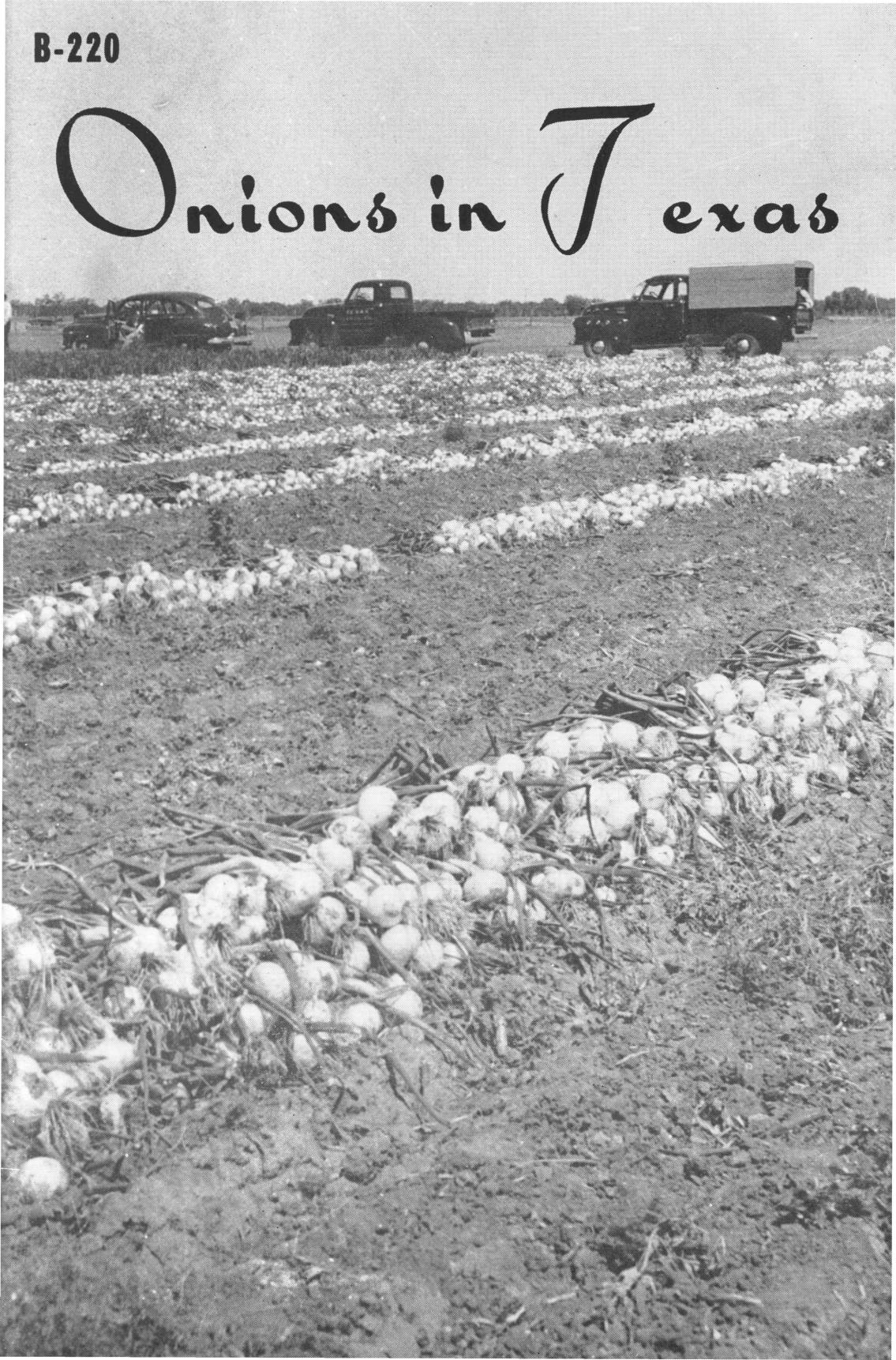
B-220

Onions in Texas



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Introduction

The onion ranks as one of the most important vegetable crops grown in Texas. It is included in practically every home garden in the State, and, commercially, Texas is one of the leading states in the production of this crop. For the ten-year period 1940-1949 the average acreage devoted to onion production was 54,300 acres annually. The average annual production during this same period was 4,822,000 50-pound sacks while the average annual return to the growers was $8,073,000. The table on page 26 presents a concise picture of acreage, yield per acre, average production and market value of Texas onions from 1940 through 1951.

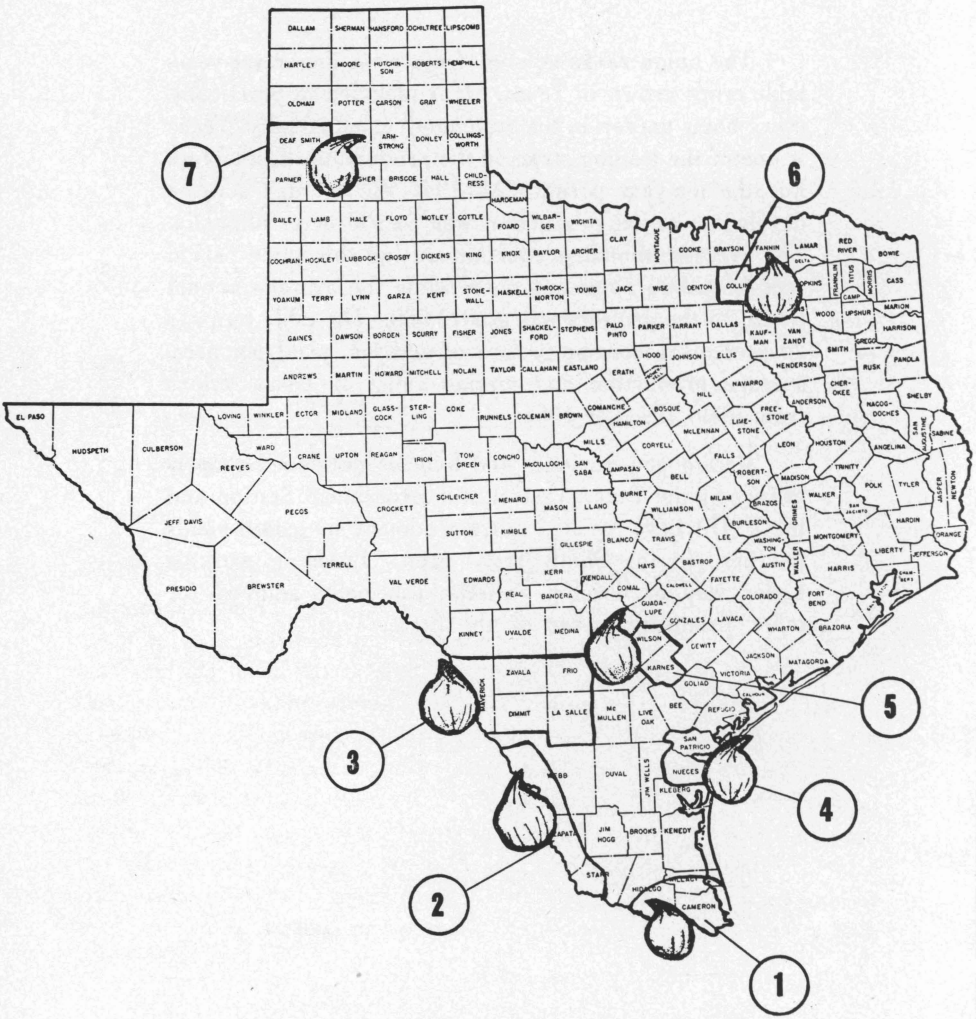
Recent new varieties and hybrids developed cooperatively by the Texas Agricultural Experiment Station and the USDA have resulted in tremendously increased yields per acre in the South Texas area. Breeding work is under way to develop varieties especially adapted for other producing areas of the State.

Areas of Commercial Production

The early spring crop is grown principally in the irrigated districts of South Texas. Producing areas include the Lower Rio Grande Valley area, the Laredo area, the Winter Garden area (Zavala, Maverick, Dimmit, LaSalle and Frio Counties), the non-irrigated Coastal Bend area and the area of Wilson and Karnes Counties.

Late spring production is centered around Farmersville and Princetown, Collin County, in North Central Texas.

In recent years considerable production and increased interest have developed in the irrigated district of the High Plains with the greatest acreage centered around Hereford in Deaf Smith County.



PRINCIPAL ONION PRODUCING AREAS OF TEXAS

Onions in Texas

JOHN E. HUTCHISON and BLUEFFORD G. HANCOCK
Extension Horticulturists
and
BRUCE A. PERRY, *Superintendent*
Winter Haven Experiment Station
Texas A. & M. College System

Soil and Climatic Requirements

Climate

Temperature and length of day are controlling factors in the successful production of onions. For best growth and bulb formation, onions require cool weather early in the growing season with moderately high temperature and relatively low humidity later on for proper ripening. The best root development occurs when the soil temperature range is from 54° to 68° F. The most rapid growth of tops occurs at temperatures of 68° to 70° F., and these temperatures need to prevail during the early part of the growing season. Temperatures of 70° to 80° F. are favorable for bulb development when day length is also favorable for a given variety. At temperatures of 50° to 60° F. bulbs will not be formed regardless of length of day. Temperatures higher than 80° F. will hasten maturity but may reduce yields. Varieties differ, however, in their temperature and length of day requirements.

Early and intermediate varieties including Crystal Wax, Yellow Bermuda, Excel, L-690, Early Grano and Texas Grano "502" are the principal varieties grown in Texas. They produce bulbs during moderate temperatures and relatively short periods of daylight (about 12 hours is minimum).

Soil

The essential characteristics of a good onion soil are a high level of fertility and good structure so as to retain moisture and plant food elements under cultivation. It should be easy to work, capable of drainage and it should allow proper expansion of the bulbs. Onions grow satisfactorily on sandy loams, silty loams, clay loams and alluvial soils.

Many of the sandy loams in the irrigated districts of southwest Texas are fairly shallow and underlain by a rather impervious clay which prevents leaching of fertilizer and makes this soil ideal for the irrigation of onions, a shallow-rooted crop. The soil reaction preference range for onions is from pH 6 to 8. They do not do well on soils which are very acid.

Sandy soils may be deficient in natural fertility and require heavy applications of commercial fertilizer to produce profitable crops, but the quality of the crop is usually good. Turning under green manure crops will increase the organic content and thereby improve the moisture-holding capacity of sandy soils. Other things being equal, onions will mature earlier on the lighter soil but may have more pink root probably resulting from higher soil temperatures.

Clay loams and alluvial soils are generally fertile but may have poor tilth, tend to run together and bake after heavy rains. They will produce off-shaped bulbs unless well supplied with organic matter. These heavier soils dry out more slowly and may give some trouble at harvest time. Such soils can be improved by turning under green manuring crops prior to growing the onion crop.

Moisture

Because onions are shallow-rooted, they require abundant moisture near the surface, especially during early growth.

Normally, new roots are formed throughout most of the growing season. They arise from the stem plate at the base of the onion plant but they are not formed unless the stem plate is in moist soil. Onion plants must be kept growing. If growth is checked by moisture deficiency, even temporarily, the outer scales seem to mature. When moisture is again available, the inner scales resume growth and may result in many splits and doubles being produced.

Onions should be ripened under comparatively dry conditions; otherwise, they may be watery and will not store well.

Varieties

Varietal Adaptations (General)

Most onion varieties are limited in adaptation. A variety may yield well in one area and yet be a failure in another. The onion grower must have a knowledge of varieties so that he can select the ones best suited to his particular conditions. Any new variety

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, time of maturity, as well as tolerance to diseases, insects and temperature. No one variety is suited to all areas nor for all purposes. 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 which 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, L-690 and Texas Grano 502, make acceptable commercial crops. The length of day and temperature is generally favorable to initiate bulbing in

SEED OF PROMISING NEW STRAINS ARE PRODUCED IN THIS SCREENED BREEDING CAGE. BEES ARE USED AS THE POLLINATORS. HERE SEED OF A PINK ROOT RESISTANT LINE IS BEING INCREASED.

PERSONNEL OF THE TEXAS AGRICULTURAL EXPERIMENT STATION EVALUATE EXPERIMENTAL TRIALS AT THE WESLACO STATION.

these varieties around the middle of February in the Lower Rio Grande Valley area. These varieties will reach maturity in six to eight 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 late varieties is reached about April 20 at Winter Haven; for other varieties the daylight is never long enough. A planting of California Hybrid Seed No. 1 in the Winter Garden area was a complete failure. This also would be true of Sweet Spanish or storage varieties generally grown in the north.

Varietal Descriptions

Yellow Bermuda. Bulbs are flat with very few thin, shiny, pale-yellow scales that are soon broken and lost in handling. The flesh is soft and mild in flavor.

THE ONIONS ON THE LEFT ARE TEXAS GRANO 502; THOSE ON THE RIGHT, GRANEX. GRANO PRODUCED 507 BAGS AS COMPARED TO 862 FOR GRANEX FROM THE SAME SIZE PLOT.

The bulbs attain a diameter of 3 to 3½ inches when grown under irrigation. Second early. Recommended for transplant crop in areas 6 and 7.

Excel. This variety is a single-plant selection from Yellow Bermuda. In most plant characteristics it is similar to Yellow Bermuda except more resistant to splitting and bolting. It is somewhat resistant to pink root. The bulbs are a little thicker than those of Yellow Bermuda and free of pink flesh. Plants have smaller tops and necks than the average for Yellow Bermuda. Early; 10-14 days earlier than Yellow Bermuda. The variety is recommended for areas 1, 2, 3, 4 and 5.

Crystal Wax. Bulbs are flat with very thin, shiny, dry, white scales that are soon broken and lost in handling. The flesh is soft and mild in flavor. The bulbs attain a diameter of 3 to 3½ inches when grown under irrigation. The variety bolts and splits rather readily. Second early. Recommended for areas 6 and 7.

L-690. It is a Crystal Wax type of good size and thick-flat shape with trim neck; flesh, clear white. The variety has a very good color in the growing plant and appears to be more resistant than other varieties to "tip blight" or "tip burn." Early; three to five days earlier than Excel and should not be planted in areas where Excel is not successful. Its extreme earliness causes it to mature while the bulbs are still small. Recommended for areas 1, 2, 3, 4 and 5.

Early Grano (Babosa). The bulbs are top-shaped and have very few thin to medium-thick pale yellow scales. The flesh is soft and very mild in flavor. It is somewhat resistant to thrips, but very susceptible to injury by the pink root fungus. The variety bolts much less readily than Yellow Bermuda and Crystal Wax in Texas when planted at the same time, and it is a heavy yielder. Second early. Later in the South Texas areas than Yellow Bermuda. Recommended for areas 6 and 7.

Texas Grano "502". Its characteristics 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 on Early Grano and the foliage is more upright. The bulbs are broader and not so pointed at the root end as is true of Early Grano. Like other strains of 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 Excel and L-690 in South Texas. Recommended for areas 1, 2, 3, 4 and 5.

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 or hard 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 in area 5.

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 thrip 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.

Granex. The female or seed parent was developed from Excel and is similar to Excel except that it is male-sterile. The pollen parent, Texas Grano 951, is an inbred out of Texas Grano "502." The shape of the bulbs of Granex are intermediate between those of the parents. The yields of Granex in experimental plots and small commercial plantings have been very good from the Lower Rio Grande Valley through the Winter Garden area, and in one experimental test at College Station. Early; three to five days earlier than either parent. Recommended for areas 1, 2, 3, 4 and 5.

Source of Seed and Planting Stock

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

It is not only important to use varieties that are adapted to the district, but for best results it is imperative that good strains of the respective varieties be obtained. Poor seed or incorrect varietal identification frequently results in almost a total crop failure. Therefore, *growers must obtain seed or transplants from a reliable source.*

Soil Preparation

The physical composition of the soil is of prime importance in onion production. The productiveness of the soil can be improved by adding fertilizers, by drainage and tillage and by incorporating organic matter. Thorough preparation of the soil is essential to the successful production of onions. Inadequate land preparation generally results in a poor stand of plants regardless of the quality of the seed.

The method of preparing the soil when irrigation is used depends upon the system of irrigation to be followed. It is essentially the same whether direct seeding or a transplant crop is to be grown. If the soil has become heavily contaminated with weeds, it will often pay to irrigate the seedbed two or three weeks prior to planting time and then kill the weeds by shallow disking or by using a pre-emergence weed killer.

In the Winter Garden area, where furrow irrigation is generally employed, a single-row system is most commonly used. The rows usually are prepared five at a time with a tractor-drawn cultivator. The height of the rows varies from five to seven inches and the distance between rows varies from 14 to 20 inches, 16 inches being most common. In other areas a double-row bed system is used most. Where this system is used the beds are six to eight inches high and the distance from center to center varies from 28 to 38 inches, with the more narrow spacing most common in the irrigated sections.

In the area centered around Laredo, a border or "melba" system has been quite common. These borders are made eight to 12 inches high and eight to 12 feet apart. The borders are laid out on the contour of the land so that the entire area between the borders can be flooded uniformly.

A FIVE-ROW CULTIVATOR IS CULTIVATING THIS SEEDBED PRIOR TO IRRIGATION.

Onions are affected by several soil inhabiting fungi, especially the pink root fungus. Therefore, a system of crop rotation is highly recommended. It is especially important to grow the onion seed bed on soil free from pink root fungus. This can be accomplished only by growing on soil not previously planted to onions or by following the practice of long rotation with non-susceptible crops. Many truck crops commonly produced in Texas are affected, in varying degrees, by the same soil fungi which attack onions. Rotations using grasses and cereals have given good results.

THIS COMMERCIAL SEEDBED HAS PLANTS READY FOR TRANSPLANTING TO THE FIELD.

Time and Method of Planting

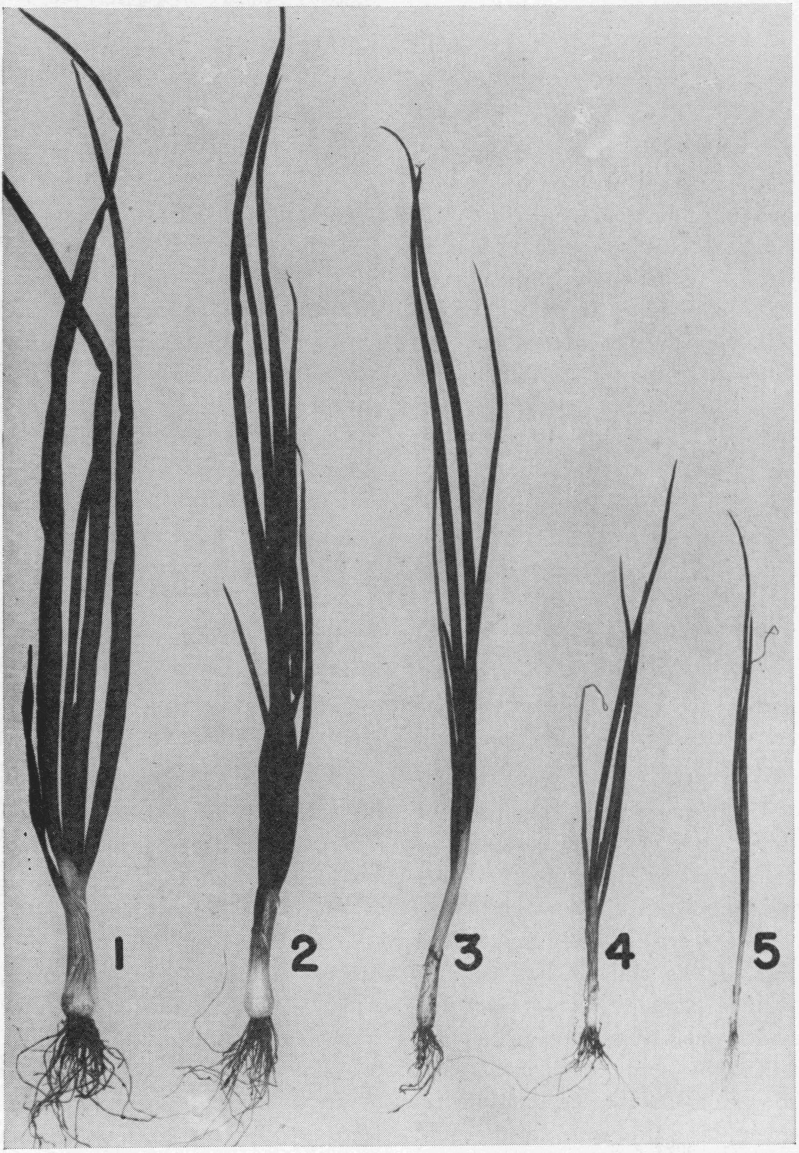
Field Seeding

Although most of the onions grown in Texas are established from green transplants, some direct field seeding is practiced.

In preparing the seedbed for direct seeding, the soil should be finely pulverized and free from previous crop residues or trash. The seed are generally sown at the rate of two and one-half to four pounds per acre and are covered about one-half to one inch deep. Since the seed are planted shallow, moisture for germination frequently is a problem. Seed should be sown as soon as possible after the land has been prepared to avoid drying out of the top soil before the seed can germinate. Various types of garden seeders are used in planting, generally run in gangs.

Growing the Transplants

The transplant seedbed should be located on disease-free soil where onions have not been grown for at least four to five years. It is especially important that the soil be free from the pink root fungus as the disease, if present, will be carried to the field at transplanting time. Generally six to 12 pounds of nitrogen and 20 to 50 pounds of phosphorus per acre are applied to the seedbed previous to planting. If the soil is very infertile and the seedlings make poor growth or develop a light green or yellow color, side dress with a nitrogenous fertilizer.



THE RANGE IN SIZE OF TRANSPLANTS IS SHOWN HERE. NUMBERS 4 AND 5 SHOULD BE DISCARDED. NUMBERS 2 AND 3 ARE DESIRABLE SIZES WITH NO. 2 BEING IDEAL. NO. 1 IS TOO LARGE AND PROBABLY WOULD RESULT IN A SEED STEM.

Ammonium nitrate at the rate of 75 to 100 pounds per acre is usually satisfactory.

About two pounds of seed commonly are planted for each acre of the transplanted crop. Growers expect to grow enough plants on one acre of seedbed to plant 10 acres. When a lighter rate of seeding is used, larger plants are produced which show a tendency to produce seedstalks; while a heavier rate produces plants that are too small and may give reduced yields.

Yellow Bermuda, Crystal Wax, Excel, L-690, Granex and Texas Grano "502" varieties are usually planted in the Winter Garden area from September 15 to September 25. Early Grano is planted from September 1 to September 15.

Considerable acreage in the Winter Garden area is devoted to producing transplants for shipment to other areas. Transplant growers commonly contract to produce and deliver the plants at a specified date. The length of time required to produce desirable transplants will depend on prevailing temperatures. The time required will vary from 80 days in early fall to 120 days through the winter, from seeding to harvesting for shipment.

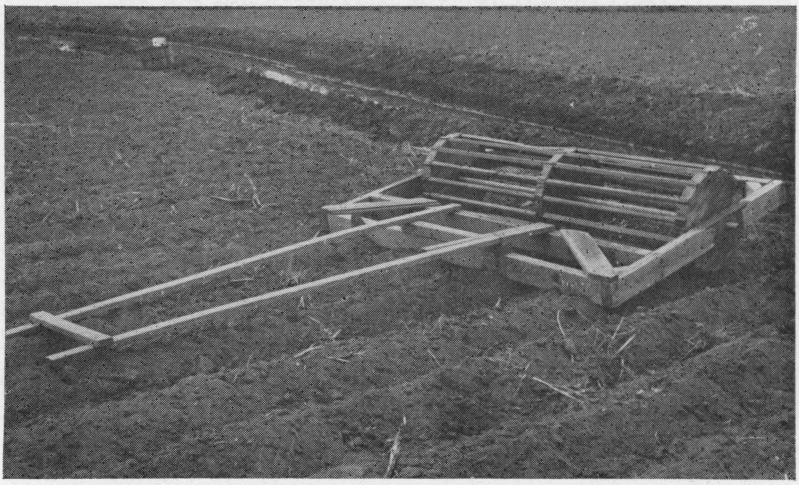
WHEN PLANTS ARE PULLED FROM A SEEDBED THEIR TOPS ARE REMOVED WITH A QUICK TWIST.

Most growers in the Princeton-Farmersville area buy South Texas transplants to set their crop but a few growers raise their own. The Bermuda types are grown almost exclusively in this area and the seed should be sown about October 15.

Setting the Transplants in the Field

When the plants are 1/4 to 3/8 inch in diameter at the soil surface (the size of a lead pencil) and seven to 13 inches high, they are ready to set in the field. Early plantings usually produce greater yields than later plantings.

Seedlings may be plowed out but it is more common to irrigate the seedbed in advance so the plants can be pulled easily without plowing. The plants are pruned by the worker as they are pulled. When he has collected a handful of plants a part of the tops are removed with a quick twist of the hand. Trimming or pruning tops and roots of onion plants has been shown to reduce yields but is practiced to facilitate handling dur. ing the transplanting operation. Very small or weak plants should be discarded. After pruning, the bunches are placed in baskets or



THIS SMALL MODEL ROW MARKER INSURES EVEN SPACING OF TRANSPLANTS IN THE ROW. THE SLATS ARE THREE TO FOUR INCHES APART.

crates. Plants should be covered from the time they are pulled until set to prevent drying out.

All of the transplanting now is done by hand although much interest has been shown in mechanical transplanters. The plants are distributed ahead of the planter along three rows at a time. A short stick or dibble is used by most workers to make a hole and to press the soil around the plant. The rows are marked in advance with a light-weight slatted roller having slats the desired distance apart to facilitate uniform spacing. These rollers cover about four to six rows at a time and the slats indent the place where plants are to be set.

Plants generally are set three to four inches apart in the row. The width between rows, however, varies widely among areas. In some of the non-irrigated sections growers use a wider than normal spacing between rows to allow cotton or other row crops to be planted between the rows before the onions are harvested. This practice reduces yields per acre. On rows 14 inches apart with a 4-inch spacing within the row, 112,000 plants are needed to set an acre. The number of plants needed for an acre at any given spacing can be calculated by multiplying the space between the rows by the space between the plants, in feet, and dividing into 43,560 the number of square feet in an acre.

Growing Onions from Dry Sets

In the Eastern part of the State green onions are produced from

sets planted in the fall. This practice is also used widely in home gardens where the sets are planted thickly and thinned as green onions are desired for the table. Those remaining grow and produce large dry onions in the spring.

Green onions can be grown from sets more quickly and with less trouble than when transplants are used. Stored food in the sets gives the plants a strong start. The larger the sets, the more quickly they produce green onions of edible size; however, the green onions grown from large sets must be pulled promptly or they may form seedstalks. Sets ½ to ¾ inches in diameter are preferred if they are to be grown for the bulb crop.

For the production of green bunching onions in Eastern Texas, the *White Pearl* variety is most commonly used. The sets are planted one to two inches apart in the row and about 100 pounds are required to plant an acre. Some growers prefer to plant double rows on each bed and plant up to 150 pounds of sets per acre. Planting is done from October through November. Harvest begins in February and extends through April.

Shallots also are used for the production of green bunching onions.

Fertilizers

Onions have responded favorably to commercial fertilizer applications on several soil types in southwest Texas. These favorable responses have been obtained both experimentally and under field conditions. Since the onion with its shallow roots has a restricted feeding zone, a fairly high concentration of available plant food elements should be maintained in the upper six to eight inches of soil.

THESE BUNDLES OF PLANTS ARE OF EXPERIMENTAL LINES AT THE WESLACO STATION. SIX REPLICATIONS ARE INCLUDED IN EACH TRIAL.

Specific fertilizer recommendations regarding kind and amount of fertilizer for a given field should be based on a chemical analysis and previous cropping history. (*See your local county agricultural agent for a copy of Fertilizer Recommendations for your area.*) Best results are obtained when the fertilizer is applied to the soil prior to planting rather than applying any part of the application as a side dressing.

The soil should contain at least a moderate amount of organic matter. This will increase the moisture holding capacity of the soil and improve aeration as well as improve soil fertility. Soils well supplied with organic matter retain more plant food elements added in applications of commercial fertilizer. The organic content of the soil should be maintained and improved by turning under green manure crops or by heavy applications (20 tons per acre) of barnyard manure where this material is available. Green manure crops should be turned under early enough so that they will be completely decayed before planting time. If the barnyard manure has not been composted or completely rotted, it should be applied to the crop preceding onions.

Irrigation

How often and how much to irrigate depends on the character of the soil, season of the year, amount of rainfall, condition of the crop, variety and presence of thrips or disease. If the soil is dry at transplanting time, onions should be irrigated as soon as possible after being set. Onions will survive 12 days or more after being set in a dry soil but such a practice always results in lower yields. Once plants have started to grow, they must *not* be allowed to suffer from lack of moisture.

WHERE THE SOIL IS DRY, IRRIGATION FOLLOWS TRANSPLANTING IMMEDIATELY.

On the sandy loams of southwest Texas five to eight irrigations are usually sufficient between transplanting and harvest. Additional irrigations may be required during seasons of heavy thrip infestations. From December to early March irrigations can be six to 10 weeks apart, but, beginning in March, the frequency usually must be increased to once every five to 14 days. In South Texas the strong winds prevalent at this time may increase the water requirement.

Over-irrigation, as well as lack of water, may cause reduced yields. The foliage of onions receiving excessive irrigation develops a yellowish-green color. This condition may be difficult to detect when infestation of thrips is severe. It has been observed that if the soil rarely gets dry on the surface, it probably has been over-irrigated.

When the plants start to mature, irrigation should cease and the soil should be allowed to dry out as much as possible; otherwise, a second root growth, which is difficult to stop, may start and complicate the process of properly curing the onions.

Cultivation and Weed Control

Onions must be kept free of weeds both in the plantbeds and in the fields to produce maximum yields. All cultivations should be shallow to prevent injuring the small feeder roots near the surface. Deep cultivation is likely to reduce the yield. The crop is usually cultivated after a heavy rain and in irrigated districts after each irrigation. This controls weeds, prevents crusting of the soil and aids the penetration of water at the next irrigation. Additional cultivations may be needed to control weeds between irrigations or rains.

Tractors equipped with multi-row cultivators are used to cultivate the crop. Generally, hand weeding must supplement cultivation both in the plantbed and in the field. In many areas hand weeding is done by contract on an acre basis. The price is governed by the weed infestation in the field. When an agreement is reached, the contractor hires a sufficient number of workers to do the job as quickly as possible. Weeding should be done before weeds are large enough to rob onions of moisture, nutrients and light. If weeds are allowed to become large, their removal may disturb the onion roots and reduce yields.

Use of Oils, Selective Herbicides and Burning to Control Weeds

Weed control involves one of the major costs of growing onions. In addition to the expense, hand weeding requires a tremendous amount of labor which is often difficult to obtain. In recent years many new chemicals, some highly selective, have been developed which promise to eliminate all of the hand weeding and most of the cultivation. *All of these new chemicals and other methods such as burning should be used with caution so as to prevent serious damage to the onions.*

THESE WORKERS HAND-WEED ONIONS, USING SMALL SHORT HANDLED HOES. THIS METHOD IS A COSTLY OPERATION.

Several materials on the market can be used as a pre-emergence treatment to kill weeds and grass in direct seeded fields or in plant beds *before* the onion seedlings emerge.

Aero cyanamide (special dusting grade) applied at the rate of 75 pounds per acre is an effective pre-emergence treatment, especially if applied in the presence of dew.

Another pre-emergence material is Stoddard Solvent. Forty to 50 gallons per acre give complete coverage if the spray equipment is properly used. In direct seeded fields, the Stoddard Solvent may be applied to the whole field or to a 3 or 4-inch band down the top of the row. Twenty to 30 gallons per acre will cover the 3 or 4-inch band down the row.

Diesel oil used in the same manner as Stoddard Solvent also has been used successfully.

The above pre-emergence materials are contact herbicides and should be used only before the onion seedlings have emerged.

Several materials which can be used as post-emergence treatments after the onion seedlings are up include:

Potassium cyanate applied as a one percent spray (5 pounds to 60 gallons of water) has shown good results in killing small weeds and grass seedlings. The weeds should be dry at the time the spray is applied and the application should be followed by at least four hours of dry atmospheric conditions and applied at least two days before the onions emerge. *No wetting or sticking agent should be used in the cyanate spray on onions.* After the seedlings have reached a height of about 6 inches, a two percent solution (10 pounds in 60 gallons of water) can be used. The nozzle is set low and the spray is directed at the base of the onion plants so the tips of the leaves will not be sprayed. Sixty gallons of liquid per acre of both the one and two percent spray are sufficient to give complete coverage. A low pressure spray rig that maintains a pressure of about 40 pounds per square inch has been found satisfactory. Nozzles which throw a wide-angled fan - shaped pattern have been found best for applying the spray. Nozzle apertures should allow 60 gallons of spray per acre at the working speed and pressure being used. Mix a fresh solution for each application and do not allow to stand overnight in the spray tank as the material in solution breaks down quickly. Onions suffering from insect or disease damage or mechanical injury as from wind or hail should not be sprayed until the plants have fully recovered. If one application does not control the weeds in the field,

it should not be repeated for at least three to four days.

Stronger solutions of potassium cyanate have been used in other states on onions after they have started to bulb but this practice has not been thoroughly tested in Texas.

Sulfuric acid sprays can be used as a post-emergence treatment for controlling weeds. However, the spray nearly always injures the onion plants and may cause reduced yields. The spray should contain two to two and one-half percent sulfuric acid by volume. The rate of application is 100 to 150 gallons per acre and should be applied preferably on a warm, dry day. The spray is more successful if applied when the weeds are small, but it must not be used until the onions have at least one true leaf 3 to 4 inches long.

A more concentrated spray of 2 gallons sulfuric acid in 48 gallons of water has been reported successful in the Rio Grande Valley. The 50 gallons of spray is applied to one acre.

Sulfuric acid spray is extremely corrosive and hard on clothes and equipment. It should be used only in spray equipment having a brass, bronze, stainless steel or glass-lined pump and a wooden tank. The acid is dangerous and its use should *not* be entrusted to laborers not fully aware of the danger in handling. Laborers should wear goggles to protect their eyes and rubber gloves to protect their hands. It is wise to have a strong soda solution on hand at all times in case of accident. Spray equipment should be washed in a soda solution at the rate of 4 pounds to 50 gallons of water and rinsed with clear water at the end of each day. The pump should be removed and submerged in water overnight while the acid spray is being used.

Another method of controlling the first weeds in the plantbed is by burning off the top of the bed. Special burners utilizing butane or other suitable fuel have been constructed on sleds that are dragged over the plant beds. Burning may be delayed until the onion cotyledons (seed leaves) appear above the soil. This allows more weeds to emerge. The onion cotyledons as well as the weeds are burned to the ground. The onions will send up new leaves from below the ground but the weeds will be killed.

Burning must be done before the first *true* leaf of the onion appears.

Bolting

Bolting, the formation of untimely seedstalk, may occur under certain conditions. When seedstalks are produced, the bulbs will not cure properly, will not meet minimum requirements for U. S. grades and therefore represent a loss to the grower.

Weather conditions during the growing season, the time of seeding and transplanting and the size of transplants all affect the percentage of bolting. Also, varieties differ in their tendency to bolt.

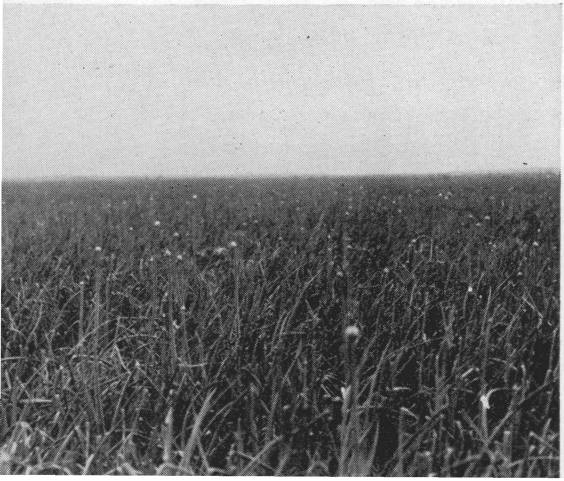
A warm fall followed by a cool spring results in many bolters. A cool fall and a warm spring, on the other hand, results in few bolters. A warm fall with continued warm weather in the spring results in practically no bolters and an early crop. A cool fall and continued cool weather in the spring results in few bolters, a late crop and low yield.

The size of the over wintering transplant affects the readiness with which the plant will bolt. Growers should avoid forcing too much growth of transplants in early fall. The rate of growth may be partially regulated by the frequency of irrigations and the amount of nitrogenous fertilizer used.

Harvesting, Curing and Grading

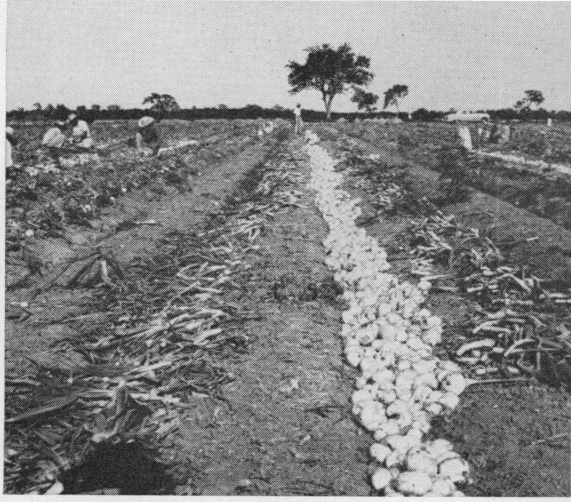
When an onion plant matures properly the neck softens just above the bulb and the top falls over while the leaves are still green. Generally, growers start to harvest when 30 to 50 percent of the tops have fallen over. However, the market price, the condition of the crop and the weather influence the actual time when harvest will begin. Most growers do not wait for the crop to mature fully. Yields continue to increase until most of the tops have fallen over or at least until the necks have softened. However, onions harvested slightly immature seem to retain their outer skins better and keep longer during the short time they are held in storage.

A HIGH PERCENTAGE OF BOLTING HAS OCCURRED IN THIS COMMERCIAL FIELD OF ONIONS.



Most growers loosen the soil by running a knife or cutter blade

THESE GRANEX ONIONS ARE READY FOR HARVEST. THE SOIL HAS BEEN PULLED BACK TO SHOW UNIFORMITY OF THE BULBS.



THE TOPS AND ROOTS ARE CLIPPED IN THE FIELD WHEN THE ONIONS ARE HARVESTED.

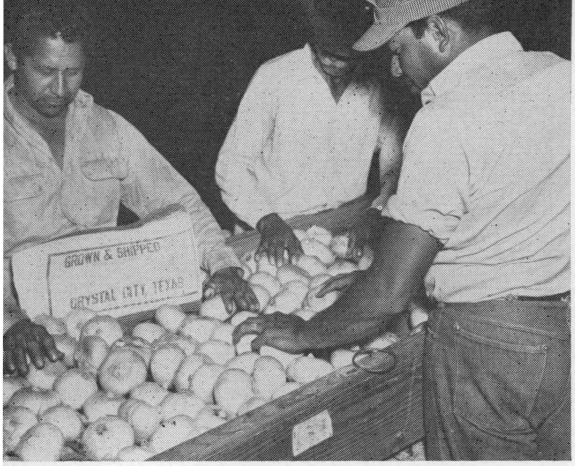
several inches below the bulbs. This cuts the roots in the same operation. As the onions are pulled they are thrown into windrows, four rows together and allowed to cure if necessary. If the crop is windrowed in very hot, sunny weather, the bulbs should be covered with the tops by "shingling" to prevent sunscald. This is especially important in handling white varieties.

If the onions are fairly mature, relative humidity low and the air movement good, it may be possible to pull, clip and ship in the same day. The tops and roots are clipped with sharp shears, leaving a short neck about one inch long. Cutting too close to the bulb will leave an open wound through which decay organisms can enter. Roots are trimmed close to the base of the bulb.

Another method of curing is to clip the tops and roots of the onions immediately and place the bulbs in baskets or crates. The onion tops can be placed over the crates or baskets to protect the top layer from sunscald. The length of curing will depend on the maturity of the crop and weather conditions.

Cured onions are generally graded at central packing sheds where jumbos and undersized onions are sorted out. The standard container for shipment is an open-mesh 50-pound sack. The onions are shipped in refrigerated cars.

A portion of the crop may be sold to truckers directly from the field without being graded. However, the onions are usually polished by dumping a bushel of onions onto a burlap sheet. The sheet is then lifted by two workers who grasp the sheet on opposite sides and roll the onions back and forth across the burlap by alternately raising and lowering the opposite sides. This rubs off loose scales



WORKERS ON THIS GRADING LINE ARE REMOVING DAMAGED ONIONS. A JUMBO PACK IS BEING RUN.

OPEN MESH 50-POUND BAGS MAKE ATTRACTIVE PACKAGES. ONIONS ARE SHIPPED IN REFRIGERATED CARS.

and soil that may have adhered to the bulbs.

Harvesting Green Bunching Onions

Harvesting of green onions begins when they have reached the size of a lead pencil. White varieties are used almost exclusively for bunching. In areas where direct seeding is practiced, green onions are harvested and sold as a thinning practice. Growers of transplants often market their surplus plants as green onions. Where onions are grown strictly for bunching purposes, several pullings are made beginning when the first plants have reached a desirable size, leaving the others to grow.

The green onions are pulled and the outer scales and soil removed to make a more attractive pack. They are then tied into bunches and packed out in bushel baskets. The size of the bunch depends partly on the size of the plants and market preference. They are marketed by the dozen bunches.

Storage

In Texas most of the onion crop is marketed directly after harvest. Most of the varieties grown in the State are of the early and intermediate groups and do not store well even under favorable conditions. They would be especially difficult to store during the hot summer. The storage life of most varieties, however, can be prolonged by placing them in cold storage at 32° F. to 33° F., and under conditions as dry as possible.

A new chemical, maleic hydrazide, looks promising for extending the storage period of onions

and certain other vegetable crops. The chemical can be sprayed on onions before harvest to prevent sprouting in storage. However, if applied too early it may *increase rotting* in storage. The material has not been tested thoroughly and it is available only to certain qualified technical personnel for use in experimental work.

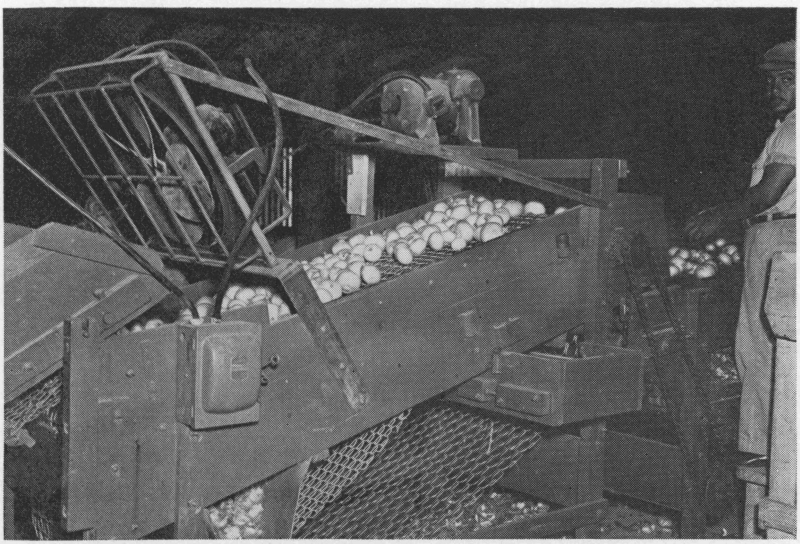
Insects and Diseases

Pink Root

Pink root, caused by the fungus *Pyrenschaeta terrestris*, ranks as the most destructive onion disease in Texas. It is serious in the plant bed and in the fields. The fungus lives in the soil and attacks roots of the onion plants causing the roots to turn pink, shrivel and die. New roots are attacked as they are formed and the plant is stunted, resulting in reduced yields.

Plant beds should be located on soil free of pink root, preferably on soils where onions have not been grown before, as the disease will be transferred to the field on the roots of transplants.

The disease is very difficult to control if the fungus becomes established in the field. *The only practical control is the development of highly resistant onion varieties.* Onions should not be plant-



THIS IS ONION GRADING EQUIPMENT IN A CENTRAL PACKING SHED. THE SIZE OF THE MESH IN THE CHAIN USED DEPENDS ON WHETHER A SMALL, MEDIUM OR JUMBO PACK IS BEING RUN.

ON AN ACRE BASIS, THE RELATIVE YIELD FROM A 30-FOOT ROW IN PINK ROOT INFESTED SOIL IS SHOWN HERE. TEXAS GRANO 502 (LEFT) PRODUCED ONLY 18 BAGS, U.S. NO. 1 BULBS; GRANEX (CENTER) PRODUCED 670 BAGS, U.S. NO. 1 BULBS; EXCEL (RIGHT) PRODUCED 440 BAGS, U.S. NO. 1 BULBS.

ed on infested soil more often than once in four to five years.

None of our present varieties are completely immune to this disease but some show more resistance than others. However, all varieties will suffer if planted on badly infested soil. Yellow Bermuda and Excel are somewhat resistant to pink root while the Grano types are highly susceptible. Granex is intermediate between Excel and Grano Types in resistance to pink root.

Damping Off

Damping off is a disease of seedlings and may occur in the plantbed or in fields that have been seeded directly. It may be caused by one or more soil inhabiting fungi. Seedlings are attacked at the soil line or just below. The tissue shrinks rapidly at that point and the seedlings fall over. Generally, the disease occurs in rough circular spots of various sizes.

No specific control for this disease is known. Good cultural practices including frequent cultivation, good drainage and good fertility tend to discourage damping off. Seed should be treated prior to planting with Semesan or Arasan dust according to the manufacturer's directions.

Sunscald

Onions may suffer severe damage when they are harvested under conditions of high temperatures and very bright sunlight. Immature bulbs, especially of white varieties, are more subject to injury. The damaged tissue, where sunscald occurs, appears bleached and becomes soft and slippery. The serious blemish resulting from sunscald will prevent the bulbs from making U. S. grades and will result in a reduced price to the grower. The most serious loss, however, occurs when bacterial

AERIAL DUSTING OF A COMMERCIAL SEEDBED FOR THRIP CONTROL IS DONE JUST PRIOR TO TRANSPLANTING.

soft rot or other decaying organisms gain entrance through the damaged tissue. This may cause complete loss of the bulb.

Sunscald can be prevented by protecting the bulbs from direct exposure to sun during curing. This is done by pulling the onions with tops intact and placing the bunches on the row so that the tops of each bunch will cover the bulbs of the previous bunch. This is called "shingling."

Thrips

Thrips are the most destructive insects to the onion crop in Texas. The amount of damage varies from season to season, but some injury occurs nearly every year. These insects have rasping mouthparts and cause characteristic whitish blotches on the blades and the tips turn brown and die. Under ideal conditions, a complete new generation can develop every two weeks. Cool weather reduces the number of generations in a season and a hard driving rain may wash the thrips from the plant and destroy some of them. Predatory insects also may help keep them in check.

THE RESISTANT STRAINS, SHOWN ON THE LEFT AND RIGHT, DID NOT FALL VICTIM TO PINK ROOT AS DID TEXAS GRANO 502, IN THE CENTER.

Close, frequent inspections should be made and when five thrips can be found per plant, control measures should be started at once. Several insecticides will give good control if properly applied either as a dust or spray. Five or 10 percent DDT dust or 10 percent toxaphene dust will give good control. One pound actual (technical) DDT or toxaphene per acre applied as a spray is effective. (See your county agent for bulletin C-323, "Guide for Controlling Insects and Diseases on Vegetable Crops in Texas" for detailed information concerning control of these and other insects and diseases. Also, USDA Farmers' Bulletin No. 1060, "Onion Diseases and Their Control" may be obtained from your county agent.)

Acreage, Yields and Market Values of Onions from 1940 through 1951

	Acres			Yield Per acre			Production (50# Sacks)			Price per 50# Sack			Crop Value		
	10-Yr. Average 1940-49	1950	1951	[1]10-Yr. Average 1940-49	1950	1951	10-Yr. Average 1940-49	1950	1951	10-Yr. Average 1940-49	1950	1951	10-Yr. Average 1940-49	1950	1951
							000	000	000	$	$	$	000	000	000
Early Spring	41,560	45,700	9,200	94	87	[2]220	3,746	3,976	2,024	1.74	1.15	2.70	6,538	4,140	5,465
Late Spring	12,740	7,800	16,000	86	65	80	1,076	507	1,280	1.64	1.75	1.85	1,535	887	1,332

[1]The tremendous increase in yield per acre of early spring onions was due in part to the introduction and use of new especially adapted varieties. These varieties were developed jointly by the Texas Agricultural Experiment Station and the USDA.

[2]The apparently low per acre yield is due in part to reduced yields from non-irrigated sections and from the practice of using abnormally wide row spacing in some areas in order to allow another row crop to be planted between the onion rows shortly before harvest.

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