Universitas Esa Unggul

Smart, Creative and Entrepreneurial

SEREALIA DAN KACANG-KACANGAN

PERTEMUAN 3

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KEMAMPUAN AKHIR YANG DIHARAPKAN

- Menguraikan fungsi, komposisi, cara memilih dan cara menyimpan serealia dan kacang-kacangan serta hasil olahnya dengan benar

Global and National Cereal

Table I Forecasts for cereal production in 2003 (million tonnes)

Area	Wheat	Rice (paddy)	Coarse grains (all other grains)
Asia	245.6	541.0	211.4
Africa	20.5	18.0	84.9
Central America	3.0	2.4	29.1
South America	22.0	19.5	76.0
North America	83.3	8.9	302.3
Europe	160.0	3.0	198.6
Oceania	22.0	0.4	10.4
World	556.4	396	912.8

Source: FAO 2003.

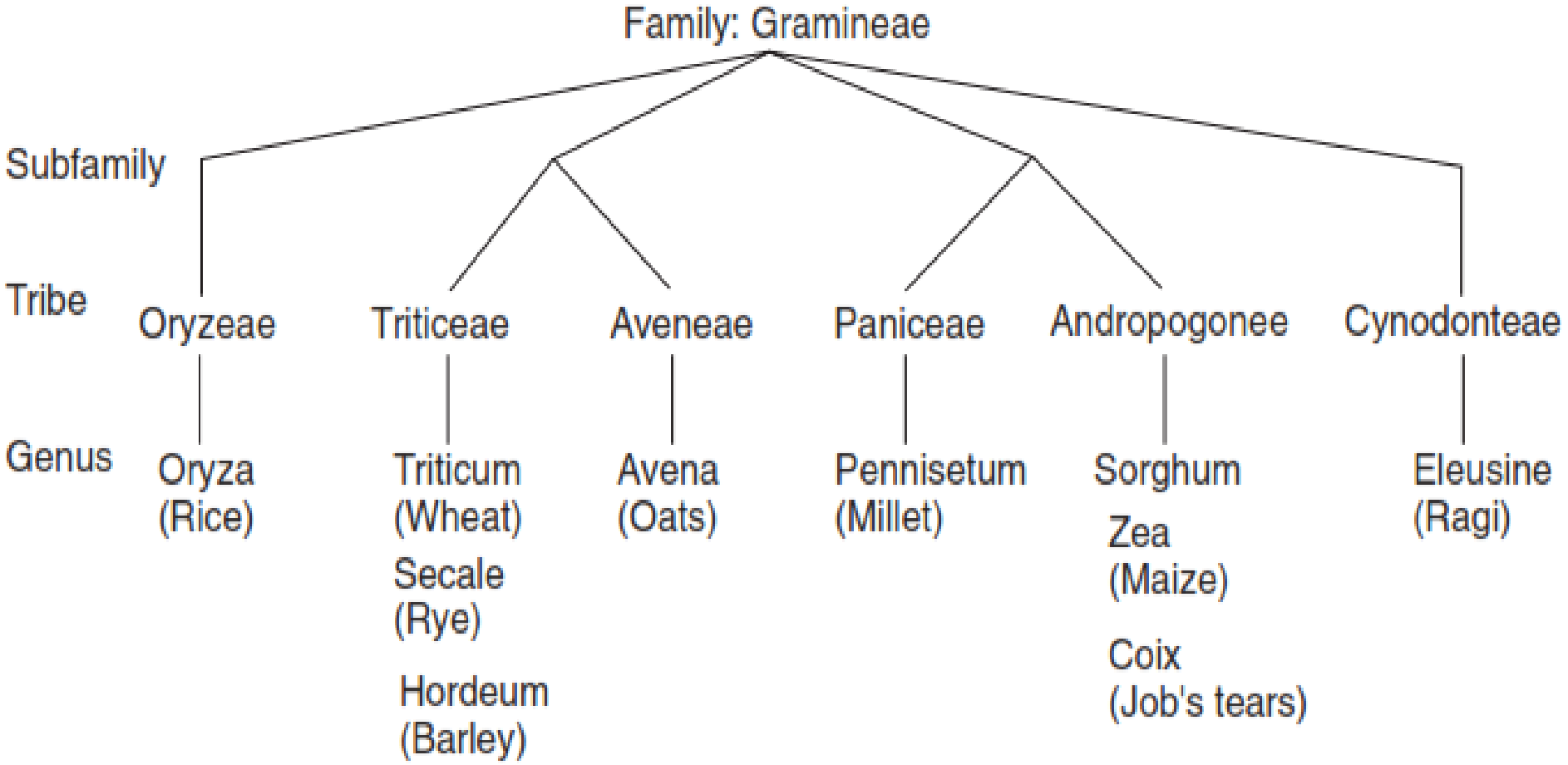


Figure 1 Taxonomy of the Gramineae family (source: Shewry *et al.* 1992).

Table 3 Codex standards for maximum moisture content (%) of selected cereals

Grain	Maximum moisture content*	Codex Alimentarius Standard†
Maize	15.5%	Codex Standard 153-1995
Oats	14.0%	Codex Standard 201-1995
Rice	15.5%	Codex Standard 198-1995
Sorghum	14.5%	Codex Standard 172-1989a (Revision 1-1995)
Wheat	14.5%	Codex Standard 199-1995
Durum wheat	14.5%	
Whole and decorticated pearl millet grains	13.0%	Codex Standard 169-1989b (Revision 1-1995)

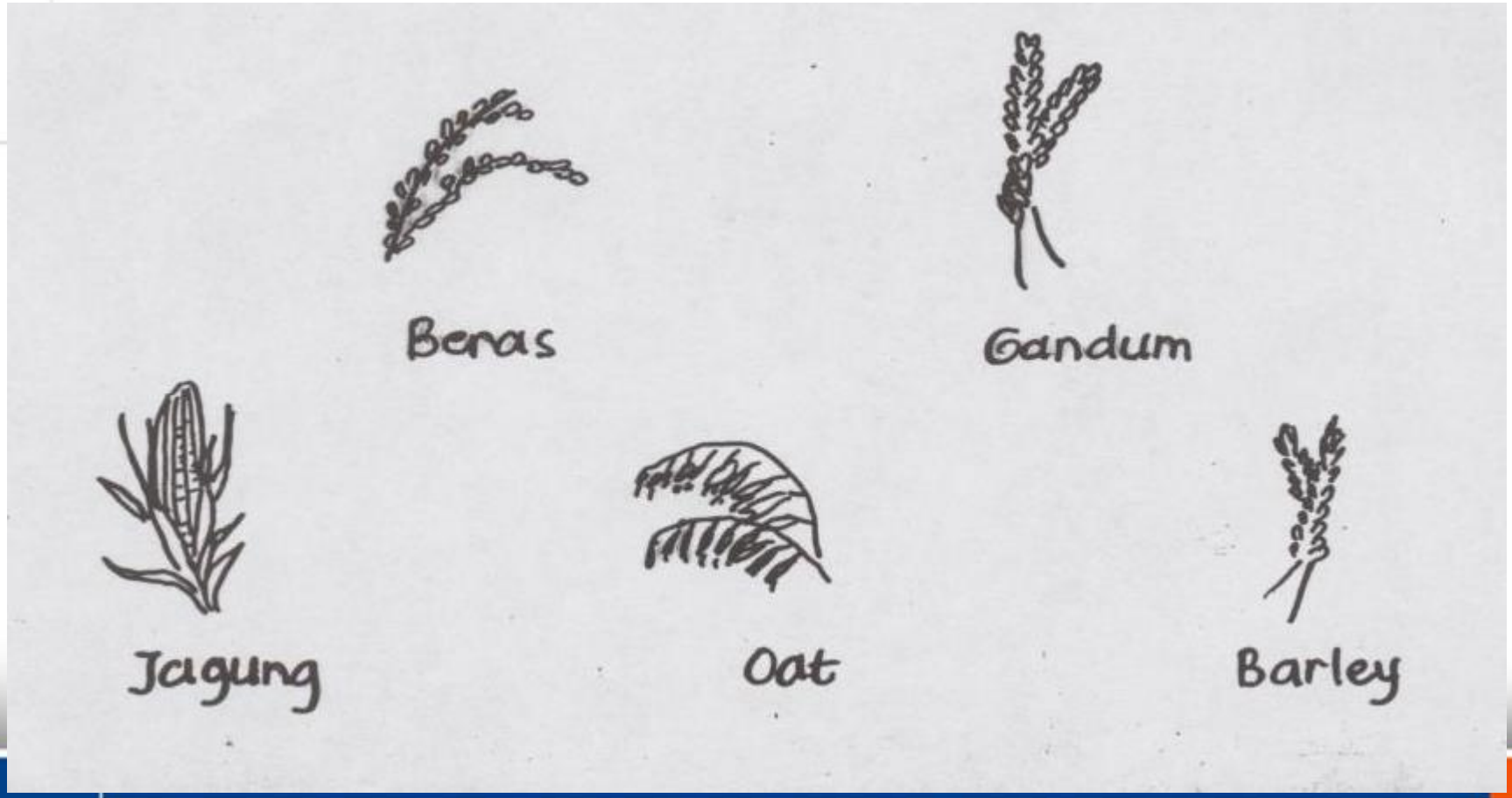
*Lower moisture limits required for certain destinations in relation to climate, duration of transport and storage. †Codex Alimentarius 1989a, 1989b, 1995a, 1995b, 1995c, 1995d.

Definisi

- Berasal dari nama “CERES” ➔ dewi romawi yang sangat kuat yang melindungi biji-bijian
- Biji-bijian dari famili rumput-rumputan yang dibudidayakan dan kaya KH

Contoh serealia :

- Padi (*Oryza sativa*)
- Gandum (*Triticum sp*.)
- Barley (*Hordeum vulgare*)
- Oat (*Avena sativa*)
- Jagung (*Zea mays*)
- Cantel (*Sorghum sp.*)
- Rogge (*Secale cereale*)
- Padi Liar (*Zizania aquatica*)



Gabah/ Padi **Gandum** **Jagung** **Oat** **Barley**

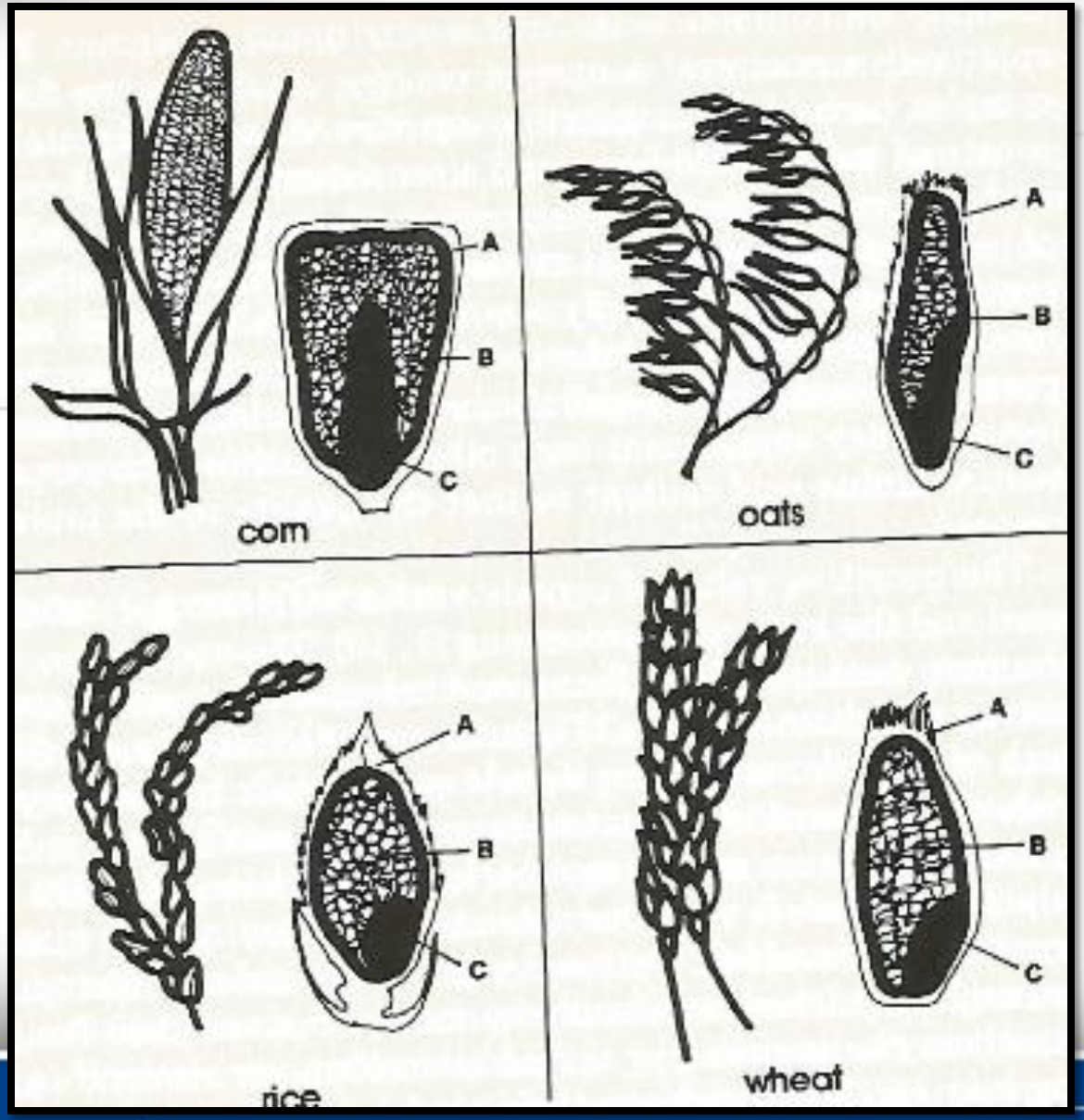
Ket : A=Sekam B=Endosperm C=Lembaga

Serealia → **digiling : pecah biji utuh endosperm + dedak & lembaga**

→ **Grits, meal atau tepung**

Jenis serealia ttt menghasilkan minyak (jagung & dedak padi)

Composition and Structure (1/2)



A: BRAN consist of several thin outer layers of the grain kernel and is its protective coat

B: ENDOSPERM is the stored food supply for the new plant which develops as the kernel germinates. It comprise about 85% of the kernel

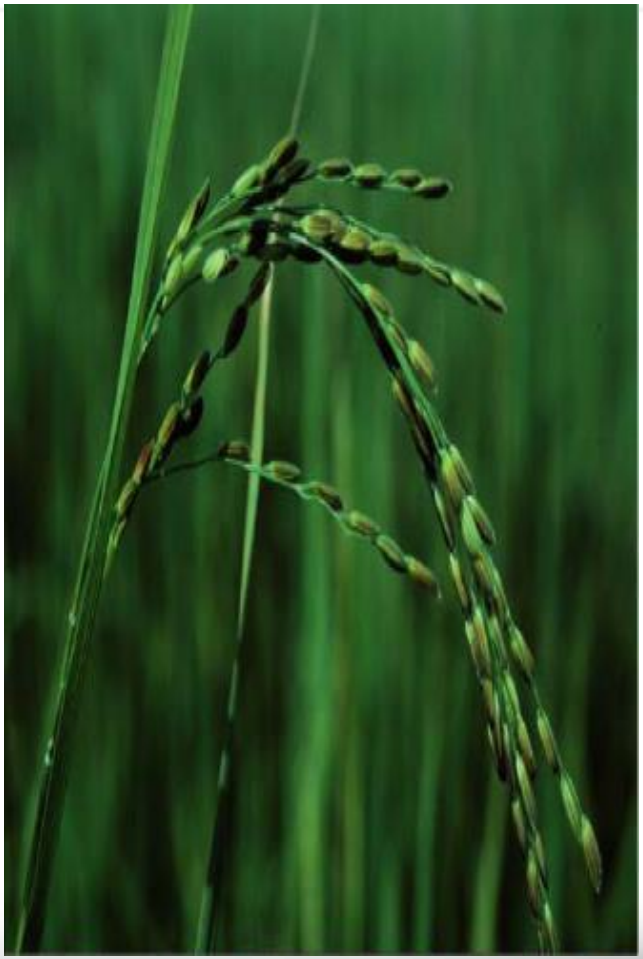
C: EMBRYO or GERM is the miniature plant which enlarges and develops after the kernel germinate

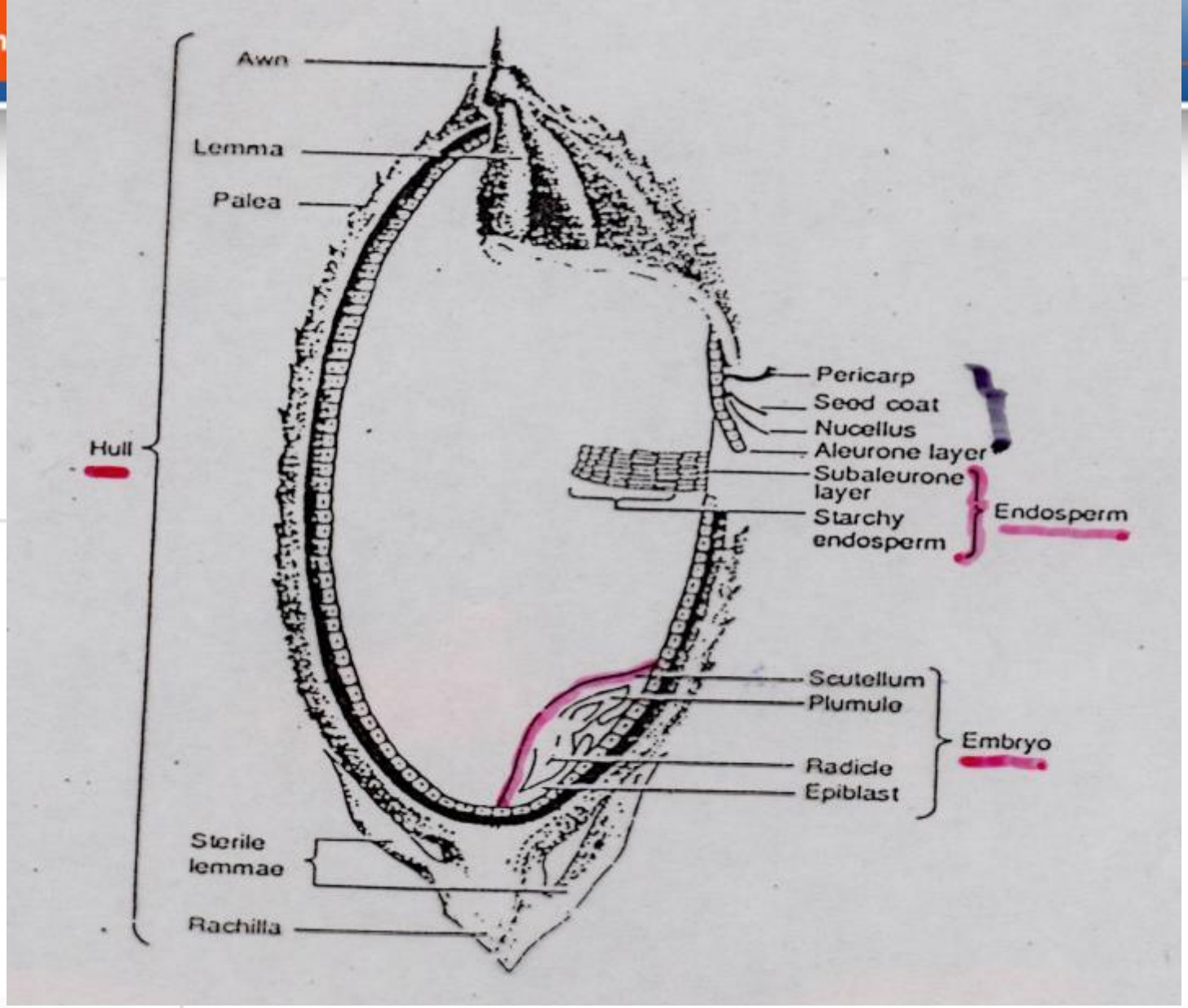
BERAS/ *Oryza sativa*

Oryza sativa: source of starch in the diet and generally consumed as a whole grain or as flour

Rice varities have different qualities.

e.g. chalky rice Illabong (risotto), the soft cooking Opus (sushi), long grain fragrant Kyeema (Asian foods), Doongara (low GI)





Penampang membujur sebutir padi (Juliano, 1993)

RICE
Family Graminaceae

Oryza sativa L.

ssp. *Japonica*

- Squat grain, that you paste in cooking,
  cv. neutrodiurne, low, precocious.
- Temperate environment: Japan, Korea, Northern China, Italy

ssp. *Indica*

- Long grain, which resists cooking + fine, sedikit pera.
- Hot environments: Southeast Asia, India, Egypt

ssp. *Javanica*

- Large and long grain,
  cv. brevidiurne, later.
- Tropical environments: Indonesia, Philippines

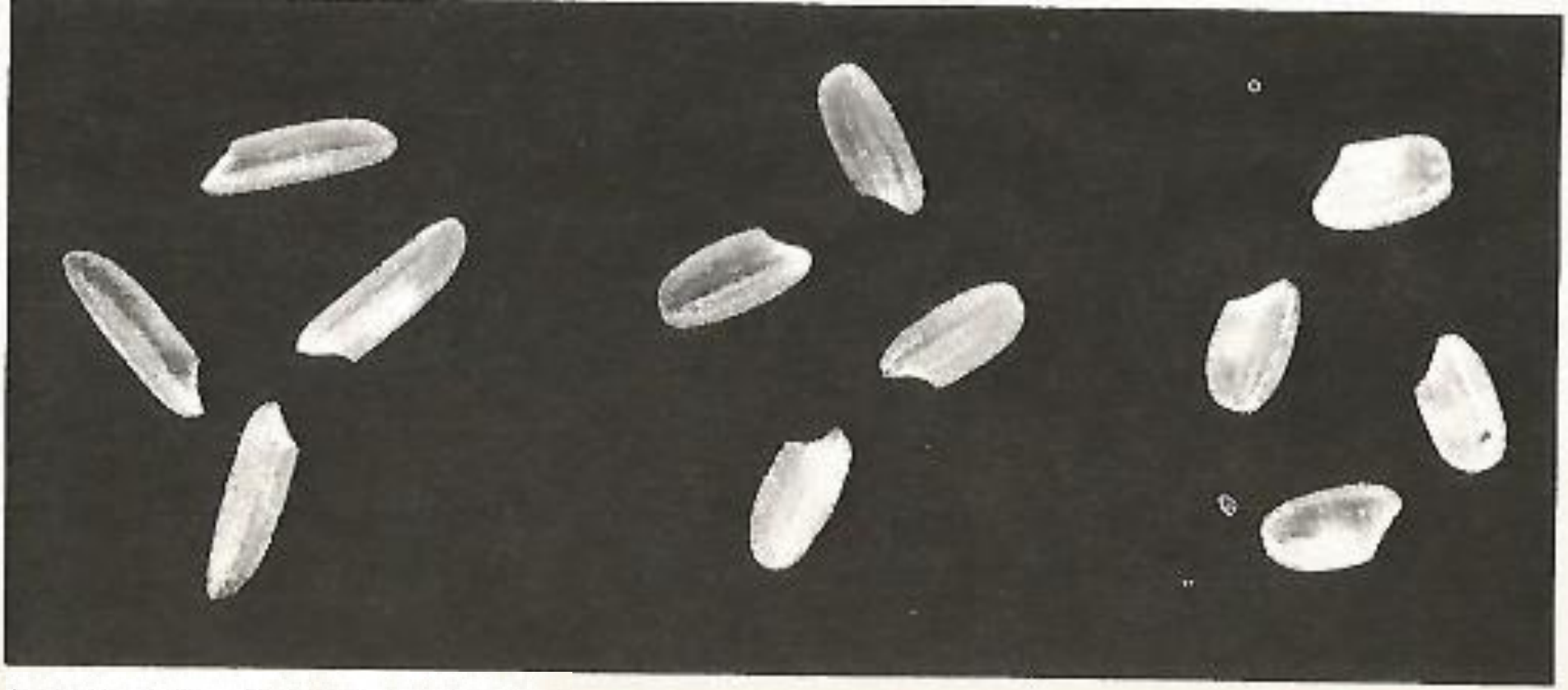
Includes 2 types: Basmati and Patna

ssp *japonica*

ssp *indica*

Oryza sativa l.

- In Africa (Nigeria, Niger, Cameroon, Senegal) is another a species : *Oryza glaberrima* Steud.
- Derived from Oryza Bart and was domesticated independently
- Suitable for harsh environments
- Recognizable by O. sativa because the kernels are **red** instead of white



17-3 *Varieties of rice: short-, medium-, and long-grain.* (Courtesy of The Rice Council)

Figure 1. Physical quality assessment. From left to right: aspirator, dehuller, mill, image analysis and the spectrophotometer.

Figure 2. Each picture shows the paddy, brown and milled grain of a medium grain (a), a chalky medium grain (b), a typical long grain (c) and a larger, medium grain (d).

Harvested grain→ aspirated (remove debris)→paddy grain →150 g of paddy grain→ dehulled→brown grain→milled (remove bran)→white grain (whole milled)→*millout percentage.*

Ward & Martin. 2009. *Rice Cereal Quality*. Primefacts. September 2009

Figure 3. Cooking quality assessment. From left to right: calorimeter, molecular marker products indicating different grain qualities, UV-vis spectrometer, viscometer and texture analyser.

F1-F4

- Grain Dimension and Chalk Content
- Length and width ratio→long, medium, short grain
- Colour (spectrometer)→white is desirable in all markets

Cooking Qualities (F5-F7)

- White rice→93% starch, 7% protein, 0.5% lipid
- Gelatinisation (F5)→temperature at which rice starch begins to melt (gelatinise) and take up water (Scanning Calorimeter). T= 65-80 C

Table 1. A summary of physical and cooking quality attributes of Australian rice varieties.

Variety	Release Year	Length (mm)	Width (mm)	Chalk	Amylose (%)	Gelatinisation Temp. (°C)	Cooking-type
Amaroo	1987	5.7	2.7	low	18	70	soft
Doongara	1989	6.7	2.0	low	24	75	firm
Illabong	1993	6.0	3.2	high	18	69	soft
Kyeema	1994	6.9	2.0	low	18	79	soft, fragrant
Langi	1994	7.0	2.0	low	18	77	soft
Millin	1995	5.5	2.7	low	17	69	soft
Opus	1999	5.0	2.8	low	18	70	soft
Paragon	2003	5.7	2.7	low	18	68	soft
Quest	2003	6.0	2.7	low	17	70	soft
Reiziq	2005	6.3	2.7	low	17	69	soft

- **Molecular markers**
  - **Amylose content**→low amylose produce a soft cooking rice. Amylose bind with iodine→blue colour with spectrofotometer→amylose content
  - **Nitrogen content:** NIR
  - **Viscosity:** energy required to stir a sample of rice flour and water as it is heated and cooled.
  - **Texture/retrogradation**: cooked rice vs re-heated rice. Measured by texture analyser.
  - **Elongation**: before vs after cooked

Oryza sativa l.

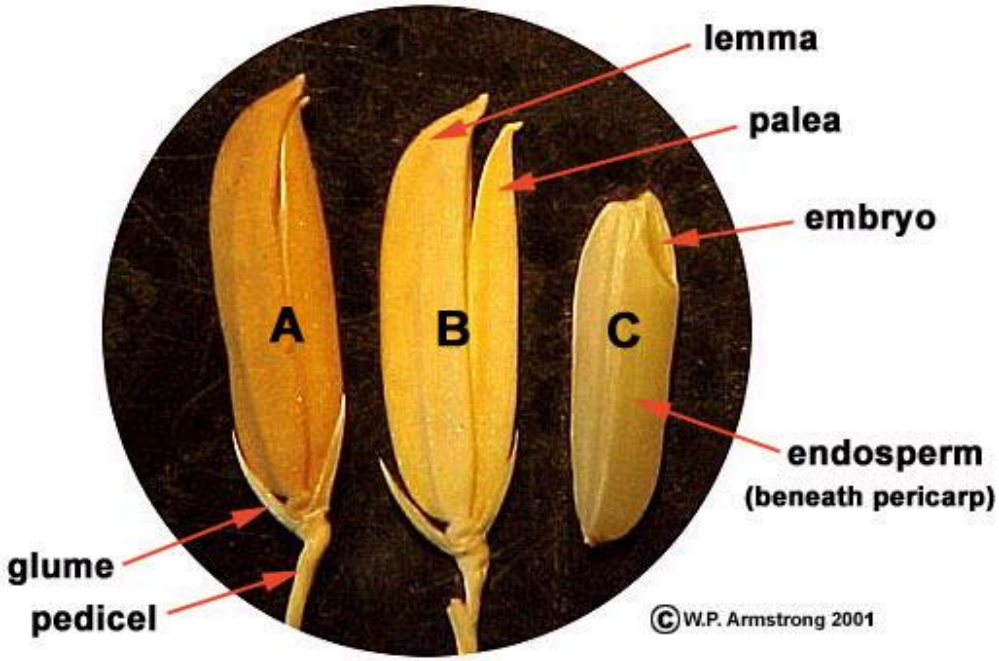
- *Oryza sativa* is a Most commonly used species
- Origin : Asian
- 150 million hectares of cultivated
- Staple food of half the world population
- In Asia, present two wild progenitor :
  Oryza Nivara(annual) and *Oryza rufipogon* (perennial)

Oryza sativa L.

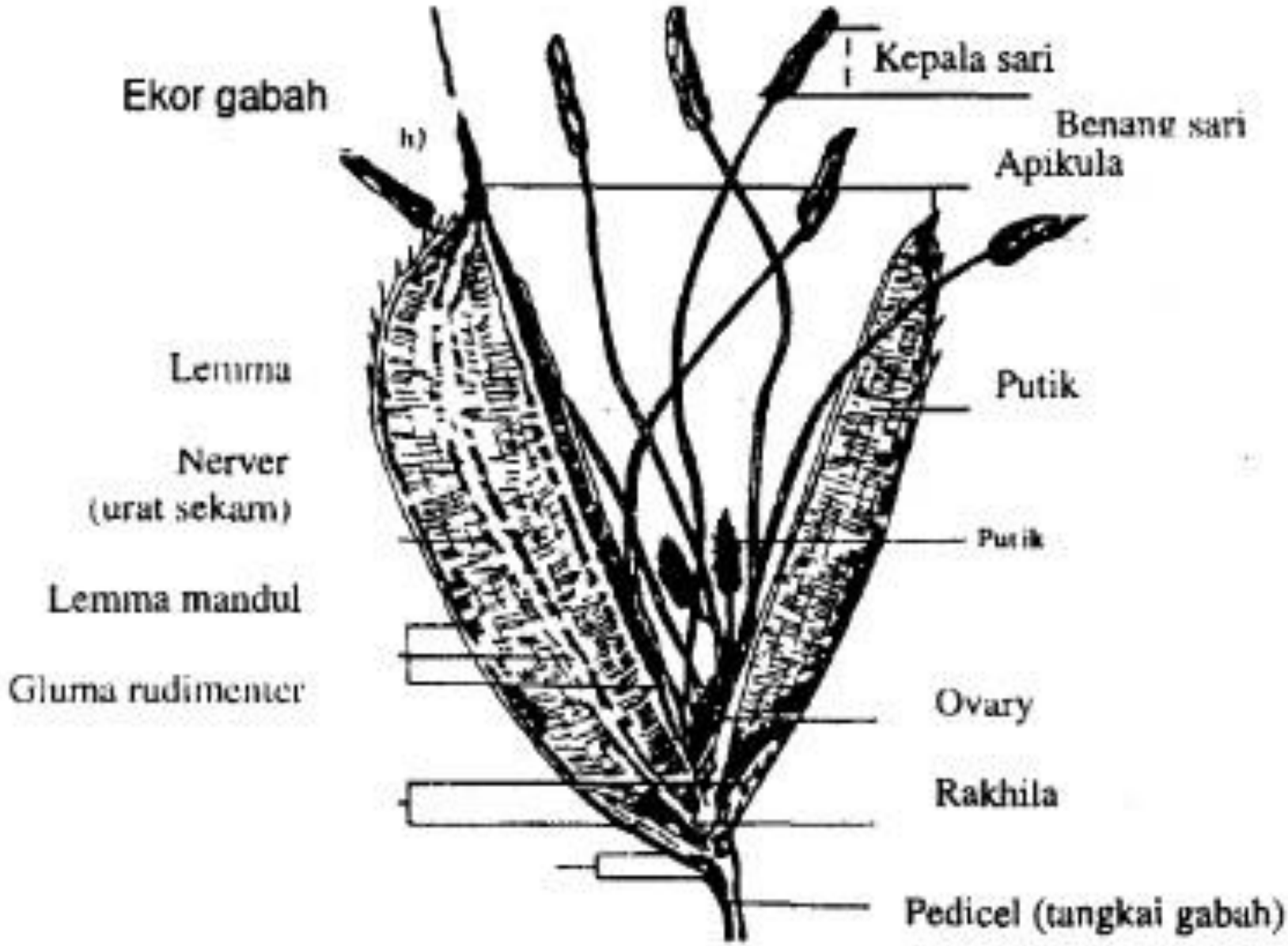
- RICE

  Brown rice (still dressed in the pericarp) is subjected to the bleaching. It has gradually removal of the pericarp, aleurone layer and germ of the compound that are a by-roduct called chaff, by achieving the polished rice.

Oryza sativa L.



A = caryopsis dressed (paddy rice)
B = glumette
C = naked caryopsis (embryo + endosperm



Gambar 5. Bagian-bagian bunga padi
Sumber: Chang and Bardenas, 1976

Product Processing : Paddy - Rice

Paddy & Rice

Yield of processing = 550-600 kg Rice / ton of Paddy
25% husk (cellulose, lignins)
15% other waste

Paddy —(cleaning, husking)→ **Integral Rice** —(**Bleaching**)→ **Chaff / sekam**

Integral Rice —(**3-5 cycles**)→ polished rice (Semi-refined rice, Mercantile, Grade I, Grade II)

polished rice —(**sorting**)→ **Rice**

polished rice —(**sorting**)→ grains discarded and broken —→ tepung beras


- Drying
- Pady Cleaner
Husker
Miller
Padi Kering Panen 100%
Pengeringan dan Penyimpanan 79%
Padi GKG 77%
Beras Pecah Kulit 61%
Beras Putih 50%
20%
Air dan Kotoran (merang, butir muda, batu, pasir, debu)
2 %
Susut Simpan
17%
Sekam
11%
Dedah 9,99%
Beras Rusak (0,76%)
Beras Berwarna (0,25%)

Paddy:
Rice in the husk.

Brown Rice:
Dried rice with its husk removed. Brown rice has the drawbacks of being hard to cook and eat, but its bran contains a lot of nutrients.

Polished / White Rice:
Rice without both the germ and bran. Polished rice is most commonly eaten, because it's not only easy to cook, but easy to eat. It consists only of the endosperm which means nutrition and ease-of-eating are poles apart.

Germinated / Sprouted Brown Rice.
During germination, dormant enzymes activate and increase nutrients. Germination softens the outer layer of the rice, which makes it just as easy to cook and eat as polished rice..

PARBOILED Rice

- Parboiled rice is rich in nutrients, easily preserve, and resistant to cooking.
- hydrothermal treatment
  (Maceration in water, steaming, drying, essicatura/drying, husking, whitening).
- Hydrophilic components of the germ and outer parts (vitamins B, Fe) spread inside of the kernel and are not dispersed during cooking.
- Partial gelatinization of starch

Oryza sativa L.

Nutritional characteristics of rice

The polished rice has a lower nutritional value than that of brown rice (whole) as the husks are removed significant amounts of protein, lipids, minerals and vitamins.

Nutritional characteristics of rice

1. PROTEINS: deficient in some essential amino acids:
   polished rice : LYS and TRP,
   grain rice : LYS-grain rice.

2. VITAMINS: loss of B1, B2 and B3 during polishing (present in the scutellum and close to the (endosperm) further reduction during washing and cooking rice.

3. MINERALS: not so different from that of other cereals (ratio Ca / P : 0.05).

Nutritive Value & Enrichment

TABLE 10-1
Composition and Energy Value of Selected Cereals (100-gram edible portion)

Cereal	Water (%)	Calories[a]	Protein (g)	Carbohydrates (g)	Fat (g)	Calcium (mg)	Phosphorus (mg)	Iron (mg)	Vitamin A Value (I.U.)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic Acid (mg)	Fiber Crude (g)	Fiber Total Dietary (g)
Amaranth	9.8	374	14.5	66.2	6.5	153	455	7.6	—	.08	.21	1.29	4.2	3.8	15.2
Barley, pearled	10.1	352	9.9	77.7	1.2	29	221	2.5	22	.19	.11	4.60	0	.7	15.6
Corn meal, degermed[b]	11.6	366	8.5	77.7	1.6	5	84	4.1	413	.72	.41	5.03	0	.6	5.2
yellow															
Farina[b]	10.5	369	10.6	78.0	.5	14	88	3.7	—	.57	.36	4.05	—	.2	2.7
Macaroni[b]	10.3	371	12.8	74.7	1.6	18	150	3.9	—	1.03	.44	7.51	0	.3	3.9
Oats, rolled	8.8	384	16.0	67.0	6.3	52	474	4.2	—	.73	.14	.78	—	1.1	10.3
Quinoa	9.3	374	13.1	68.9	5.8	60	410	9.3	—	.20	.40	2.93	0	—	—
Rice															
Brown	10.4	370	7.9	77.2	2.9	23	333	1.5	—	.40	.09	5.09	0	1.3	3.5
White[b]	11.6	365	7.1	79.9	.7	28	115	4.3	—	.58	.05	4.19	0	.3	1.0
Flour															
All-purpose[b]	11.5	364	10.3	76.3	1.0	15	108	4.6	—	.79	.05	5.90	0	.3	2.7
Triticale	10.5	336	13.1	72.1	2.1	37	358	2.6	—	.42	.12	1.43	0	2.6	14.6
Whole wheat	10.3	339	13.7	72.6	1.9	34	346	3.9	—	.45	.22	6.37	0	2.1	12.6

[a]1 kilocalorie = 4.185 kilojoules.
[b]Enriched
—= Data not available
Source: U.S. Dept. Agr. Handbook No. 8-20, *Composition of Foods. Cereal Grains and Pasta. Raw, Processed, Prepared.* Revised 1989.

Table 3 Codex standards for maximum moisture content (%) of selected cereals

Grain	Maximum moisture content*	Codex Alimentarius Standard†
Maize	15.5%	Codex Standard 153-1995
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Wheat	14.5%	Codex Standard 199-1995
Durum wheat	14.5%	
Whole and decorticated pearl millet grains	13.0%	Codex Standard 169-1989b (Revision 1-1995)

*Lower moisture limits required for certain destinations in relation to climate, duration of transport and storage. †Codex Alimentarius 1989a, 1989b, 1995a, 1995b, 1995c, 1995d.

Table 7 Essential amino acid composition of cereal grains

Amino acid (g/ 100 g protein)	Wheat (hard)	Rice		Maize		Barley	Oats	Rye	Millet (average of 7 types)	Sorghum	
		B	M	N	HL					N	HL
Phenylalanine	4.6	5.2	5.2	4.8	4.3	5.2	5.4	5.0	5.5	5.1	4.9
Histidine	2.0	2.5	2.5	2.9	3.8	2.1	2.4	2.4	2.0	2.1	2.3
Isoleucine	3.0	4.1	4.5	3.6	3.4	3.6	4.2	3.7	3.8	4.1	3.9
Leucine	6.3	8.6	8.1	12.4	9.0	6.6	7.5	6.4	10.9	14.2	12.3
Lysine	2.3	4.1	3.9	2.7	4.3	3.5	4.2	3.5	2.7	2.1	3.0
Methionine	1.2	2.4	1.7	1.9	2.1	2.2	2.3	1.6	2.5	1.0	1.6
Threonine	2.4	4.0	3.7	3.9	3.9	3.2	3.3	3.1	3.7	3.3	3.3
Tryptophan	2.4	1.4	1.3	0.5	0.9	1.5	-	0.8	1.3	1.0	0.9
Valine	3.6	5.8	6.7	4.9	5.6	5.0	5.8	4.9	5.5	5.4	5.1

B, brown; M, milled; N, normal; HL, high-lysine.

Source: Macrae *et al.* 1993.

Table 8 Fatty acid profiles of selected cereals

Fat & fatty acids (g/100 g food)	Barley, pearl, raw	Oatmeal, quick cook, raw	Wheat flour, white	Rye flour	Rice, brown, raw	Rice, white, raw
Total fat	1.7	9.2	1.2	2.0	2.8	3.6
Saturated fatty acids	0.29	1.61	0.16	0.27	0.74	0.85
Cis-monounsaturated fatty acids	0.14	3.34	0.13	0.21	0.66	0.91
Polyunsaturated fatty acids:						
Total cis	0.77	3.71	0.51	0.95	0.98	1.29
n-6 (as 18:2)	0.70	3.52	0.48	0.82	0.94	1.26
n-3	0.07	0.19	0.03	0.13	0.04	0.03

Source: Ministry of Agriculture, Fisheries and Food 1998.

Gabah

↓

Pembersihan & Conditioning

(Pelunakan 1:20, 1-2 mt, Pengeringan 1-2 jam, 50^0C)

↓

Pengupasan (Huller/Rubber Roll)

Sekam ← ↓

Beras pecah kulit

↓

Penyosohan (polisher)

Dedak / bekatul ← ↓

Beras Giling

Produk lanjutan : tepung beras, bihun

Gabah { Sekam
Caryopsis : perikarp (1-2%), seed coat+ nucellus+aleuron (4-6%), lembaga (1%), scutellum (2%), & endosperm (90-91%)

Dedak 10% ☞ dedak/bran (7%) + bekatul/ polish (3%)

Dedak : lapisan sebelah luar dr butiran padi dg sejml lembaga.

Bekatul : lapisan sebelah dlm dr butiran padi trmsk sebagian kecil endosperm berpati.

- **Mutu Beras**

Secara umum 4 kel :

1. Mutu pasar
2. Mutu rasa & mutu tanak
3. Kandungan gizi beras
4. Standar fisik utk penampakan & kemurnian biji.

(I) Mutu pasar → mutu giling & penampakan fisik biji

~ penyimpanan

(II) Mutu rasa & mutu tanak serta faktor2 yg mempengaruhi.

~ industri pengolahan beras

~ genetik → kriteria dr deskripsi varietas

Grade beras → sangat beragam

Beberapa golongan yang sering dijumpai :

1. Asal daerah → beras Cianjur, beras Solok, beras Banyuwangi, dsb.
2. Jenis/Kel. Varietas padi → beras Rojolele, beras Bulu, beras IR, dsb.
3. Cara *processing* → beras tumbuk & beras giling
4. Derajat penyosohan → beras slip I & beras slip II
5. Gabungan antara varietas dg tkt penyosohan yg berlaku utk suatu daerah.

   Mis: di Jateng : beras TP, SP & BP

   Jabar : beras TA, BGA & TC

Komponen	Ketentuan
Kadar air maksimum	14 gr
Derajar sosoh minimum	90 %
Butir patah maksimum	35 %
Butir menir maksimum	2 %
Butir mengapur maksimum	3 %
Butir kuning / Rusak maksimum	3 %
Butir merah maksimum	3 %
Butir asing maksimum	0,05 %
Butir gabah (Butir/100 gr)	2

Sumber : Bulog, 1983

Beras enak : Rojolele, Cianjur, Arias, Solok & Banyuwangi.

3 sifat utama beras yg menentukan mutu rasa :

- penampilan
- tekstur
- aroma

} **Nasi Pera & Nasi Pulen**

Pemilihan beras :

- dipengaruhi oleh varietas / nama dagang

→ Kel beras unggul yg nasinya pulen mis: Cisadane, IR 64

→ rasa nasi enak, pulen & tersedia anggaran belanja.

- Penampakan : derajat putih, derajat sosoh, persentase beras kepala, kotoran & bau.

- **Dedak padi** : 10 % dari berat total gabah
- Produksi beras sekitar 29 juta ton per tahun, > 4 juta ton dedak dihasilkan tiap tahun (Tangenjaya, 1991a).
- **Penggunaan dedak padi** : pakan dan diekspor, bahan baku industri farmasi (vitamin B) dan makanan manusia (biskuit dan kue). Bahan baku industri : asam fitat untuk bahan pengkelat.
- **Komersial** : minyak goreng dan bahan pembuatan sabun (Tangenjaya, 1991a, Tangenjaya, 1991b).
- **Kendala** : mudah tengik krn aktivitas lipase & lipoksigenase segera setelah digiling. Kenaikan asam lemak bebas 5-10%/hr atau 70% dlm sebulan pd kondisi penyimpanan dgn kelembaban tinggi.


A
Kuning
B
Hitam
C
Merah
D
Putih /
Jawa
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Tabel Komposisi Beras

Zat gizi	Beras putih	Beras merah	Beras hitam
Energi	357	352	351
Protein	8,4	7,3	8
Lemak	1,7	0,9	1,3
Karbohidrat	77,1	76,2	76,9
Serat	0,2	0,8	20,1
Indeks glikemik	64	59	42,3

Sumber: Tabel Komposisi Pangan Indonesia, 2009

Deskripsi	Inpari 13	IR 64	Ciherang
Bentuk Beras	Panjang ramping	Panjang ramping	Panjang ramping
Bentuk Tanaman	Tegak	Tegak	Tegak
Tekstur Nasi	Pulen	Pulen	Pulen
Kadar Amilosa (%)	22,4	23,0	23,0
Rata-rata hasil (t/ha)	6,6	5,0	6,0
Potensi hasil (t/ha)	8,0	6,0	8,5
Umur tanaman (hari)	101-103	110-120	116-125
Tinggi tanaman (cm)	103	115-126	107-125
Jumlah anakan produksi (batang)	17	20-35	14-17
Ketahanan terhadap hama	Tahan wereng coklat biotipe 1, 2, dan 3	Tahan wereng coklat biotipe 1 dan 2	Tahan wereng coklat biotipe 2
Tahun dilepas	2009	1986	2000

Bahan baku Lokal : Dedak Padi

Manfaat : Me↘ kadar kolesterol darah, mencegah terjadinya kanker, memacu pertumbuhan, dan memperlancar sekresi hormonal

Komponen :

1. Serat makanan
   - Larut
   - Tidak Larut

2. Zat Antioksidasi : tokoferol, tokotrienol, orizanol

Komposisi kimia dedak sangat bervariasi.

Tergantung : - faktor agronomis padi → pemupukan, tanah, varietas padi

- proses penggilingan

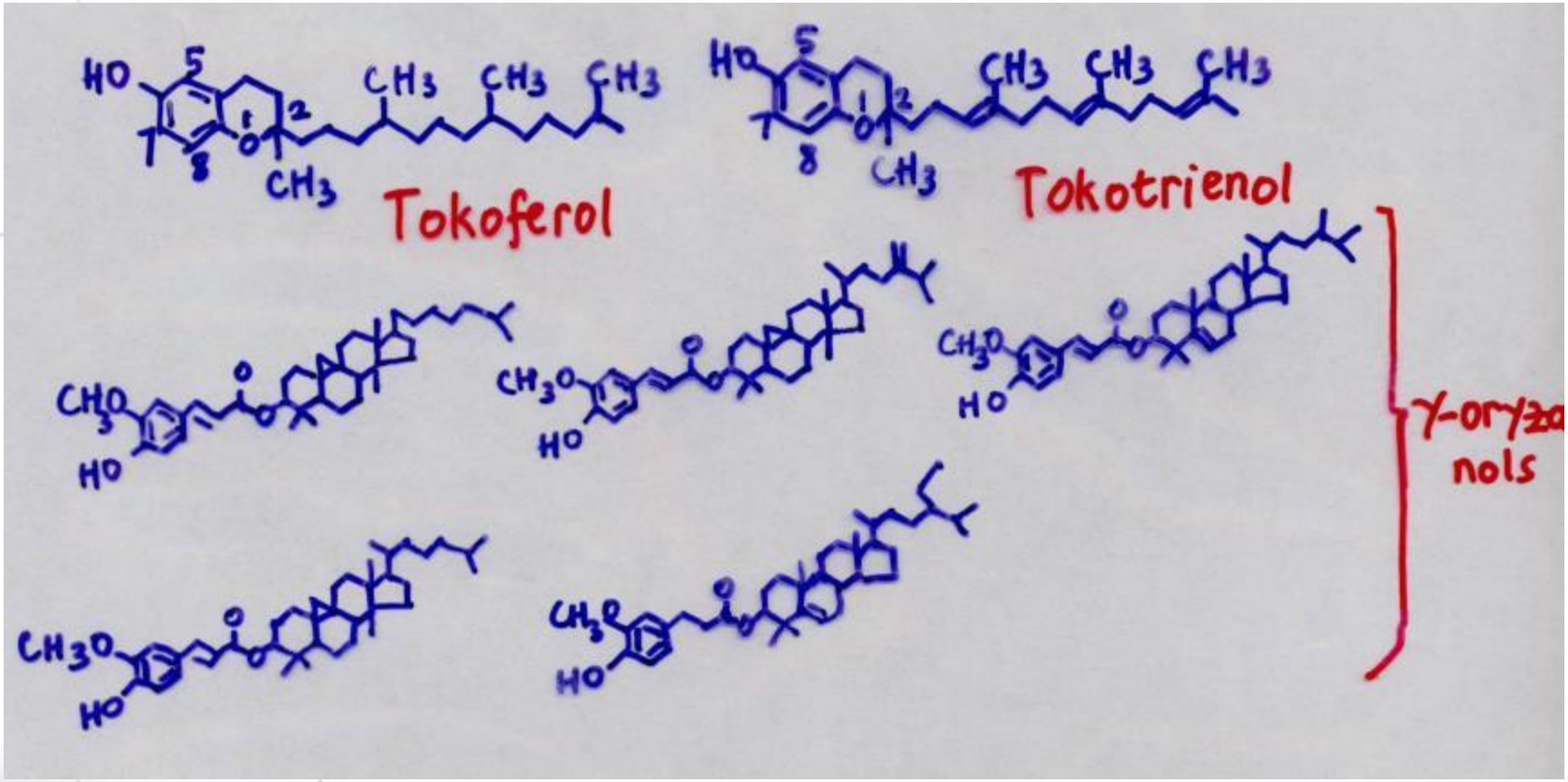
Kisaran Komp. Proksimat

Kandungan	% bk
Protein	11.5 -17.2
Lemak	12.8 – 22.6
Serat Kasar	6.2 – 14.4
Abu	8.0 – 17.7
BETN	33.5 – 53.5

Sumber : Barber & Barber

- **Tokoferol, Tokotrienol & γ-oryzanols**

Vit. E & Oryzanol = 2 – 5 % di m. dedak → me ↓ kolesterol



Oryzanol → me ↓ kolesterol (Sectharamiah & Chandrasekhara, 1989)

- Kanker

  Jacobs (’87), Burkitt (’88) & Potter (’88) :

  Hub. yg erat antara faktor lingk dg kanker.

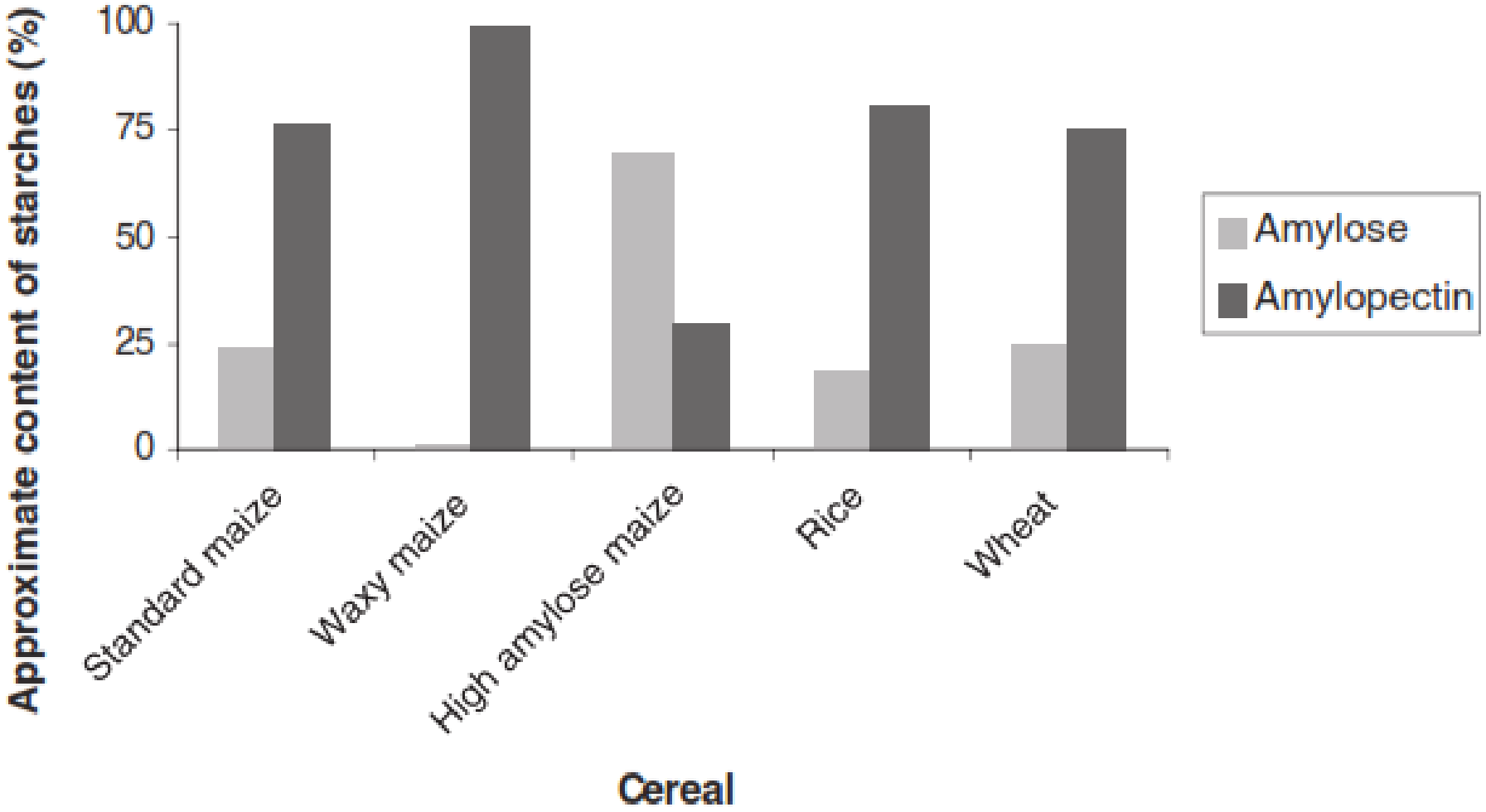
  → makanan : faktor utama

  Mekanisme : pe ↓ waktu transit → serat yg kurang larut & kurang dpt difermentasi, mis : selulosa

Beras Pulen dan Beras Pera

- Tergantung pada kandungan amilosa dan amilopektin
- Amilosa : rendah : 10-20%, menengah : 20-25%, tinggi : 25-33%

Amylose: amylopectin
25%: 75%
The higher amylose content cause the lower of the digestibility

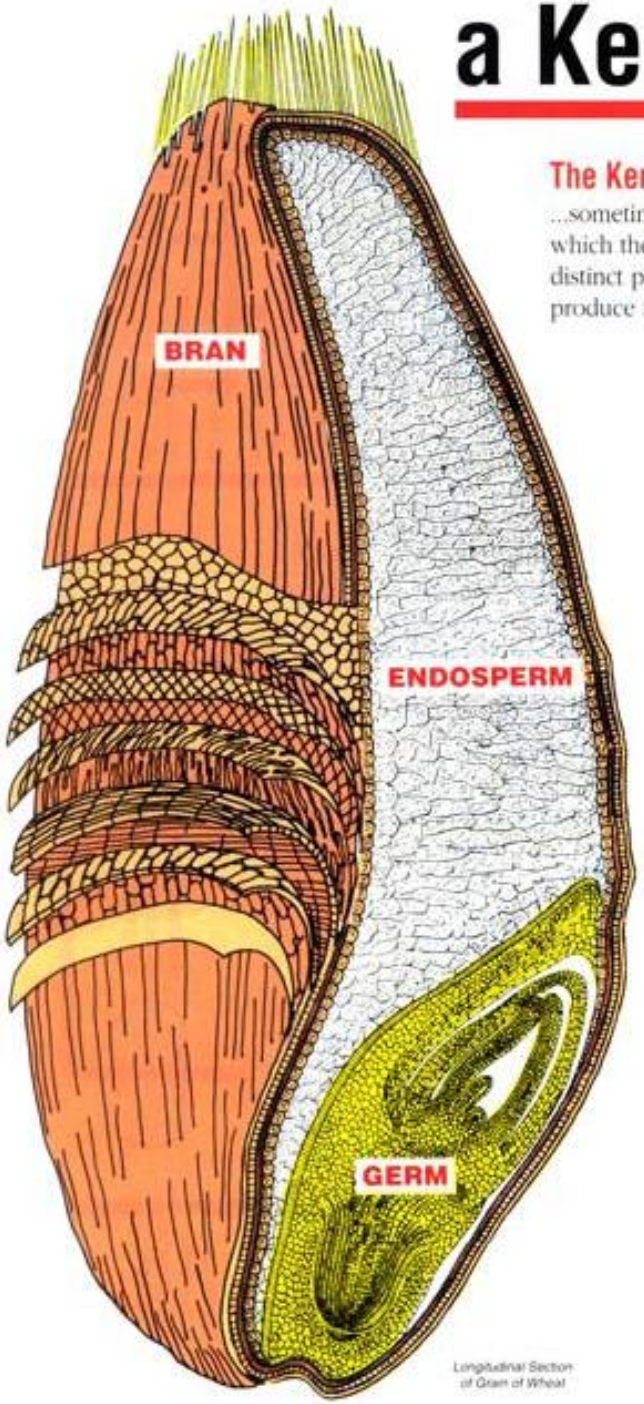

Approximate content of starches (%)
100
75
50
25
0
Standard maize
Waxy maize
High amylose maize
Rice
Wheat
Amylose
Amylopectin
Cereal

Tabel : Nilai indeks glikemik beras beberapa varietas padi

Varietas	Kadar amilosa (%)	Indeks glikemik	Keterangan
Cisokan	26,7	34	Rendah
Margasari	25,0	39	Rendah
IR36	27,3	45	Rendah
Logawa	25,5	49	Rendah
Martapura	26,4	50	Rendah
Air Tenggulang	28,6	50	Rendah
Batang Lembang	25,6	54	Rendah
Ciherang	22,9	54	Rendah
Aek Sibundong (beras merah)	22,0	56	Sedang
IR42	26,3	58	Sedang
Beras Taj Mahal	28,0	60	Sedang
Cigeulis	21,1	64	Sedang
IR64	24,0	70	Sedang
Batang Piaman	29,4	71	Tinggi
Setail (ketan hitam)	7,7	74	Tinggi
Ketonggo (ketan putih)	7,5	79	Tinggi
Ciliwung	26,2	86	Tinggi
Mekongga	23,1	88	Tinggi
Sintanur	15,4	91	Tinggi
Celebes	19,8	95	Tinggi
Gilirang	16,6	97	Tinggi
Bengawan Solo	17,2	106	Tinggi
Ciasem (ketan putih)	7,3	130	Tinggi

Gandum / Wheat

a Kernel of Wheat



Longitudinal Section of Grain of Wheat

The Kernel of Wheat

...sometimes called the wheat berry, the kernel is the seed from which the wheat plant grows. Each tiny seed contains three distinct parts that are separated during the milling process to produce flour.

Endosperm

...about 83 percent of the kernel weight and the source of white flour. The endosperm contains the greatest share of protein, carbohydrates and iron, as well as the major B-vitamins, such as riboflavin, niacin, and thiamine. It is also a source of soluble fiber.

Bran

...about 14½ percent of the kernel weight. Bran is included in whole wheat flour and can also be bought separately. The bran contains a small amount of protein, large quantities of the three major B-vitamins, trace minerals, and dietary fiber — primarily insoluble.

Germ

...about 2½ percent of the kernel weight. The germ is the embryo or sprouting section of the seed, often separated from flour in milling because the fat content (10 percent) limits flour's shelf-life. The germ contains minimal quantities of high quality protein and a greater share of B-complex vitamins and trace minerals. Wheat germ can be purchased separately and is part of whole wheat flour.

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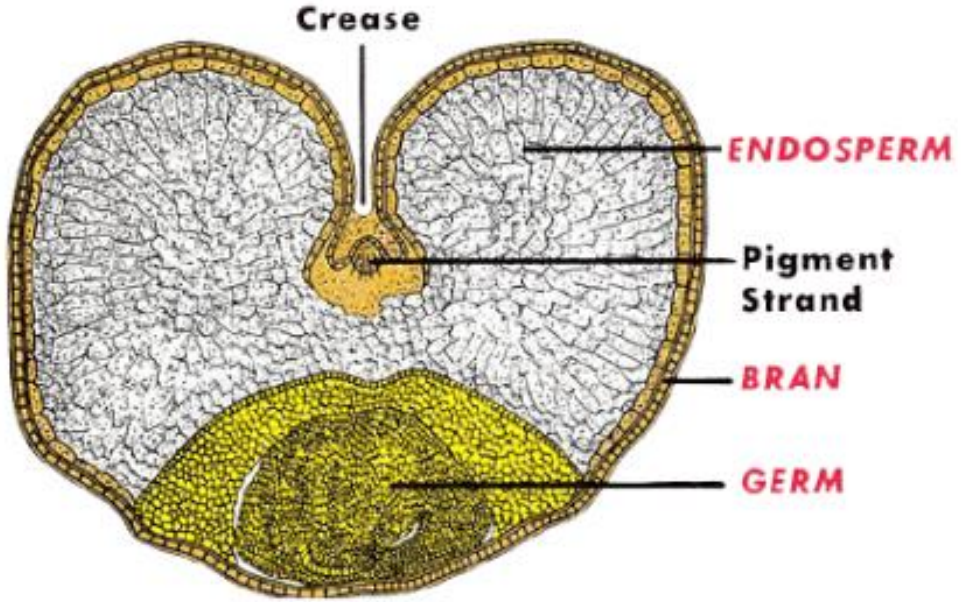
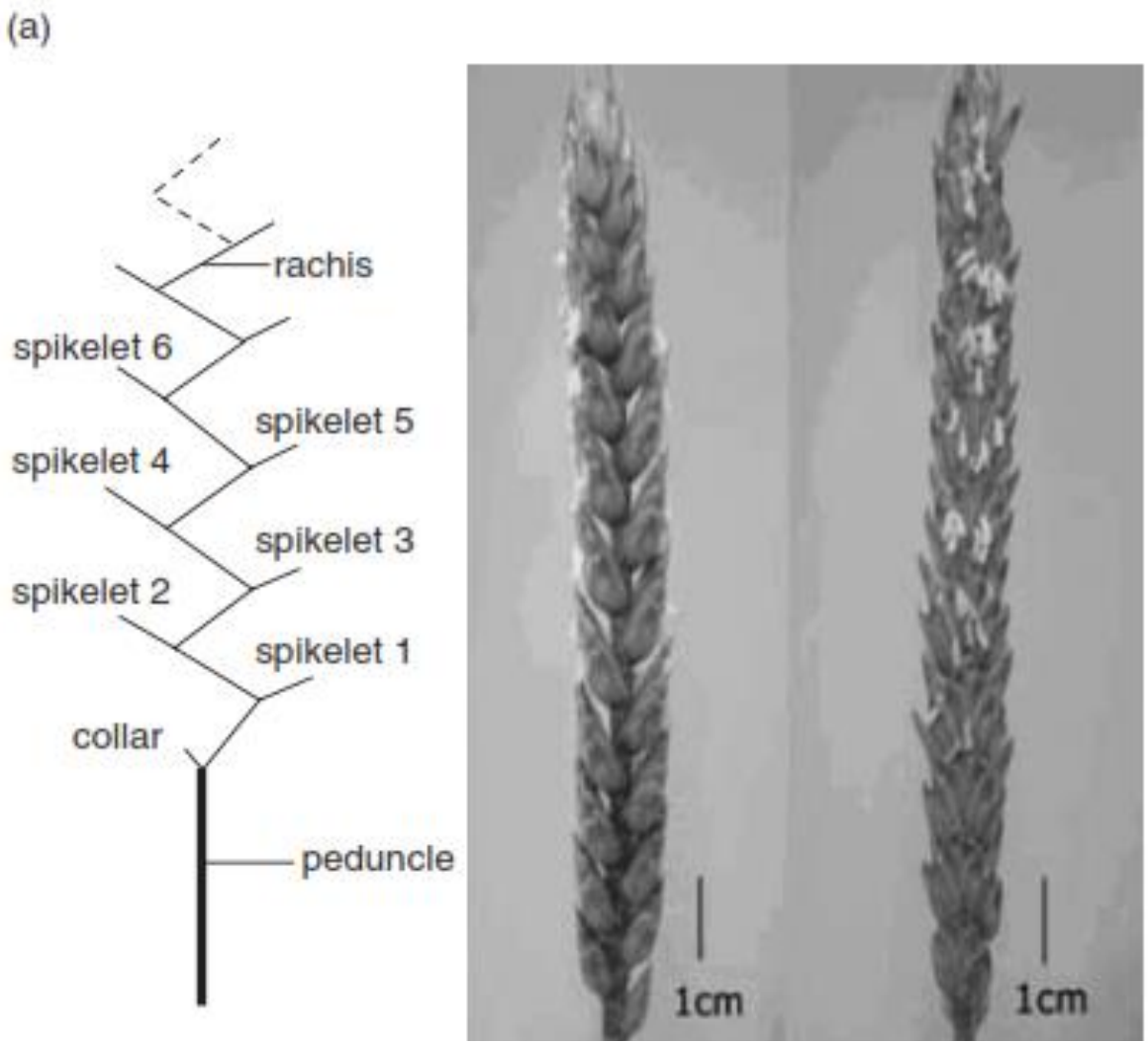
PARKER, CO 80138 • 303/840-8787

Bran

Fine white flour



Wheat



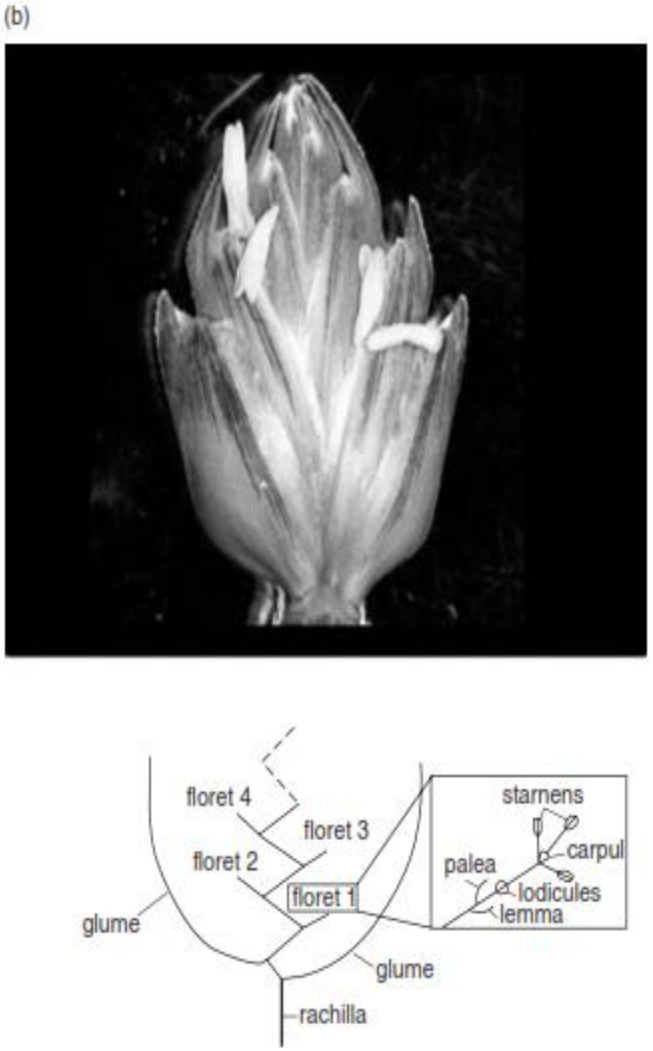


Figure 3 (a) Ear of wheat (b) Wheat grain. (source: Wheat: The Big Picture (Dr Gary Barker, webmaster: Gary.Barker@Bristol.ac.uk).

Triticum genus. e.g. *Triticum monoccum,*

Tab. 1: Typical composition of wheat kernel fractions[a] (% d.b.)

Parameter	Whole wheat	Pericarp	Aleuron layer	Bran[b]	Starchy endosperm	Germ
Weight	100	9	8	17	80	3
Ash	1.5	3	16	9	0.5	5
Protein	12	5	18	11	10	26
Lipids	2	1	9	5	1	10
Crude fiber	2	21	7	14	> 0.5	3
Other carbohydrates[c]	82	70	50	61	88	56

[a] *Modified from Pomeranz, 1987*
[b] *Includes pericarp and aleuron layer*
[c] *Calculated*

Milling the wheat

FORMATION OF THE DOUGH

- The formation of the dough ready to be fired is the result of structural changes of gluten, following the production of CO2 and ethanol, and the weakening of protein binding.

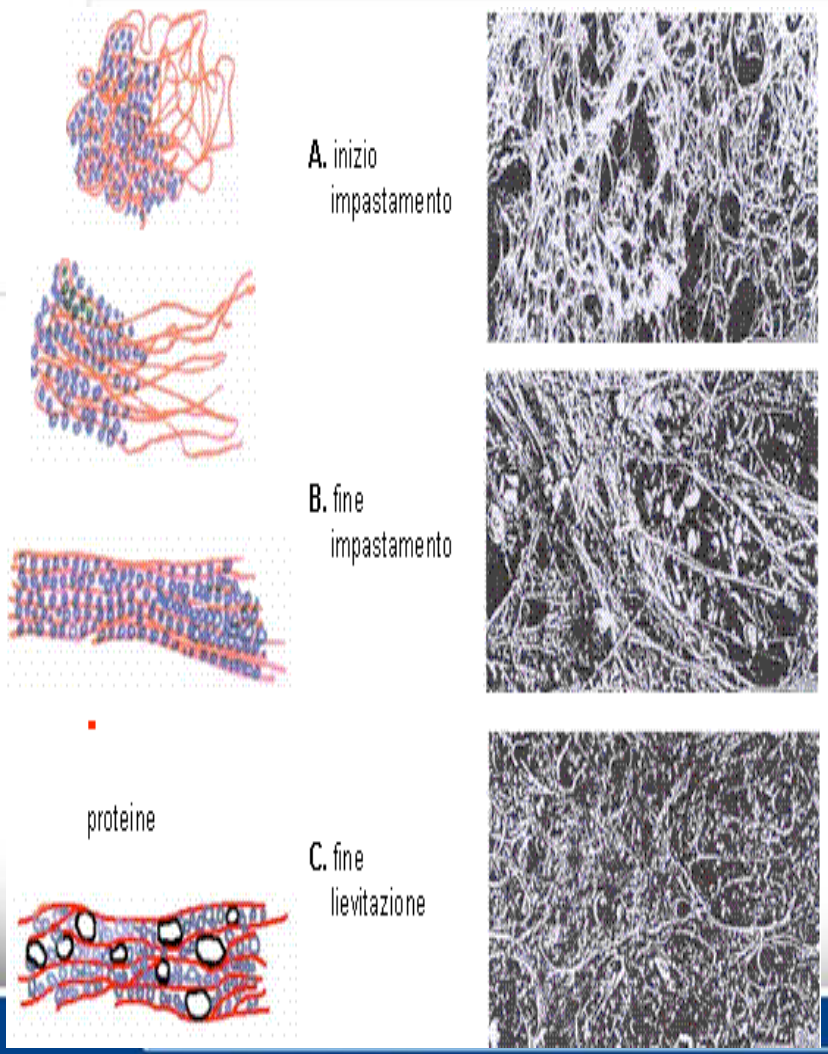
FORMATION OF THE DOUGH

Flour → **Dough**

Gliadin + glutenin → **Gluten**

- Necessity of adding water = 40-50% by weight of flour.
- Hydration of all the molecules which have a strong affinity for this solvent.

Formation of the dough



Beginning of kneading

The end of kneading

The end of Leavening / rising

Trapping of CO2 in the mesh gluten

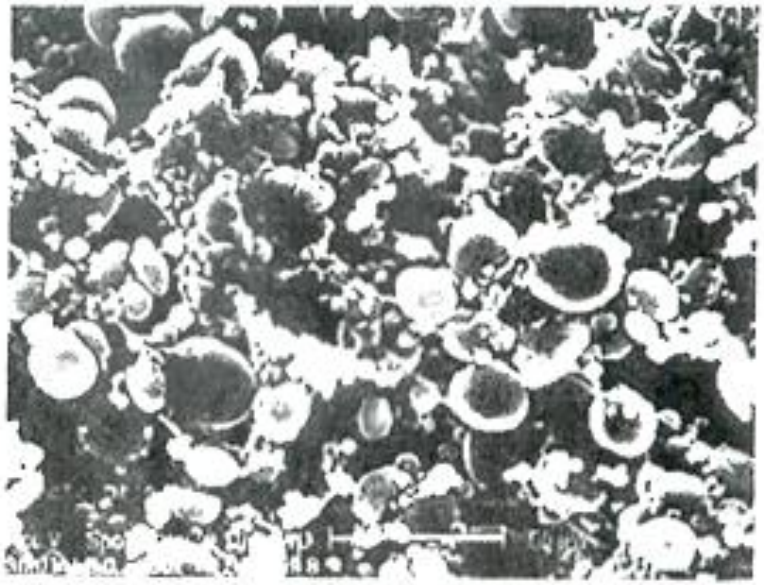


Fig. 7. impasto a mano, esame al microscopio elettronico prima della lievitazione

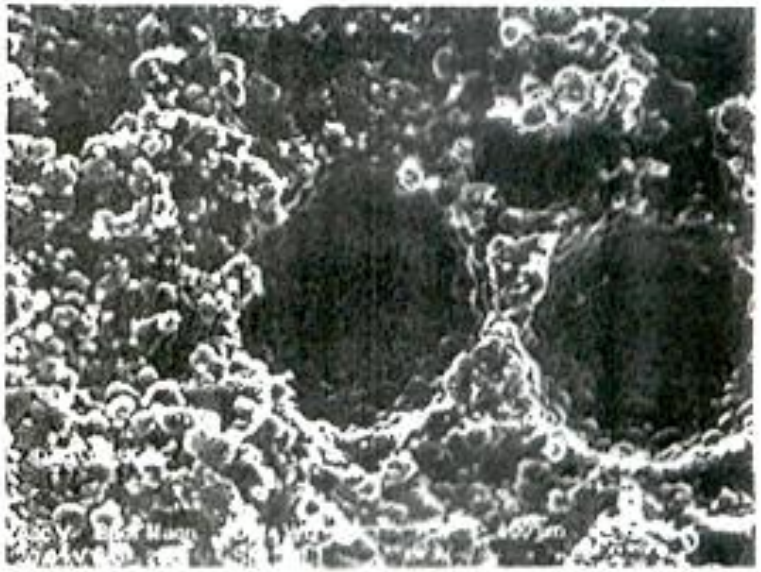


Fig. 8. impasto a mano dopo 4,5 ore di lievitazione; si notano granulazioni grandi (amidoi) e piccole (glutine)

TYPES OF LEAVENING

- chemical leavening
  Chemical reactions induced by chemicals (sodium bicarbonate or ammonium for sweet products)

- Proving biological fermentation process supported by micro-organisms

ACTIVITIES DURING FERMENTATION THE PREPARATION OF The Dough

- Alcoholic fermentation with production of CO2 and ethanol.

  $C_6H_{12}O_6 \rightarrow 2\ CO_2 + 2\ C_2H_6O$

- homo-lactic fermentation with lactic acid production.

  Ac. → pyruvate + $NADH_2$

  Ac. lactic acid + NAD

- hetero-lactic fermentation with producing lactic acid, acetic acid and CO2 and / or ethanol.
  Glucose -> CO2 + Ethanol + lactic acid

Gandum (*Triticum vulgare*) dibagi menjadi 4 klp utama :

1. Hard red spring wheat

   Tumbuh utama di Northern Great Plains State

   Prot. ↑ & kekuatan Gluten ↑

2. Hard red winter wheat

   Tumbuh utama di Southern Great Plains State (US ↑!)

   Protein : sedang & kekuatan Gluten sedang

3. Soft red winter wheat

   Tumbuh di banyak negara, tp terutama di timur dari S.Missouri & Mississipi & Great Lakes. Kebanyakan u/ cakes, cookies & pastries. Prot. ↓ Gluten relatif lemah

4. White wheat

   Tumbuh di negara^2 ttt. Prot. < soft red.

   U/ cakes, pies, cookies, produk^2 pastries.

Pengolahan Gandum

- Mirip dg pengolahan beras, perbedaannya pd bentuk akhir yg digunakan.
- Biji gandum → mesin penggiling : membersihkan dari biji-bijian asing, debu → merendam shg k.a 17% agar diperoleh sifat giling optimum.
- Penggilingan terdiri atas rangkaian bertahap dari penghancuran diikuti dg pengayakan.

- Penghancuran : seperangkat rangkaian roller yg semakin dekat satu sama lainnya.
- Hasil akhir : tepung putih, bersifat semakin baik utk pembuatan roti, tp ↓ kd vit. & min.
- Kd. prot. & pati tepung tgt varietas & jenis gandum, bukan proses penggilingan.

Pemanfaatan Tepung Terigu

- Roti → makanan pokok
- Ind. Bakery :

  ~ roti, adonan manis, cakes, biskuit, crackers

  ~ breakfast cereal

  ~ saus, soup, permen
- Pasta : makaroni : spaghetti, bentuk lainnya dari mie & pasta. Bahan baku utama : tep. terigu, air, telur, garam, & komponen minor lainnya.

Pasta tidak memerlukan pengembangan → hard durum wheat (semolina) : 100 bg terigu + 30 bag air → diekstrusi mjd lembrn tipis & dipotong membentuk mie → dioven ka 12%.

- Disamping tep. terigu, terdapat bulgur : gandum parboiled. (mirip beras parboiled).

  Cara : memanaskan seluruh biji gandum dg air → dikeringkan → memecah biji → membuang dedak

Pemilihan Tepung Terigu :

1. Jenis ~ penggunaan
   - Gluten

   Bogasari : 3 jenis
   Terigu Cap Cakra ↑ protein
   Terigu Cap Kunci ↓ protein
   Terigu Cap Segitiga Biru

   } sesuaikan dg tujuan penggunaan

2. Kerusakan :
   - berulat
   - apek
   - menggumpal

SUPLEMENTASI & KOMPLEMENTASI PROTEIN

- Total protein serealia relatif ↓ + a.a.Lysin & a.a. ttt. ↓. Masalah ini dapat diatasi dg pencampuran yg tepat dg Legume atau produk oilseed.

  Campuran : kd protein ↑

- Legume & oilseeds me ↑ mutu protein serealia dg suplementasi a.a. pembatas spt lysin (kadang-kadang triptofan & threonin) = suplementasi protein.
- Sebaliknya Legume & oilseeds yg defisien metionin dpt disuplementasi oleh serealia.

  Keseimbangan mutual masing-masing a.a. dikenal sbg **komplementasi protein.**

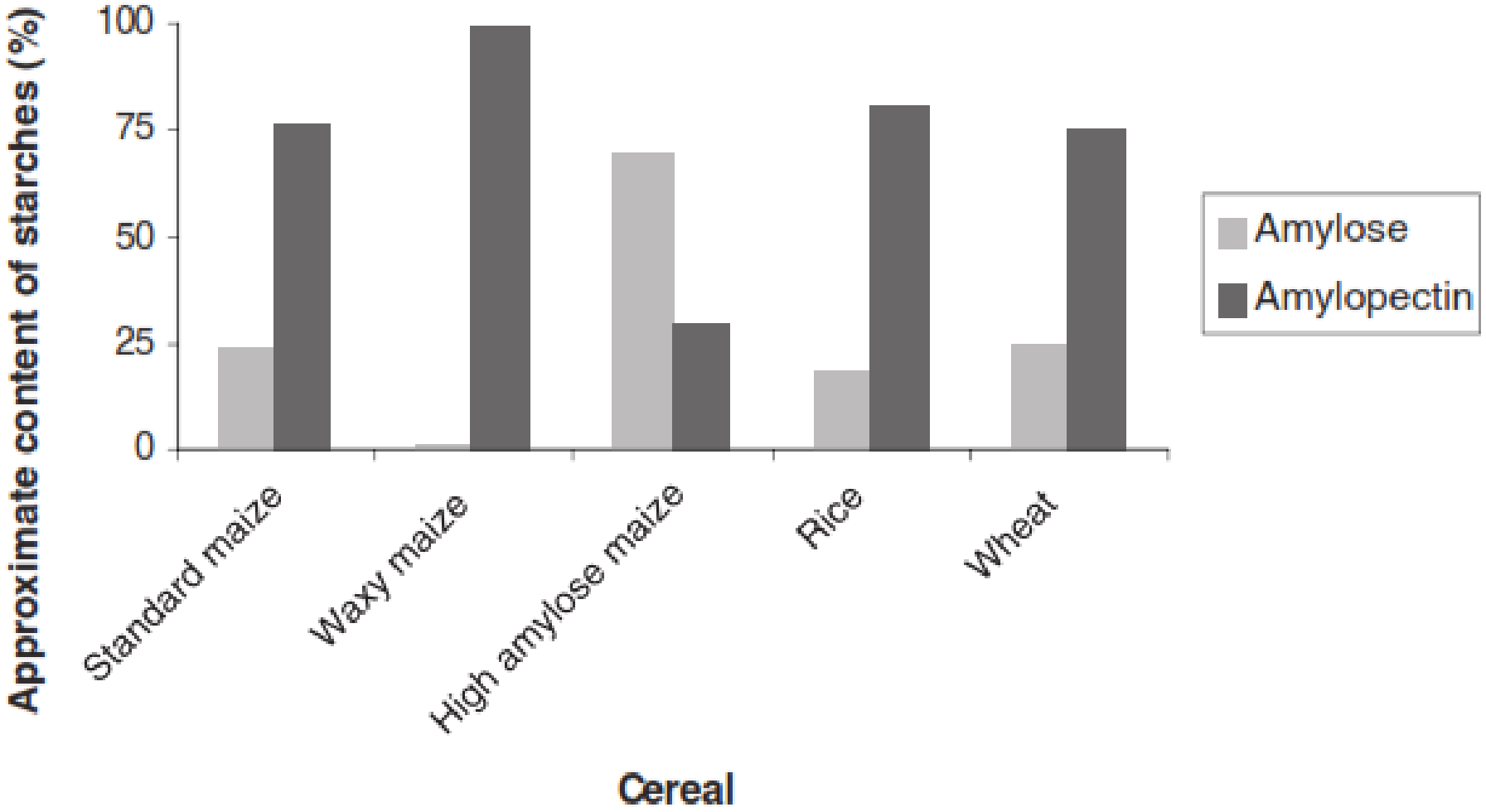
CORN : Zea mays

- There are numerous varieties of the species Zeamays.
- World production: 600 million tons / year
- Centre origin: Mexico
- Introduced in Europe in the sixteenth century still present in Mexico and Central America up to now
- Wild Progenitor: teosinte

(Euchlaena mexicana)

Zea Mays

1. Protein: 10-12%, especially: zeanina, Zeina.
2. Carbohydrates: 73%. Starch, cellulose and reducing sugar.
3. LIPIDS: about 4.5% (80% of lipids is localized in the germ).
4. VITAMINS thiamine, riboflavin and niacin. The yellow corn is also a good source ofβ-carotene and other carotenoids with provitamin A active
5. MINERALS: P and Fe.


Approximate content of starches (%)
100
75
50
25
0
Standard maize
Waxy maize
High amylose maize
Rice
Wheat
Amylose
Amylopectin
Cereal

Zea mays

- CORN

  Used as food in various forms:

  1. popcorn
  2. cornflakes
  3. grits (obtained by grinding coarse) used for the production of beer instead of barley
  4. oil (extracted from the germ)
  5. Products from the milling of the kernel, which yields the polenta

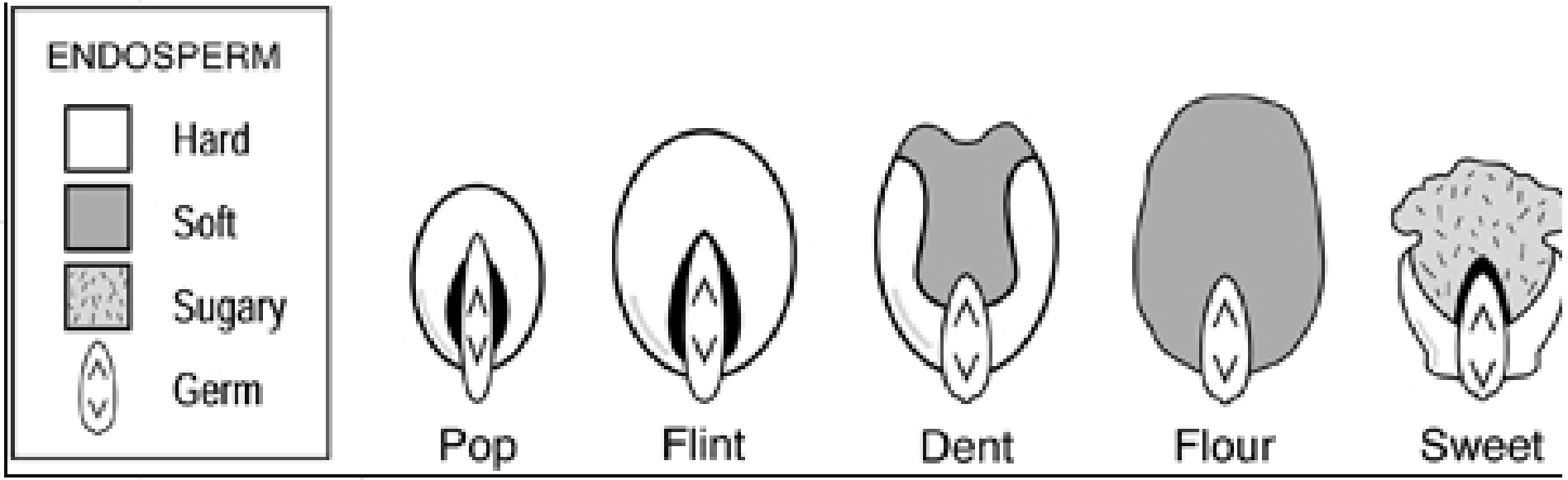
Zea mays L.

(1)dent maize (identified by the dent in the crown of the kernel);

(2)flint maize (hard, round kernels);

(3)sweet corn (a dent-type maize);

(4


ENDOSPERM
Hard
Soft
Sugary
Germ
Pop
Flint
Dent
Flour
Sweet

No.	Varietas	Gambar	Jenis	Produktivitas	Keunggulan spesifik	Pemulia
1	Pulut URI-1		Bersari bebas jagung pulut	7,8 t/ha pipilan kering (KA 15%)	Memiliki rasa khas yang pulen seperti ketan Kadar amilopektin > 55%	Dr. R. Neni Iriany M.
2	Pulut URI-2		Bersari bebas jagung pulut	7,3 t/ha pipilan kering (KA 15%)	Memiliki rasa khas yang pulen seperti ketan. Kadar amilopektin > 55%	Dr. R. Neni Iriany M.
3	URI-Ayu		Hibrida silang tunggal jagung manis	20 t/ha tongkol segar jagung muda	Memiliki kandungan gula mencapai 11,26 °brix	Dr. Andi Takdir Makkulawu
4	Bima 19 URI		Hibrida silang tiga jalur	12,5 t/ha pipilan kering (KA 15%)	Sesuai untuk bahan baku industri pakan *Stay green*	Dr. Muhammad Azrai
5	Bima 20 URI	 	Hibrida silang tiga jalur	11,7 t/ha pipilan kering (KA 15%)	Sesuai untuk bahan baku industri pakan *Stay green*	Dr. Muhammad Azrai

Tabel 2. Komposisi kimia berbagai tipe jagung.

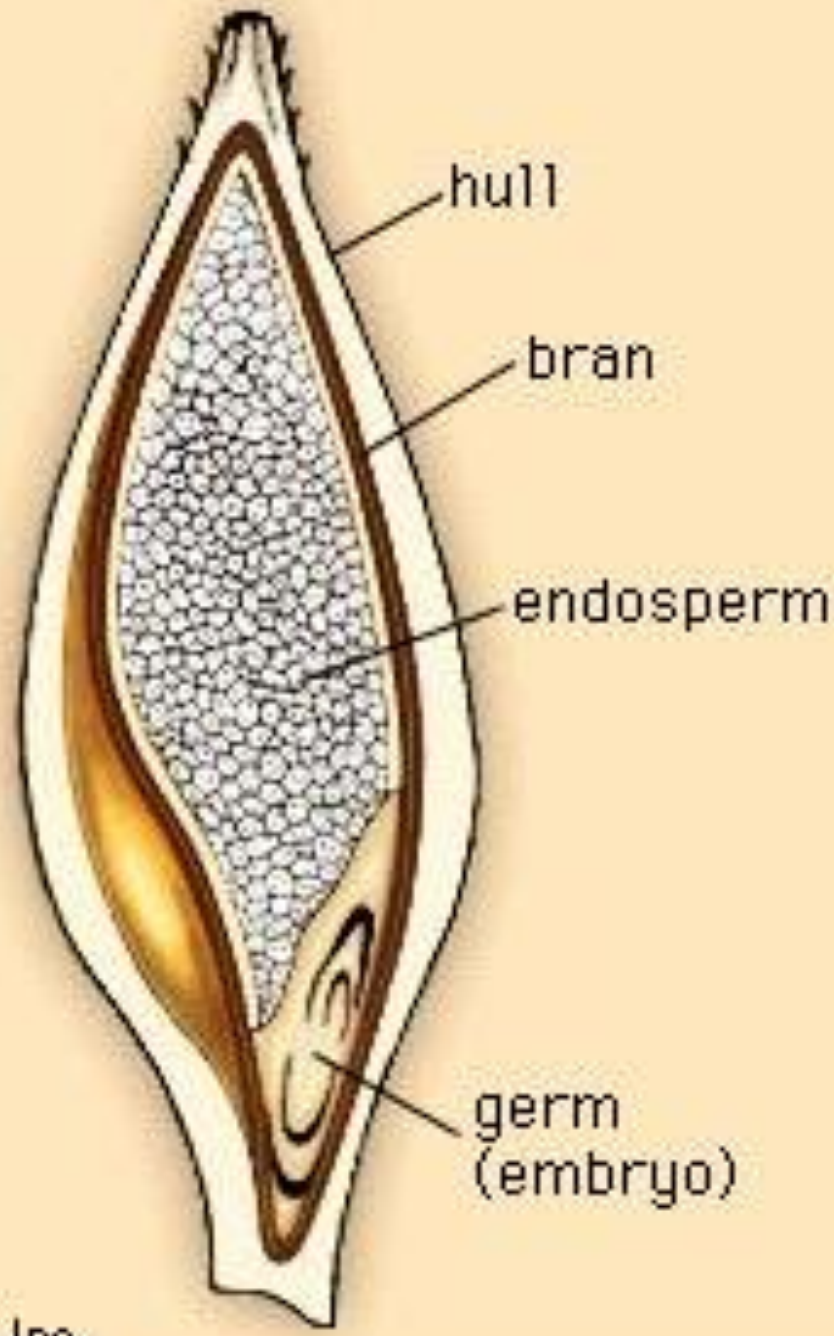
Varietas	Air	Abu	Protein	Serat kasar	Lemak	Karbohidrat
	(%)					
Kristalin	10,5	1,7	10,3	2,2	5,0	70,3
Floury	9,6	1,7	10,7	2,2	5,4	70,4
Starchy	11,2	2,9	9,1	1,8	2,2	72, 8
Manis	9,5	1,5	12,9	2,9	3,9	69,3
Pop	10,4	1,7	13,7	2,5	5,7	66,0
Hitam	12,3	1,2	5,2	1,0	4,4	75,9
Srikandi Putih*)	10,08	1,81	9,99	2,99	5,05	73,07
Srikandi Kuning*)	11,03	1,85	9,95	2,97	5,10	72,07
Anoman*)	10,07	1,89	9,71	2,05	4,56	73,77
Lokal pulut*)	11,12	1,99	9,11	3,02	4,97	72,81
Lokal nonpulut*)	10,09	2,01	8,78	3,12	4,92	74,20
Bisi 2**)	9,70	1,00	8,40	2,20	3,60	75,10
Lamuru**)	9,80	1,20	6,90	2,60	3,20	76,30

Barley

Hordeum vulgare

Barley is a resilient plant, tolerant of a range of condi- tions, which may have been cultivated since 15 000 BC

Pearled barley is eaten in soups and stews in the UK and in the Far and Middle East; barley is also used in bread (as flour) and ground as porridge in some countries (Kent & Evers 1994).



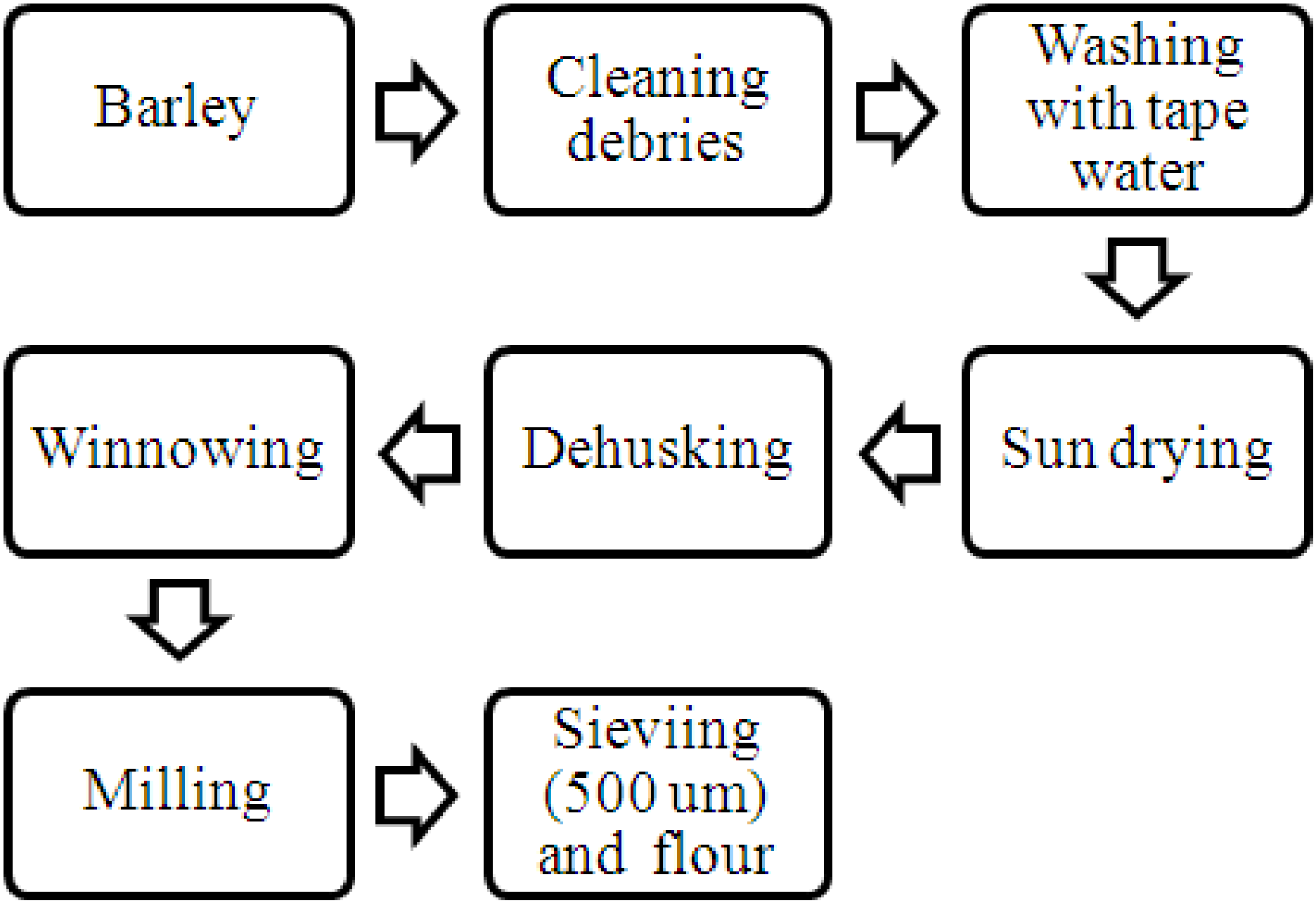

Barley
Cleaning debries
Washing with tape water
Sun drying
Dehusking
Winnowing
Milling
Sieviing (500 um) and flour

Table 2.1. Average composition of cereal grains.

	Rice	Wheat	Maize	Sorghum	Millet	Barley	Oats	Rye
Moisture,%	12.0	12.5	13.8	11.0	11.8	11.1	8.3	11.0
Calories/100 g.	360	330	348	332	327	349	390	334
Protein,%	7.5	12.3	8.9	11.0	9.9	8.2	14.2	12.1
Fat, %	1.9	1.8	3.9	3.3	2.9	1.0	7.4	1.7
N-free extract,%	77.4	71.7	72.2	73.0	72.9	78.8	68.2	73.4
Fiber, %	0.9	2.3	2.0	1.7	3.2	0.5	1.2	2.0
Ash, %	1.2	1.7	1.2	1.7	2.5	0.9	1.9	1.8
Thiamine, mg./100g.	0.34	0.52	0.37	0.38	0.73	0.12	0.60	0.43
Riboflavin, mg./100g.	0.05	0.12	0.12	0.15	0.38	0.05	0.14	0.22
Niacin, mg./100g.	4.7	4.3	2.2	3.9	2.3	3.1	1.0	1.6

Health Benefits of Barley

Organic Facts

Nutrients*	Vitamins*	Minerals*
Dietary Fiber 62%	Niacin 23%	Manganese 66%
Carbohydrate 26%	Vitamin B6 13%	Selenium 54%
Protein 20%	Thiamin 13%	Phosphorus 22%
Calories 18%	Riboflavin 7%	Copper 21%

*% Daily Value per 100g. For e.g. 100g of barley provides 66% of daily requirement of manganese.

- Preserves skin elasticity
- Reduces risk of gallstones
- Strengthens immune system
- Helps to prevent osteoporosis
- Controls blood cholesterol levels
- Keeps colon and intestine healthy
- Effectively manages type 2 diabetes
- Prevents cancer and heart ailments


GROWN NATURALLY
100% WHOLE BARLEY FLOUR
Hamilton's
BARLEY
FLOUR
FARINE D'ORGE
2.5 kg / 5.5 lb
GROWN NATURALLY
100% WHOLE BARLEY FLOUR
Hamilton's
BARLEY
FLOUR
FARINE D'ORGE
2.5 kg / 5.5 lb
1890
sugar
granulé
DARK
Flour
FARINE DE SEIGL
For Traditional Bak
2.5 kg
5.5 lb
7.69
6.28
GOLDEN

Oats

A. *Sativa L.* (white) and *A. byzantina* (red)

The groat,: 65–85% of the oat kernel, remains: bran layers (pericarp, seed coat and aleurone cells).

A small proportion is produced for human consumption

oatmeal for porridge and oatcakes, rolled oats for por- ridge, and oat flour for baby foods and for ready-to-eat (RTE) breakfast cereals, cosmetics and adhesives (Macrae

Betaglucan→ interest non-nutrient component

Taken from: https://eatingrules.com/types-of-oatmeal/

Sorghum

Sorghum bicolor L. Moench) is a warm sea- son crop, intolerant of low temperatures but fairly resis- tant to serious pests and diseases. It is known by a variety of names (such as great millet and guinea corn in West Africa, kafir corn in South Africa, jowar in India and kaoliang in China)

Staple food in many parts of Africa, Asia, and parts of the Middle East. Most of the sorghum produced in North and Central Amer- ica, South America and Oceania is used for animal feed (FAO 1995).

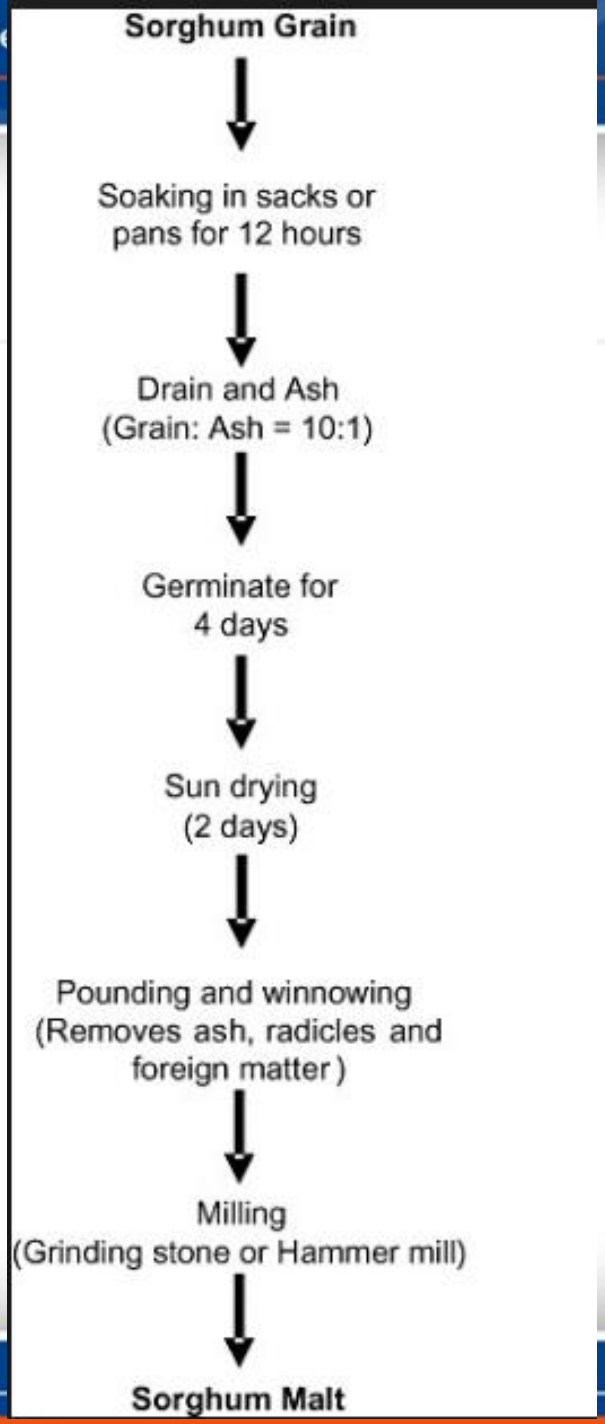
Sorghum

(1) grain sorghum;

(2) forage sorghum;

(3) grass sorghum;

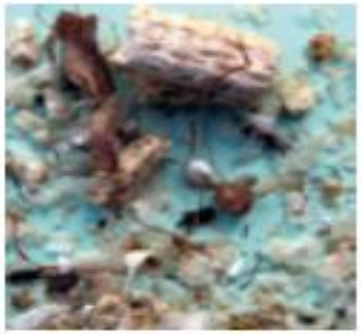
(4) Sudan sorghums and broomcorn

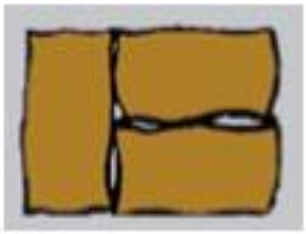

Sorghum Grain
Soaking in sacks or pans for 12 hours
Drain and Ash (Grain: Ash = 10:1)
Germinate for 4 days
Sun drying (2 days)
Pounding and winnowing (Removes ash, radicles and foreign matter)
Milling (Grinding stone or Hammer mill)
Sorghum Malt

Storage

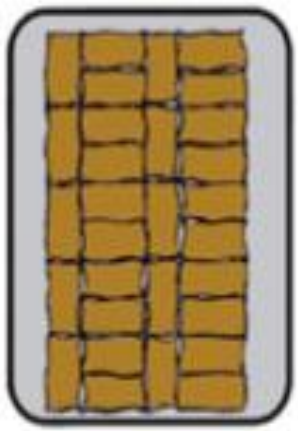
- Normal water (13-14%): ventilation, movement, artificial
- High water→ aw 0.60-0.85: stabilization, iridiation, an-aerob
- Vacuum or atm modification→ adv: inhibit mold growth, prevent insect, keep product dried

Table 2.1: Low quality factors that are often assessed when grain is graded

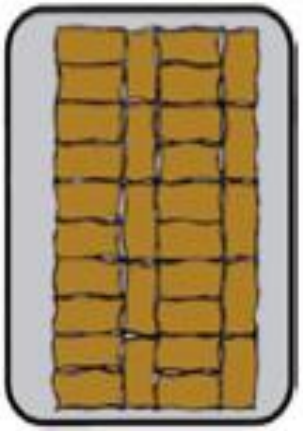
High quality grain	Low quality factor	
		**Foreign matter and filth** Grain may be contaminated with foreign matter that is either organic (e.g. maize cob cores, tassels etc) or inorganic (e.g. stones). Examples of filth are rodent dropping and dead insects. Careful sieving can reduce much of the foreign matter content.
		**Broken** Most broken grain comes from poor postharvest handling especially shelling or threshing.
		**Damaged by insect pests** Insects make holes in grains and hollow 



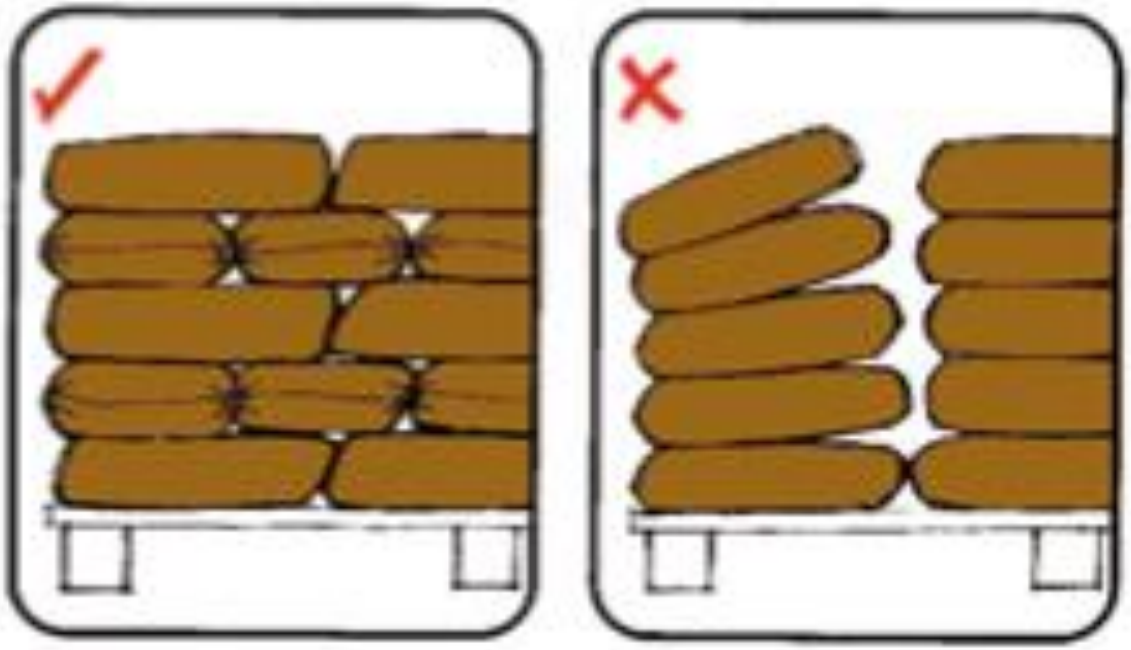
Units of three sacks (viewed from above)



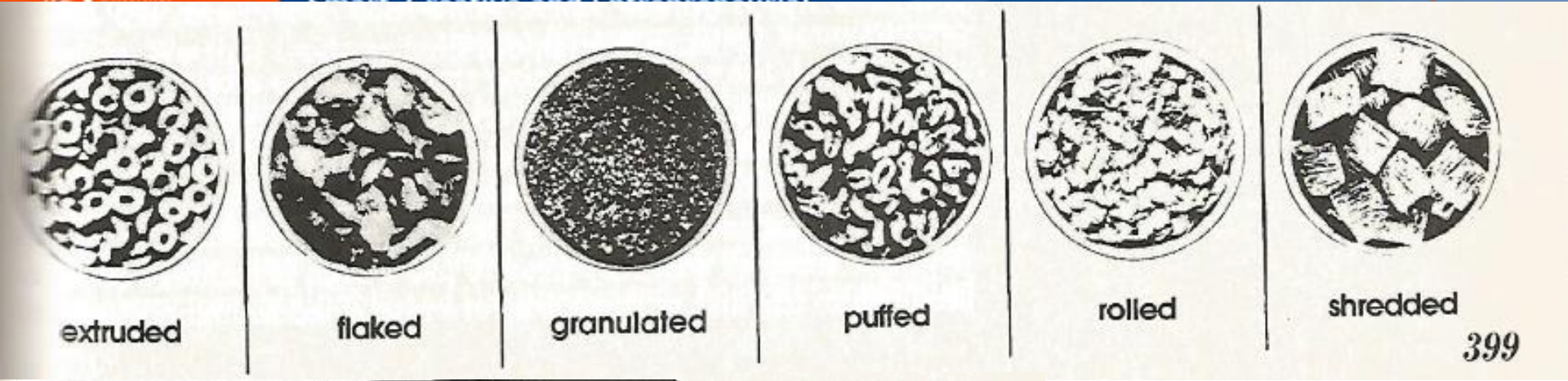
The first layer of sacks (and 3rd, 5th etc)

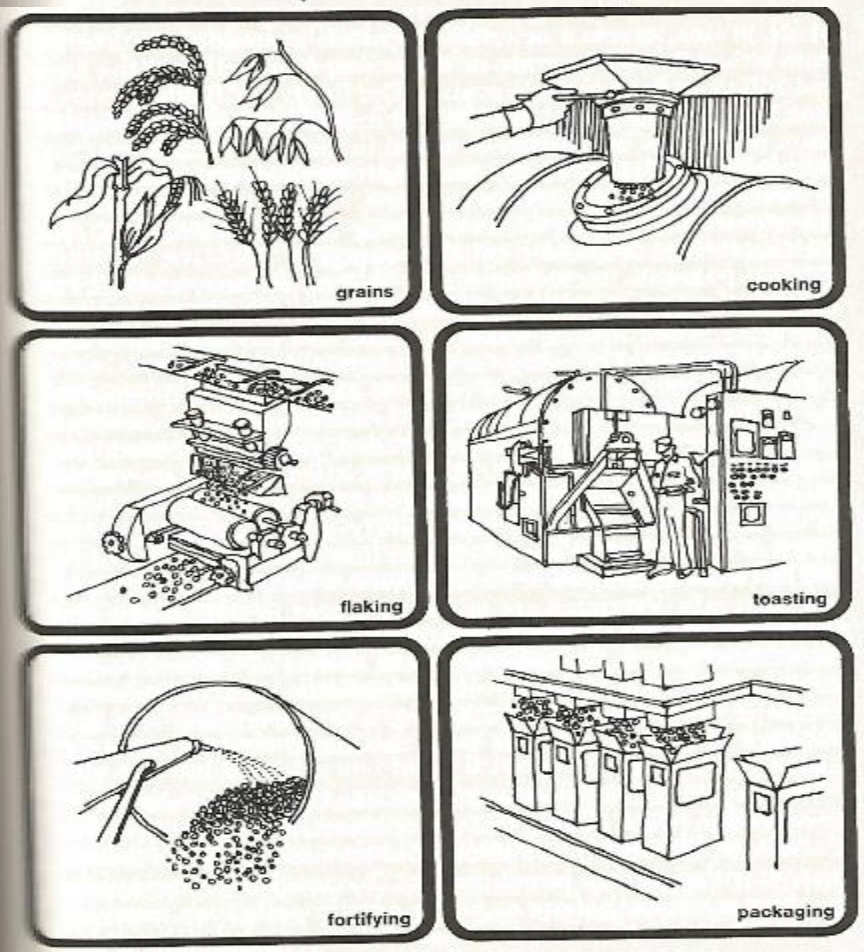


The second layer of sacks (and 4th, 6th etc)



Sacks in a house placed on a pallet made of sticks, with good clearance from the walls





17-4 *Major steps in the processing of grains into flaked cereals; types of prepared cereals.* (Courtesy of Cereal Institute, Inc.)

Thank you

KACANG-KACANGAN

Outlines

- Composition and nutritive value
- Varieties of legumes used for food
- Cooking legumes
- Storage
- Flatus bean

Composition and nutritive value (1/3)

- Sebagian besar kacang-kacangan: protein lebih banyak daripada daging (dalam 100 gram yang sama)
- Kualitas proteinnya lebih rendah karena kurang *methionine*.
- Konsumsi campuran kacang-kacangan dengan serealia dapat meningkatkan kualitas asupan protein, karena proteinnya saling melengkapi.
- Mengandung provitamin A (carotene) dan asam askorbat (vitamin C)
- Juga mengandung antivitamin atau racun (FAO, diakses 2015) (misal *Lonchocarpus* dan *Derris*, mengandung rotenone untuk insektisida atau racun ikan) (Duranti, 2006)

Composition and nutritive value (2/3)

- Berdasarkan warna: putih, kuning, merah muda, merah tua, orange (jenis lentils), hijau, hitam (kedele)
- Berdasarkan bentuk: bulat (kedelai, kacang hijau), lonjong pipih (koro), lonjong tebal (k. gude), ginjal (kacang merah)

Composition and nutritive value (3/3)

Jenis Tepung Kecambah dan Perlakuan *Blanching*	KA (%)	Protein (g%)	Lemak (g %)	Vit. C (mg %)	Vit. E (mg%)	Serat (%)	Total phenol ppm
Beras Kukus	6.25	8.315	1.29	15.98	540.5836	12.26	793.06
Beras Rebus	4.5	7.97	1.443	15.99	544.4666	12.22	757.14
Beras Sangrai	6.7	8.025	1.433	15.98	552.8371	14.64	953.77
Jagung Kukus	7.45	5.995	3.647	15.99	596.6993	12.54	2367.06
Jagung Rebus	6.39	5.98	3.998	15.97	605.8901	18.84	2323.02
Jagung Sangrai	7.14	5.99	4.18	15.98	647.9923	13.86	2409.92
Kedelai Kukus	4.69	37.5	18.64	29.93	447.7764	25.54	4245.24
Kedelai Rebus	3.53	37.45	19.08	27.94	525.0528	30.04	2505.16
Kedelai Sangrai	5.3	37.39	18.51	27.94	793.0094	25.3	3143.65
Kacang Hijau Kukus	8.16	20.79	4.979	30.92	438.5953	16.59	1722.62
Kacang Hijau Rebus	6.23	19.36	4.295	15.97	425.3145	12.31	984.52
Kacang Hijau Sangrai	7.92	19.54	4.485	23.78	451.0262	18.54	1496.83
Tolo Kukus	6.23	18.85	1.491	15.96	442.0176	13.54	1026.98
Tolo Rebus	5.35	19.32	1.748	15.93	451.4611	13.51	838.49
Tolo Sangrai	5.65	19.59	2.302	15.85	427.3011	14.21	1006.15

Tabel 1. Konsumsi kacang-kacangan di Indonesia 1990-2002 (kg/kapita/tahun)
Tabel 1. Beans consumption in Indonesia in 1990-2002 (kg/man/year)

Kacang-kacangan/ *Type of beans*	Tahun/*Years*					Pertumbuhan rata-rata/ *Growth rate* (%)
	1990	1993	1996	1999	2002	
Kacang tanah/*ground bean*	0,78	0,68	1,14	0,52	0,99	33,33
Kacang kedelai/*soybean*	0,10	0,10	0,10	0,05	0,10	27,78
Kacang hijau/*mungbean*	0,57	0,57	0,73	0,31	0,57	0,00
Kacang merah/*redbean*	0,31	0,31	0,00	0,00	0,00	0,00
Kacang polong/*chickpea*	0,00	0,00	0,00	0,00	0,00	0,00
Kacang tunggak/*cowpea*	0,05	0,05	0,00	0,00	0,00	0,00
Kacang mete/*cashewnut*	0,00	0,00	0,01	0,01	0,01	11,11
Kacang lainnya/*others*	0,10	0,10	0,31	0,16	0,21	8,83
Tahu/*tofu*	4,42	5,04	5,36	6,08	7,70	7,44
Tempe/*tempeh*	4,63	5,20	5,88	6,76	8,27	13,33
Tauco/*tauco*	0,05	0,05	0,04	0,03	0,04	5,88
Oncom/*oncom*	0,21	0,16	0,08	0,09	0,10	0,00
Lainnya/*others*	-	-	-	0,01	0,01	-

Sumber/*Source*: Anonymous, (2004)

Tabel 3. Kacang-kacangan lokal yang tumbuh di Indonesia
Table 3. Indonesian local beans

Nama/*Names*			Produktivitas/ *Productivity* (ton/ha)	Referensi/*References*
Lokal/*Local*	Inggris/ *English*	Latin/*Latin*		
Kacang tunggak	*Cowpea*	*Vigna unguiculata*	0,9-2,0	Kasim dan Djunainah (1993)
Kacang komak	*Lablab bean*	*Dolichos lablab*	1,0-1,5	Trustinah dan Kasno (2002)
Kacang jogo	*String bean*	*Phaseolus vulgaris* L	2-3	Suharsono dan Rahmianna (2002)
Kacang bogor	*Bambarra groundnut*	*Vigna subterranea* L	3-5	Marwoto dan Suhartina (2002)
Kacang faba/ Kacang babi	*Faba bean*	*Vicia faba*	0,70-1,5	Adisarwanto (2002)
Kacang gude	*Pigeon pea*	*Cajanus cajan*	0,7-2	Radjit dan Riwanodja (2002)

Tabel 4. Komposisi gizi utama kacang-kacangan per 100 g
Table 4. Nutrition composition of beans/100 g

Jenis /*Type*	Air/ *Water* (g)	Protein/ *Protein* (g)	Lemak/*Fat* (g)	Karbohidrat/ *Carbohydrate* (g)	Kalori/ *Calori*
Kedelai/*soybean*	7,5	34,9	18,1	34,8	331
Kacang hijau/*mungbean*	10,0	22,2	1,2	62,9	345
Kacang tunggak/*cowpea*	11,0	22,9	1,4	61,6	342
Kacang gude/*pigeon pea*	12,2	20,7	1,4	62,0	336
Kacang bogor/ *bambarra groundnut*	10	16,0	6,0	65,0	370
Kecipir/*wheat bean*	9,7	32,8	17,0	36,5	405

Sumber/*Source*: Depkes, (1984)

Tabel 8. Komposisi kimia dan nilai uji organoleptik tempe kacang tunggak-kedelai
Table 8.Chemical composition and organoleptic test value of cowpea-soybean tempeh

Komponen */Components*	Proporsi kacang tunggak dan kedelai/ *Ratio of cowpea to soybean* (w/w)				
	100:0	75:25	50:50	25:75	0:100
Air/*Water* (%)	64,42	62,63	61,36	59,87	56,46
Abu/*Ash* (%)	2,08	2,33	2,54	2,76	2,87
Protein/*Protein* (%)	20,52	27,08	32,53	36,03	38,08
Warna/*Color* (skor/score)	2,00	1,86	2,28	2,23	2,28
Kekompakan/*Solid* (skor/score)	2,28	2,43	2,43	2,57	2,57
Rasa/ *Taste* (skor/score)	2,43	2,71	2,10	2,57	2,00

Sumber/*Source*: Richana dan Damardjati, (1999)

Keterangan *Remarks*:

Kriteria warna dan rasa/ *Color and taste criteria*: 1=sangat suka/*very like*,
2=suka/*like*,
3=agak suka/*fairly like*,
4=tidak suka/*unlike*

Kriteria kekompakan/ *Solid criteria*: 1=sangat kompak/*very solid*,
2=kompak/*solid*,
3=agak kompak/*fairly solid*,
4=tidak kompak/*unsolid*

Varieties of legumes used for food

- Beans : oval atau bentuk ginjal
  seperti kacang merah, *pink beans*

- Peas ; bundar
  seperti *black-eyed peas*, whole peas

- Lentils : bentuk pipih

Kidney Beans

Yellow Split Peas

Flageolet Beans

Soya Beans

Green Lentils

Pinto Beans

Marrowfat Peas

Black Turtle Beans

Chick Peas

Puy Lentils

Green Split Peas

Aduki Beans

Mung Beans

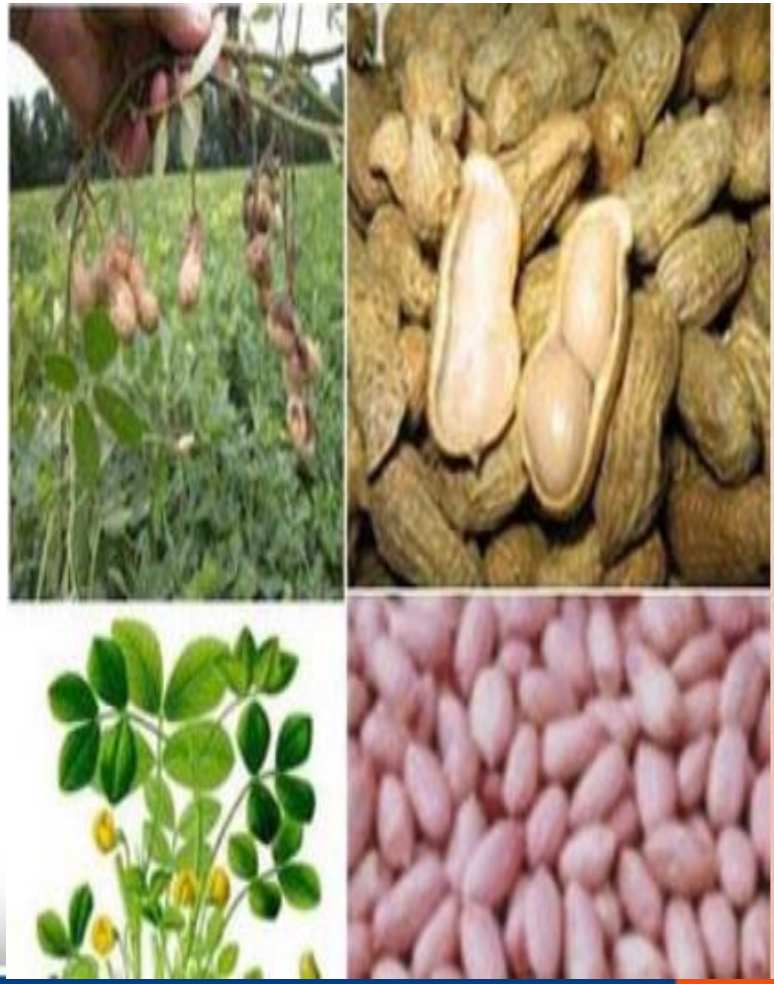
Red Lentils

Mixed Beans

Black Eyed Peas

Kacang Tanah (*Arachis hypogeae* L.)

- Tanaman berupa semak berasal dari Amerika Selatan (Brazilia)
- Nama lain (In): kacang una, su-uk, jebrol, k. bandung, k. tuban, k. kole, k. banggala. En: *peanut* atau *groundnut*



Kacang Tanah (*Arachis hypogeae* L.)

- Sistematika Tumbuhan

Kingdom: *Plantae* (tumbuh-tumbuhan)

Divisi: *Spermatophyta* (berbiji)

Sub Divisi: *Angiospermae* (biji tertutup)

Kelas: *Dicotuledoneae* (biji keping dua)

Ordo: *Leguminales*

Famili: *Papilionaceae*

Genus: *Arachis*

Spesies: *A. hypoheae L: A.tuberosa Benth, dll*

Kacang Tanah (*Arachis hypogeae* L.)

- Pemanfaatan (BPP Teknologi, 2000)
  - Pembuatan keju, mentega, sabun dan minyak goreng
  - Hasil samping dari pembuatan minyak→bungkil dan oncom (*fermented*)
  - Daun: sayuran, pakan ternak, serta pupuk hijau
  - Lemak (40,5%), protein (27%)
- Sentra tanam: P. jawa, sumatera utara, sulawesi

Pasca panen: Kacang Tanah (*Arachis hypogeae* L.)

- Penyortiran dan Penggolongan
  - Pilah polong yang tua dan yang muda, sortir berdasarkan derajat ketuaan, seleksi polong yang rusak atau busuk untuk dibuang
- Penyimpanan
  - Polong kering→karung goni, kaleng tertutup simpan dalam tempat kering
  - Biji kering→ kadar air kurang dari 9% lalu masukan wadah

Syarat Mutu Kacang Tanah (*Arachis hypogeae* L.) berdasarkan SNI

SNI 01-3921-1995

- Jenis: mutu I, mutu II, mutu III
- Syarat umum
  - bebas hama, bebas bau busuk, apek, bau asing lainnya
  - Bebas dr bahan kimia e.g. insektisida dan fungisida
  - Suhu normal

Syarat Mutu Kacang Tanah (*Arachis hypogeae* L.) berdasarkan SNI

- Syarat khusus mutu kacang tanah biji (wose)

Variabel	Mutu I	Mutu II	Mutu III
Kadar air maks (%)	6	7	8
Butir rusak maks (%)	0	1	2
Butir belah maks (%)	1	5	10
Butir warna lain maks (%)	0	2	3
Butir keriput maks (%)	0	2	4
Kotorang maks (%)	0	0.5	3
Diameter (mm)	8	7	6

Syarat Mutu Kacang Tanah (*Arachis hypogeae* L.) berdasarkan SNI

- Syarat khusus mutu kacang tanah polong (gelondong)

Variabel	Mutu I	Mutu II	Mutu III
Kadar air maks (%)	8	9	9
Kotoran maks (%)	1	2	3
Polong keriput maks (%)	2	3	4
Polong rusak maks (%)	0.5	1	2
Polong biji satu maks (%)	3	4	5
Rendemen min(%)	65	62.5	60

Kedelai (*Glycine max* L.)

- Asal: Manshukuo (cina utara)
- Sistematika Tanaman
  - Familia: Leguminosae
  - Subfamili: Papilionoidae
  - Genus: Glycine
  - Species: *Glycine max L.*

Sumber: BPP Teknologi. 2000. *"Tentang Budidaya Pertanian: Kedelai (Glycine max L)"*

Kedelai (*Glycine max* L.)

- Pemanfaatan (BPP Teknologi, 2000)
  - Tepung kedelai→ protein kedelai & minyak kedelai
  - Protein kedelai→susu, vetsin, kue-kue, permen dan daging nabati (*meat analog*), juga kertas, cat cair, tinta cetak dan tekstil
  - Minyak kedelai
    - gliserida→ minyak goreng, margarin, bahan lemak lainnya
    - Lecithin→margarin, kue, tinta, kosmetika, insectisida dan farmasi
- Sentra tanam: Pesisir utara P. Jawa, Jawa Tengah, Jawa Barat, Sumatera Utara, Lampung, Sumatera Selatan dan Bali

Penyimpanan

- Setelah disortir→simpan di tempat kering (misal karung)
- Karung-karung ini ditumpuk yang diberi alas kayu agar tidak langsung menyentuh tanah/lantai
- Jika disimpan dalam waktu lama, setiap 2-3 bulan harus dijemur sampai kadar air 9-11%

Syarat Mutu Kedelai (*Glycine max* L.)berdasarkan SNI

SNI 01-3922-1995

- Syarat umum
  - bebas hama, bebas bau busuk, apek, bau asing lainnya
  - Bebas dr bahan kimia e.g. insektisida dan fungisida
  - Suhu normal

Syarat Mutu Kedelai (*Glycine max* L.)berdasarkan SNI

- Syarat khusus

Variabel	Mutu I	Mutu II	Mutu III	Mutu IV
Kadar air maks (%)	13	14	14	16
Butir rusak maks (%)	1	4	3	5
Butir belah maks (%)	1	2	3	5
Butir warna lain maks (%)	1	3	5	10
Butir keriput maks (%)	0	1	3	5
Kotoran maks (%)	0	1	2	3

Kacang Hijau (*Vigna radiata*)

Tabel 2. Jumlah aksesi plasma nutfah kacang hijau berdasarkan karakter morfologi (Hakim 1998)

Karakter	Kelompok	Jumlah aksesi
Warna hipokotil	Hijau	673
	Merah	351
Warna polong	Hitam	706
	Cokelat	244
	Hitam kecokelatan	74
Bentuk polong	Silindris	601
	Gepeng	423
Warna biji	Hijau mengilat	506
	Hijau kusam	450
	Kuning	30
	Cokelat	21
	Hitam	17
Ukuran biji	Besar (>61 g/1.000 biji)	233
	Sedang (50-60 g/1.000 biji)	407
	Kecil (<50 g/1.000 biji)	384
Tipe tanaman	Tegak	792
	Agak merambat	232

Sumber Table: Hapsari, Trustinah, Iswanto. 2015. *Review: Keragaman Plasma Nutfah Kacang Hijau dan Potensi Pemuliaan Kacang Hiijau*. Pros Sem Nas Masy Biodiv Indo Vo. 1, No 4. Hal 918-922

Kacang Hijau (*Vigna radiata*)

- Kacang hijau dengan protein tinggi (>26%) cocok untuk makanan bayi atau bahan fortifikasi makanan (Trustinah dkk.2007)
- Hijau mengkilap→mutu lebih baik dan lebih cepat mekar(Ginting *et al*. 2008)

Gambar 1. Keragaman warna biji dan polong masak plasma nutfah kacang hijau

Kacang Bogor (*Vigna subterranea* L.)

- Famili: Fabaceae
- Upfamili: faboideae
- Bangsa: Phaseoleae
- Genus: Vigna
- Spesies: V. subterranea

General Storage

- Beans deteriorate in both flavor and texture in six months at room temperature (25 C) if moisture content below 13 percent
- If below 10 percent it could be kept two years
- Storage condition will influence cooking time e.g. at 29 C and RH 65%→ bean hard-to-cook
- Phytase hydrolizes phytic acid→ Ca & Mg
- Increased membran degradation allows these cations to diffuse to the middle lamella where they form unsoluble salts with pectic substances.
- This hard-to-cook is reversible when stored subsequently at low temperature

Cooking legumes (1/2)

- Legumes increase two to three times in volume when cooked
- Cooking→gelatinize the starch, alters the texture, and ↑ the flavors (palatable)
- Moderate heating→↑ availability of protein
- Dried beans→ lectin (hemaglutinin, toxic) and several anti-nutritional factors including goitrogenic and tannins
- Raw soybean and most beans contain trypsin inhibitor which prevent the digestive enzyme trypsin from hydrolizing protein into amino acids

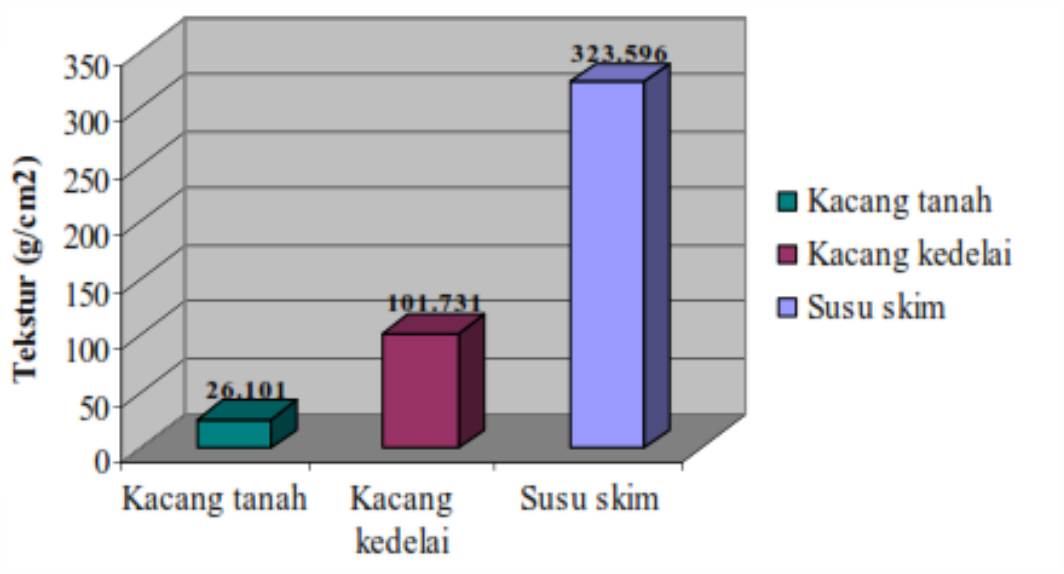
Cooking legumes (2/2)

- Heating
  - 15’→↑ nutritional factor in soy bean
- Boiling
  - 40’ → inactivates trypsin inhibitor in red kidney bean
- Microwave heating
  - 9’→ inactivate antinutritional constituent in soybean
- Lectins are more easily inactivated by heat than trypsin inhibitor

Flatus bean

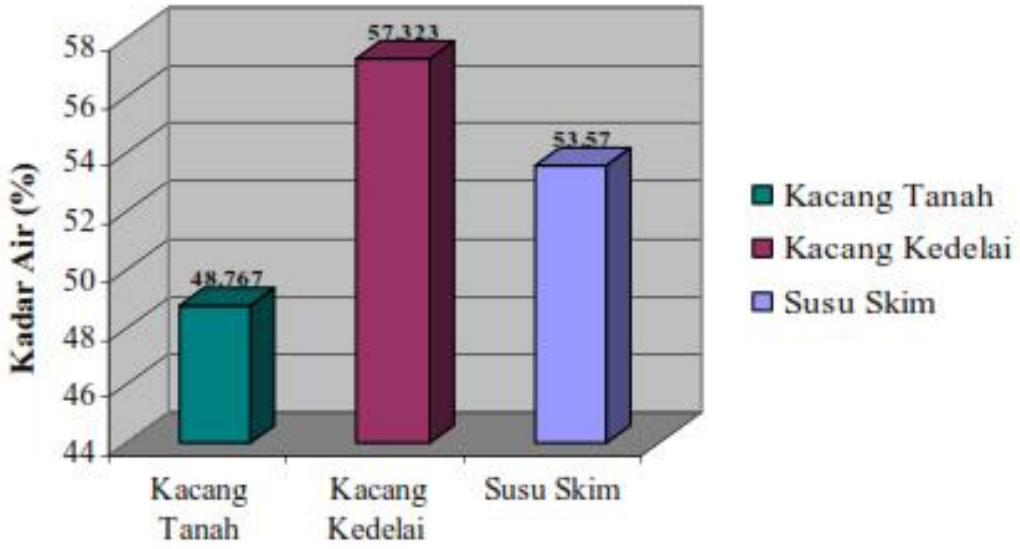
- five to seven hours after ingesting beans→ elevated levels of hydrogen and especially CO2
- Due to lack of alfa-galactosidase in upper intestinal tract
- Sprout of beans reduce flatulence
- Germination→ lower lectins, saponin and part of phytic acid is hydrolized

Keju dari Kacang? (1/4)



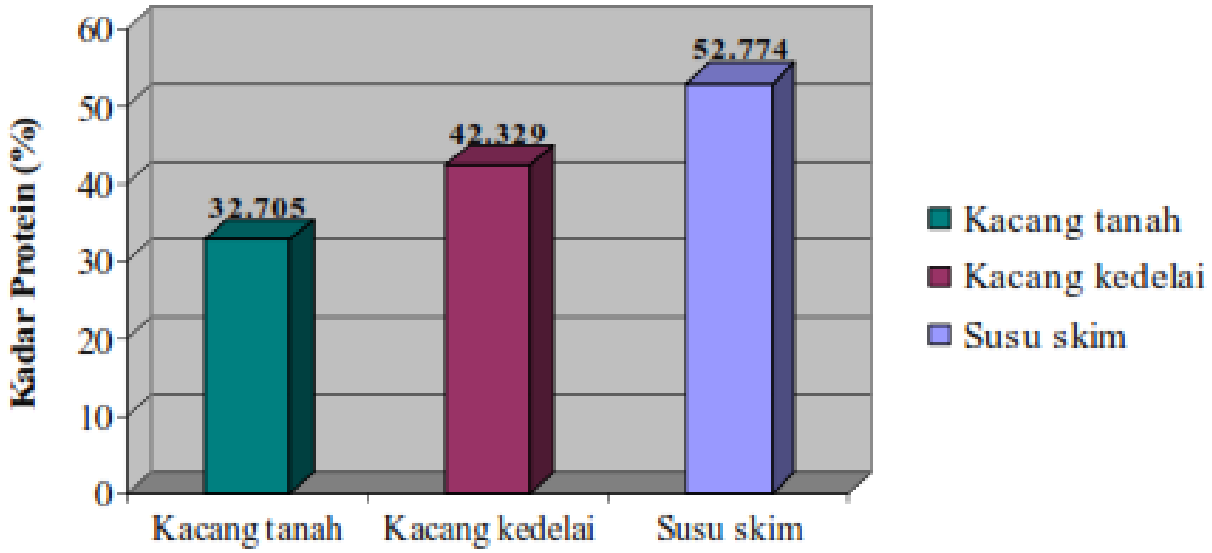
Gambar 2. **Histogram nilai rata-rata tekstur (g/cm^2) keju yang dibuat dari susu skim dan berbagai jenis kacang yang difermentasi dengan memanfaatkan isolat BAL F_2 sebagai penggumpal.**

Keju dari Kacang? (2/4)



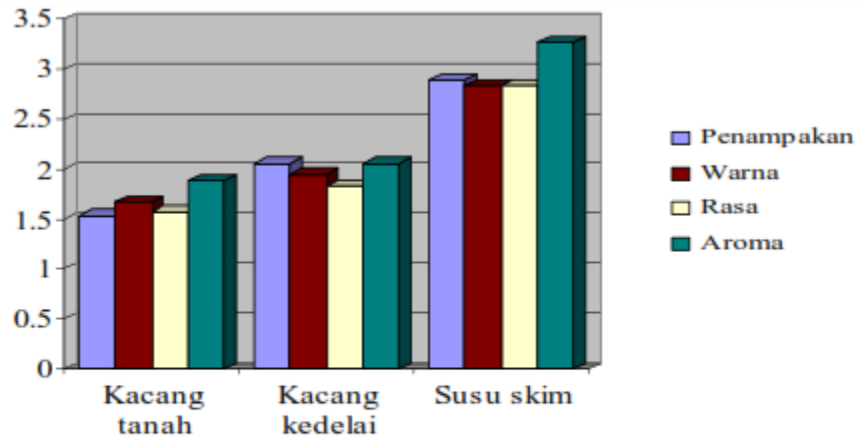
Gambar 3. Histogram nilai rata-rata kadar air (%) keju yang dibuat dari susu skim dan berbagai jenis kacang yang difermentasi dengan memanfaatkan aktivitas isolat BAL F_2 sebagai penggumpal.

Keju dari Kacang? (3/4)



Gambar 4. Histogram nilai rata-rata kadar protein (%) keju yang dibuat dari susu skim dan berbagai jenis kacang dengan memanfaatkan aktivitas isolat BAL F_2 sebagai penggumpal.

Keju dari Kacang? (4/4)



Keju susu skim, keju kacang kedelai dan keju kacang tanah memiliki tingkat kesukaan yang berbeda, baik dari segi aroma, rasa, warna dan penampakan. Dimana keju susu kacang kedelai dan keju kacang tanah memiliki tingkat kesukaan lebih rendah dibandingkan keju susu skim. Rendahnya tingkat kesukaan panelis terhadap keju kacang kedelai dan kacang tanah ini dikarenakan adanya pengaruh aroma, rasa, warna dan penampakan yang dihasilkan tidak sama dengan keju yang tersedia dipasaran, sehingga panelis belum terbiasa dengan aroma, rasa, warna dan penampakan yang dihasilkan.

Gambar 5. Histogram nilai rata-rata organoleptik keju yang dibuat dari susu skim dan berbagai jenis kacang dengan memanfaatkan aktivitas isolat BAL F_2 sebagai penggumpal.

Thank you