

High quality wheat

- locally grown and processed
- organic
- whole grain

Refined flour implicated in:

- Pellagra & beriberi*
- Heart disease**
- Colon cancer**
- Obesity**
- Diabetes**
- Gluten intolerance
- Neural tube defects*
- Alzheimer's disease*

* Reduced by adding vitamins back into refined flour

** Reduced by eating whole wheat flour

High quality wheat in California 1860 -1880

- Virgin soil
- Draught & grazing animals
- No irrigation
- Mediterranean climate wheat varieties
(short season = spring types; planted in
the fall)

“White” wheat grain color



Whole wheat bread from “white” wheat



1870s Hard Red wheat grown in Great Plains

- “Turkey” hard red wheat introduced in Kansas, grows well in Continental climate of Mid-West
- “Red Fife” hard red wheat growing well in Canada

1880 Roller milling of hard red wheat

- Roller mills quickly replaced stone mills almost completely in Western world
- Soft wheat varieties, white and red, were rejected by roller millers
- Only 66% refined flour from soft wheat vs. 75% from hard wheat

1900 Breeding for the millers

- Breeders crossed soft wheats with hard to make hard red wheat that would grow in Western and Eastern States, to please the roller millers
- Californian farmers grow less wheat, and instead grow fruit, & nuts

1950s

- Breeding for hard red & short stature, to withstand dense planting, high input fertilizer and irrigation, used to increase yield
- Herbicides used to remove weeds
- Short stature reduced risk of lodging with dense plant growth.

Landrace vs modern hybrid (both conventionally grown)



Approximately 1980s

- Breeders created “hard white wheat”
- Problematic as “white” wheat for health conscious buyers of whole wheat products

1860s Purified baker's yeast

- New leavening: bakers yeast + sugar
- Successful bread with refined flour
- Not symbiotic with lactic bacteria
- Disappointing bread with whole wheat, especially “white” wheat, and “durum” wheat

Durum wheat = pasta wheat

- Landrace durum wheat is very tall
- Highly drought tolerant
- Less breeding changes than for common wheat
- 1950s onwards, breeding for short stature and increased yield under high fertilizer input and irrigation

California wheat crop 2009

- Total 702,000 acres
- 57% Red wheat - half is feed wheat
- 12% Hard white wheat - some exported
- 6% Soft white wheat - milled out of state
- 25% Durum - a third of this is exported

Local whole wheat needs:

- Locally appropriate varieties, without irrigation
- Sustainable soil fertility for high quality
- Organic control of fungal disease - prevention is best
- Local grain infrastructure
- Whole wheat foods appreciation

Climate vs wheat type

- Mediterranean climate & low rainfall areas: white common, durum, pollard, turanicum, emmer
- Continental climate, cold winter: hard red common (long season), spelt
- Continental climate, intensely cold winter: hard red common (short season), spelt, possibly durum, turanicum, & emmer
- Coastal moderated, humid summer: soft red common, spelt (dry summer: soft white)

Whole wheat bread from “white” & “durum” wheat needs:

- Enzyme action from sprouted (malted) grains, to release gluten & sugars
- Sourdough ferment containing symbiotic yeasts and lactic bacteria, to acidify dough and control enzyme activity
- 15% protein in whole wheat, for good volume

14-15% protein is possible in California Sonora wheat

- 15.6%, farmer Sally Fox (Yolo County):
2001 following alfalfa
- 14.3%, Degge Hays at Frogs Leap
Vineyard (Napa County): 2004 organic
vegetable plot

Co-planted annual crimson clover and wheat



Suggesting annual clover in 3-4 year dry-farm wheat rotation

- Year 1: wheat + clover
- Year 2: grazing + clover (or fallow + clover)
- Year 3: vegetable + clover (optional)
- Year 4: peas + clover (or chickpeas + clover)

California wheat yield

Conventional irrigated modern varieties

- Common wheat in 2009: 4,800 # / acre (80 bushels / acre)
- Durum wheat in 2009: 6,000 # / acre

Organic dryland landrace

- Initially project approximately half or less of the conventional irrigated yields
- Added value is improvement of the soil and improved yield, and quality, in future years

Avoiding fungal disease in wheat

- Locally appropriate and resistant variety
- Fertile, moderately well drained soil
- Timely planting for rain and shine
- No irrigation
- Clean, dry and store grain immediately
- Rotate wheat out of field for at least 2 years

Planning for wheat

- Seed source?
- Planting equipment
- Combine harvester - small or large?
- Grain cleaner - on farm is best
- Storage and bagging of clean grain
- Stone mill, needs special clean room
- Marketing

Experimental loaf pollard wheat



Wheat Botany - simplified

1. Non-threshable wheat

- Diploid: Einkorn
- Tetraploid: Emmer
- Hexaploid: Spelt

2. Threshable wheat

- Diploid: none exist
- Tetraploid: Durum, Pollard, Turanicum & others
- Hexaploid: Common wheat & others

3. Common wheat

- Soft red
- Soft white
- Hard red
- Hard white
- Short and long season types possibly exist for all of these

Spring vs Winter wheat

- Short season wheat is needed for Spring planting, after non-survivable Winter
- Short season wheat is needed for late Fall planting and Winter growth, as in California
- Long season wheat is needed for a Fall planting through a cold, survivable, winter

Some original landrace “white” wheat* introductions in California

- *Sonora, from Mexico*
- *Little Club, from Chile*
- *White Australian, Pacific Bluestem, from Australia*
- *Foisy, from Oregon*

* White wheat requires dry summer to avoid sprouting in the ear