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## Durum wheat in Spain

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**SUMMARY** - The durum wheat area in Spain has increased by sixfold from 100,000 ha to more than 600,000 ha in less than 5 years. The production has increased from 400,000 to more than 1200,000 metric tons. Traditional tall varieties were replaced by productive ones. The leading variety is Vitron and covers 46% of the total area. The grain quality is dependant on environmental variations. Late rains affect vitreousness and falling number, and drought the test weight. Yellow pigment and sedimentation test showed an important genetic effect, whereas test weight, protein content, and grain strong seasonal effects.

**Key words:** Varietal evolution, production, yield, yellow pigment, sedimentation test, vitreousness, test weight, protein content.

**RESUME** - "Le blé dur à l'Espagne". La surface emblavée en blé dur en Espagne a été multipliée par six et est passée de 100.000 ha à plus de 600.000 ha en moins de cinq ans. La production a augmenté, passant de 400.000 à plus de 1.200.000 tonnes métriques. Les variétés traditionnelles de haute taille ont été remplacées par d'autres plus productives. La variété qui vient en tête est Vitron, qui représente 46% de la surface totale. La qualité du grain est dépendante des variations environnementales. Les pluies tardives affectent la vitrosité et le nombre de chutes, et la sécheresse affecte le poids moyen des grains. Le pigment jaune et le test de sédimentation ont montré un effet génétique important, tandis que le poids moyen des grains, la teneur en protéine, et le rendement en grain comportent des effets saisonniers importants.

**Mots-clés :** Evolution variétale, production, rendement, pigment jaune, test de sédimentation, vitrosité, poids moyen des grains, teneur en protéine.

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Durum wheat has been historically grown across the Iberian peninsula. Higher yields of soft wheat and barley relegated this crop to drylands and high altitude areas. In 1978, durum wheat crop area reached its historical minimum of 88,000 ha, one third of the area grown in 1965 (Fig. 1). Through the late eighties, durum wheat was seeded around 100,000 ha, 6% of the total wheat area and 2-3% of total cereal area. In the last three years, EEC subsidies have caused a sharp increase that reached 600,000 ha in 1992. This represents 29% of the total wheat area and 7% of the total cereal area. Durum wheat crop area has increased at the expenses of soft wheat. Durum wheat is grown in two distinct areas: South (Andalucía and Badajoz) and North-Centre. 85% of the crop area and 75% of the production occurs in the Southern zone. Increase in crop area due to subsidies in the last years has been shown in both zones.

The Southern zone climate is Mediterranean with mild winters and variable rain patterns (average of 450 mm distributed along the growing season). CIMMYT early varieties are sown at the end of November or December and harvested in May-June. Yields vary from 2-4 t ha<sup>-1</sup> in drylands to 6-7 t ha<sup>-1</sup> in irrigated fields. Diseases like *Septoria*, stripe rust and powdery mildew can be a problem due to high temperature and humidity. Precocity allows escape from stem rust attack. Overall quality is high.

The North-Centre zone includes the rest of the country, mainly the Ebro valley (Aragón). Weather is more continental with higher frost risk in winter. Rainfall is lower (200-300 mm) and less evenly

distributed. Longer cycle varieties are sown in November and harvested in June-July. Drylands have lower yields, but irrigated fields reach 7-8 t ha<sup>-1</sup>. Diseases are less important except for BYDV and quality is acceptable.

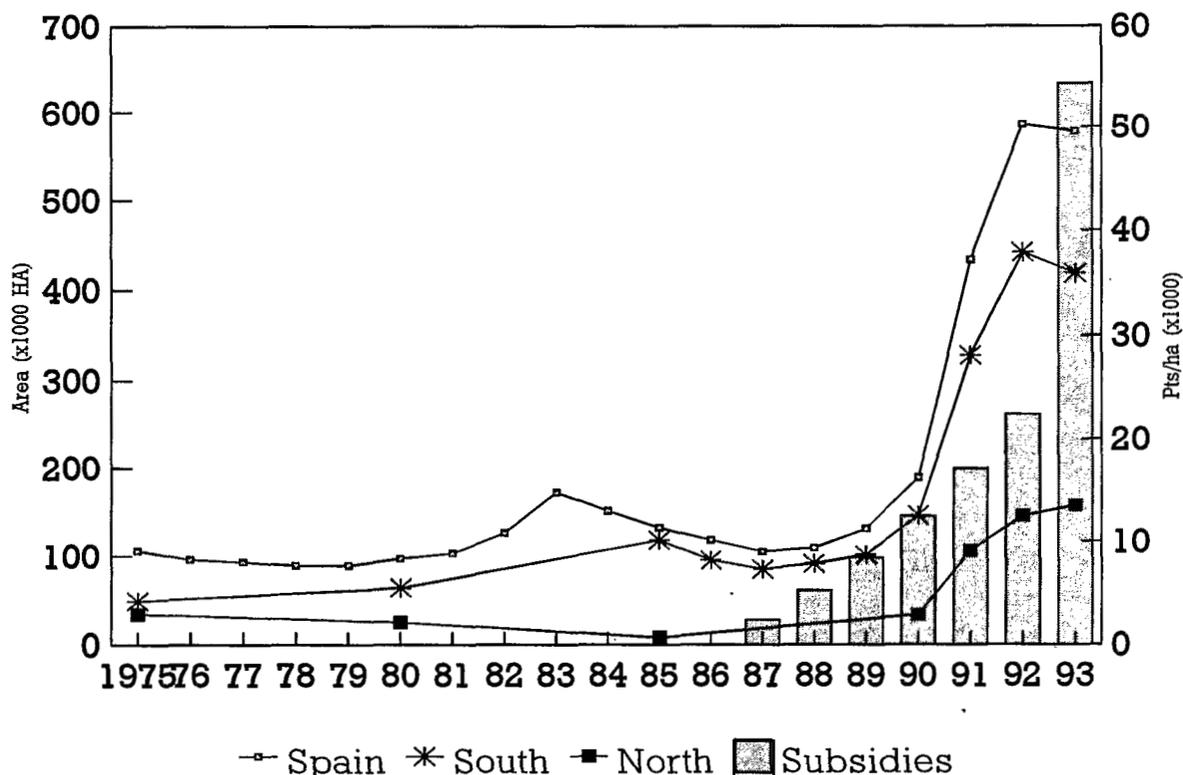


Fig. 1. Evolution of durum wheat area in Spain (Source: MAPA).

Up to 1971, mean yield was below 1 t ha<sup>-1</sup>. Since then, yield increased gradually mainly due to high yielding new CIMMYT varieties (Fig. 2). Yearly variations are mainly due to overall quantities and distribution rainfall patterns. Total production increased from 300,000 t in the 1980's to more than 1,200,000 t in the last year.

Varietal structure has evolved over time (Fig. 3). Traditional tall varieties ("Farto", "Bidi 17", "Andalucía 344" and "Senatore Capelli") were preferred through 1976 when new CIMMYT varieties were released. "Cocorit" first, and "Mexa" during the 1980's reaching 80% of the crop area have dominated the market. In the last few years "Mexa" is being replaced by "Vitrón" and "Jabato" in the South and by "Antón" in the North. The National List includes over 50 commercial varieties. Lately, more than 20 varieties are under registration tests every year. Until now, not a single variety has both high yield and good quality. This is why in the next years there should be important changes in the varietal structure.

Use of certified seed is around 20%, lower than in other European countries. In 1993 there were 25 varieties in the market, making a total of 19,857 t of certified seed. The five top varieties made 86% of total production and were:

"Vitrón"	46.0%
"Mexa"	19.2%
"Jabato"	12.6%
"Antón"	4.5%
"Roqueño"	3.8%

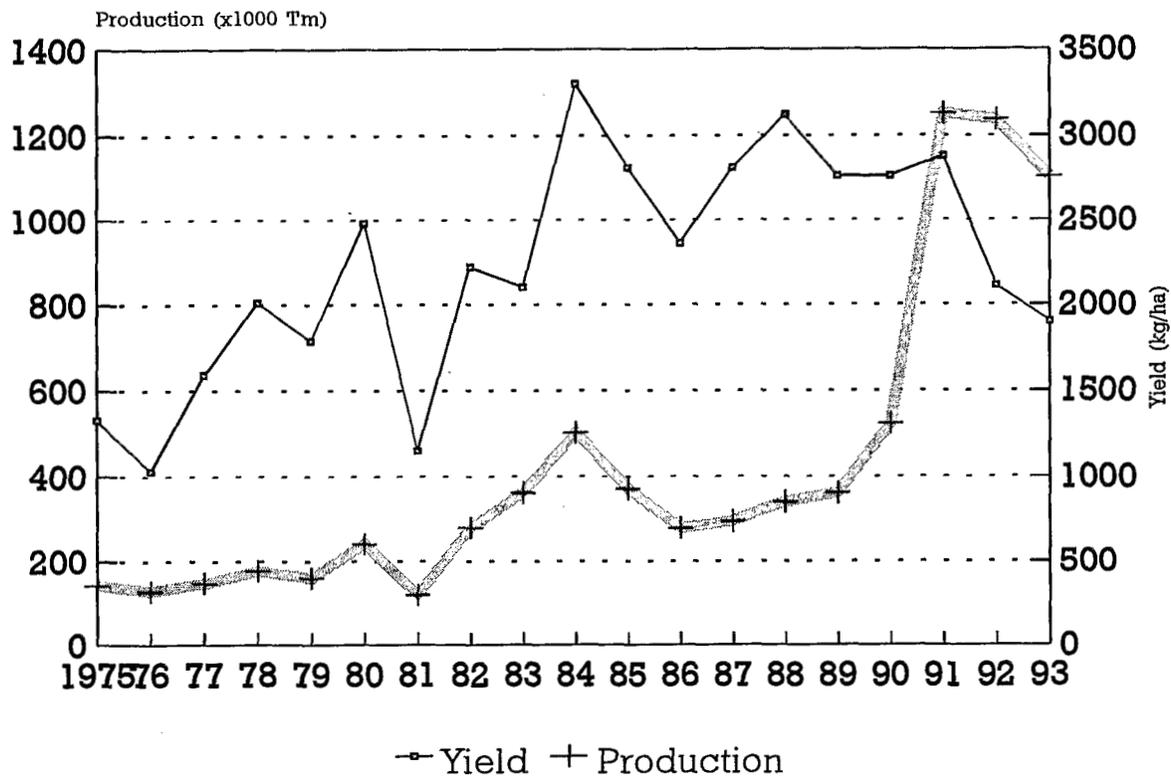


Fig. 2. Evolution of production and yield of durum wheat in Spain (Source: MAPA).

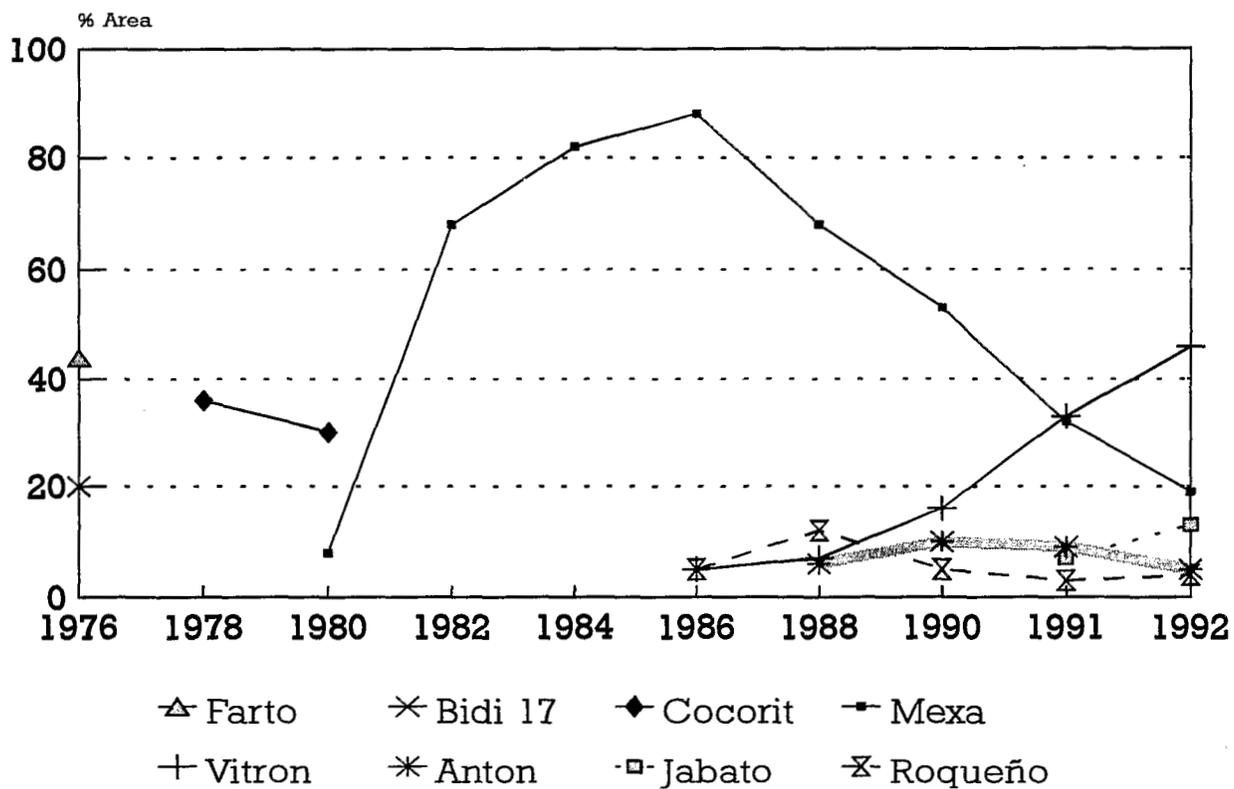


Fig. 3. Varietal evolution in durum wheat in Spain (Lupton, 1992; INSPV).

In the South there is also an important fraction of non certified seed of unregistered varieties.

Table 1. Results of the "Survey on quality of durum wheat in Spain" by zones and varieties (Source: Grupo de Trabajo de Cereales)

1991	Area (%)	TW (kg hl <sup>-1</sup> )	Vit (%)	Prot (%)	Ash (%)	YP (ppm)	FN (s)
Andalucía (South)	78.2						
Vitrón	48.3	81.6	82.9	12.1	1.7	7.1	383
Mexa	41.6	79.9	82.1	12.3	1.7	7.1	374
Gallareta (Altar) <sup>†</sup>	10.0	82.8	81.7	11.3	1.6	6.8	373
Extremadura (South)	6.8						
Vitrón	54.5	81.2	88.7	12.9	1.7	7.3	387
Mexa	36.4	78.8	92.0	12.5	1.7	7.6	380
Aldura	9.1	82.2	96.0	15.4	1.7	6.5	385
Aragón (North)	9.6						
Antón	47.4	77.7	85.5	14.2	1.6	7.3	362
Roqueño	26.3	79.6	92.8	13.5	1.6	6.6	400
Bidi 17	21.0	80.8	97.5	14.4	1.5	6.7	383
1992	Area (%)	TW (kg hl <sup>-1</sup> )	Vit (%)	Prot (%)	Ash (%)	YP (ppm)	FN (s)
Andalucía (South)	72.7						
Vitrón	47.2	79.3	66.0	13.7	1.7	5.3	301
Mexa	43.1	76.6	74.8	15.5	1.9	5.4	318
Gallareta (Altar) <sup>†</sup>	5.9	79.4	86.0	13.9	1.8	4.7	367
D. Pedro (Carc/Auk) <sup>†</sup>	3.9	77.4	94.0	16.5	2.0	5.6	357
Extremadura (South)	8.3						
Vitrón	50.0	77.7	24.7	13.6	1.7	5.4	205
Duradero	33.3	72.5	38.0	18.3	2.3	6.8	70
Aragón (North)	19.8						
Antón	65.0	75.6	75.0	13.6	1.8	7.9	324
Bidi 17	25.0	76.1	87.2	16.0	1.4	8.7	307
1993	Area (%)	TW (kg hl <sup>-1</sup> )	Vit (%)	Prot (%)	Ash (%)	YP (ppm)	FN (s)
Andalucía (South)	61.2						
Vitrón	41.2	79.1	81.0	14.3	1.7	6.9	306
D. Pedro <sup>†</sup>	27.5	79.2	85.0	14.9	1.7	7.9	302
Mexa	17.5	77.4	84.0	14.4	1.8	7.8	324
Extremadura (South)	7.9						
Vitrón		76.3	70.0	15.5	1.8	7.6	349
Aragón (North)	23.3						
Antón	80.0	77.4	92.0	13.3	1.9	8.6	356
Bidi 17	11.4	79.1	96.0	14.6	1.7	6.3	345

<sup>†</sup>Non registered varieties

TW: Test weight, Vit: Vitreousness, Prot: Protein content, YP: Yellow Pigments, FN: Falling Number

Centralized information about quality of Spanish durum wheat production is not available. Table 1 summarizes the results of a "Survey on quality of durum wheat in Spain" that started in 1990. Samples are analysed in proportion to the area of each variety in each zone. Overall quality is good, but there are occasional quality drops due to adverse weather conditions. For instance, in the South in 1991 grain had low protein content, probably associated with high yields. Drought during the growing season

and late rains in 1992 resulted in low test weight, vitreousness and falling number which is infrequent in the South. Low test weight due to lack of rainfall is the quality limiting factor in drylands of the North zone.

To analyze the causes for variation in the quality of durum wheat in Spain, official checks of the National Variety Registration Trial were used. Results of 10 sites in 1991 and 7 sites in 1992 belonging to both South and North zones were analyzed. Variance components were estimated according to a mixed model. Zone (Z) was considered as a fixed factor and the others (year (Y), site (S), variety (V) and their interactions) were considered as random factors. Test weight, vitreousness, protein, yellow pigments and SDS sedimentation test were determined by the Cereal Quality Laboratory of INSPV.

No significant differences were detected between both North and South for all quality traits and yield analyzed. Variance components estimated for random factors are included in Fig. 4. Yellow pigments and SDS sedimentation test were traits with an important genetic component. New varieties should incorporate good expression for both characters. Vitreousness showed an important variation due to Z x S interaction. This different response of some sites inside a determined zone together with low magnitude of the interaction involving years, suggests that improvement for this character could be attained by the use of specific agronomical techniques (fertilization, irrigation, etc.) to improve that trait. Test weight, protein content and yield showed a more uncontrollable variation since the main components of variance estimated those interactions involving year.

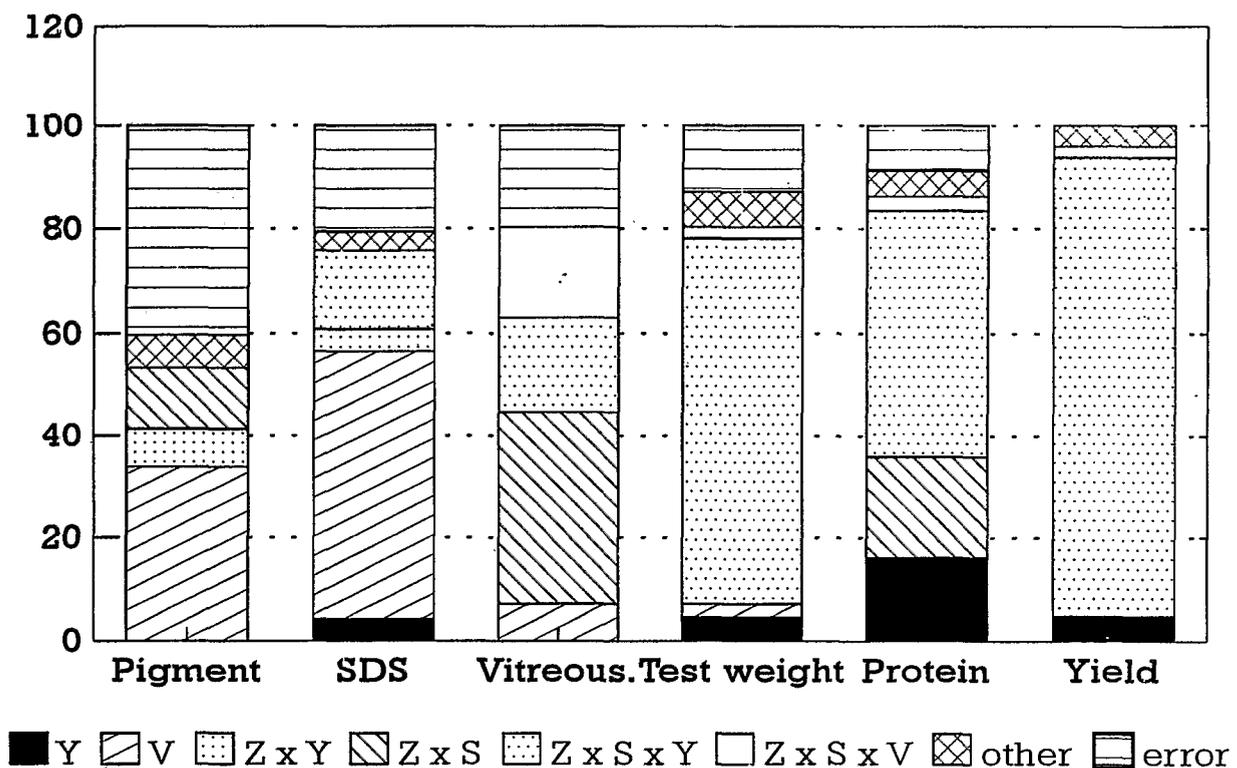


Fig. 4. REML variance components estimates of 5 quality parameters in durum wheat.

Durum wheat future in Spain is uncertain. New varieties, growing techniques, quality standards and EEC policies are part of the unknowns. On top of this, Spanish agriculture needs to change its commercial structure and to develop its agrarian research.