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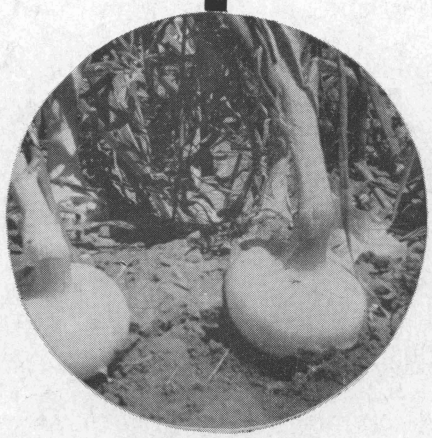
Onion varieties in TEXAS



TEXAS AGRICULTURAL EXPERIMENT STATION
R. D. LEWIS, DIRECTOR, COLLEGE STATION, TEXAS
IN COOPERATION WITH THE
UNITED STATES DEPARTMENT OF AGRICULTURE

DIGEST

Texas ranks first in the United States in total acreage planted to onions. The 5-year average, 1949-53, of 44,860 acres represents 36.8 percent of the total acreage planted to onions in the United States. The average annual production during this period of 4,569,000 50-pound bags in Texas was 10.7 percent of the total for the United States. In total value, the Texas onion crop at $8,131,000 constitutes 14.3 percent of the 5-year average annual value of all onions produced in the United States (1).

Practically all onions produced in Texas are of the Bermuda and Grano types. Because they are adapted to short days and moderately cool temperatures, varieties of this type are particularly suited to Texas when grown as winter and early-spring crops. Onions from Texas are the first on the market in the spring, and because of their mild flavor and attractive appearance they generally command a premium over old-crop or storage onions.

The tremendously expanded onion-breeding program developed cooperatively by the Texas Agricultural Experiment Station and the U. S. Department of Agriculture has resulted in many new varieties and hybrids.

Contents

Onion Varieties In Texas

BRUCE A. PERRY and HENRY A. JONES*

THE BERMUDA ONION WAS INTRODUCED into South Texas in 1898 when a packet of onion seed was planted near Cotulla (10). The onions were shipped to Milwaukee, Wisconsin, where they were so enthusiastically received that a larger acreage was planted. The first carload of Bermuda onions shipped from Texas originated at Cotulla in the spring of 1899.

By 1904, approximately 500 acres were planted to Bermuda onions in South Texas. In the spring of 1907, 1,011 carloads of onions were shipped from South and Southwest Texas; in 1908, production had more than doubled and 12 counties shipped 2,920 carloads in 1909. Shipments reached 6,735 carloads in 1917; this figure was not exceeded until 1928 and 1929 when the total movements were 7,055 and 7,232 carloads, respectively. The largest movement in 50 years for a single season was 10,164 carloads in 1946.

The Canary Islands, principally Teneriffe Island, produced most of the onion seed planted in Texas until about 1946. Until recent years, the two types of Bermuda onions generally grown in Texas were known as Yellow Bermuda and White Bermuda or Crystal Wax.

As the acreage planted to Bermuda onions increased, the Canary Island growers were overtaxed to meet the demand for seed and after 1920 the declining quality of Island seed was noticeable. There was an increased mixing of strains and varieties, probably because new and inexperienced growers were entering the seed business and the better growers could not find sufficient isolation for their seed fields. The increase in bolting and splits and doubles caused the per-acre yield of U. S. No. 1 onions to become so low that South Texas growers seriously considered changing from the Island-grown Bermuda seed to the Babosa, or Grano varieties, which were imported originally from Spain in 1925.

To develop varieties better adapted to South Texas, the Winter Garden station inaugurated an onion-breeding program in 1933. The program was expanded considerably in 1939 with the establishment of a cooperative breeding program by the U. S. Department of Agriculture and the Texas Agricultural Experiment Station. The breeding work was again expanded in 1946 when breeding lines, experimental varieties and hybrids were planted cooperatively in growers' fields throughout South Texas.

AREAS OF COMMERCIAL PRODUCTION

The early spring crop of onions is grown principally in the irrigated areas of South Texas, Figure 1. Producing areas include the Lower Rio

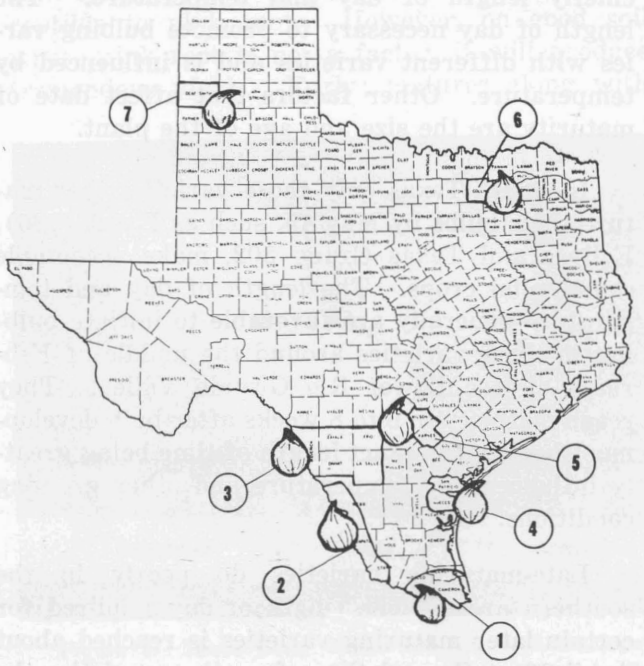


Figure 1. Principal onion producing areas of Texas.

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Grande Valley area (1), the Laredo area (2), the Winter Garden area (Zavala, Maverick, Dimmit, LaSalle and Frio counties) (3), the non-irrigated Coastal Bend area (4) and the area of Wilson and Karnes counties (5).

Late spring production is centered around Farmersville and Princeton, Collin county, in North-central Texas (6).

Considerable production and increased interest have developed in recent years in the irrigated district of the High Plains with the greatest acreage centered around Hereford in Deaf Smith county (7).

VARIETAL ADAPTATIONS

Most onion varieties are limited in adaptation. A variety may yield well in one area and be a failure in another. The onion grower should have a knowledge of varieties so that he can select the ones best suited to his particular conditions. A new variety or hybrid should be tested in small plantings until it is proved to be adapted to an area.

The varieties grown in Texas differ in size, shape, color of bulb, bolting habit, pungency and time of maturity, as well as tolerance to diseases, insects and climatic conditions. The adaptation of varieties to an area is determined primarily by the conditions which affect bulb development, chiefly length of day and temperature. The length of day necessary to promote bulbing varies with different varieties and is influenced by temperature. Other factors that affect date of maturity are the size and age of the plant.

In South Texas only those varieties that mature their bulbs by May 15, such as Excel (986), Eclipse and Texas Grano 502, make acceptable commercial crops. The length of day and temperature generally are favorable to initiate bulbing in these varieties around the middle of February in the Lower Rio Grande Valley. They reach maturity in 6 to 8 weeks after bulb development begins, the exact length of time being greatly influenced by temperature and other growing conditions.

Late-maturing varieties do poorly in the southern areas. The length of day required for certain later maturing varieties is reached about April 20 at Crystal City; for other varieties the daylight is never long enough.

VARIETAL DESCRIPTIONS

Open-pollinated Varieties

Crystal Wax. Bulbs are flat with very thi shiny, dry, white scales that are soon broken a lost in handling. The flesh is soft and mild flavor. The bulbs reach a diameter of 3 to 3 inches when grown under irrigation. The va ety bolts and splits rather readily. Second ear Recommended for areas 6 and 7.

The Crystal Wax onion was first listed by G. Hastings in 1897 with a sufficiently clear d scription to distinguish it from White Bermud which has a light yellow skin and later becam known more correctly as Yellow Bermuda (9).

Yellow Bermuda. Bulbs are flat with ver few thin, shiny, pale-yellow scales that are so broken and lost in handling. The flesh is so and mild in flavor. The bulbs reach a diamet of 3 to 3½ inches when grown under irrigatio Second early. Recommended for areas 6 and 7.

The Bermuda onion with pale-yellow ski was first listed by Peter Henderson & Co. in 18 as White Bermuda. D. Landreth & Co. for 18 says that although shipped as White Bermuda really "has quite a yellowish character" and, a though known as a product of Bermuda, is Italian origin (9).

Red Bermuda. Same as Yellow Bermuda ex cept for being red.

Early Grano (Babosa). The bulbs are to shaped and have very few thin to medium-thi pale-yellow scales. The flesh is soft and ver mild in flavor. Early Grano is somewhat resis ant to thrips, but very susceptible to injury b the pink root fungus. The variety bolts muc less readily than Yellow Bermuda and Crysta Wax in Texas when planted at the same time. It is a heavy yielder in the absence of pink roo Second early. Later in South Texas areas tha Yellow Bermuda. Recommended for areas 6 and 7.

The Early Grano onion was imported orig nally from Valencia, Spain, in 1925 under th name Valencia Grano 9452. The New Mexic Agricultural Experiment Station grew seed fro the original lot and made selections. The nam Early Grano was proposed for the selected strai in 1931 in Bulletin 193 of the New Mexico St tion (9).

White Grano (Babosa). Same as Early Grano except for being white.

Red Creole. The bulbs are small to medium size, oblate to flattened. They are dull buff red on the lower half, with more buff in the veins and on the upper half toward the neck; dry scales become more dull and more buff with age. The flesh is very firm and very strong or pungent in flavor. This variety is grown on a limited acreage in Texas, chiefly for export. Second early; matures along with Yellow Bermuda or slightly later. Recommended for area 5.

Red Creole has been grown in Louisiana for over 100 years. The source of the original variety is not known, although it is supposed to be of Italian origin (9).

White Creole. Same as Red Creole except for being white.

Sweet Spanish. Bulbs are medium to large size, round to slightly oval shaped, having many medium-thick, brownish-yellow dry scales that are fairly well retained during storage and handling. Fairly resistant to thrips damage and may be stored for short periods if well cured. The flesh is firm but of mild and sweet flavor. Late. Recommended for area 7.

This variety was introduced from Spain in 1916 and improved and introduced by Aggler & Musser (9). Many strains now are available.

White Sweet Spanish. Same as Sweet Spanish except for being white.

San Joaquin. Bulbs intermediate in shape between a full globe and a typical Grano top shape, light yellow. The flesh is soft and mild in flavor. Somewhat resistant to damage by thrips. Second early; matures somewhat later than Yellow Bermuda in South Texas and in some years only a small percentage of plants produce marketable bulbs. Recommended for areas 6 and 7.

San Joaquin was developed from a cross between Stockton G 36 and Early Grano 62, and backcrossed to Early Grano. It was introduced in 1941 by the California Agricultural Experiment Station and the USDA (2).

Excel (986). In most plant characteristics, Excel is similar to Yellow Bermuda but it splits and bolts less. It is resistant to pink root. The bulbs are a little thicker than those of Yellow Bermuda and free of pink flesh. Plants have smaller

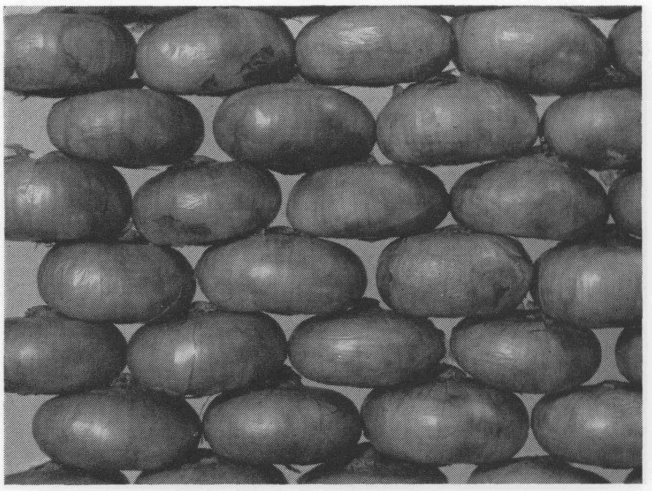

Figure 2. Excel (986) is uniform in shape and size.

tops and necks than the average Yellow Bermuda. Early; 10 to 14 days earlier than Yellow Bermuda. Recommended for areas 1, 2, 3, 4 and 5.

Excel is a single-plant selection from Yellow Bermuda that was developed and introduced in 1945 cooperatively by the USDA and the Texas Station (7).

Texas Early Grano 502. Characteristics of Texas Early Grano 502 are similar to those of Early Grano except that it is more uniform and much earlier in maturity. The tops are not as heavy as those of Early Grano and the foliage is more upright. The bulbs are broader and not so pointed at the root end as those of Early Grano. Like other strains of Early Grano, it is very susceptible to pink root. However, on good soil where pink root is not a factor, it will produce tremendous yields. Early; matures along with

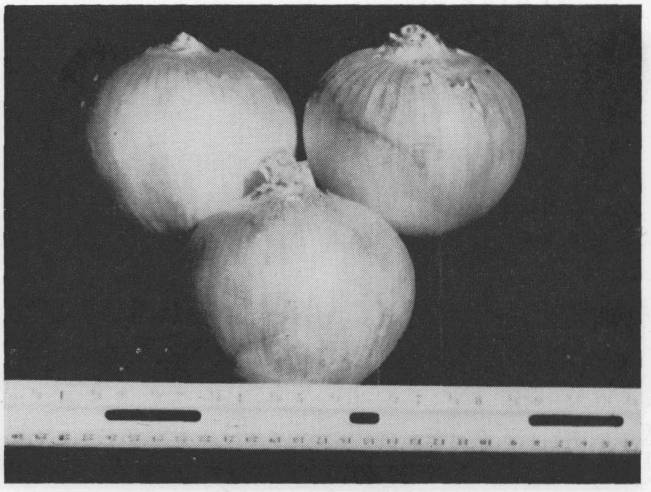

Figure 3. Texas Early Grano 502 has well-developed bulbs that are more rounded on the root end than in the original Early Grano.

Figure 4. The earliness of Early Crystal 281 (right) as compared with L-365 (left) is indicated by all tops being down.

Figure 5. Eclipse in soil infested with pink root fungus.

Figure 6. Bulbs and tops of Early Crystal 281 at harvest time. Note uniform medium size of bulbs, characteristic of this variety.

Excel in South Texas. Recommended for area 1, 2, 3, 4 and 5.

A selection out of Early Grano was released by the Texas Station as Texas Grano in 1944 (3). An earlier selection with small upright tops was released in 1947 as Texas Early Grano 502 to replace the original release.

L-690. A Crystal Wax type of good size and thick, flat bulb shape with trim neck; flesh clear white. The variety has a very good color in the growing plant and appears more resistant than other varieties to "tip blight" or "tip burn." Early; 3 to 5 days earlier than Excel and should not be planted in areas where Excel is not successful. Because of its tendency to produce splits and doubles, L-690 has been replaced largely by more recent introductions. Recommended for areas 1, 2 and 3.

L-690 was developed cooperatively by the Texas Station and the USDA to give the onion growers of South Texas a white onion for early shipment. It was released to seedsmen in 1949. The variety came from a series of crosses and selections involving Crystal Wax, Yellow Bermuda and White Persian (11).

L-36. This variety is similar to Excel, but matures about a week earlier. It is a very refined onion with a small neck and when well cured is more attractive than Excel. Bulbs are somewhat firmer and tend to keep better than those of Excel. The variety is highly resistant to pink root. Early. Recommended for areas 1 and 2.

L-36 was developed and released jointly by the Texas Station and the USDA in 1953. It has a mixed ancestry, involving Yellow Bermuda and White Persian, but the last two backcrosses before selfing were to Excel (12).

L-365. A Crystal Wax type similar to L-690. It has consistently outyielded L-690. This variety is highly resistant to pink root and has an exceptionally heavy root system. Less subject to splits than L-690. It tends to bolt more than desirable, especially if planted too early. For this and other reasons, it probably will be replaced by Eclipse. It matures about 10 days later than L-690. Early. Recommended for area 4.

L-365 was developed and released by the Texas Station and the USDA in 1953. The pedigree

of L-365 involves Crystal Wax and a plant of Excel that survived the pink root test (12).

Eclipse. A Crystal Wax type highly resistant to pink root, bolts and splits less than previous introductions of this type, and very productive. It is mild in flavor, and the bulb is a very attractive white. It matures about the same time as L-365, or a few days earlier, and about a week to 10 days later than L-690. Recommended for areas 1, 2, 3, 4 and 5.

Eclipse was developed by the USDA and the Texas Station. It was released in 1954. The pedigree of Eclipse involves Crystal Wax and Excel. Two lots of white segregates from the selfed-backcrosses L-302 and L-303 gave rise to the variety Eclipse (5).

Early Crystal 281. A Crystal Wax type about 10 days earlier than Eclipse, has considerable resistance to pink root and is very highly nonbolting. Because of its earliness, it is somewhat less productive than Eclipse; it is slightly more pungent. The bulb is an attractive white. Because of its delayed bolting habit, the bulb-to-seed method should be used for seed increase. Early. Recommended for areas 1 and 2.

Early Crystal 281 was developed jointly by the Texas Station and the USDA. It was released in 1955. The pedigree of Early Crystal 281 involved the varieties Crystal Wax and Excel (13).

F_1 Hybrids

Granex. A yellow, F_1 (first-generation), Bermuda-type hybrid. Bulbs are intermediate in shape between Bermuda and Grano. Resistance to pink root is intermediate between the two parents. This hybrid is very mild in flavor, which makes it a good salad onion. Early; 3 to 5 days earlier than Excel. Recommended for areas 1, 2, 3, 4 and 5.

Granex, developed cooperatively by the USDA and the Texas Station, was released in 1952. The female, or seed, parent was developed from Excel and is similar to Excel except that it is male-sterile. The pollen parent, Texas Early Grano 951, is an inbred out of Texas Early Grano 502 (4).

White Granex. A first-generation white hybrid is similar to Granex in shape and general appearance, except for being white. The bulbs

Figure 7. Commercial planting of Granex, approximately 1 week before harvest. Note uniform development of bulbs. Yield from this field ran 780 bags U.S. No. 1 per acre.

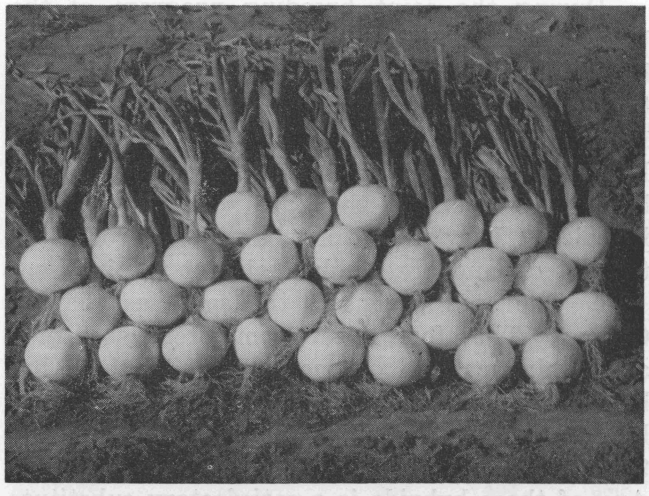

Figure 8. Bulbs and tops of White Granex at harvest time. Bulbs are intermediate in shape between Bermuda and Grano varieties.

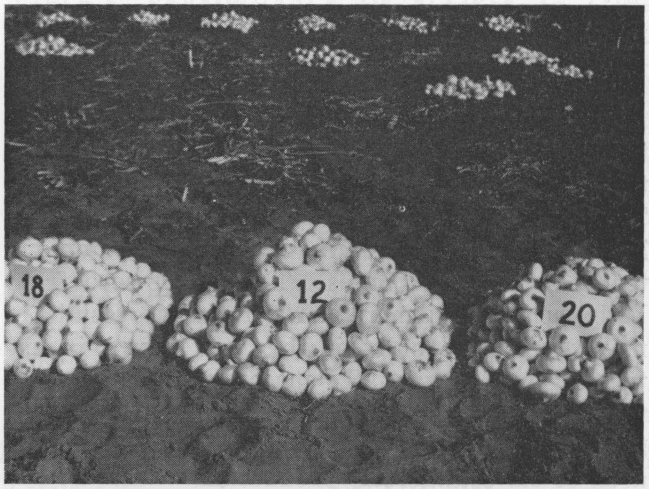

Figure 9. Yields in this test for pollen parent B-1410 (18), White Granex (12) and seed parent L-303 (20) were 561, 757 and 494 bags (50 pounds) per acre, respectively.

are thick and flat, intermediate in shape between the two parents. The tendency to bolting and doubling is about the same as for Eclipse and Granex. Resistance to pink root is intermediate, same as that of Ganex. White Granex is 7 to 10 days later in maturity than Granex. Early. Recommended for areas 1, 2, 3, 4 and 5.

White Granex was developed through the cooperative onion-breeding program of the USDA and the Texas Station, and was released in 1956 (8). It is an F_1 hybrid from the cross L-303 x B-1410. The male-sterile, or seed, parent, L-303, is a selection out of Eclipse. The pollen parent, B-1410, is a white F_2 selection from a cross between Texas Early Grano 951 and Crystal Grano.

Miscellaneous Hybrids

During the joint breeding program of the USDA and the Texas Station many additional hybrid combinations have been produced and tested. Two combinations made and tested in 1953 were 986 x L-303 and 986 x L-365 (14). Both of these combinations produce bulbs similar to Excel, except they are somewhat lighter in color. They are somewhat more productive than Excel and are highly resistant to pink root (6). The seed parent is the same as that of Granex. Therefore, a few commercial seedsmen are producing seed of one or both of these hybrid combinations under the names Texas Hybrid 23 and Texas Hybrid 28. The combination 986 x L-281 also gives satisfactory performance. Any of these hybrids is a satisfactory substitute for Excel and should yield 10 to 20 percent better. Early. Recommended for areas 1, 2, 3, 4 and 5.

SOURCE OF SEED AND TRANSPLANTS

A variety or strain of onions should be selected or developed in the general area where it is to be grown. This is especially true of South Texas where, even in June, the days are not as long as is required for many varieties of onions to produce mature bulbs. The use of seed from bulbs selected in more northern areas results in many immature bulbs if they are grown in extreme South Texas. To maintain the early-maturing habit, the bulbs for production of stock seed for a given variety should be selected in the area of its commercial production.

For best results, good strains should be obtained. The use of poor seed or incorrect variety identification frequently results in an almost total crop failure. Therefore, growers should obtain seed or transplants from a reliable source.

For information on cultural practices and disease control see publications: Onions in Texas Extension Bulletin 220, Texas A&M College System; Growing the Transplant Onion Crop, Farmers' Bulletin 1956, U. S. Department of Agriculture; and Onion Diseases and Their Control Farmers' Bulletin 1060, U. S. Department of Agriculture.

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APPENDIX

TABLE 1. PERFORMANCE OF EXCEL IN COMPARISON WITH YELLOW BERMUDA[1]

Location	Year	Marketable yield, 50-pound bags per acre, U. S. No. 1	
		Yellow Bermuda	Excel
Crystal City	1951	306	440
Laredo	1951	535	517
Laredo	1952	279	440
Weslaco	1952	103	273
Laredo	1952	307	690
Winter Haven	1952	233	506
Crystal City	1952	95	725
Rio Grande City	1953	164	355
Laredo	1953	190	715
Laredo	1953	162	699
Winter Haven	1953	105	508
Crystal City	1953	116	481
Average		216	529

[1]Two tests at some locations in the same year.

TABLE 2. PERFORMANCE OF L-690 IN COMPARISON WITH CRYSTAL WAX

Location	Year	Marketable yield, 50-pound bags per acre, U. S. No. 1	
		Crystal Wax	L-690
Crystal City	1950	288	401
Winter Haven	1950	254	341
College Station	1952	92	275
Laredo	1952	134	257
Laredo	1952	183	620
Winter Haven	1952	132	397
Crystal City	1952	47	498
Rio Grande City	1953	115	309
Laredo	1953	139	372
Laredo	1953	105	250
Winter Haven	1953	74	292
Crystal City	1953	111	442
Average		140	371

TABLE 3. PERFORMANCE OF L-36 IN COMPARISON WITH EXCEL (986)

Location	Year	Marketable yield, 50-pound bags per acre, U. S. No. 1	
		Excel	L-36
Laredo	1949	271	294
Laredo	1949	506	486
Winter Haven	1949	573	439
Crystal City	1949	768	532
Laredo	1949	666	706
Laredo	1950	325	352
Winter Haven	1950	327	301
Crystal City	1950	482	367
Crystal City	1951	440	388
Rio Grande City	1953	355	359
Crystal City	1953	481	447
Winter Haven	1953	508	456
Crystal City	1953	511	633
Laredo	1953	699	602
Laredo	1953	715	699
Weslaco	1953	394	585
Average		501	478

TABLE 4. PREFORMANCE OF L-365 IN COMPARISON WITH L-690

Location	Year	Marketable yield, 50-pound bags per acre, U. S. No. 1	
		L-690	L-365
Weslaco	1952	239	262
Raymondville	1952	285	370
Laredo	1952	257	450
Laredo	1952	620	852
Winter Haven	1952	397	614
Crystal City	1952	498	689
College Station	1952	275	439
Rio Grande City	1953	309	362
Crystal City	1953	442	516
Winter Haven	1953	292	459
Laredo	1953	250	593
Laredo	1953	372	645
Weslaco	1953	384	509
Average		355	520

TABLE 5. PERFORMANCE OF WHITE GRANEX IN COMPARISON WITH ECLIPSE AND GRANEX

Location	Year	Marketable yield, 50-pound bags per acre, U. S. No. 1		
		White Granex	Eclipse	Granex
Weslaco	1955	694	585	729
Laredo	1955	352	383	417
Winter Haven	1955	757	517	724
Crystal City	1955	609	477	619
College Station	1955	638	414	560
Weslaco	1956	632	453	697
Laredo	1956	430	443	411
Winter Haven	1956	446	312	381
Crystal City	1956	643	581	667
College Station	1956	484	473	597
Average		569	464	580

TABLE 6. PERFORMANCE OF ECLIPSE IN COMPARISON WITH L-365

Location	Year	Marketable yield, 50-pound bags per acre, U. S. No. 1	
		Eclipse	L-365
Laredo	1952	515	450
Winter Haven	1952	616	614
Crystal City	1952	567	689
Rio Grande City	1953	561	362
Laredo	1953	729	645
Laredo	1953	929	593
Winter Haven	1953	554	459
Crystal City	1953	603	516
Crystal City	1953	750	623
College Station	1953	376	282
Weslaco	1954	511	299
Laredo	1954	622	382
Winter Haven	1954	539	516
Crystal City	1954	717	736
Crystal City	1954	468	597
College Station	1954	507	417
Average		598	511

TABLE 7. PERFORMANCE OF GRANEX IN COMPARISON WITH EXCEL AND TEXAS EARLY GRANO 951

Location	Year	Marketable yield, 50-pound bags per acre, U. S. No. 1		
		Excel	Granex	TEG 951
Winter Haven	1951	440	698	517
Laredo	1951	517	790	621
Weslaco	1952	273	576	328
Laredo	1952	690	862	507
Winter Haven	1952	506	869	683
Rio Grande City	1953	355	775	483
Winter Haven	1953	508	760	583
Crystal City	1953	481	682	610
Crystal City	1953	511	981	778
College Station	1953	343	472	316
Weslaco	1954	485	691	567
Weslaco	1954	399	571	262
Winter Haven	1954	500	711	489
Crystal City	1954	736	931	804
Crystal City	1954	592	881	279
College Station	1954	414	632	525
Winter Haven	1955	526	724	621
Crystal City	1955	340	619	378
College Station	1955	273	560	425
Weslaco	1956	415	597	540
Winter Haven	1956	244	381	255
Crystal City	1956	486	667	223
Average		456	701	491

TABLE 8. YIELDS OF ONIONS GROWN ON SOIL INFESTED WITH THE PINK ROOT FUNGUS, LAREDO

Variety or pedigree	Yield per acre, 50-pound bags, U. S. No. 1				
	1951-52	1952-53	1953-54	1954-55	Av.
Texas Early Grano 502	18	95			57
Texas Early Grano 951		94	32	84	70
L-690	257	250			254
Granex	670	591	557	417	559
Excel	440	699	562	452	538
L-36		602		385	494
Eclipse (L-303)	515	929	622	387	613
Early Crystal 281	502	700	495	324	505
L-365	450	593	382	366	448
Excel x L-281	691	964	724	363	686
Excel x L-303		861		405	633
Excel x L-365	499	806	479	435	554
Crystal Wax	134	99			107
Yellow Bermuda	279	128			204
L.S.D., 5 percent	86	114	94	93	
L.S.D., 1 percent	113	150	125	123	

TABLE 9. PERFORMANCE OF EARLY CRYSTAL 2 IN COMPARISON WITH ECLIPSE

Location	Year	Marketable yield, 5 pound bags per ac U. S. No. 1	
		Early Crystal 281	Eclips
Laredo	1952	502	515
Winter Haven	1952	458	616
Crystal City	1952	738	567
Laredo	1953	616	729
Laredo	1953	700	929
Rio Grande City	1953	493	561
Winter Haven	1953	504	554
Crystal City	1953	614	603
Crystal City	1953	727	750
College Station	1953	317	376
Weslaco	1954	416	511
Weslaco	1954	346	382
Laredo	1954	495	622
Winter Haven	1954	443	539
Crystal City	1954	615	717
Weslaco	1955	502	573
Laredo	1955	324	379
Winter Haven	1955	510	502
Crystal City	1955	326	491
College Station	1955	207	414
Average		492	564

TABLE 10. YIELDS OF ONIONS GROWN ON SOIL INFESTED WITH THE PINK ROOT FUNGUS, ZAPATA COUNTY

Variety or pedigree	Yield per acre, 50-pound bags			
	Mildly infested soil 1951-52		Badly infested soil 1952-53	
	Culls	U. S. No. 1	Culls	U. S. No. 1
Texas Early Grano 502	121	507	136	36
Texas Early Grano 951			90	28
L-690	83	620	116	372
Granex	11	862	14	585
Excel	10	690	63	715
L-36			36	699
Eclipse (L-303)			9	729
Early Crystal 281	4	592	0	616
L-365	39	852	93	645
Excel x L-281	0	621	40	885
Excel x L-303			13	828
Excel x L-365	4	955	21	779
Crystal Wax	319	183	324	139
Yellow Bermuda	274	307	362	190
L.S.D., 5 percent	112	146	49	63
L.S.D., 1 percent	147	192	57	85

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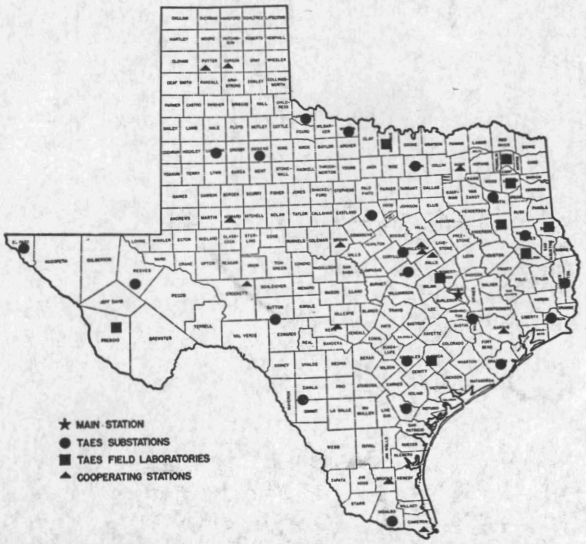

Location of field research units in Texas maintained by the Texas Agricultural Experiment Station and cooperating agencies

State-wide Research

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The Texas Agricultural Experiment Station is the public agricultural research agency of the State of Texas, and is one of nine parts of the Texas A&M College System

IN THE MAIN STATION, with headquarters at College Station, are 16 subject-matter departments, 2 service departments, 3 regulatory services and the administrative staff. Located out in the major agricultural areas of Texas are 21 substations and 9 field laboratories. In addition, there are 14 cooperating stations owned by other agencies. Cooperating agencies include the Texas Forest Service, Game and Fish Commission of Texas, Texas Prison System, U. S. Department of Agriculture, University of Texas, Texas Technological College and the King Ranch. Some experiments are conducted on farms and ranches and in rural homes.

RESEARCH BY THE TEXAS STATION is organized by programs and projects. A program of research represents a coordinated effort to solve the many problems relating to a common objective or situation. A research project represents the procedures for attacking a specific problem within a program.

THE TEXAS STATION is conducting about 350 active research projects, grouped in 25 programs which include all phases of agriculture in Texas. Among these are: conservation and improvement of soils; conservation and use of water in agriculture; grasses and legumes for pastures, ranges, hay, conservation and improvement of soils; grain crops; cotton and other fiber crops; vegetable crops; citrus and other subtropical fruits, fruits and nuts; oil seed crops—other than cotton; ornamental plants—including turf; brush and weeds; insects; plant diseases; beef cattle; dairy cattle; sheep and goats; swine; chickens and turkeys; animal disease and parasites; fish and game on farms and ranches; farm and ranch engineering; farm and ranch business; marketing agricultural products; rural home economics; and rural agricultural economics. Two additional programs are maintenance and upkeep, and central services.

RESEARCH RESULTS are carried to Texas farm and ranch owners and homemakers by specialists and county agents of the Texas Agricultural Extension Service.