Bulletin 280 October, 1956

Growing Onions In Arizona

Published by the AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF ARIZONA, TUCSON

SUMMARY

Varieties grown in Arizona are chosen for yielding ability and immediate market acceptability; not for their keeping or storage qualities. Excellent yellow or white skinned varieties are available. Plant only white skinned varieties for green bunching onions.

Planting may be done from October 10 to 20 for early varieties and from November 5 to 15 for late ones. In Greenlee County they are seeded from January 1 to 20.

Soils, whether medium-heavy clay loams or lighter sandy loams, should be loose and friable to a depth of 12 inches. Soils which crust or "puddle" easily should not be used for onion production.

Irrigation is one of the most important factors in onion production. The pre-planting irrigation is used to bring about weed seed germination and emergence; not supply sub-soil depths with water. Frequent light, though thorough, irrigations are suggested for both green and bulb onion production.

Fertilizer. Nitrogen is the most important element. In addition to the 40 to 50 pounds of nitrogen as a pre-planting application, frequent (3 to 5) light (15 to 20 pounds per acre) applications are necessary for maximum yields. The total amount of nitrogen needed is from 100 to 150 pounds per acre. An early application of phosphate, up to 45 pounds P_2O_5 per acre, is often required.

Weed control chemicals which are most effective are 7 to 10 pounds of potassium cyanate in 50 gallons of water per acre or sulfuric acid (approximately 5% concentration) at 100 gallons per acre. In either case, chemicals should be applied when weeds are small.

Harvesting should be started after 10 to 25 per cent of the necks have broken over. In the Salt River Valley areas this will be in May and June, in Greenlee County from August 15 to October 15. Harvesting onions that are too green will result in losses due to shriveling and soft rot. Harvest bunching onions when shanks are 1/4 to 3/8 inches in diameter.

Insect damage caused by thrips may seriously reduce yields of both bulb and green-bunching onions. Thrips occur wherever onions are grown and must be controlled to produce quality onions. They are best controlled by applying 2% dieldrin, 10% chlordane, or 20% toxaphene dust at 15 to 20 pounds per acre.

Diseases seriously affecting onions in Arizona are few in number. Pink root, the most important one, is caused by a soil-borne fungus. This fungus may attack the plants at any stage of growth and may reduce yields greatly. It is best controlled by using resistant varieties.

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GROWING ONIONS IN ARIZONA

By W. D. Pew[1]

The onion[2] is the only bulb crop grown extensively in Arizona. Compared with the other major vegetable crops grown in the state, the onion generally ranks about midway in the list on an acreage basis. The vast majority of commercial onions—both dry or bulb and green bunching—are grown in Maricopa County, with smaller commercial production areas found in Greenlee, Yuma and Pinal counties. Production in other counties is restricted chiefly to local consumption demands.

During the past 10 years the total acreage has fluctuated from 2,400 acres to less than 700 acres. These wide fluctuations have resulted for the most part from the available onion supply and market needs at the time Arizona's crop is harvested.

New information regarding management of this crop, its fertilizer and water requirements and about improved varieties, has increased production per acre. In 1944 with 2,400 acres, the average yield was 160 fifty-pound bags per acre. Ten years later, in 1953 with 2,200 acres, the average yield was 650 fifty-pound bags.

Onions are grown not only for consumption in the mature bulb stage but also in the immature stage as green bunching onions. Growing the crop for these two uses differs in several respects. Therefore, they are discussed separately where such differences influence the method of production and harvesting.

SOIL TYPE

Although onions can be grown on many soils found in Arizona, the most desirable is a sandy loam. The soil should have enough clay to improve the water holding capacity of the lighter soils and yet have enough sand to provide good tilth and minimize crusting and packing. Above all, the soil should be loose and friable.

Each soil must be considered individually, especially from irrigation and fertilization standpoints. Plant growth and maturity are much slower on heavy types of soil than on the lighter sandy loam soils. This fact should be carefully considered in planning for the most efficient harvest.

VARIETIES

DRY (BULB) ONIONS

Excel (Bermuda 986)

The Excel (Bermuda 986) variety is an early strain of Yellow Bermuda used in the early fall plantings in Arizona. Its bulbs are rather small and flat, with a light yellow skin. The flesh is white to cream color, soft, and mild in flavor. The tops and necks

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[2]Onion: *Allium cepa.*

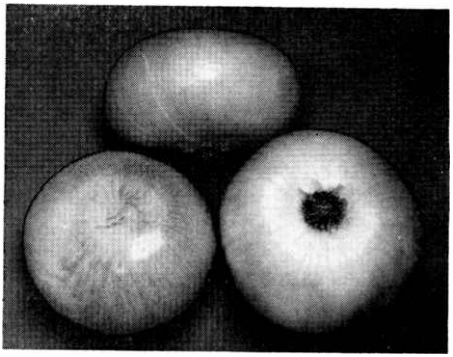


Figure 1.—Typical bulbs of Excel (Bermuda 986) variety grouped to show side, top and bottom views.

are relatively small. This variety may be planted in early October.

White Sweet Spanish

White Sweet Spanish is an excellent late variety of the large, mild type. It forms large bulbs that are globular in shape and glistening white in color. The flesh is white, firm, and rather mild. In the major production areas of Maricopa County it should not be planted before early November because of its tendency to bolt.[3] This variety will store quite well and for this reason is grown in the northern counties for storage and later use. The Yellow Sweet Spanish is similar in all respects except skin color.

White Grano

The White Grano is an early, medium-sized variety. It forms deep, top-shaped, or half-globe shaped bulbs with glistening white skin. The flesh is white, rather soft, sweet and mild. The tops are small. It is a relatively

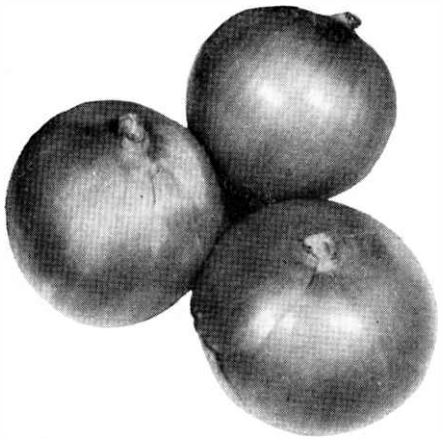


Figure 2.—Yellow Globe onions, grouped to show top, bottom and sides of typical bulbs.

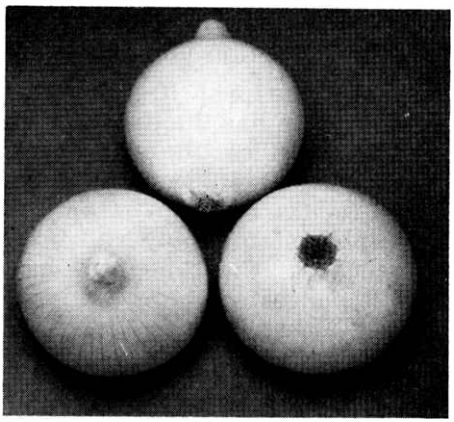


Figure 3. — Typical bulbs of the white Sweet Spanish onion, showing side, top and bottom views.

non-bolting variety, and consequently may be planted in early or mid-October. It is the most popular variety grown in the southeastern part of the state. In this area the White Grano is seeded in the period of Feb. 15 to Feb. 28. (The Yellow Grano is similar except for its yellow skin.)

[3]The term "bolting" in onions refers to the plant developing a seed stalk before bulbs reach a marketable size.

Yellow Globe

The Yellow Globe is a medium early variety with medium-sized bulbs. The bulbs are globular to slightly round, with copper-colored skin. The flesh is firm, yellowish white and mildly to strongly pungent. The tops are relatively small. Yellow Globe is an excellent shipper. In Arizona it is grown primarily in the southeastern part of the state.

GREEN BUNCHING ONIONS

White Sweet Spanish

White Sweet Spanish is the most popular green or bunching onion variety grown in Arizona. It develops heavy, strong tops with deep-green color. Its shanks are rather long and are crystal white in color. Green onions of this variety have a medium strong flavor. The Utah-type White Sweet Spanish is preferred because it is slower to bulb than the regular-type White Sweet Spanish.

Crystal Wax

The Crystal Wax variety is used for bunching onions. It tends to be smaller than White Sweet Spanish. It produces weaker tops which are lighter green in color than those of the Sweet Spanish variety. The shanks of this variety are long and white and have a medium strong flavor. This variety is most popular for planting during September.

Southport White Globe

Southport White Globe is used in limited amounts for bunching onions. Seeds of this variety germinate rapidly, but produce less vigorous seedlings and young plants than the previously mentioned varieties. Its shanks are long and crystal white in color and have a mild flavor. The tops are medium sized with a rich green color..

PLANTING DATES

DRY (BULB) ONIONS

Planting dates for dry (bulb) onions in the lower irrigated valleys, especially the Salt River Valley, vary from early October to mid-November, depending on variety. The most desirable planting period for the early varieties is from October 10 to 20 and from November 5 to 15 for late varieties. The White Sweet Spanish and other late varieties should not be seeded prior to November because of their tendency to bolt — that is, to form seed stalks prematurely. (See Section on Temperature and Photoperiod.) In Greenlee County, seeding is done from January 1 to 20.

GREEN BUNCHING ONIONS

Onions to be harvested as green bunching onions may be planted at any time of year. For continuous harvesting, plantings should be made at approximately three to four-week intervals depending on the speed of harvest. Onions seeded in April, May, and June for harvest during late July, August and early September will produce a larger percentage of culls than those seeded during any other period. Onions planted during this time of the year tend to bulb prematurely, which is an undesirable condition in green onions. To help overcome this tendency they should be harvested in a less mature stage than during other periods.

TEMPERATURE AND PHOTOPERIOD

Temperature and photoperiod (length of day) have a pronounced effect on seeding and bulbing in certain onion varieties. Onion plants beyond the seedling stage exposed to relatively low temperatures (50 to 60 degrees F.) and a short day length (9-12 hours) are stimulated to produce seed readily. Of the varieties commonly grown in Arizona the Sweet Spanish type is one of the chief offenders.

Relatively high temperatures (70° to 80° F or higher) and long days (approximately 15 hours) are necessary in bulb formation. This explains why green bunching onions planted during late April, May, and June to be harvested in late July, August, and September often bulb before they are large enough for bunching.

PLANTING RATES

DRY (BULB) ONIONS

The recommended rate of seeding for dry (bulb) onions is two to three pounds per acre depending on soil type and condition, variety, and method of planting. Planting rates should be regulated so that thinning is not necessary and the plant population is just thick enough to produce the greatest number of desirable market-sized, uniform, smooth bulbs. Flat-sided onions often result from stands that are too thick.

GREEN BUNCHING ONIONS

The recommended rate of seeding for green onions is from 20 to 30 pounds per acre, depending largely on the method of planting and season. Seeding should be regulated to get as heavy a plant population as the soil will support from a fertility and moisture standpoint.

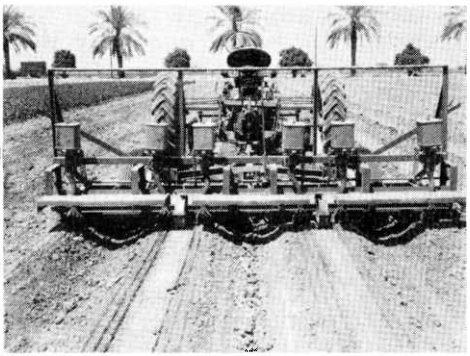
PLANTING AND SEED BED PREPARATION

Seed bed preparation and planting follows closely that used for other bedded winter-grown vegetable crops.

Soil preparation need not be as deep as for many of the other vegetable crops because of the limited fibrous root system characteristic of the onion plant. However, because of this limited rooting habit, soil preparation should be such that the most favorable water penetration and aeration is obtained to a depth of 12 to 15 inches. It is very important not to pulverize the top few inches. Pulverizing the seed bed soil will reduce water intake and aeration.

All tillage operations should have two chief aims: (1) provide optimum moisture penetration and (2) eliminate soil irregularities in the field. Under no circumstances should a greater number of tillage operations be used than is absolutely necessary. Method of soil tillage is very important because of the limited fibrous root system.

After the soil is broken, the area should be bordered and the pre-planting irrigation applied. Use of the corrugation method is not recommended for the pre-planting irrigation especially on soils with a tendency toward salt accumulation on ridges.



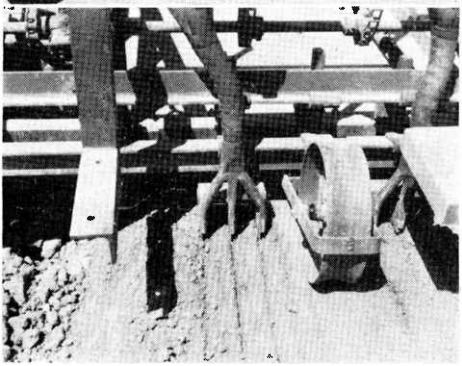


Figure 4.—(top, left) 4-inch splatter-type shoe. Note triangle-shaped tongue in center of shoe to aid in spreading seed.

(below, left) Grouping of 3 lettuce-type shoes.

(top, right) Rear view of planting sled with grouping of lettuce-type planting shoes.

Following the pre-planting irrigation, the borders are removed and the land given one and not more than two diskings to dry the upper six inches of soil. After the soil has had time to dry, a light float or drag is applied, being drawn at an angle different from that to be used in planting.

Listing or furrowing-out is the next operation, followed by seeding in a dry soil with a lettuce- or carrot-type sled. The packer wheel is attached to the planter unit where the 2½-3½ inch "splatter-type" planter shoes are used. A newer and perhaps a little more desirable method of seeding for dry onion production involves the use of groupings of "lettuce-type" planter shoes. In this case the packer wheel is not used. A grouping of three "lettuce-type" shoes is arranged side by side and one such group is used to seed each side of the bed. Using this method, each bed contains six distinct seed rows—two groups of three each. The seed rows within a group are about 1½ to 2 inches apart. This method provides a more uniform distribution and placement of seeds and thereby generally reduces the number of flat-sided mature bulbs. For seeding a green onion crop, the 3 or 3½-inch "splatter-type" shoe is recommended.

The ideal seed depth for planting onions is ¼ to ½ inches. Where the "splatter-type" shoe is used in planting, the depth of the seed falling in the center of the seed band should be about

½-inch, grading upward to ¼-inch on the outer edges of the seed row. Where the groupings of lettuce-type shoes are used, they should be set so the majority of the seed is placed ½-inch deep. For soils that have a tendency to crust, run together or "puddle," a slightly shallower seeding is advised.

After planting, the field is readied for the germination irrigation. Onion seeds germinate rather slowly but produce fairly strong, vigorous seedlings. Seeds usually begin germinating in five to seven days with a stand being established in 10 days to two weeks after the germination irrigation. After emergence the seedlings appear to grow slowly for a week or so and then begin a period of rapid growth. After this period of rapid growth begins, their growth should never be retarded.

SPACING

The grower should consider the equipment available to determine the best row width. However, the beds should not be closer than 36 inches nor wider than 40 inches for best production. Because most vegetable equipment is designed for a 40-inch bed, this spacing is the most popular.

Plant spacing within the row cannot be specifically defined but must be regulated by the rate of seeding. Hand thinning is not practiced, hence one must attempt to get as ideal a stand as possible by carefully regulated planting. Individual plants for dry onion production should average 1½ to 2 inches apart.

It is more difficult to control individual plant spacing in the heavier, medium loam soils than in the lighter sandy soils. In the lighter soils there is a certain amount of surface soil shifting not found in heavier soils. Consequently there is less danger of deformed bulbs during the time they are enlarging rapidly.

Seed for green bunching onions should be sown as thick as the soil can support the young plants properly from a fertility and moisture standpoint. Heavier soils will normally support thicker stands than will lighter ones. Green onions for bunching can be obtained from fields intended for dry onions by thinning stands which are too thick for proper bulb development. This is not always a profitable procedure. Consequently, the type of crop desired should be decided first and the seeding carefully regulated accordingly for the specific crop.

IRRIGATION

Because onions have a characteristically small root system and less vigorous rooting habits than most other vegetables, the irrigation procedure is one of the most important features of production if success is to be realized.

A pre-planting irrigation is important in onion production for two reasons: first, to germinate and sprout weed seeds which can then be destroyed by a subsequent disking operation before the crop is seeded, and second, to leach the soluble salts below the bed zone and thus improve germination and emergence. Applying a pre-planting irrigation for

the sole purpose of re-charging the sub-surface soil with moisture cannot be justified with this crop because of its shallow rooting.

The duration of the germination irrigation (the irrigation following the planting operation) will vary depending on such factors as soil type, bed height and width, time of application, length of run, slope, and season. However, generally speaking, it should be long enough to allow the beds to become "blacked" or soaked through. Where short runs—⅛-mile rows or less—are used, an 18- to 24-hour irrigation will normally be sufficient for the first irrigation. The second irrigation should follow in from two to three days after the first application. Irrigations must be applied at fairly frequent intervals until the plants are well established. The roots should always be in moist but not wet soil.

From this point on, irrigation procedure will vary for dry onions and for bunching onions.

DRY ONIONS

For dry onions, subsequent irrigations will be required at 10-day to two-week intervals until near bulbing time. During the bulbing period, irrigations should not be withheld longer than seven to 10 days under normal climatic conditions. As the onions reach maturity, water is withheld for a 10- to 14-day period just before the start of harvesting to aid in curing the bulbs.

BUNCHING ONIONS

For bunching onions, the subsequent irrigations will follow at rather close intervals until "pulling" (harvest) time. These irrigations should be applied every four to six days. This will keep the plants in a "forced" growing condition until harvest.

FERTILIZATION

On Arizona soils nitrogen will produce the quickest and most pronounced effect on onion yield. Onions are fairly heavy users of nitrogen throughout their entire growth cycle. Because of their limited root systems they are somewhat restricted in their uptake of nutrients from the soil. Light (15 to 20 pounds) and frequent applications of nitrogen fertilizer are therefore recommended. For the same reason additional phosphate fertilizer is suggested. This is especially needed where phosphates have not been applied to the soil for previous crops. However, phosphate applications need not be made throughout the growing season because P_2O_5 does not move appreciably in the soil nor is it leached out of the root zone by irrigations, but remains in the area where applied until used by plants. A single properly applied application at pre-planting time or during first cultivation period will be sufficient.

The quantity of fertilizer materials needed will depend largely on soil type, previous cropping history, residual fertilizer, and several other factors. From 100 to 150 pounds of actual nitrogen and 45 pounds of actual P_2O_5 will normally produce an excellent crop of onions.

In the pre-planting broadcast application, one should apply ap-

proximately 40 to 50 pounds of actual nitrogen per acre. All of the phosphorus intended to be used to produce this crop should be applied at this time. If pre-planting fertilizers are used, they should be worked into the upper few inches of soil or be applied in the pre-planting irrigation prior to listing or furrowing-out for planting. This will allow for folding most of the fertilizer into the beds while furrowing-out the field in preparation for planting. If a pre-planting application of P_2O_5 is not used and this material is to be included in the program, it should be applied not later than the first cultivation period after seedling emergence.

Three to five additional light applications of nitrogen should be used. Side-dressing with dry fertilizer materials or water applications of agricultural ammonia or liquid nitrogen may be used. The choice of nitrogen fertilizer appears to depend more on cost per unit of N than on other characteristics. Therefore, the least expensive type and the form best adapted to the specific field conditions should be selected. Each of the subsequent applications will require from 15 to 20 pounds of actual nitrogen per acre. The last application should be made before the bulbs form. Nitrogen applied after bulb formation and during their development will generally result in the production of thick-necked onions which do not cure properly.

For bunching onions, the supply of nitrogen should be kept high to stimulate active vegetative growth and development throughout the entire life of the plant. Three to five side-dressings or water applications of fertilizer may be necessary to maintain a high fertility level.

High quality poultry or feed lot manures are excellent fertilizers for onion production. This is especially true where green bunching onions are being grown. Yields have been greatly increased with applications of five tons of poultry manure or 10 to 20 tons of feed lot manure per acre. Although quality poultry manure is in short supply, its use is recommended when available. Poultry manure containing an abundance of lime should be avoided. When manures are included in the fertilizer program, the inorganic fertilizer supply should be reduced by ⅓ to ½ the amount normally recommended where only inorganic materials are used.

When dry-type fertilizers are side-dressed they should be placed two to three inches to the furrow side and just deep enough to be covered with the soil. An easy and effective way to apply nitrogen is in the irrigation water as agricultural ammonia or nitrogen solutions. In applying nitrogen in the irrigation water, one should be cautioned to control the amount of run-off to prevent loss of fertilizer.

CULTIVATION

For onions, as for other vegetable crops, there are only a few reasons why cultivation may be necessary. These are:

1. To control weeds. (This is the most important reason.)
2. To mulch the area to facilitate proper side-dressing with commercial fertilizers.

Figure 5.—Good and poor weed control: At left, "clean" rows of onions thriving because they have no competition from weeds. At right, weed-choked rows in which onions have a desperate fight for survival and growth.

3. To loosen the top soil as an aid in water penetration.
4. Break up surface crusts. (To allow for soil aeration.)

Excessive numbers of cultivations are time consuming and expensive. Because of the shallow, less extensive rooting habits of onions, very shallow cultivations are recommended. Deep cultivations may cause serious damage through root pruning. Above all, do not cultivate when fields are wet.

WEED CONTROL

To minimize the necessity of chemical weed control measures or hand weeding, the onion beds should be evenly spaced, of uniform height, and with rows shaped uniformly on the beds to aid in close, precision cultivation. Careful and efficient mechanical cultivation will eliminate or minimize much costly hand weeding. (Remember, cultivation is used chiefly for weed control.) Where weeds have been allowed to grow much beyond the cotyledon stage, hand weeding will be necessary, since chemical weed control is not very effective on older weeds. In this case extreme care must be exercised so that the onion roots are not disturbed.

Grasses, because of their extensive fibrous root systems, should never be allowed to get out of hand in onion plantings.

CHEMICAL WEED CONTROL

Chemical weed control can be effective if recommended materials are properly applied. If such

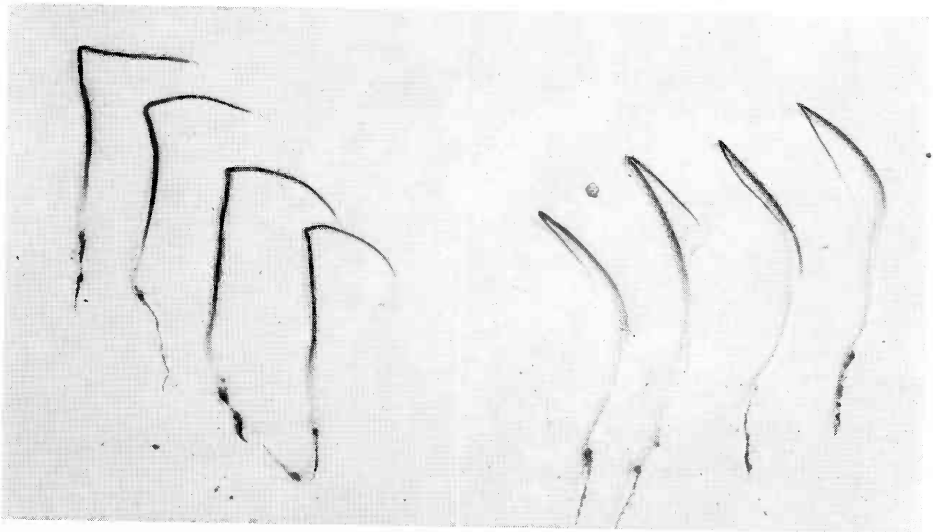


Figure 6.—Stages of development in onion seedlings: Left, the flag stage; at right, the crook or knee stage.

chemicals are improperly applied they can be costly and ineffective. Although far from ideal, the generally recommended chemical for weed control in onions is potassium cyanate — commercially marketed as Aero Cyanate weed killer. The suggested dosage is seven to 10 pounds dissolved in 40 to 50 gallons of water per acre if the entire area — bed and furrow — is to be sprayed. For row or band treatment this rate should be reduced proportionately for the specific area to be covered. To be effective, the plants — both onions and weeds — should be in an active growing condition. The onions should be in the knee or crook stage and the soil should be moist, but not wet. The plants, however, should be dry and free from dew. Fan type nozzles are recommended. They should be arranged so as to get complete plant coverage. The application should be made at 30 to 40 pounds pressure. The speed of the sprayer unit should be slow enough for thorough coverage, which depends on orifice size, pressure, and nozzle spacing. However, the maximum speed should not exceed three miles per hour.

Applications of potassium cyanate will be ineffective in killing weeds if: (1) Temperatures are cold enough for several days to retard growth, (2) The weeds have been hardened off—regardless of cause, (3) Heavy dew has accumulated, (4) Applied when evaporation rates are high. Often more than one application of Aero Cyanate is necessary to do an adequate weed control job.

Experiments conducted in the Salt River Valley have shown that agricultural or commercial grade sulfuric acid is an effective weedicide against bur clover and many other difficult-to-kill broadleaf weeds. The use of five gallons of concentrated sulfuric

acid added to 100 gallons of water (approximately a 5% solution) applied at 100 gallons per acre gave satisfactory weed control without damage to the onions. The solution should be applied when the onions are in the seedling stage.

Because sulfuric acid is extremely difficult and dangerous to handle, the following precautions **must be** exercised in mixing and using it.

1. **Mix by pouring acid slowly down the side of the spray tank into the water. Never mix by adding water to acid. (Heat is generated by this mixing and explosive spattering may result.)**
2. **Sulfuric acid, either dilute or concentrated, is destructive to shoes, clothing and skin.**
3. **Wear acid-resistant clothing, rubber gloves and goggles when handling either dilute or concentrated sulfuric acid.**
4. **Have a supply of bicarbonate of soda solution handy to wash off any acid that might fall on the skin.**
5. **Never put either diluted or concentrated acid in galvanized iron containers.**
6. **Wash out sprayer with dilute bicarbonate of soda solution, or ammonia solution, followed by fresh water or if these solutions are not available, use an abundance of fresh water.**
7. **Sulfuric acid is very corrosive to equipment. Always use a bronze, brass or stainless steel-lined pump and a wooden, brass or lead-lined tank. This will hold corrosion to a minimum.**
8. **Tractor drivers should wear goggles to prevent spray from injuring their eyes.**

If you are using this treatment for the first time, it is recommended that your county agent be asked to assist you in getting started.

HARVESTING

DRY (BULB) ONIONS

Harvesting dry (bulb) onions in the major producing areas of the Salt River Valley normally begins in early May and continues into June. In Greenlee County, harvesting is done from July 15 to August 15. Speed and methods used in onion harvesting must be determined in accordance with the total acreage to be harvested at a given time so that the bulk of the crop can be harvested in prime condition.

The commonly accepted practice is to begin harvesting when from 10 to 25 per cent of the necks have broken over. After they have reached this stage and after the water has been withheld for 10 to 14 days, the remaining upright tops may be broken over by the use of rollers. If this procedure is used in determining maturity, a few bulbs will be too green and a few overmature, but the bulk of the bulbs will be of proper maturity. Onions should not be harvested when a large percentage of bulbs are too green, because of the losses due to shriveling and susceptibility to soft rot.

UNDERCUTTING

Undercutting is done with the aid of cultivator knives or similar apparatus. The knives are adjusted to completely sever the roots, but with a minimum of lifting and exposure of the bulbs themselves. Exposure to the hot sun for even short periods of time will cause damage to the bulbs. In heavy soils the bulbs are sometimes pulled by hand after under-

Figure 7.—Onions loaded in a freight car for shipment. Note how these 50-pound bags are spaced so there is free air movement around the bags.

cutting and laid in the field in a shingling fashion, tops of one layer of plants covering bulbs of the next layer of plants and so on, to prevent the sun from causing damage to the bulbs during the curing process.

Usually undercutting is done with a custom made, 3 to 4-inch wide knife-like blade. The blade is firmly connected to two heavy duty shanks. It is adjusted to run parallel to the soil surface and with a slight downward tilt from rear to front. The knife is set just deep enough to completely cut the roots and to cause a slight lifting and loosening of the bulbs. The tops usually wilt quickly and thus cover and protect the bulbs until topped. If the stand is too thin or the tops too small some sunburning may result. Under these conditions, the layering method is recommended.

TOPPING

Onions are usually topped in two to four days following undercutting, depending on the condition of the tops. Tops should be cut about ½ to ¾ inch from the bulb to allow for proper drying and sealing of the stem and thus reduce later spoilage. After the tops are clipped, the bulbs are placed in field bags where they continue curing until moved into the packing shed. If the tops of the bags are open and the onions are unprotected while curing in the field, a handful of clipped tops should be placed over the open bag to prevent sun burning of the exposed bulbs.

GRADING AND SACKING

In the Salt River Valley and Yuma Valley, onions are sorted and graded into three market-

able sizes and sacked in 50-pound mesh bags. Sizing is as follows:

Small (boilers) onions—1 to 2 inches in diameter.

Medium sized onions — 2 to 3 inches in diameter.

Large (jumbo) onions — Over 3 inches in diameter (10 per cent larger than 3½ inches in diameter).

In grading, care should be exercised to eliminate diseased bulbs.

Since most of the varieties grown in Maricopa, Yuma, and Greenlee counties are not storage types, they should be consumed within a two-month period after harvest. In the smaller areas of the northern Arizona counties, onions are often stored for two to four months or even longer before being used or packaged and sold on the market.

GREEN BUNCHING ONIONS

Green bunching onions are harvested when they reach about 1/4 to 3/8-inch in diameter. Pulling is done by hand when the soil is still quite moist. The soil being moist makes pulling easier and reduces breaking of leaves from the shanks or the shanks from the roots. When the soil is too dry or hard for easy pulling, spading forks are used to loosen the soil.

Since the entire plant is marketed, all discolored or broken leaves or leaf-tips should be removed. After the plants are checked, they are tied in bunches of 7 to 9 plants each. Tying may be done with rubber bands or paper covered tying wires. One dozen of these bunches are tied together and stacked with roots down into western-type lettuce

Figure 8.—Harvesting of green bunching onions. At left, individual bunches are being tied into 12-bunch groups; right, a field crate of green bunching onions ready for washing. A 12-bunch group is shown outside the crate.

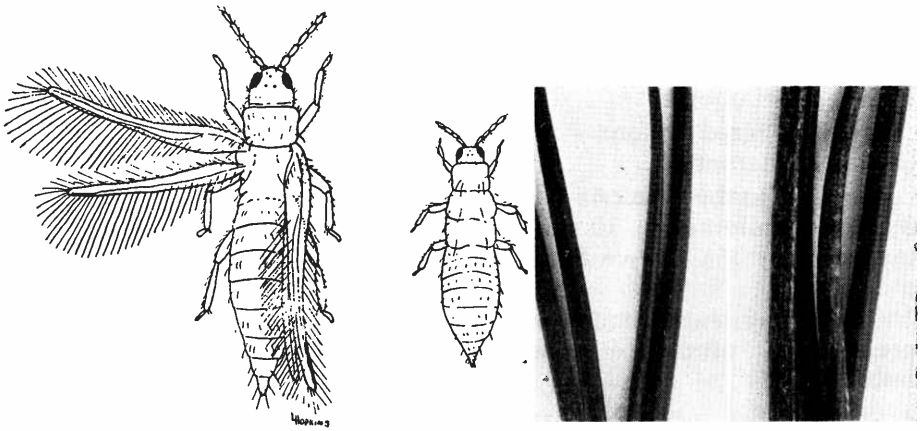


Figure 9.—(a) Onion thrips; adult at left and nymph at right.
(b) Thrips damage. Plant at left is normal and healthy, while plant at right shows the typical "silvering" spots indicating thrips damage.

crates. They are then washed, while still in the crates, to remove any remaining soil from the roots. After draining they are loaded for shipment to local markets. For out-of-state shipment they are packed horizontally in western-type lettuce crates, three layers deep with five dozen bunches per layer. The roots of each layer face in the direction opposite to those of adjoining layers. Each layer is separated from the next layer by a sheet of heavy waxed paper and a layer of crushed ice.

YIELDS

Bulb onion yields will vary considerably, but will average 500 to 800 fifty-pound bags per acre. Excellent yields are 1,100 to 1,200 fifty-pound bags per acre. By comparison these yields are well above those in many other onion-producing areas.

Average green onion yields are 5,000 to 6,000 dozen bunches with excellent yields amounting to 10,000 to 11,000 dozen bunches.

INSECTS*

Onion Thrips *Thrips tabaci* (Lindeman)

The onion thrips is the most important insect attacking onions. It infests onions wherever they are grown in Arizona.

Adult thrips are small elongated insects, pale yellow to light brown in color, and about 1/20 of an inch long. The nymphs (immature forms) are smaller and paler in color. Thrips are usually not noticed on onion plantings until a heavy population develops. The resulting injury shows up as spotted-blades, blasted blade-tips, or slow growth. The adult thrips first attack the on-

*The author wishes to express his appreciation to Dr. Lemac Hopkins, formerly Assistant Entomologist, University of Arizona, for supplying information on insects.

ion in the growing bud, where they produce numerous offspring. As the number of thrips per plant increases, they move out onto the leaf blades, where they concentrate their feeding near the tip, causing the characteristic tip blasting. During cool periods or the hot part of the day most of the thrips move back to the protected bud area and may not be noticed by casual field inspection. Eventually, infested onions take on a greyish appearance due to the removal of the green coloring matter by the feeding of this insect. This feeding slows the growth of the bulb and in severe infestations may kill the plants.

Steps should be taken to control these insects as soon as injury becomes apparent. Effective control can be obtained by applying either 2% dieldrin, 10% chlordane or 20% toxaphene dust at 15 to 20 pounds per acre.[4] A 2½% heptachlor dust is also very effective and relatively inexpensive.[4] These materials should be applied by ground equipment with the dust directed down into the crown or neck of the plants. In most cases additional applications at weekly intervals will be necessary to keep the insects under control. Thorough coverage is essential for good control. In order to meet federal residue tolerances, these insecticides should not be applied later than 30 days before harvest. Residue tolerances are set by the U. S. Food & Drug Administration.

Occasionally other insects, such as grasshoppers, armyworms, cutworms, and crickets may become a problem in onion production. If this should happen, it is suggested that you contact your county agricultural agent for specific control measures.

DISEASES*

Bacterial Soft Rot *Erwinia spp.*

Bacterial soft rot disease begins in maturing fields of onions, but its presence may go unnoticed until after harvest. The disease is caused by bacteria, which enter the neck tissue through dead or old leaves and progress down one or more scales without passing from one scale to another. When rot has progressed down between the scales for some time, the diseased bulbs can be detected by gentle pressure. This pressure causes a watery fluid to exude from the neck of the onion. The slimy decay is usually accompanied by a foul, sulfurous odor.

The disease can be prevented by letting the crop mature well before undercutting. The tops should be allowed to dry as long as possible before the topping operation. Sunburned and bruised bulbs are very likely to rot in storage and should be culled out before bagging.

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[4]The following residue tolerances at harvest time have been established for these insecticides: dieldrin 0.1 ppm; chlordane 0.3 ppm; toxaphene 7.0 ppm and heptachlor 0.1 ppm.

*The author wishes to express his appreciation to Dr. R. B. Marlatt, Assistant Plant Pathologist, University of Arizona, for supplying the information on diseases.

Pink Root *Pyrenochaeta terrestris*

Pink Root is caused by a soil-borne fungus and may be found in young seedlings or at any time during the growth period of the onions. Affected roots turn pink, shrivel and die. As the plant sends out new roots they eventually become diseased also. Thus diseased plants have a large number of dead roots. Affected plants often produce small bulbs, fail to bulb or, less frequently, the entire plant may be killed. During the growing season there may be few above-ground symptoms. The plants may appear to be somewhat stunted if pink root is very severe. However, the diseased plants become very noticeable at harvest time. Size of the bulbs is an indication of the seriousness of the attack. The more serious the disease, the smaller the bulbs.

The fungus can cause disease in garlic, shallots, and sometimes chives and leeks. It persists in the soil indefinitely. Thus onions planted on infested soil are likely to become diseased.

Pink root is prevented by growing pink-root-resistant varieties. If a susceptible variety is found to be infected when the plants are small, an abundance of nitrogen fertilizer and water have occasionally been helpful. Forcing the growth in this manner will permit the plants to form new roots to replace those that are diseased.

Production Cost Guide — Dry Onions

	No. of Times	COSTS[1] Per Acre	COSTS[1] Per Sack	YOUR COSTS Per Acre	YOUR COSTS Per Sack
Land Preparation and Planting[2]					
Plowing	1	$ 3.00			
Disking	1	.70			
Land Planing	1	1.25			
Fertilizing (broadcast)	1	.40			
Disking (optional)	1	.70			
Listing or furrowing-out	1	.75			
Sledding and Planting	1	1.50			
TOTAL		$ 8.30	.0138		
Culture[2]					
Irrigating	15	18.75			
Cultivating	4	3.00			
Spraying (weed control)	2	2.00			
Hand Weeding	1	2.00			
Dusting (insect control)	3	3.00			
Fertilizing	4	2.80			
TOTAL		31.55	.0526		
Materials					
Irrigation Water, 4 A/Ft.		20.00			
Insecticide		10.50			
Seed		8.26			
Fertilizer (135 lb. N, 45 lb. P_2O_5)		23.42			
Weed Sprays (15 lb. in 2 appl.)		11.25			
TOTAL		73.43	.1224		
Harvesting					
Undercutting		2.50			
Topping		187.14			
Sacks and Pads for car loading		123.90			
Haul to Shed		19.26			
Sorting, Grading, Sacking		53.40			
Loading on car		12.00			
Inspection		9.78			
TOTAL		407.98	.6800		
Farm Overhead					
General Farm Expense, 6 mo.[3]		24.00			
Equipment Depreciation and Expense, 6 mo.[4]		12.50			
Industrial Insurance		4.00			
Interest on Investment, 6 mo. @ 5%		10.00			
Taxes, 6 mo.		3.00			
TOTAL		53.50	.0891		
GRAND TOTAL		$574.76	.9579		

[1]Based on 1955 commercial costs for production of 600 50-pound bags of dry-onions per acre in the Salt River Valley in Arizona.

[2]All items of Land Preparation, Planting, and Culture include labor, fuel, grease, but not overhead. (Not custom operator price.)

[3]General Farm Expense includes management, fence repair, fence line and ditch weed control, and miscellaneous.

[4]Equipment Depreciation and Expense includes depreciation on all equipment used to produce a dry-onion crop.

Adapted from information prepared by Ray L. Milne, Assistant County Agricultural Agent, University of Arizona Extension Service, Maricopa County, Phoenix, Arizona.

Management Checklist for Growing Dry Onions

(Listed in Normal Sequence)

SOIL PREPARATION*

1. Plow
2. Disk
3. Land Plane or Float
4. Fertilize, Broadcast (optional)
5. List or Furrow-out

PLANTING AND GROWING

6. Bed Shaping and Planting (Sled)
7. Irrigate (2 or 3 times)
8. Cultivate
9. Irrigate
10. Weed Spray Application
11. Irrigate
12. Cultivate
13. Weed Spray Application (if needed)
14. Fertilize
15. Irrigate
16. Hand Weed (if needed)
17. Cultivate
18. Fertilize
19. Irrigate (10 times)
20. Fertilize (3 times). Apply every other irrigation during first 6 irrigations. (See item 19.)

Dust for insect control 3 times (or more as needed). Apply first dusting when insect damage is observed.

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*All listed operations are not always necessary.

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Harold E. Myers

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