

10 Argentinian Wheat

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10.1 Wheat Growing Areas

Argentina's wheat growing region is divided into seven zones: I, II North and II South, III, IV, V North and V South (Fig. 31).

The zones differ in respect of both climate and the nature of the soil, with higher temperatures and dryness in the northern zones and lower temperatures, sometimes even cold conditions, in the south. Usually there is more precipitation in Zones III and IV.

This means that the yield per hectare is higher in these areas, but the protein values are often lower. Nor is it easy to draw conclusions about processing and baking quality, since in recent years, especially, there has been a trend towards higher-yield wheat in Zones IV and V South, in some cases resulting in poorer baking properties.

10.2 Marketing of Wheat

Wheat is currently marketed in the categories shown in Tab. 46.

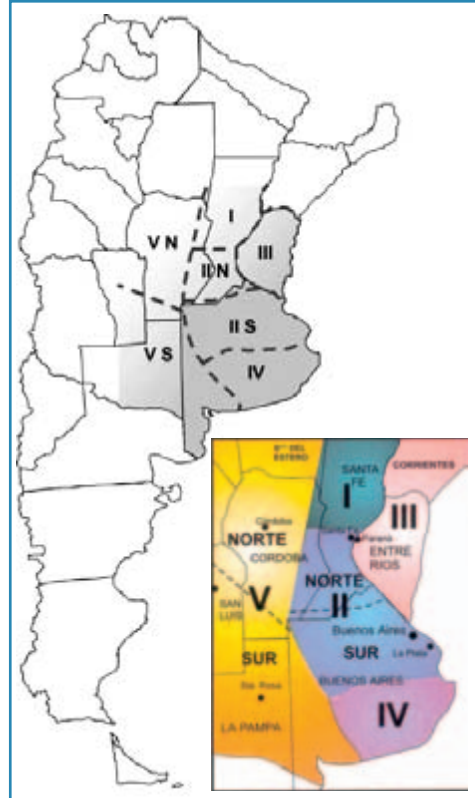


Fig. 31: Argentina's principal wheat-growing areas

Tab. 46: Current standards for the marketing of Argentinian wheat

Attributes		Category			Adaption
		1	2	3	% ^a
Hectolitre weight, min.	kg/hL	79	76	73	2.0
Foreign bodies	%	0.60	1.25	3.00	1.0
Heat-damaged grains	%	0.50	1.00	1.50	1.5
Damaged grains	%	1.00	2.00	3.00	1.0
Bunt-infected wheat	%	0.10	0.20	0.30	5.0
Soft wheat	%	15.00	25.00	40.00	0.5
Shrivelled wheat	%	1.25	2.50	5.00	0.5
Bitten grains	%	0.50	0.50	0.50	2.0
Foreign seeds	in 100 g	8	8	8	2.0
Moisture, max.	%	14	14	14	. ^b

^a Deductions or additions in percent for the differences between the values shown.

^b For deviations from the specified 14% moisture there is a special table of additions and deductions to take account of the cost of any necessary drying.

Tab. 47: Size of crops and flow of commodities for Argentinian wheat

Year	Yield	Size of crop	Domestic consumption	Export
	kg/ha	1,000 t	1,000 t	1,000 t
1950/1	1,106	5,796	2,789	2,767
1960/1	1,160	4,200	3,046	2,486
1970/1	1,329	4,980	3,391	2,307
1980/1	1,549	7,780	3,568	2,481
1990/1	1,892	10,959	4,131	5,866
2000/1	2,491	15,959	5,073	10,795
2001/2	2,270	15,160	4,700	10,459
2002/3	2,190	12,448	4,673	8,872

The uses of Argentinian wheat are shown in Fig. 32, taking the year 2003 as an example. Most of the wheat is exported (Tab. 47). The most important customer is Brazil, which imports about 70% (Tab. 48). Other buyers are Bolivia, Paraguay, Uruguay and Chile.

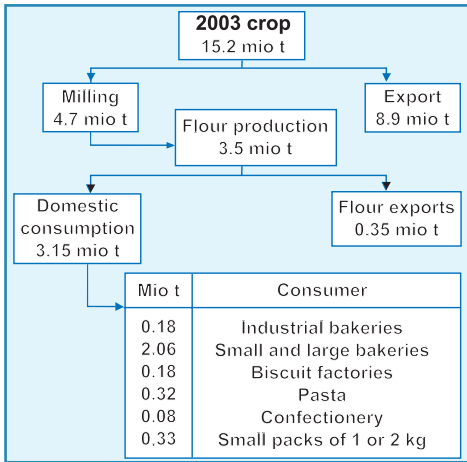


Fig. 32: Uses of Argentinian wheat, 2003

Exports are falling year by year because there are no quality standards. If Argentina could offer quality wheat, exports would increase again immediately. The neighbouring countries and other countries of South America that currently import quality wheat from the USA, Canada and even Europe would buy guaranteed quality. Of course Argentina's wheat producers would be more than happy to

Tab. 48: The chief importers of Argentinian wheat

Country	2000	2001	2002
Brazil	7,110,729	6,172,182	5,455,868
Bolivia	67,842	111,764	70,749
Chile	192,576	34,848	85,669
China	5,400	0	13,513
Colombia	39,150	0	40,263
Holland	540	1,864	559
Indonesia	46,150	0	140,814
Iran	437,802	973,141	728,849
Lebanon	55,678	14,206	0
Libya	85,626	0	0
Malaysia	31,440	0	0
Mozambique	25,950	49,672	28,952
Nigeria	71,424	33,600	55,160
Paraguay	71,321	43,196	0
Peru	529,278	372,505	468,623
Portugal	0	6,000	0
Syria	26,180	0	236,250
South Africa	261,234	310,958	235,226
Turkey	51,810	0	0
Uruguay	4,400	21,067	153,805
Venezuela	4,200	0	0
Other countries	1,676,191	1,200,015	1,158,321
Total	10,794,921	9,345,018	8,872,621

increase their production if they could achieve better prices, but this can only be done through guaranteed and consistent quality. Tab. 55 gives an overview of wheat qualities and their fluctuations.

10.3 The Market for Flour

Much the same applies to exports of wheat flour as to exports of wheat. The biggest buyers of flour made from Argentinian wheat are Brazil, Bolivia, Paraguay and Chile (Tab. 49). In Argentina, wheat flour is divided into 5 types (Tab. 50).

Tab. 49: Exports of flour (t)

Year	Angola	Bolivia	Brazil	Chile	Paraguay	Other countries	Total
1992	0	87,149	0	16,523	1,271	34,415	139,358
1993	0	83,443	0	9,549	10,133	67,638	170,763
1994	0	100,642	0	13,573	15,192	154,236	283,643
1995	0	87,558	0	6,038	8,290	122,039	223,925
1996	0	132,226	0	11,322	12,968	163,989	320,505
1997	3,645	134,000	0	12,000	9,000	474,235	478,035
1998	9,091	160,626	0	15,016	15,782	284,602	485,117
1999	20	142,175	171,527	13,501	37,180	9,788	374,191
2000	222	140,156	179,816	13,503	30,002	121,419	485,118
2001	242	164,726	142,453	17,533	17,697	142,466	485,117

The big industrial bakeries, biscuit and pasta factories and other bulk consumers are supplied exclusively by large mills that are able to meet the quality requirements stipulated by the buyers.

Tab. 50: Grades of Argentinian wheat flour

Flour type	Max. moisture	Ash content
	%	%
0000	15.0	0.492
000	15.0	0.650
00	14.7	0.678
0	14.7	0.873
1/2 0	14.5	1.350

But many medium-sized and small bakeries (processing up to 1,500 and 500 kg/day respectively) have quality problems, and there are about 20,000 such bakeries in Argentina. Most of them are supplied by small and medium-sized mills whose flour quality differs greatly and also fluctuates. So most bakeries buy their flour from 2 - 4 mills and mix it to keep the quality fluctuations as small as possible. In the choice of suppliers the price of the flour plays an important role, and the price is nearly always lower if the quality is poor. Flours for making bakery products and pasta are expected to have the following basic characteristics (Tab. 51). This means that only certain wheat varieties are suitable for particular applications. Some others may be "pepped

Tab. 51: Flour requirements for specific applications

Product	Protein	Ash	Wet gluten	Falling No.	Stability	W
	%	%	%	s	min	J-10 ⁻⁴
Baguettes		< 0.7	28-30			> 280
Hearth bread			> 30	300-330	> 20	330-370
Pannetone			32			280
Pizza			26			200-300
Fresh noodles	> 12	< 0.5	> 33	> 280		> 270
Crackers	> 11	< 0.7	27			200-400
Cookies	> 11		20-23	225		250
Durum pasta	> 12-13	< 0.55	28-34			180

10.4 Wheat Harvest of 2003

up" for these purposes by flour treatment. Because of the poor wheat qualities, many mills treat their flours. This requires careful consideration, since nearly all bakeries use baking improvers. Overdoses may easily result, and they impair the quality of the bread.

10.4 Wheat Harvest of 2003

At 3.84 mio t, Zone V South had by far the biggest crop (Tab. 52). The main reasons for this were the good quality of the soil, the fresh ground water, the use of fertilizers in some cases and normal precipitation and temperatures. Conditions were similar to this in Zone IV, where the second-largest crop was achieved.

But the consequence of the large crops in the two zones was very low gluten levels. It is noticeable that in these zones the stability of the Farinogram was very good, whereas water absorption was poor. Apparently the reason was the unusually low soil temperatures during the ripening period.

The average attributes of the 2003 harvest are shown in Tab. 53. The quality values of the harvest are very typical.

5,559 samples were taken in the 7 zones of the wheat growing region. From these, 314 average samples of 4 kg of wheat each (representing 4,000 t) were made up for the quality tests on the basis of the quantities harvested in the zones. The samples were

Tab. 52: Size and quality of the 2003 crop according to zones

Zone	Quantity (t)	Quality
I	796,375	Very good
II North	1,445,625	Very good
II South	1,187,113	Very good
III	465,133	Good
IV	2,647,335	Normal
V North	1,035,520	Very good
V South	3,837,691	Normal
Others	885,870	Good
Total	12,300,662	
Argentina		
	4,464,633	Very good
	1,351,003	Good
	6,485,026	Normal

ground on a Bühler laboratory mill at SENASA (*Servicio Nacional de Sanidad y Calidad Agroalimentaria*; the government supervisory authority for animal and vegetable products). The flours were analyzed in the laboratories of the corn exchanges in Buenos Aires, Rosario and Bahía Blanca.

The attributes of the 2003 harvest as a raw material are shown in Tab. 53. The following factors are noticeable in comparison with the harvests of 1999-2002 (Tab. 55):

Tab. 53: Attributes of the 2003 harvest as a raw material

Attributes		Min.	Max.	Mean
Hectolitre weight	kg/hL	69.20	84.90	79.41
Damaged grains	%	0.00	8.30	1.31
Foreign bodies	%	0.08	2.18	0.53
Shrivelled or broken grains	%	0.23	3.04	1.02
Soft grains	%	0.00	39.90	3.18
Protein, 13.5% m.b.	g/100 g	8.90	13.50	11.60
1000-Kernel weight	g	22.67	39.90	31.47
Ash content of dry matter	g/100 g	1.480	2.172	1.919

a) reduced 1000-kernel weight;
b) increase in the whole-grain ash content each year;

c) reduced gluten content;
d) larger bread volume.

Tab. 54: Quality attributes according to zones (harvest of 2003)

Attributes		I	II N	II S	III	IV	V N	V S	Mean
Milling									
Yield	%	71.7	70.7	67.2	69.8	71.7	70.4	68.4	69.7
Ash content (d.b.)	%	0.622	0.619	0.604	0.576	0.556	0.608	0.590	0.585
Flour									
Moisture	%	13.20	12.80	13.40	13.20	12.60	13.30	13.40	13.10
Wet gluten	%	30.7	29.6	27.9	27.8	22.2	29.5	20.9	24.3
Dry gluten	%	11.2	10.8	10.1	10.7	8.3	10.5	8.0	9.0
Gluten Index		97	96	95	96	98	98	99	98
Falling Number	s	318	393	386	402	359	392	363	372
Zeleny test	mL	41	35	34	35	38	40	36	37
Farinogram									
Water absorption	%	59.6	61.8	59.7	60.5	56.6	62.0	55.7	57.9
Dough development	min	7.9	8.8	6.4	8.2	8.0	12.9	7.9	8.3
Stability	min	13.8	11.5	13.6	8.6	15.9	13.3	15.1	14.2
Dough softening	FU	39	80	59	134	49	74	35	56
Mixogram									
Dough development	min	4:00	3:30	4:0	3:30	4:00	3:30	4:30	4:02
Class		6	6	6	6	6	6	6	6
Argentinian class^a		A	A	A	B	A	A	A	A
Alveogram									
P	mm	90	101	94	80	83	116	88	90
L	mm	95	82	95	89	71	77	75	78
G		22	20	22	21	19	19	19	20
W	$J \cdot 10^{-4}$	309	293	307	250	220	328	235	255
P/L		0.95	1.23	0.99	0.89	1.16	1.51	1.17	1.16
Alveogram curves									
Results of baking									
Water absorption	%	62.5	61.0	62.5	61.0	61.6	62.5	61.0	61.5
Dough-making time	min	3:00	3:00	3:00	2:30	3:00	3:00	3:00	2:48
Fermentation time	min	160	160	160	160	160	160	160	160
Bread volume	mL	815	800	830	780	719	795	660	733

^a Argentinian rating of the Mixograph results: class A - good or very good stability; class B: little stability, large softening

10.4.1 Whole-Grain Ash Content

The differences are very large, the minimum being 1.480% and the maximum 2.172% at an average of 1.919%. There are various reasons

for the high ash content. They include small grains, very salty ground water and a dry climate. A noticeable feature is that the ash content increases from one year to the next. It was 1.757% in 1999 and 1.919% in 2003.

Tab. 55: Wheat quality in the years 1999 - 2003

Attribute		1999	2000	2001	2002	2003
General values						
Hectolitre weight	kg/hL	82.01	80.79	80.68	79.00	79.41
1000-grain weight	g	34.7	32.7	32.4	37.6	31.47
Moisture	%	12.7	11.6	11.5	11.7	11.6
Ash content (d.b.)	%	1.757	1.780	1.879	1.848	1.919
Protein, 13.5% m.b.	%	11.0	11.6	11.1	11.1	10.9
Wet gluten	%	25.2	26.2	25.0	24.7	24.3
Dry gluten	%	9.4	9.5	9.0	8.9	9.0
Gluten Index		95	-	95	97	98
Falling Number	s	365	364	378	384	372
Zeleny test	mL	36	37	37	38	37
Farinogramm						
Water absorption	%	64.2	59.2	59.8	59.6	57.9
Dough development	min	11.24	9.4	9.4	6.1	8.3
Stability	min	15.24	17.9	16.4	10.7	14.2
Dough softening	BU	53	38	44	61	56
Mixogram						
Dough development	min	4:24	4:08	4:25	4:13	4:02
Class		6	6	6	6	6
Alveogram						
P	mm	98	104	102	93	90
L	mm	82	73	76	88	78
G		-	18	19	21	20
W	$J \cdot 10^{-4}$	297	291	277	269	255
P/L		1.21	1.43	1.41	1.06	1.16
Results of baking						
Water absorption	%	62.2	61.7	62.0	61.7	61.5
Dough-making time	min	3:30	3:24	3:11	3:12	2:48
Fermentation time	min	160	160	160	160	160
Bread volume	mL	642	647	644	700	733

10.4.2 Gluten Content

The gluten content was normal in all the zones except IV and V South, where it was only 22.2% and 20.9% respectively. The main reason for this was the wheat varieties with extremely high yields of about 6,000 to 8,000 kg/ha. The normal yields of wheat varieties with a gluten content of 28 - 32% are around 2,000 - 2,500 kg/ha.

In these zones the mills have to be very careful when buying wheat.

10.4.3 Falling Number

In none of the zones were there problems with sprouted wheat. The mean values were all above 300 s. The Falling Number for a normal baker's flour is 300 - 350 s. So nearly all the mills have to correct the high Falling Numbers by adding α -amylase.

10.4.4 Farinogram

It is noticeable that a dough stability of 15.9 and 15.1 min was found in Zones IV and V South in spite of the low gluten content of 22.2 and 20.9%. A normal baker's flour with a gluten content of 26 - 28% has a dough stability of 10 - 12 min, and only special flours with 28 - 32% gluten usually achieve as much as 15 min.

10.4.5 Alveogram

The best results were found in Zones I, II North, II South and V North. This is due to the optimum climatic conditions and the wheat varieties grown.

10.4.6 Results of Baking

The average bread volume of 733 mL from 100 g of flour is the highest of the past four years. The reasons for it are the very good qualities of the wheat varieties used and the climate in Zones I, II North and II South, which achieved volumes of more than 800 mL.

No appreciable differences are to be found between the average quality attributes of the 2003 crop and those of the harvests of 1999 to 2002 (Tab. 55), but a noticeable feature is the low 1000-grain weight of the 2003 crop and the continuous increase in the whole-grain ash content since 1999.

There are, however, considerable differences in quality between the seven growing zones. Whereas the wet gluten content is 30.5% in Zone I, it is only 22% in Zone V South. And these are only average values; the differences between the lowest and highest values are much greater still.

The general opinion of the millers is that the quality of the wheat has deteriorated in recent years. This is due largely to the many new wheat varieties that have been bred for higher yield rather than quality. But this is contradicted by the high baking quality of the wheat from Zones IV and V South, which shows that an increase in yield does not necessarily result in deterioration of all the technical attributes of the wheat.

10.5 The Problem of Non-Classification of Wheat

Argentina still has no standards for classifying wheat according to quality. But there are buyers who would be willing to pay extra for a specific, guaranteed quality. The consequence is that marketing has become increasingly complicated and expensive.

The problem starts with the farmer. As he is not paid more for quality, he chooses varieties with a high yield rather than the best quality.

To avoid quality problems the mills have to analyze every truck load of wheat. In many cases Farinograms and Alveograms have to be made in addition to the traditional analyses for gluten content, Falling Number etc. For example, Argentina's biggest bread factory only buys flours from mills that have a Farinograph. It demands a water absorption of 60 - 62% and a stability of 15 - 17 min. Biscuit factories ask for a gluten content of 18 - 22% for sweet biscuits and 30 - 32% for crackers.

Wheat dealers and exporters are obliged to make a careful analysis of the wheat in laboratories of their own in order to charge better prices. Moreover, some Brazilian mills are now asking for Farinogram values.

Failure to classify wheat has also led to a situation where Uruguayan mills import wheat from Germany and Poland although they are only 250 - 400 km from Buenos Aires.

Argentina has always sold its exports of about 10 mio t of wheat by charging low prices, never on the basis of quality, although the country does produce some high-quality wheat. But since there is no classification, the latter can never be proved.

Many experts are of the opinion that Argentina is pursuing a trading strategy that is no longer acceptable internationally. As an exporter of wheat, Argentina has to compete with Canada, the USA, Australia and now even with France, Germany, Poland and some other countries. Quality has become a precondition for every transaction, which means that it is no longer possible to sell Argentinian wheat on the international grain market without a quality guarantee. Internationally, the lack of quality wheat is a fact. Argentina has a chance to position itself on the world market with wheat of good quality. It remains to be seen whether the intended classification is enough to achieve this objective.

10.5.1 Proposed Classification

Work on this proposal is currently being carried out by the following institutions:

- AAPROTRIGO – Asociación Argentina de Productores de Trigo
- CONASE – Comisión Nacional de Semillas
- INTA – Instituto Nacional de Tecnología Agropecuaria
- SENSA – Servicio Nacional de Sanidad y Calidad Agroalimentaria

The classification is expected to come into effect in 2005. The protein values are calculated on the basis of 13.5% moisture.

Quality class TDA 1 SUPERIOR ¹³

Argentinian hard wheat 1 with 3 protein levels: 10.5 - 11.5%, 11.6 - 12.5% and over 12.5% protein.

Quality class TDA 2 SPECIAL

Argentinian hard wheat 2 with 3 protein levels: 10.0 - 11.0%, 11.1 - 12.0% and over 12.0% protein.

Quality class TDA 3 STANDARD

Argentinian hard wheat 3 with 2 protein levels: 10.0 - 11.0% and over 11.0% protein.

10.6 The Most Common Shortcomings of Argentinian Wheat

Typical shortcomings are low gluten levels and gluten quality, too little amylase activity and, in recent years, infestation with *Fusarium*.

The quantity and quality of the gluten depends on the wheat variety and the zone. In the southern growing areas, gluten levels of only 18 - 22% are not uncommon. Moreover, these glutenins are often short and have poor extensibility.

Low amylase activity is usual. The typical Falling Numbers are between 350 and 450 s. Very occasionally there are wet harvests in a few zones, and the Falling Number may then drop to 150 - 250 s.

Infestation with *Fusarium* has become more common in recent years. There are no standards of any kind for marketing *Fusarium*-infested wheat. The mills rely on visual inspections and try to remove the infested wheat in the cleaning process. The wheat is then usually ground on a hammer mill and mixed with the bran.

¹³ TDA = Trigo Durum Argentina