

B. Origin and Breeding History

UC 15 is the varietal name proposed for line 8615 of the UC Davis garbanzo breeding program. The selection is a Fusarium-wilt resistant garbanzo line derived from a cross of wilt-susceptible UC5 x the wilt-resistant Mexican variety Sonora, made in 1981 by Dr. Ken Foster. F₃ families were screened in a wilt infested field (Dutra field) in Santa Barbara county in 1983. The F₄ was grown at Davis and selected for seed type. The F₅ was grown in Baja Mexico (in winter 1984-85) and subsequent generations have been grown at several wilt infested locations in the Central Coast, at Davis, and in the San Joaquin Valley at West Side Field Station. Breeders seed was established from a 1987 Davis planting of the F₇ generation, bulked in the F₆.

Those involved in the selection in the wilt field in the F₃ generation were Ken Foster, Bill Isom, and Warren Bendixen. Recent on-farm yield trials in the Central Coast have been handled by Bill Isom in cooperation with growers and with farm advisors Warren Bendixen, Mike Smith, and Harry Agamalian.

C. Description of the Variety

Species: Cicer arietinum; subgroup "Kabuli".

The plant type and size of line 8615 resemble those of UC5. The leaf morphology is compound, with pinnate leaflets. The line is a typical Kabuli type garbanzo, with a large growth habit, white flowers and large cream-colored

and wrinkled seeds. It differs markedly from the wilt-resistant garbanzo (Surutato) now being grown in California by having compound rather than simple leaves and by having a larger plant form, and slightly smaller seeds (at 4 coastal locations seed size of 8615 averaged 51.7 g/100 seeds and that of Surutato, 58.8/100 seeds).

D. Performance

1) Disease Background

In the 1960 and 1970's the garbanzo industry in the Central Coast was afflicted with a soil-borne disease problem which was investigated and considered to be due mainly to the root rot pathogen Fusarium solani f. sp. pisi.

At that time Fusarium wilt was not thought to be a problem on garbs in California. Growers and others apparently brought in seed from Portugal and possibly Spain and Mexico and tried out these new varieties. It is probable that the wilt pathogen was introduced on seed from one or more of the these locations.

In an attempt to obtain and release a "root-rot" resistant line, selection was carried out within the old California landrace "White Spanish" in a "root-rot" field near Buelton, and the result was the variety "Mission", released in 1980. In addition, a second variety of higher quality was developed from "White Spanish" and named UC5.

Neither variety proved resistant to whatever was causing early death, and the industry was only temporarily

saved by the introduction, in about 1981, of a variety from Mexico (Surutato), which had been bred there for resistance to Fusarium wilt. It is not known if this variety has resistance to root rot, but in any case it has survived and Mission and UC5 could not continue due to their susceptibility to wilt, which had become widespread in the Central Coast.

Although resistant to wilt, Surutato proved to be low yielding in comparison with earlier yields of White Spanish and the lines derived from it.

As it has turned out, wilt is much more devastating to garbs than is root rot due to F. solani, so recent work has concentrated on obtaining resistance to wilt.

2) Disease resistance: Field:

Line 8615 was grown in 1985, 1986, and 1987 at the Giorgi farm in Santa Barbara County where UC5 was killed by Fusarium wilt in nearby rows each year. Line 8615 did not show wilt symptoms, remaining healthy and yielding well, whereas UC5 died in the seedling stage.

In 1986 and 1987 it was also grown at the Tonini farm in San Luis Obispo county where it did not suffer wilt, unlike nearby plots of UC5 which died before maturity due to Fusarium wilt.

In 1987 it was grown at the Wineman farm in San Luis Obispo county and it remained healthy where UC5 nearby was generally killed before maturity due to Fusarium wilt.

At Davis and at the West Side Field Station, locations without the chickpea wilt Fusarium, line 8615 has yielded well and has shown only minimal damage from virus diseases and from Sclerotinia blight. It is neither more nor less vulnerable to these pathogens than the average for all breeding lines. The viruses involved are Beet Western Yellows, Legume Yellows and Subterranean Clover Red Leaf.

3) Disease Resistance: Greenhouse

Line 8615 has been grown in the greenhouse at Davis in soils from 8 locations in 3 coastal counties and it has remained healthy in the same pots where UC5 has been killed consistently before flowering.

Isolations have been made from UC5 and from other susceptible lines in the same pots, and the wilt pathogen Fusarium oxysporum f.sp. ciceri has been obtained from each soil. Identification of the pathogen has been based on accepted morphological criteria and the accuracy of our identification has been confirmed independently by Dr. Shirley Nash Smith, the Berkeley Fusarium expert who worked many years with Prof. W. C. Snyder.

Based on the diversity of coastal location soils where line 8615 remains wilt resistant, it is concluded that this line is resistant to the strains of wilt now present in California.

4) Quality

Canning quality is of paramount importance, after wilt-resistance, for any new garb release for California. This is because most of the product is canned, and appearance after canning is a key to acceptance and pricing. This is also due to the fact that the import competition from Mexico is carefully sized in Mexico, resulting in size uniformity both before and after canning.

The existing California grown, wilt-resistant variety is the Mexican variety Surutato and it has been assumed that it is the standard for quality.

However, in competitive canning tests with Surutato, from different locations in California, line 8615 has consistently been rated by the canners as superior to Surutato (Table 1).

Table 1. Comparison of canning quality of line 8615 with variety Surutato.

	<u>Ratings, seed source, and canner</u>					\bar{X}
	Tonini	WSFS	Wineman	Davis	WSFS	
	CHB	S&W	S&W	S&W	S&W	
	5/87	8/87	11/87	11/87	11/87	
<u>Entry</u>						
8615	2	2	2	1	1.5	1.7
Surutato	3	3	3	3	2	2.8

 CHB = Davis Cannery at Atwater

S&W = S&W at Modesto

1 = Superior appearance; for main S&W label

2 = Good appearance, some size and color variation and slight cracking. No splits or starch.

3 = Not acceptable due to splits and starch release or excessive color or size variation.

From both coastal and valley locations, line 8615 was rated superior to Surutato on the basis of better color, better firmness, and less starch leakage (which results from splits and cracks). Across environments, line 8615 has shown greater consistency of color than Surutato. Surutato has been downrated by the canners for its final pale white color, in comparison to the light golden color of line 8615.

In addition, Surutato has had more seed coat cracking and its larger size (58.8 g/100 seed) are both considered negative factors by California canners when compared with line 8615.

5) Yield Potential

Yields of all our lines, including line 8615, and of Surutato vary greatly depending on year and location. At the coast with dryland summer production on residual winter rainfall, yields are generally low for all lines, and superiority of a particular line is difficult to confirm consistently. Under irrigation, either at the coast or in the central valley, line 8615 consistently outperformed variety Surutato in yield (Table 2). In Monterey county in 1987 line 8615 yielded 42 bags/acre in comparison with 32 for Surutato.

Table 2. Yields of 8615, UC5, and Surutato at four coastal locations, 1987.

<u>Entry</u>	<u>Yield and Location</u>			
	Morgantini	Pata	Wineman	Tonini
	Monterey, Co.	St. Barb. Co.	S.L.O. Co.	S.L.O Co.
8615	41.7	27	13.1	14.7
UC5	40	23.6	(4)	(0)
Surutato	32.4	27	12.9	14.3

C.V. %	9.7	14.3	16.2	9.5
LSD at 5%	4.96	5.09	3.57	1.89

Note: Yield calculated as cwt/acre based on plots
5'x25' rows with four replications.

Note: First two locations were irrigated. The last
two were dryland, on wilt soils, and UC5 was not
part of statistical analysis at those sites.

In Santa Barbara county over two years, line 8615 outyielded Surutato by 6 bags/acre (Table 3). Under dryland conditions at two coastal locations the yields of the two are more or less equal. However, line 8615 produces a larger, more branching plant and on good sites it has greater yield potential.

Table 3. Yield of 8615, UC5, and Surutato over two years on wilt infested soil in Santa Barbara County, grown with supplemental irrigation.

<u>Entry</u>	<u>Yield and Year</u>		
	<u>1986</u>	<u>1987</u>	<u>\bar{X}</u>
8615	24	29.2	26.6
Surutato	14.5	26.7	20.6
UC5	0	0	0

C.V. %	20.3	13	
LSD at 5%	5.2	6.0	

Note: Yield in cwt/acre with four reps of plots 5'x25'.

In the central valley at WSFS, line 8615 has outyielded Surutato over two years by over 9 bags/acre and it slightly outyielded the wilt susceptible UC5 (Table 4).

Table 4. Yields of 8615, UC5, and Surutato on a non-wilt soil at the West Side Field Station over two years.

<u>Entry</u>	<u>Yield and Year</u>		
	<u>1986</u>	<u>1987</u>	<u>\bar{X}</u>
8615	22.2	26.1	24.2
UC5	23.9	20.6	22.3
Surutato	12.4	16.7	14.6
C.V. %	*	6.3	
LSD at 5%	*	2.6	

Note: *1986 data not analyzable due to late harvest loss
1987 data based on 5'x98' plots and two reps.

E) Area of Adapatation

UC15 is recommended for growing in the Coastal areas of California, specifically in the counties of San Luis Obispo, Santa Barbara, and Monterey. It is well adapted to these areas, with appropriate duration for spring/summer dryland cultivation as well as for cultivation with supplemental irrigation. It is appropriate, due to its wilt resistance, for growing in both wilt or non-wilt infested soils in these counties.

F) Procedure for Maintaining Seed Stocks

The specifications for garbanzos of the California Crop Improvement Association are to be followed. Foundation seed is to be planted for registered seed, which is to be planted to produce certified seed. The Foundation seed project will maintain Foundation seed. Approximately 700 pounds of breeders seed is available for planting as Foundation seed in April of 1988. This should provide approximately 30,000 pounds of Foundation seed by September of 1988.

H. Seed Production Restrictions

It is recommended that Foundation seed be grown only on wilt-free soils.