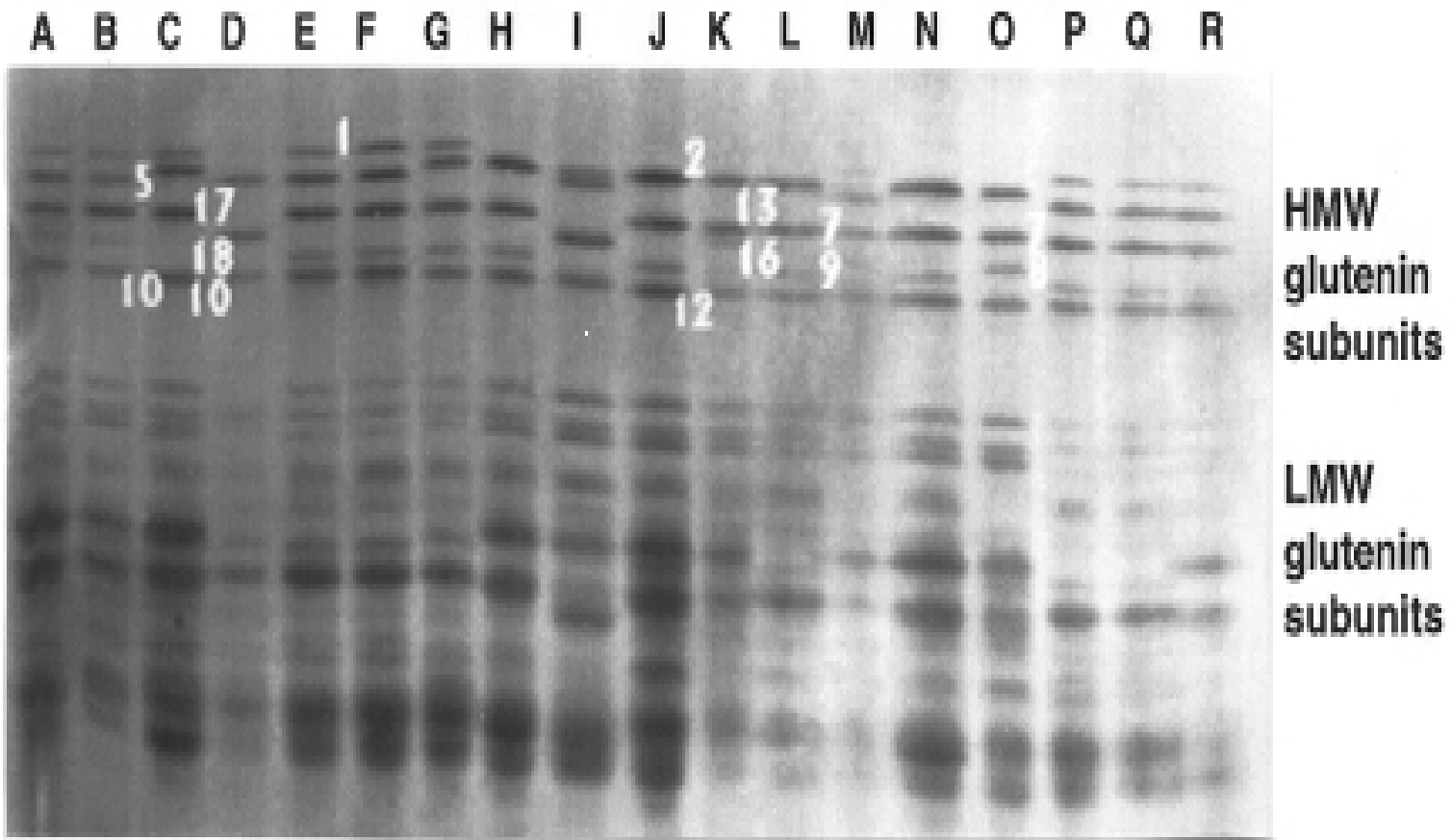
2. F5 selection can be SDS .

3. PYT, YT, RYT AND CANDIDATES SELECT REOLOGIC (alveograf, farn.,miks) AND COOKING BREAD

**HMW –GLUTEN SUB UNITS HAS RELATION AT
BREAD QUALITY**

NO RELATION WITH PASTA MACORONY

HMW-G AND LMW-G PROTEINS BANDS



GEL FILTRATION METHODS

- HIGH GLUTENIN- LONG KNEAD, HIGH QUALITY

- ELECTROPHORESIS BANDS - W(energy), L (LONGLES OR EXTENDNESS) HAS POSITIVE CORRELATION

Can be use for crossing

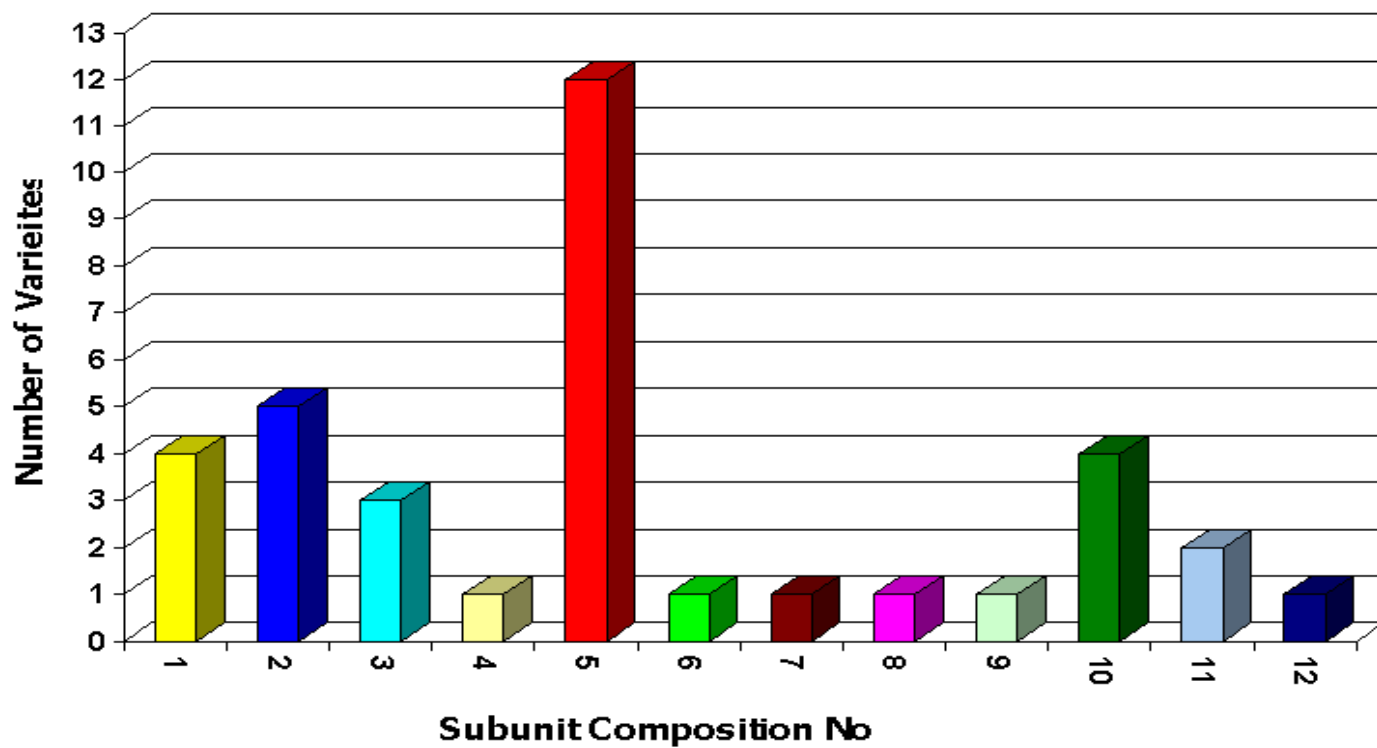
HMW G and LMW –G IN TURKEY 1986

MATERIAL :
-GENERAL GLUTENIN SUB UNIT COMPOSITION IN TURKISH

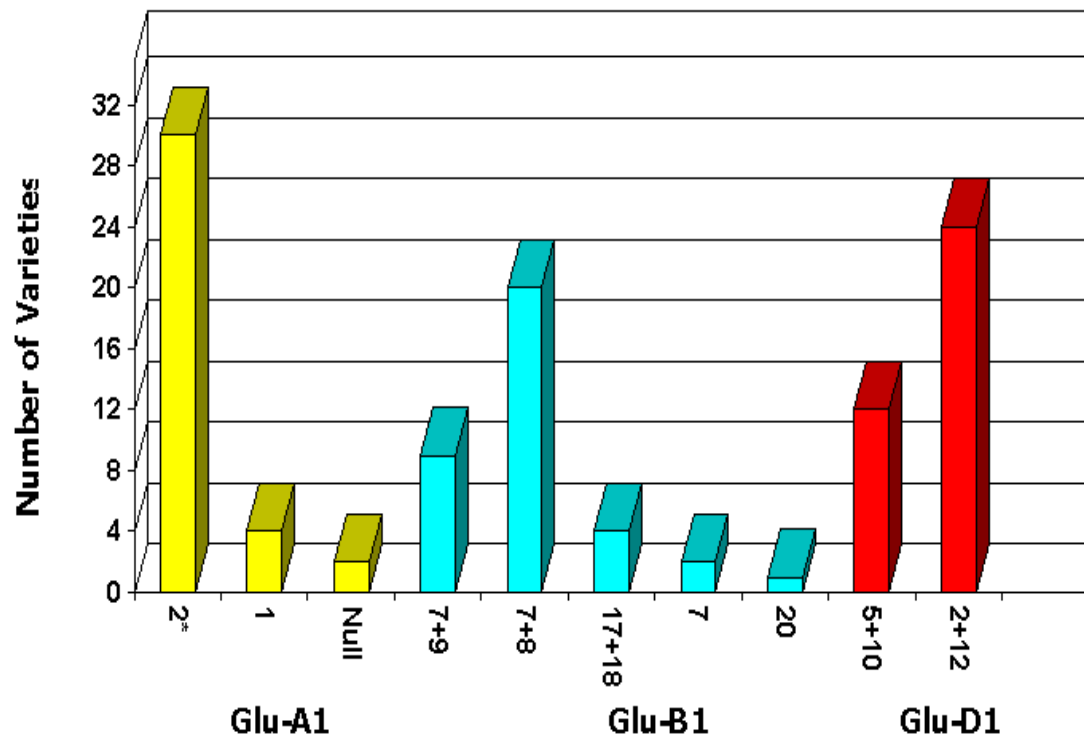
-Genaraly - 2*,7+8,2+12; 2*,7+8,5+10 ve 2*,7+9,5+10

-BEZOSTAYA- 2*,7+9, 5+10, GEREK- 79; 2*,7+8 ve 2+12

Distribution of Subunit Composition of some Turkish Winter Wheat Varieties



Frequencies of HMWG Subunits among the Varieties



QUALITY POINTS OF HMW MA-GLUTENIN

QUALITY POIN	CROMOSOM		
	1A	1B	1D
4	-	-	5+10
3	1;2	17+18;7+8	-
2	-	7+9	2+12;3+12
1	0	7;6+8	4+12

HMW G SUB-UNIT COMPOSITIONS

VARIETY	Glu-A1	Glu-B1	Glu-D1	GLU1 POINT
Bezostaya	2* (3)	7+9 (2)	5+10 (4)	9
Flamura	2*	7+8 (3)	5+10	10
Pehlivan	2*	7+9	2+12 (2)	7
Ikizce 96	1	7+8	5+10	8
Sünter	2*	7+8	2+12	8
Dogu 88	N	7+9	5+10	7
Vratza	1	7+8	2+12	8
Karasu	N	7+8	5+10	8
Murat-1	1	7+9	2+12	7
P8-6	2*	17+18	2+12	8
Sultan	2*	7	2+12	6
Libellul	1	20	2+12	6

Dr. Javier Pena QUALITY POINTS

FINLAND 8.3

WINTER 7.8

SPRING 8.8

ENGLAND 5.2

GERMANY 5.8

FRANCE 5.8

TURKEY. 8,0

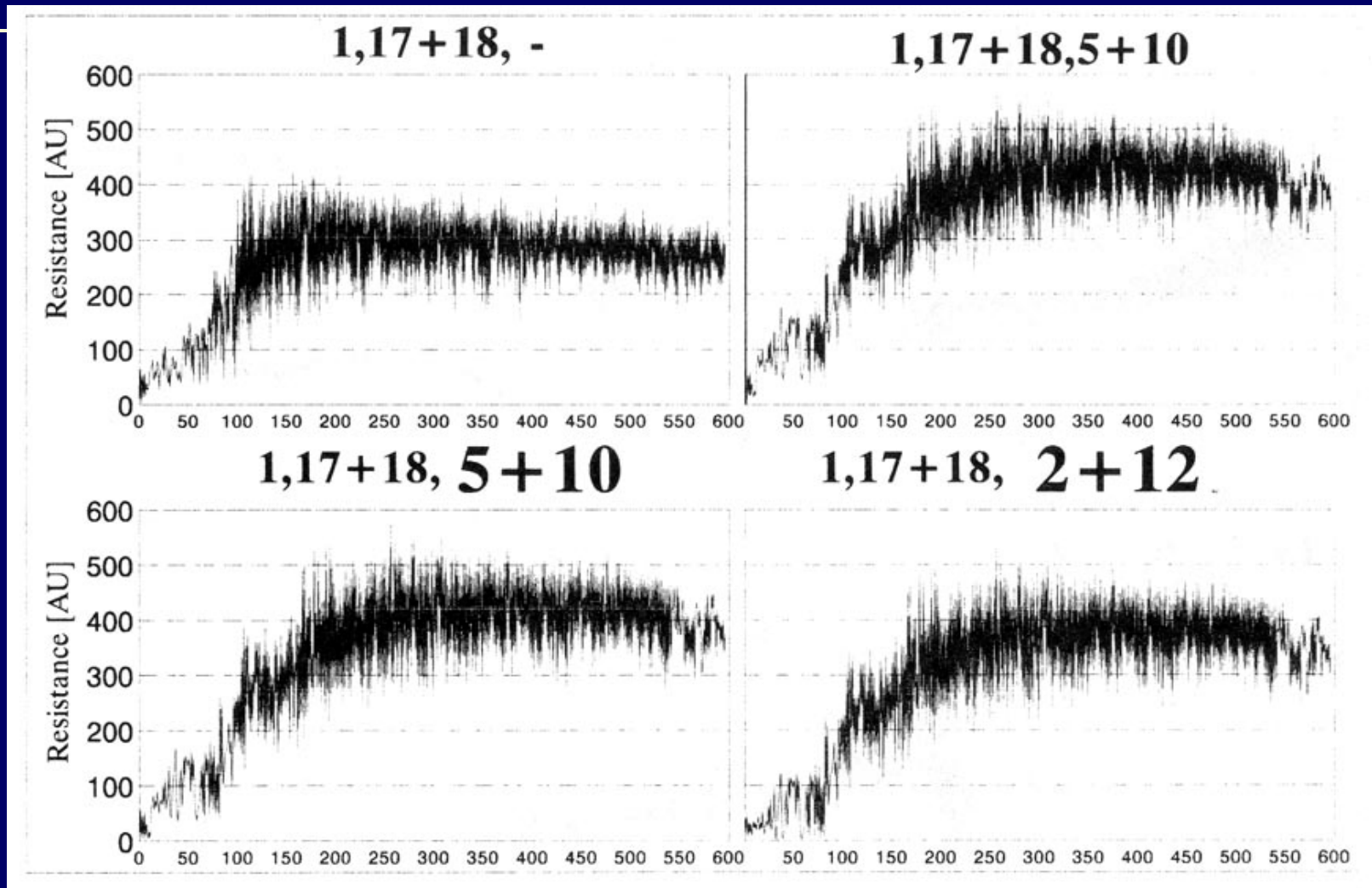
EFFECTS OF PROTEIN BANTS

GLU-1>GLI-1>GLI-2

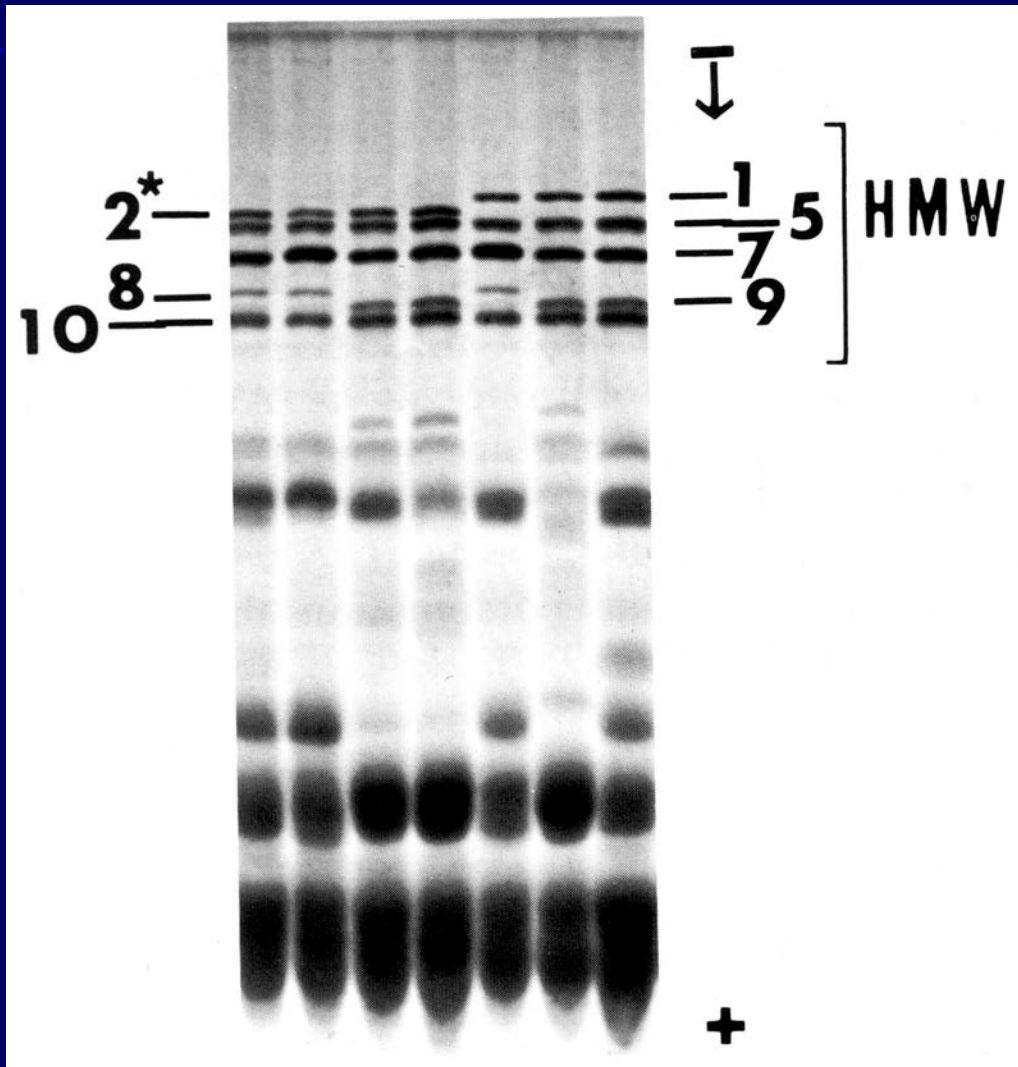
HMW-G SUB UNITS DISTRIBUTION OF DIFRENT COUNTRIES

	GLU-A1 (3-3-1)			GLU-B1			GLU-D1		
	1	2	NULL	6+8	7+8	7+9 (1-3-2)	2+12	5+10	(2-4)
CANADA	78,3			65,3			100		
USA	76,1			64,2			64,2		
RUSSIA	53,5	40,1		83,0			93,5		
ENGLAND	17,6	5,9	76,5	52,6	17,6		41,2		
GERMANY	69,6			56,1			47,0		
CHEKOSLAVACIA	61,5			29,2			45,3	57,7	
SLOVACIA	54,5		40,9	77,5			86,4		
HUNGARY	66,8			83,4			66,6		
ROMANIA	50,0		41,9	41,9	58,1		85,5		
TURKEY	50	54,5		13	41,0		73,3	81,1	

EFFECT OF HMW GLUTENIN SUB-UNITS ON MIKSOGRAM



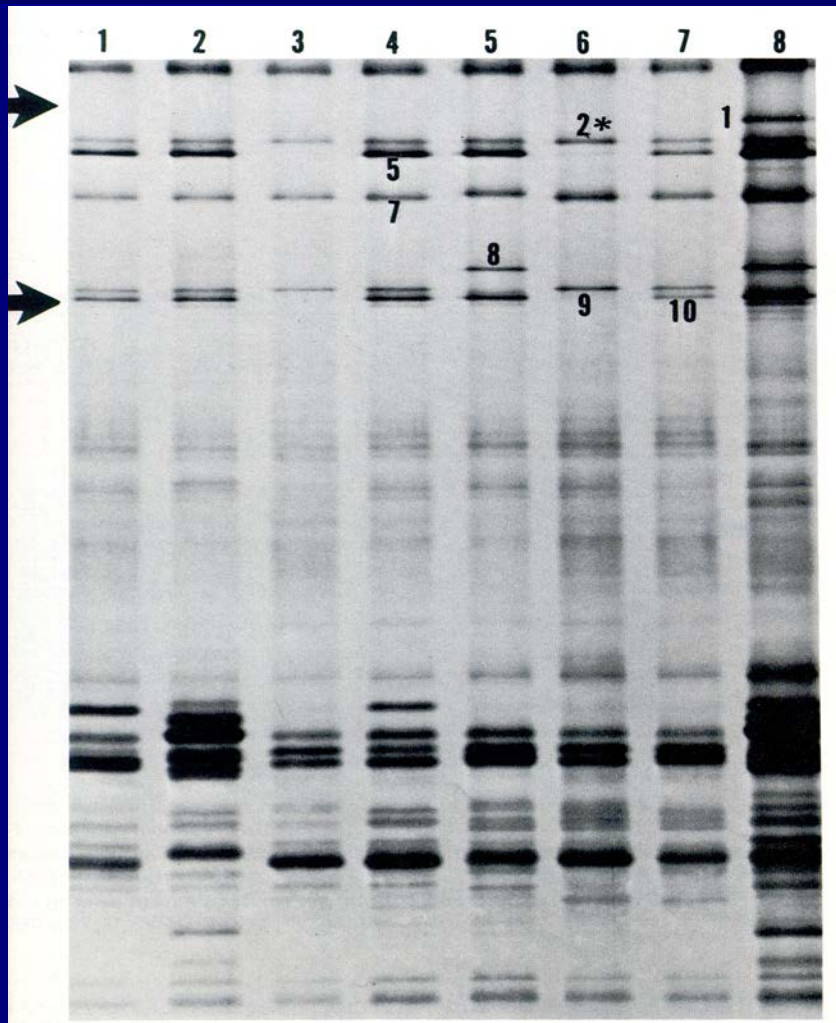
DISTRIBUTIONS OF HMW-G SUB-UNITS SDS-PAGE ELECTROPHORESIS



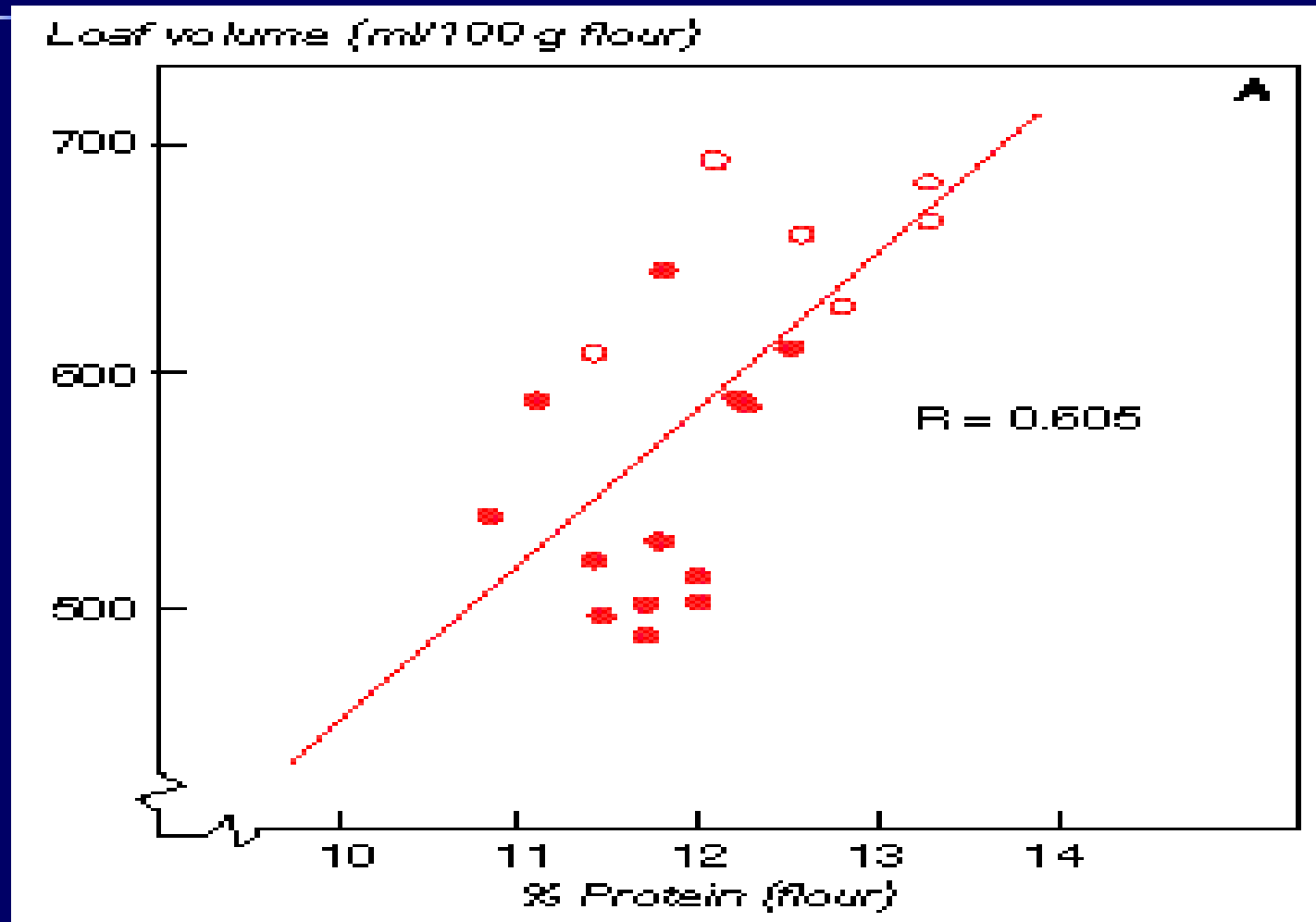
REGION OF SDS-PAGE'HMW -GLUTENIN SUB UNITS

- 1. 2, 7+9,5+10
- 2. 2, 7+9,5+10
- 3. 2, 7+9
- 4. 2, 7+9
- 5. 2,7+8,5+10
- 6. 2,7+9
- 7. 2,7+9,5+10
- 8. 1,2,7+8,5+10

1B/1R
RYE :SECALIN
43 K MOBILITY

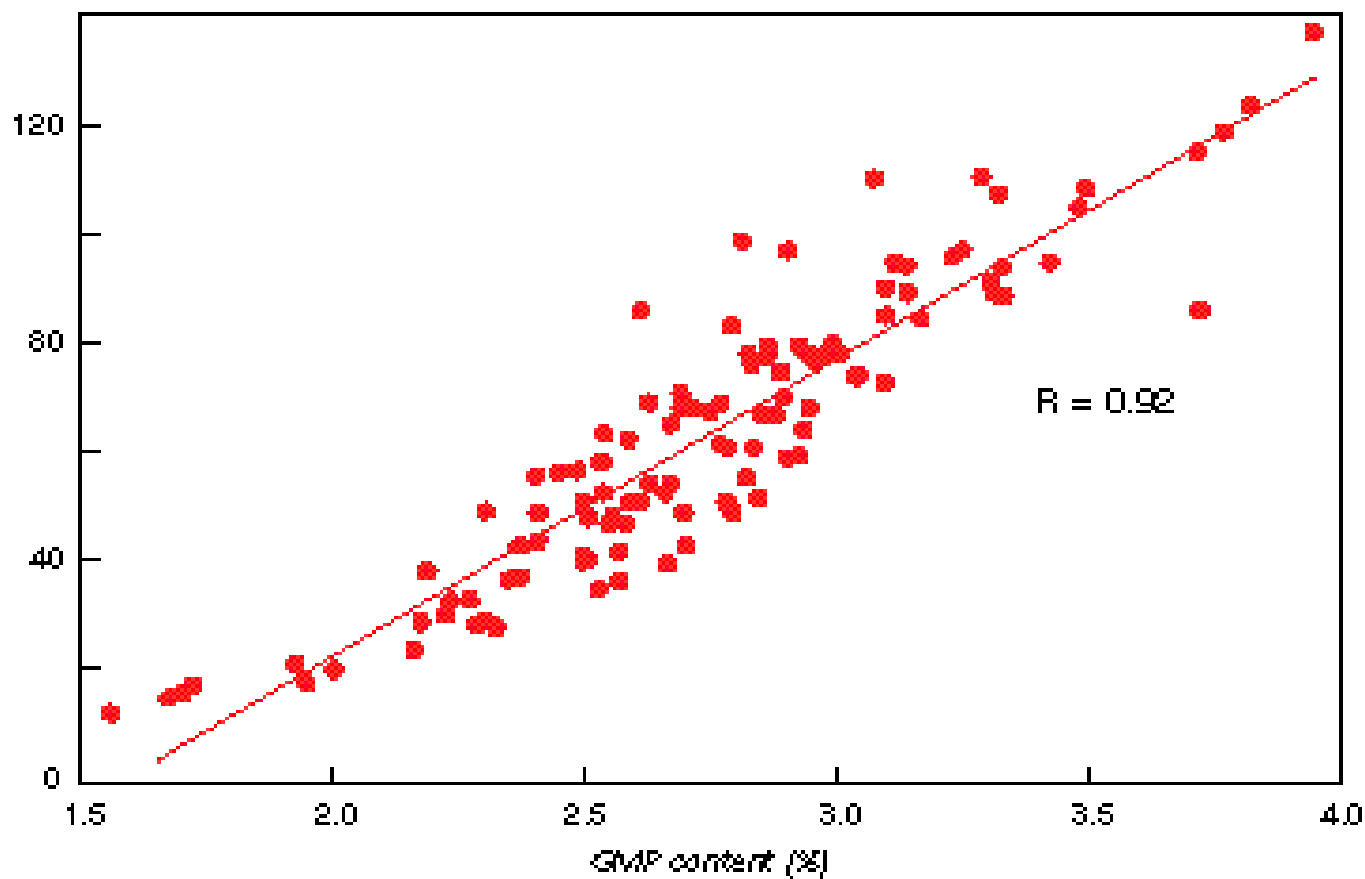


RELATIONS BETWEEN BREAD WOLVME AND PROTEIN AMOUNTS



PROTEIN AND EXTENSOGRAF AREA RELATION

Extensogram area



BREAD WHEAT QUALITY ANALYSIS

1- GRAIN QUALITY

- 1000 kernel weight
- Hektolitr weight
- Hardness
- Protein amount
- Protein quality (SDS Sedimentation)
- Flour yield

2-Reologjik Analysis

- Alveograf
- farinograf
- Gluten
- Mixograf
- Zeleny Sedimentation
- Extensograf

QUALITY TEST FOR BREEDING MATERIAL

1. (F2-F6) : 3-5 g GRAIN SELECTION , HARDINES, PROTEIN, SDS SEDIM
2. PYT 250 g; SDS SEDİM. PROTEIN ve MIXOGRAF.
3. YT 500 g: + ZELENY SEDİM FARINOGRAF FLOUR YIELD
4. RYT :3 kg + EXTANSOGRAF ALVEOGRAF (GRAIN , WHOLE WHEEAT 1mm , FLOUR)

1.GRAIN- hardness ,color,big,1000 kernel weight, Hectolitre weight .

2.WHOLE WHEAT 1mm – Protein Ash content Sedim,

(Flour must weight 15 days for natural improvement)

3.FLOUR- flour yield , Protein , Zeleny Sedimentation, ash, , REOLOJİK K ANALISYS ; FARİNO, MİXO, ALVEO, EXTENS, BREAD MAKING

STABLE QUALITY CHARACTERS

**HARDINESS (PI=PEALING NUMBER, NIR/PSI-NI),
1000 k w.,
ZELENY SEDIMENTATION DEGREE
(EARLY GENERATION)**

PROTEIN PERCENTAGE IS NOT STABLE

STABLE VARIETY

drought , Rainy

Low protein content

Genetically show good performance at different conditions.

FAST QUALITY ANALYSIS

NIR/NIT

Single kernel characterisation system (SKCS)

Digital spectre analysis(SEM)

Micro Quality analysis

(Protein ,humidity, hardness, sds, mini,

sds)

SDS-Sedimentation

**SDS-PAGE ELECTROPHORESIS
HMW-G AND GLIADIN PROTEIN
SUB UNITS**

USING BIOTECHNOLOGY IN BREEDING

3 STEP PROCESS:

1. GENERATE GENETIC VARIATION
2. SELECT GENOTYPE WHICH MAY BECOME A VARIETY
3. SELECT GENOTYPE WITH SPECIFIC TRAITS LIKE QUALITY, DISEASE RESISTANCE AND YIELD

GENETIC VARIATION:-

IN THE PAST: MUTATION AND HYBRIDIZATION AS SOURCES

GENETIC ENGINEERING:

TRANSFER GOOD GENES FROM ONE ORGANISM TO ANOTHER
SYNTHETIC GENES

MOLECULAR MARKERS RELATED WITH IMPORTANT TRAITS

HIGH PROTEIN CONTENT

HIGH FLOUR YIELD

STARCH AND NOOD QUALITY

VISCOSITY OF FLOUR

BREAD QUALITY

GRAIN HARDINESS

RELATIONSHIP BETWEEN DURUM WHEAT QUALITY AND GLIADIN AND GLUTENIN SUB-UNITS

HMW G-

6+8; 7+8 General

20 very few

Influence of HMW G in quality:

6+8;7+8 Very good quality

6+8 LMW-2 Excellent quality

7+8- High sedimentation
High elasticity

Yellow PIGMENT- new quality criteria

- **XANTOPHYLS** (yellow **PIGMENT**)

Lipoxidase enzyme break yellow pigments (Genetic)

.....Durum Wheat Quality

Gama-Gliadin 45 band: high quality and high cooking quality
Genetic transformation can be used to improve quality

For pasta quality you need:

Hard grain

Big grain

Golden colour grain

Durum wheat quality for:

SPAGETTÌ

NOODLE

Durum wheat Semolina must be:

Hard

Elastic

Not sticky

For quality two aspects are important:

Genotype

Environment

CONCLUSIONS

- Each country has different quality criteria
- Each bread type needs different quality traits
- Milling, dough preparation, and cooking are very important steps of bread preparation
- Quality criteria are related to each other
- High flour yields reduce quality
- Breeder objective must match with miller and consumer objectives

MAKARNALIK BUĐDAY ISLAH MATERYALİNİN KALİTESİNİN BELİRLENMESİ

Hazırlayan:Tülin ÖZDEREN, Nurettin ÇİNKAYA, Aliye KARAHAN
SUNU: Dr. Emin Dönmez



MAKARNA YAPIMI



Yoğurma



Presleme



Kurutma



Duyusal test



İrmik Değirmeni

2001 / 5 / 18



PURİFAYR(İrmik Sasörü)

2001 / 5 / 18

TEŞEKKÜRLER