

# *Lettuce Seed Production in Arizona*



# SUMMARY

Lettuce seed is an important horticultural crop in Arizona. In acreage planted, lettuce for seed greatly exceeds such crops as sweet corn, celery, sweet potatoes, and cauliflower and compares very favorably with cabbage, winter carrots, and onions. In value of product, lettuce seed surpasses most of these crops. The lettuce seed industry in Arizona, while still relatively small and specialized, may be expected to grow as the market for seed increases and as the full potentialities of Arizona as a seed-producing state are realized.

For the individual grower, the production of lettuce seed offers diversification to his cropping program, the challenge of a relatively new enterprise, and an opportunity for substantial income. The crop is well adapted to Arizona growing conditions and farming methods.

Fields used for growing lettuce seed should be chosen carefully. Natural fertility and structure of the soil are very important as are such considerations as crop history, weed population, and adequate isolation from other lettuce seed production.

While any type of lettuce seed may be grown successfully in Arizona, only the adapted strains are recommended, especially for the novice grower. With any variety, it is very important to plant only the best seed available for increase. The lettuce certification program of the Arizona Crop Improvement Association offers an excellent source of high quality stock seed.

Even though the primary interest may be in the production of seed, every effort should be made to grow a good "head" crop before making seed. A superior vegetative crop insures a better seed crop

by making roguing more efficient and by providing a good start for the seed plants.

Harvesting the head crop is strongly recommended to provide income, to evaluate the strain, and to eliminate extra cultural operations. A method for producing both a market crop and a seed crop from the same plants is outlined in this bulletin.

The quality of lettuce seed produced is directly proportional to the care taken in roguing the field. Roguing is the most important step since only a good job of roguing will insure harvesting high quality seed which is pure and true to type. Since roguing is a complicated procedure, it is thoroughly discussed and illustrated in a section of this bulletin.

Fortunately, the growing of seed plants, control of insects and diseases, and the harvesting of the seed are relatively easy. Proper fertilization, weed control, and a single application of insecticide will usually bring a crop to maturity without trouble. Harvesting is best done by hand in several steps.

Arizona is the only state which has an organized program for certifying lettuce seed. Any grower who meets certain requirements and who follows a few simple rules and regulations may produce this premium seed. The Arizona Crop Improvement Association and the University of Arizona are anxious to help any lettuce seed grower with certification or any other problems.

The hazards of growing lettuce seed are few and are all dependent upon weather. These problems as well as an interesting section on lettuce breeding are discussed briefly in this bulletin.

# *Lettuce Seed Production in Arizona*

R. E. Foster and C. W. Van Horn<sup>1</sup>

Growing of commercial crops of lettuce seed is at present a relatively small but important industry in Arizona. Annually there are about 1,000 acres devoted to this crop, with a current value of nearly a million dollars.

The crop is important in that it represents a variation from the usual vegetable crops grown in the state and because of its future potentialities. Lettuce seed was first grown on a commercial scale in Yuma County in 1931 and the industry has continued successfully in Arizona since that time. In past years, production of lettuce seed in Arizona has been confined largely to the irrigated regions of the Yuma and Salt River valleys. However, a lettuce seed crop may be grown in any area of southern or central Arizona where head lettuce is grown. Because growing lettuce seed is a specialized enterprise, and because of its rather important future possibilities, this information has been written to serve as a guide to those who are considering the crop for the first time, as well as a source of reference for more experienced growers.

## **CHOICE AND PREPARATION OF THE FIELD**

Fields should be chosen carefully. It is important to keep the crop in a healthy, vigorous growing condition for periods up to 10 months. The ground should be fertile, well drained, and with a history of low

weed count. A field should be chosen which has not grown a lettuce crop for several years, and which has not shown extensive damage from sclerotinose or big vein disease. The field should be located so that it can be managed efficiently for a full year, and should be isolated from other fields in which lettuce seed is to be grown.

Lettuce does not cross-pollinate readily. Isolation of fields devoted to seed production is desirable to eliminate cross-pollination entirely and to reduce the spread of disease and insects between fields. For the production of the various classes of certified lettuce seed, minimum isolation distances are set forth in the regulations of the Arizona Crop Improvement Association. These rules will be discussed later.

Because it will not be possible to work the land for a rather long time, deep plowing (subsoiling, renovating) is recommended in advance of seed bed preparation in order to improve percolation rates and general tilth of the soil. For other land operations the same procedures should be followed as for the regular commercial production of the crop.

## **PLANTING SEED**

Only the best seed should be used for seed increase. Foundation seed from the Arizona lettuce seed certification program is particularly valuable. This seed has been produced under Arizona conditions by very careful selection and roguing. It

<sup>1</sup>Associate Horticulturists, Arizona Agricultural Experiment Station.

represents the purest stock and will produce plants most nearly true to type. For varieties not under certification, seed stocks should be chosen which are known to contain a minimum of hybrids and other off-types. Seed lots which may carry excessive amounts of mosaic virus should be avoided. Trial plantings are recommended to evaluate particular stocks for subsequent seed production.

## VARIETIES

Any variety of lettuce adapted to Arizona growing conditions can be carried on to seed production. This applies not only to the common heading varieties, but also to Endive, and Romaine or Cos lettuce. In this report, emphasis is placed upon seed production of the "crisp-head" or "iceberg" types of head lettuce. Minor variations in procedure may apply to production of other types. Seed of those varieties which are especially adapted for other regions can be grown in Arizona. However, except in special cases, non-adapted varieties are not recommended. Because strains not adapted to Arizona may show atypical development at maturity, roguing is difficult. Unless very special care is taken, seed production of undesirable types may be inadvertently emphasized.

## GENERAL CULTURE

Planting should be done during the usual season for growing a "head" crop of the particular variety. Seeding should be rather heavy (2½ to 4 pounds per acre). Roguing will reduce the plant population in the field, and so it is important that the initial stand be as perfect as possible.

Fertilizer and irrigation practices should be those which have proven best for the particular field. Related recommendations are described in Arizona Agricultural Experiment Station Bulletin 278. Almost

all fields in Arizona will produce increased yields if supplementary nitrogen is applied. Some fields may require additional phosphorus, but potash is not likely to be necessary in any of the irrigated areas. Experimental seed production at the Yuma Experiment Station has been high in fields given 90 pounds of P<sub>2</sub>O<sub>5</sub> band-placed below the seed line prior to sowing, plus 50 pounds of nitrogen side-dressed or in the irrigation water. This is not a specific recommendation because the actual amounts and types of materials to be used in the fertilizer program must be determined by individual growers.

Special care is necessary in thinning lettuce grown for seed in order to provide uniform spacing. This insures a uniform head crop and facilitates evaluation of mature plants at roguing time. The field should be checked carefully for "doubles" since two plants growing in the same spot will rarely form normal heads.

Weeds should be controlled at all stages in the crop development, not only to reduce competition to the commercial crop, but also to help reduce the spread of mosaic disease. Listed in Table 1 are the weeds and other common plants which can serve as carriers or reservoirs of the virus causing lettuce mosaic. The complete host range of lettuce mosaic virus has not been studied in Arizona. Other weeds may be carriers of this virus, and so it is important that all weeds be kept at a minimum in the lettuce fields and around the edges of the fields, ditch banks, etc. In Table 2 are listed the primary noxious weeds of Arizona. These weeds must be eliminated from seed fields.

Cultivation and all other cultural practices should be followed to produce the best commercial head crop of lettuce possible. More specialized phases in the culture of the seed plants will be discussed later.

## INSECTS AND DISEASES

On the head crop of lettuce, the most important insects are the salt marsh caterpillar, cabbage looper, green peach aphid, lettuce aphid, leaf miner, yellow striped army worm, cut worms and sometimes crickets<sup>2</sup>. Information on these insects and their control is in Arizona Agricultural Experiment Station Bulletin 278.

On the seed plants, the important insects are the aphids, mites, corizids, and lygus. These insects, particularly aphids, are capable of producing severe damage to the seed plants. Fortunately, recent experiments<sup>3</sup> have shown that all of these insects may be controlled easily by a spray program involving airplane application of one pint of systox<sup>4</sup> plus three pounds of toxaphene in five gallons of water per acre. Usually one application applied to the young seeding plants is sufficient to give thorough control. A second application may be applied if necessary at any time up to 21 days before seed harvest.

Diseases sometimes found on lettuce in Arizona are rib discoloration, yellowing, tip burn, sclerotinose, mosaic, downy mildew, damping off, big vein, slime, pink rib, root knot, powdery mildew, aster

yellow and spotted wilt. Of these, the diseases of most importance to seed production are probably the following:

**Yellowing**, a physiological abnormality in the plant that usually occurs in the winter or early spring due to soil compaction and overwatering. The condition may be alleviated by careful irrigation and by deep tillage.

**Sclerotinose**, a fungus disease, attacks plants at or near the soil line and causes severe damage or death through a watery soft rot. This disease may best be controlled by avoiding fields known to carry the disease. Under severe conditions it may be controlled by the application of calcium cyanamide at the rate of 800 to 1,000 pounds per acre before planting.

**Big Vein**, a soil-borne disease, is thought to cause some loss by reducing yields from affected plants. The loss usually is not serious and a reasonable percentage of infected plants can be tolerated. Fields known to show excessive amounts of this disease should be avoided for seed production. Under certain conditions the symptoms of big vein may be confused with those of lettuce mosaic. (Figure 1.)

**Lettuce Mosaic**, a virus disease, is of considerable importance in the production of lettuce seed. Principal symptoms are stunting of the plant and a mottling of green leaf color. (Figure 2.) This disease can be seed-borne and the virus may be found in virtually all commercial lots of lettuce seed. Since it is common in some of the head lettuce-producing areas, considerable emphasis has been placed recently upon the production of mosaic-free seed. The virus can infect weed hosts and is spread by aphids, so it is virtually impossible to produce a crop of seed free of the mosaic disease unless some very special

---

<sup>2</sup>Courtesy of Dr. Lemac Hopkins, formerly Assistant Entomologist, University of Arizona.

---

<sup>3</sup>Experiments leading to recommendation given were conducted by Dr. D. M. Tuttle, Assistant Entomologist, University of Arizona.

---

<sup>4</sup>At present, Systox is not registered for use on lettuce for food and therefore cannot be used on the head crop. Use is permitted on the seed crop until 21 days prior to harvest.

TABLE 1

## Host Plants of Lettuce Mosaic Virus

Cultivated Lettuce.....	<i>Lactuca sativa</i> L.
Common Groundsel.....	<i>Senecio vulgaris</i> L.
Prickly Sow Thistle.....	<i>Sonchus asper</i> L.
Prickly Lettuce.....	<i>Lactuca Serriola</i> L.
Wild Lettuce.....	<i>Lactuca virosa</i> L.
Endive.....	<i>Cichorium Endiva</i> L.
Aster.....	<i>Aster</i> spp.
Cineraria.....	<i>Cineraria cruenta</i> Mass.
Marigold.....	<i>Calendula officinalis</i> L.
Zinnia.....	<i>Zinnia elegans</i> Jacq.
Sweet Pea.....	<i>Lathyrus odoratus</i> L.
Lincoln Pea.....	<i>Pisum sativum</i> L.
Chicory.....	<i>Cichorium Intybus</i> L.

TABLE 2.

## Primary Noxious Weeds of Arizona

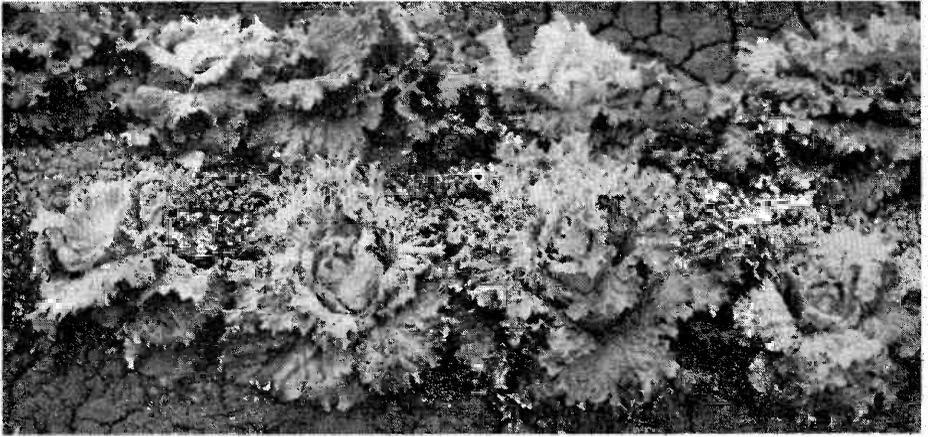
**A. Prohibited**

Camel Thorn.....	<i>Alhagi camelorum</i> Fisch.
Russian Knapweed.....	<i>Centaurea repens</i> L.
Canada Thistle.....	<i>Cirsium arvense</i> (L.) Scop.
Field Bindweed.....	<i>Convolvulus arvensis</i> L.
Nut Grass.....	<i>Cyperus rotundus</i> L.
Chufa Nut Grass.....	<i>Cyperus esculentus</i> L.
Leafy Spurge.....	<i>Euphorbia esula</i>
Morning Glory.....	<i>Ipomoea purpurea</i> (L.) Roth.
	<i>Ipomoea hirsutula</i> Jacq.
	<i>Ipomoea heterophylla</i> Ortega
Hoary Cress.....	<i>Cardamine Draba</i> L. var <i>repens</i> Thell.
Peppercress.....	<i>Cardamine pubescens</i> Desv.
White Horse Nettle.....	<i>Solanum elaeagnifolium</i> Cav.
Carolina Horse Nettle.....	<i>Solanum carolinense</i> L.
Perennial Sow Thistle.....	<i>Sonchus arvensis</i> L.
Johnson Grass.....	<i>Sorghum halepense</i> (L.) Pers.
Blueweed.....	<i>Helianthus ciliaris</i> DC.

**B. Restricted**Limitations per pound  
of certified seed

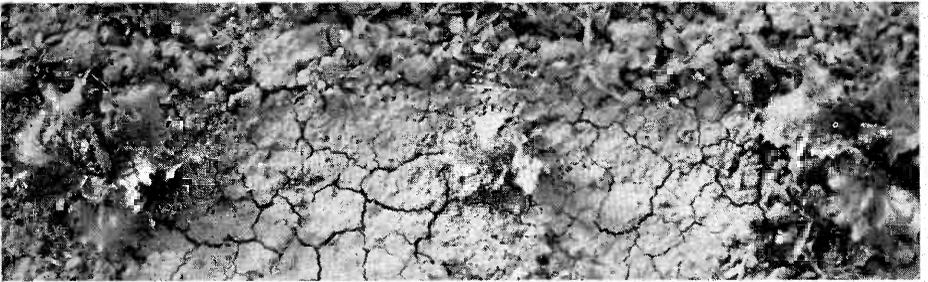
Dodder.....	<i>Cuscuta</i> spp.	45
Dock, curly.....	<i>Rumex crispus</i> .	300
Mallow, alkali.....	<i>Sida hederacea</i> .	300
Mustard, wild.....	<i>Brassica</i> spp.	300
Oat, wild.....	<i>Avena fatua</i>	100
Puncturevine.....	<i>Tribulus terrestris</i> .	100
Russian thistle.....	<i>Salsola kali</i> var. <i>tenuifolia</i> .	300
Sandbur.....	<i>Cenchrus pauciflorus</i> .	100

Sum Total Restricted Noxious Weed Seeds (Subject to above limitations) 500 per pound.



**Figure 1. Two lettuce plants affected with big vein.**

**Dos plantas de lechuga atacadas por "vena gorda"**



**Figure 2. A seedling lettuce plant stunted by mosaic.**

**Plantita de lechuga detenida en su desarrolls por ataque de mosaico.**

precautions and control measures are taken. However, effort should be made toward the reduction of mosaic in the seed crop. Both in obtaining high yields of seed and in producing seed containing smaller percentages of mosaic, it would be to the advantage of the grower to follow several steps aimed toward control of the virus: (1) Completely remove weed hosts of the virus, (2) Effectively control aphids in all stages of lettuce development, and (3) Remove infected plants during careful preliminary roguing.

## **ROGUING**

Roguing may be defined as the removal of plants which are undesirable in one or more respects. Roguing is practiced to prevent the multiplication of seed from plants that are not representative or true-to-type of the variety being propagated. It is also used to avoid the production of disease-infested seed. Except in the production of certified seed, the extent of the roguing is entirely at the discretion of the grower or the buyer of the seed, or both. It may be either severe

or light, depending upon the requirements of the particular seed crop grown and the relative purity of the original stock.

While roguing is a very important part of any seed production program, limitations of the procedure must be recognized. Roguing will eliminate from the seed stocks many of the undesirable individuals. However, many of the genetically controlled undesirable traits cannot be removed entirely by roguing. This is true for characteristics controlled by peculiar genetic inheritance and for characteristics, such as seed color, which cannot be recognized prior to blossoming time.

Unless roguing is practiced very carefully, it may actually result in a change in the characteristics of the variety grown. This is a particular danger in the production of seed of varieties not especially adapted to Arizona, as for example,

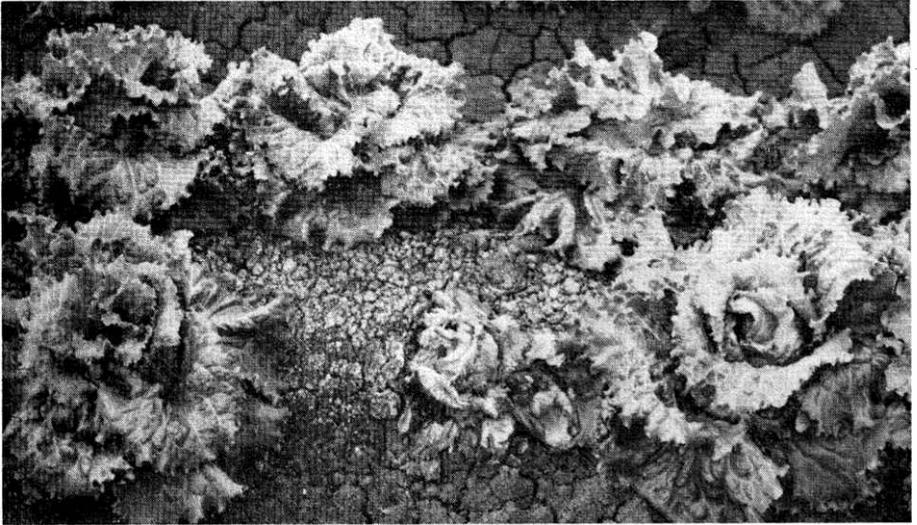
“Eastern” strains. Those plants, which do not grow particularly well in Arizona and therefore may be removed as rogues, may be the very individuals which make the variety valuable in other regions.

The extent of roguing should be adjusted to conform to the standards of the variety grown. For example, the older Regular Great Lakes strain is normally made up of a number of closely related types and the wide adaptation of this particular strain is due, partly, to the variable nature of the individuals within the strain. On the other hand, some of the newer strains of Great Lakes have been refined and have been selected to much narrower limits of variability. For this reason, in fields of Regular Great Lakes, variability can be allowed between plants during the roguing process; for the highly-refined strains, roguing should be more strict.



**Figure 3.** When chopping out plants, cut deep below the surface of the soil so that the plants will not grow back again.

**Cuando esten entresacando plantas, corten hondo, debajo de la superficie del suelo, para que ellas no vuelvan a crecer.**



**Figure 4. Get rid of small, weak plants. The one in this picture is sick and should be removed.**

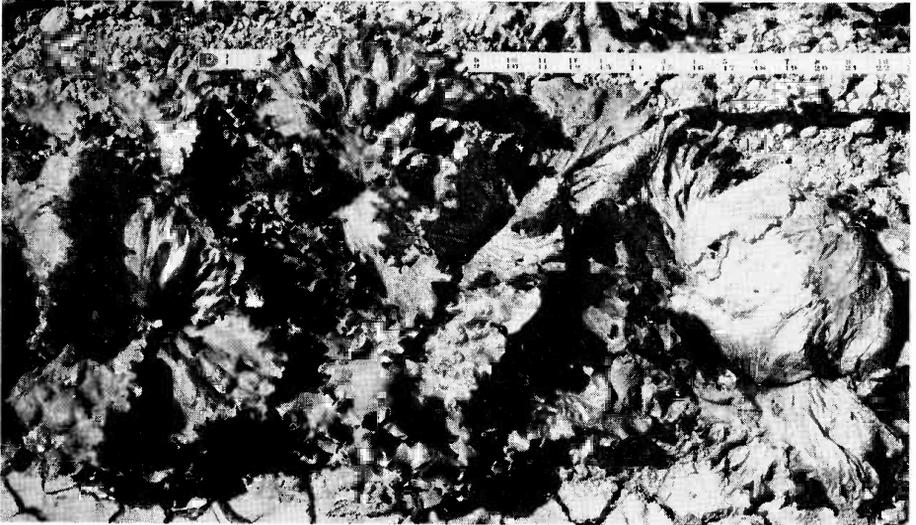
**Eliminar las plantas de lechugas que sean chicas y raquíticas. La de la fotografía es planta enferma, y debe ser eliminada.**

Roguing of lettuce grown for seed production is usually accomplished in two or more steps. For individual fields and individual roguing these should be done in as short a time as possible. For this reason it is usually necessary to employ a crew of workers to rogue a field within one to two days. It is suggested that each five or six members of the roguing crew be supervised by a foreman, and foremen be directed by a general roguing supervisor. The general supervisor and the foremen should be thoroughly familiar with the variety being grown and with the goals to be achieved in the seed production program. Individual crew members are usually assigned a single furrow in a field and are requested to rogue out undesirable plants on either side of that furrow.

It is very important that the crew members be instructed to cut rogue plants below the crown, that

is, below the soil surface, to prevent subsequent sprouting and seed production. (Figure 3.) The foreman supervising five or six crew members is able to check the roguing carefully and be available to make decisions and answer questions. The general supervisor can check the activities of the various foremen, emphasizing or de-emphasizing procedures in the roguing program. In Arizona, crews of Mexican National laborers are often used for roguing.

The number of roguings necessary will depend upon the goals to be achieved, upon the purity of the stock planted, and upon the performance of the lettuce being grown. Usually it is necessary to have a preliminary roguing at least 14 days prior to crop maturity. In this first roguing, types to remove are: (1) Plants that are immature or are stunted due to mosaic or other disease, (Figure 4.);



**Figure 5.** Plants that are a lot older than the rest should be removed. Such plants, like the one on the right side of the picture, are usually light colored and have dried leaves covering the head.

Plantas de lechugas que sean mucho mas viejas que las demás, deben ser eliminadas. Plantas, como la que se ve en el lado derecho de la fotografia, son por lo general de poco color y tienen hojas secas cubriendo la cabeza.



**Figure 6.** On the right an obvious off-type plant that should be removed at the first roguing.

En el lado derecho una planta evidentemente de eliminación que debió sacarse durante el primer raleo de plantas no correspondientes a la variedad.

(2) Plants which are overmature, (Figure 5); and (3) Any obvious off-type plants, such as hybrids and varietal mixtures, (Figure 6). Removal of underdeveloped or overmature plants will help preserve a uniform maturity in crops grown from the seed produced. This is of prime importance to the lettuce industry. During the first roguing, "doubles" may be removed which have been missed in the thinning operations.

The second roguing, or main roguing, is considered the most important and should be made at crop maturity, or no more than one to

two days before harvest time of the head crop. At this time, those plants which are immature or overmature should be removed. Any plants which tend to bolt (premature formation of the seed stalk, Figure 7) should also be removed. This is of particular importance in those varieties which are adapted to the early fall season in Arizona or to seasons in other areas where bolting ordinarily causes trouble.

Any plants representing a varietal mixture should be removed during this main roguing. For example, Great Lakes heads may appear within strains of Imperial types of



**Figure 7.** Premature seed stalk formation (bolting) as shown in the center of the picture is a very undesirable characteristic. Plants of this type should be removed during any of the first three rougings.

Prematura formación del tallo de semilla a sea "bolting" (como se ve en el centro de la fotografía) es una característica bastante indeseable. Plantas de este tipo deben ser eliminadas durante cualquiera de las primeras tres veces que se ralee.



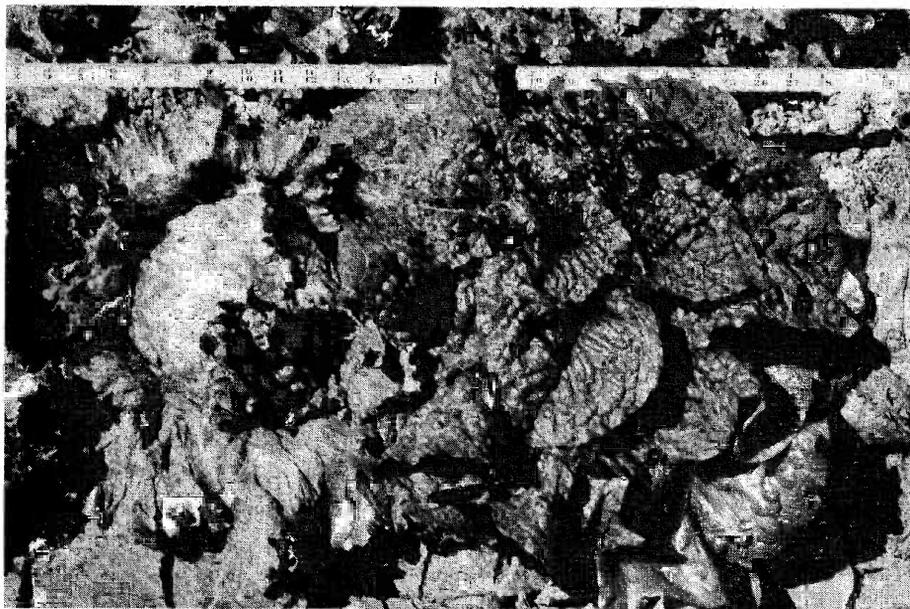
Figure 8. Remove "freak" plants or those that look different from the rest of the plants in the row. For example, the plant on the right-hand side has large smooth leaves compared to a good plant on the left.

Eliminar todas las matas que no sean normales, o sea aquellas que se vean diferentes de las demás en el surco. Por ejemplo, la mata en el lado derecho tiene hojas grandes y lisas, comparada con la buena planta del lado izquierdo.

lettuce or vice versa. If, for some reason, the percentage of mixtures is relatively large, the off-type heads can be packed for sale providing, of course, that the entire plant is removed in the process. All other off-type plants (Figures 8 and 9) should also be removed. It is difficult to describe undesirable plants in a general way because the particular characteristics of the variety grown will determine the classifications of off-type plants. In any variety, however, the following rogues must be removed: (1) Plants which are either too leafy (Figure 10) or conversely, (2) Plants which are too bald or in other ways have a poor wrapper condition; (3) Plants which have not formed heads (Figure 11), or (4) Plants which are either too

small (Figure 12) or too large (Figure 13), for the particular variety.

It is also usually to the grower's advantage to remove any diseased plants. This is particularly true for plants affected with lettuce mosaic (Figure 14) as an attempt to reduce the amount of mosaic in the seed crop. It also applies to plants with sclerotinose (Figure 15), not because the disease is seed-borne, but because removal of affected plants tends to arrest development of the fungus and thereby improves the condition of the field for future crops of lettuce. Actually, plants which show symptoms of sclerotinose at maturity very rarely produce any seed. If big vein is not extensive in the field, affected plants may be removed. Seed produced from these plants usually



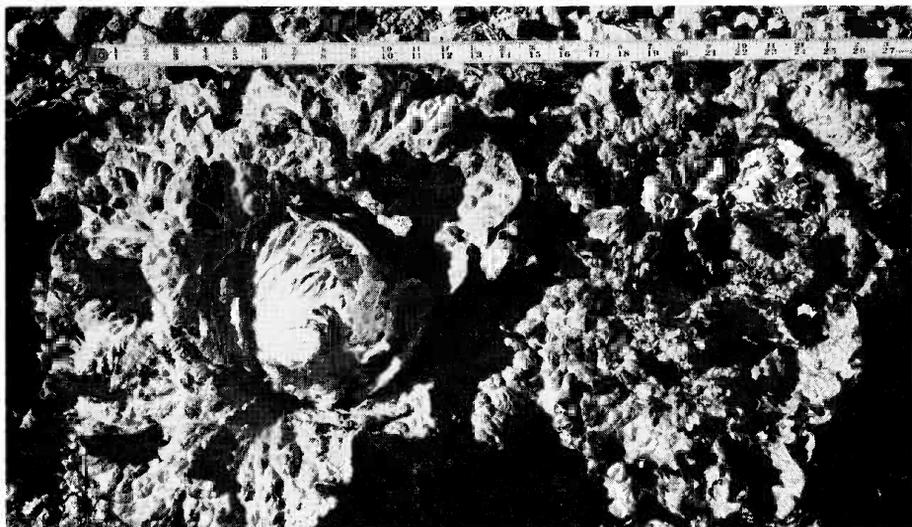
**Figure 9.** The plant on the right is a very bad type. It is large, dark green, and has not formed a head. Kill all plants like this.

**La planta de lechuga que se ve en el lado derecho de la fotografía es un tipo sumamente malo. Es muy grande, de color verde oscuro, y no ha formado cabeza. Destruir todas las plantas de este tipo.**



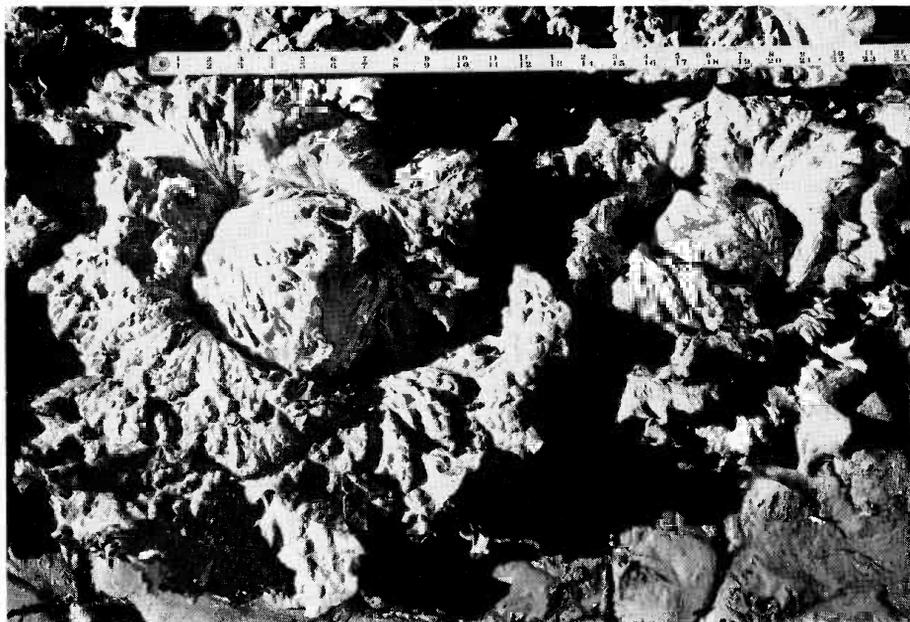
**Figure 10.** Chop out plants with too many leaves surrounding the head. The plant on the right-hand side has too many leaves for this variety.

**Eliminar aquellas plantas de lechuga que tengan demasiadas hojas alrededor de la cabeza. La planta de lechuga que se ve en el lado derecho, tiene demasiadas hojas como para calificarla correspondiente a la variedad.**



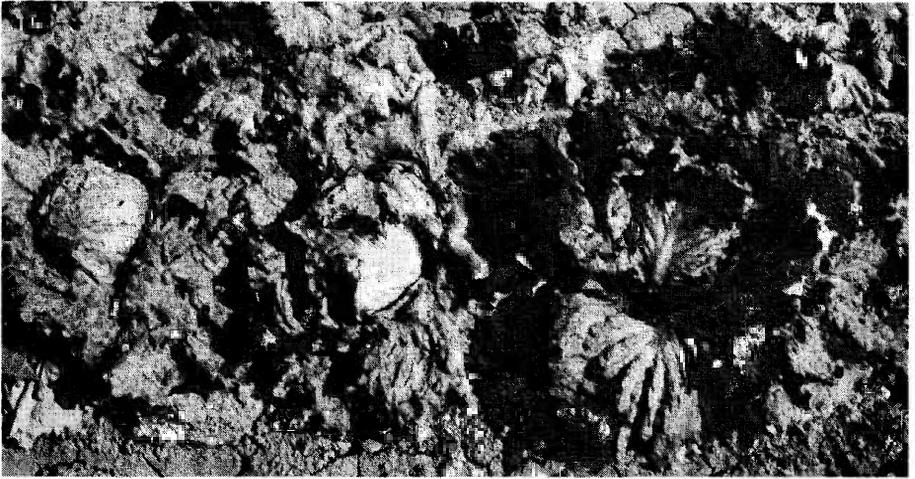
**Figure 11. Chop out plants that have not formed heads.**

**Eliminar todas las plantas que no hayan formado cabezas.**



**Figure 12. Even though they may be of good formation, plants which are smaller than the rest should be removed from seed production.**

**Aunque sean de buen tamaño, plantas más chicas que las demás deben ser eliminadas en la producción para semilla.**



**Figure 13.** Remove plants that have heads that are too large compared to the rest of the heads in the row.

**Eliminar las plantas de lechugas que tengan las cabezas demasiado grandes en comparación con las demás plantas en el mismo surco.**



**Figure 14.** The plant on the right is weak and light colored. Plants like this should be removed.

**La lechuga de el lado derecho es débil y de poco color. Plantas como ésta deben ser eliminadas.**



**Figure 15.** The plant on the right-hand side is sick and wilted. It is rotten underneath. Plants like this should be chopped out and turned over to dry.

**La planta de lechuga en el lado derecho de la fotografía ésta enferma y marchita. Está dañada debajo. Plantas de lechugas como ésta deben de ser sacadas, y volteadas para que se sequen.**

matures later than the seed from normal plants. However, if big vein is extensive, it would not be economical to remove affected plants. Unless the disease is very severe, affected plants will complete the life cycle and produce an adequate amount of seed.

After the main roguing, the heads may be harvested. Within six to 10 days after harvesting is completed, all plants which were not harvested should be removed. Stumps of plants rogued from the field should be examined to make sure that there is no secondary

growth from the crown. Weeds may also be removed at this time.

A fourth roguing step may be taken six to 10 days prior to seed harvest in which a spot-check can be made for seed color. If a mixture of black seeded and white seeded plants is found, additional roguing may be necessary to produce a pure crop. A very high percentage of such mixing will call for a decision from the supervisor of the seed production or the potential buyer to see whether the crop will be pure enough, even after the fourth roguing, to warrant seed harvesting costs.



**Figure 16. Cut the heads high enough to leave two or three leaves attached to the stump.**

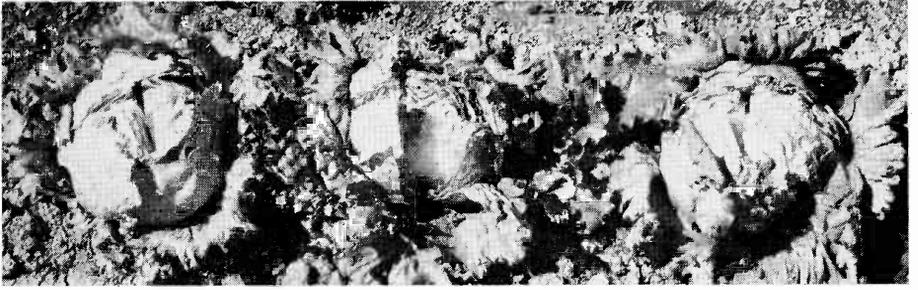
**Cortar las cabezas de lechugas a suficiente altura para dejar dos a tres hojas en el tallo.**

### **HARVESTING OF THE HEAD CROP**

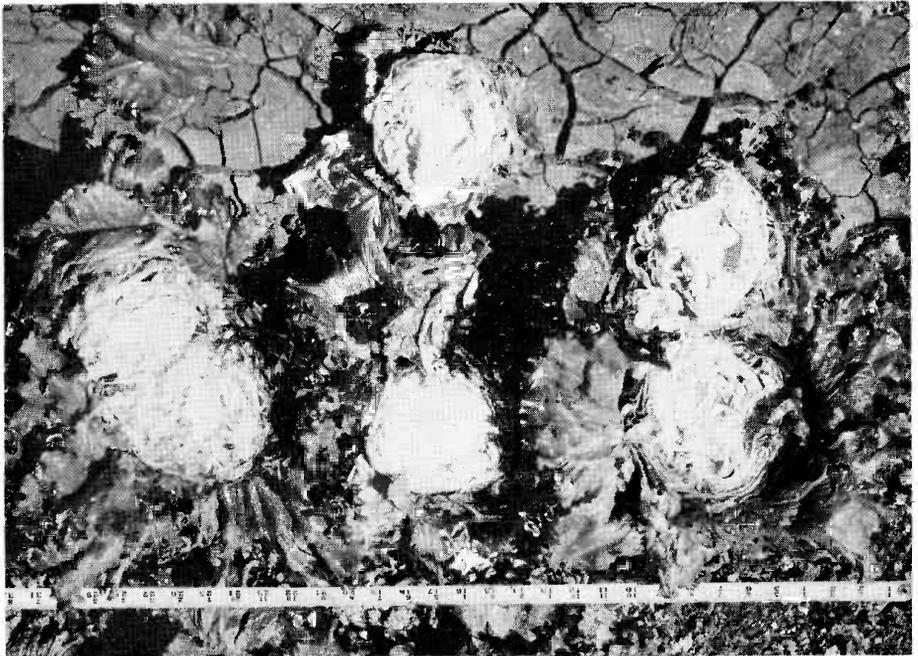
Harvesting must not be done on any portion of the field before the completion of the main roguing procedure. After this main roguing has been completed in a thorough manner, harvesting of the head crop can be accomplished and is strongly recommended. Harvesting may be carried out in any of the usual ways. The only precautions to observe are the following: (1) cut only the best types of heads, (2) cut the heads high on the plant leaving one or two leaves intact on the stump to permit future growth from dormant side buds (Figure 16), and (3) keep truck, tractor, or trailer damage to a minimum to avoid destroying any more plants than necessary. Since lettuce planted for seed production is usually well grown, harvesting of the

mature heads will be profitable and for that reason recommended whenever possible.

If for some reason the head crop cannot be harvested, it will be necessary to open up the heads to assure normal seed stalk formation. Heads may be criss-crossed with a knife cut (Figure 17) or the top of the head may be cut off (Figure 18) to allow the seed stalk to emerge. The criss-cross cut is made with a knife having the blade so short that the growing point of the lettuce head is not damaged. The tops of mature heads may be cut off with sharpened, short-handled hoes. Experiments conducted by the University of Arizona have shown that there is no measurable difference in yield of seed grown either from stumps left after harvesting, criss-crossed heads, or from plants with the top of the head cut.



**Figure 17. Make a criss-cross cut on the top of the heads. Do not cut too deep!**  
**Hacer un corte en cruz o "X" en la parte de arriba de las cabezas.**  
**No cortar demasiado profundo.**



**Figure 18. Chop the top half of the head off. Do not cut too low!**  
**Cortar la mitad superior de la lechuga. No cortar demasiado abajo.**

## CULTURE OF THE SEED PLANTS

Following the period of head maturity, the crop should be fertilized again. This may be done either by side dressing or by the application of fertilizers in the irrigation water (University of Arizona Experiment Farm uses 25 pounds nitrogen per acre). The latter method is advised because there is less chance of damaging the root system.

Irrigation and other cultural practices should be so done as to stimulate rapid growth of the plants. It has been shown that the more rapid and vigorous the growth of the seed plants, the greater the production of seed.

Weed control is very important and presents a special problem within the field of plants bearing seed stalks. Tractor work will be limited because of the height of seed stalks and extensive development of root systems. Tractor cultivation should be done frequently, but lightly and carefully, as long as possible. After the plants become large, weed control becomes a matter of hand operation. It is very important that primary noxious weeds, restricted weeds, and those weeds capable of carrying the mosaic virus be removed. The wild types of lettuce, if allowed to bloom in the field, can cross with the cultured variety, resulting in the formation of hybrid seed.

Insect control should be complete at this stage and, whether or not insect population is high, the control measure involving systox and toxaphene should be used.

Before the lettuce plants come into flower, the field isolation should be checked. Escape plants or wild types growing at the edge of the field or along ditch banks should be eliminated.

## HARVESTING OF THE SEED CROP

Harvesting is different for lettuce seed than for most other crop seed. Lettuce belongs to the botanical group called "composites." As such, it bears very tiny florets in groups or in heads surrounded by the yellow bracts making up the small yellow "flower". These groups of florets are produced at different times and on different levels on the lettuce seed stalk. Each tiny floret produces a single seed. Since the flowers open at different times, the seeds will mature unevenly on the lettuce plant. Therefore, at any given time there will be on the same plant, mature seed, immature seed, and open flowers. During seed development, the bracts and the subtending tissues are closed tightly about the seed. After the seed becomes mature, however, these bracts open up somewhat, permitting the seed to drop out. For this reason, it is important that steps be taken to prevent the loss of seed by shattering.

Harvesting of lettuce seed can best be accomplished by hand. This operation is performed by crews of workers, carrying wide-mouthed cloth harvest bags, who proceed from plant to plant, tipping the top of the seed stalk into the bag and gently shaking the plant, thus collecting the mature seed (Figure 19). Workers should be careful not to damage the seed stalks because additional harvests may be made from the same plants later (Figure 20). Depending upon development of the crop, two or three harvests may be necessary, the first one coming at a time when a third to half of the seed is dry. Subsequent harvests are made later, when more of the seed becomes mature. Harvest of any one field



**Figure 19. Harvesting lettuce seed by shaking the top of the plant over wide-mouthed cloth bag.**

**Cosechando semilla de lechuga sacudiendo la parte superior de la planta sobre un saco de boca ancha.**

dry storage. For almost all types of lettuce seed, it is advisable to store the seed for one year before planting. Lettuce seed must pass through a so-called "dormant" period before it will germinate well. Fresh lettuce seed contains an oil which inhibits germination. During the storage period this oil is dried and evaporated away from the seed. If for some reason it is necessary to use fresh seed the following planting season, drying and evaporation of the oil may be hastened by stirring the seeds spread in a thin layer on canvas in the sun. This should be continued for three or four days. This process will greatly improve first-year germination.

## **LETTUCE SEED CERTIFICATION**

may extend over 7 to 21 days during the period between May and July depending upon date of planting, weather conditions, and variety. The harvested seed is spread out on canvas and allowed to dry. Seed may be given a preliminary screening in the field. Final cleaning is done by standard seed-cleaning equipment.

There is available to Arizona growers a well-established program for certification of lettuce seed. By following the rules and regulations of the Arizona Crop Improvement Association, six lettuce varieties can now be certified. These are Imperial 44 or Arizona 44, Imperial 101 or Arizona 101, Imperial 152 or Arizona 152, Imperial 615 or Arizona 615, Great Lakes and Imperial E-4. Additional varieties or strains may be made eligible for certification upon action by the pure seed committee of the Improvement Association. Rules and regulations affecting certification of lettuce seed may be obtained directly from the Arizona Crop Improvement Association, University of Arizona, Tucson.

Machines of the combine type have been tried for use in harvesting lettuce seed, but without success. Two main factors associated with the lettuce plant preclude the possibility that any machine may be developed for lettuce harvest. First, the non-uniformity in seed development occasions a reduction in yield if all seed stalks are harvested at one time. Second, the presence of large amounts of latex within lettuce tissue effectively gums up almost any type of machinery used.

Briefly, the regulations regarding lettuce seed certification state:

A yield of 300 to 400 pounds of seed per acre may be expected from a field that is well handled. The seed can be cleaned efficiently in a clipper-type mill. After cleaning, seed is bagged and placed in cool,

1. Application for certification must be made with the County Agricultural Agent, who will be in a position to assist with the application and with other items in the certification program.



**Figure 20. First harvest of lettuce seed. The plants are not injured so that another harvest can be made later.**

**Primera cosecha de semilla de lechuga. Las plantas no han sido dañadas por lo que se podrá hacer otra cosecho posteriormente.**

2. Only the varieties approved for certification, as listed above, or a new variety which receives approval from the pure seed committee, can be grown for certification.

3. Growers are eligible to produce either registered or certified seed. The regulations pertaining to registered seed are more strict than those for certified seed.

4. The field to be used for seed production must not have grown a lettuce seed crop for the two years previous to the seed crop. For the registered seed, fields must be isolated by a distance of at least 40 rods in any direction from other lettuce grown to seed. For the certified crop, the distance is a minimum of 20 rods in any direction.

5. Roguing must be practiced thoroughly enough to pass inspec-

tion by a representative of the Arizona Crop Improvement Association. Fields may be rejected for certification at the discretion of the inspector. Varietal mixtures and off-type plants must be kept to a minimum and the primary noxious weeds must be eliminated completely from seed fields.

6. For harvesting, bagging and cleaning, all equipment must be cleaned prior to use on the lettuce crop to the satisfaction of an inspector from the Crop Improvement Association. Lettuce seed must be cleaned and then sampled for laboratory analysis. To be eligible for a registered or certified tag, seed lots must contain seed of no other crops, varieties, or noxious weeds, and must meet other minimum standards of purity and germination.

## HAZARDS

As for all agricultural enterprises, there exist certain hazards in producing lettuce seed in Arizona. Since the crop is grown for a relatively long time compared to other vegetable crops, dangers are increased proportionately. Weather conditions affecting seed germination and growth of seedlings and plants to head-maturity are well recognized. They can be controlled (irrigation, etc.) well enough to permit the completion of the first half of the life cycle of lettuce usually without serious consequence. After head maturity has been reached and the lettuce begins the reproductive portion of the cycle, adverse weather conditions may become very important.

Low temperatures of sufficient duration to damage young seed stalks have been recorded in all lettuce areas in Arizona. Fortunately, freezes of this magnitude are infrequent and the lettuce plant is capable of withstanding, or recovering from, moderate cold spells. Overabundant rainfall rarely causes any losses because it is injurious only when seed is maturing. Of more frequent concern during seed development periods are occasional winds which cause shattering and loss of seed. Harvesting as quickly as possible after seed is mature will reduce chances of loss from wind. In Arizona, variations in temperature (except for freezing), relative humidity, or amount of sunlight have never been known to affect seed production or subsequent germination of the seed grown.

Diseases may cause loss to the head crop, as in the case of any commercial lettuce deal. Except

for those diseases discussed earlier (sclerotiniose, big vein, mosaic) little damage has been experienced from disease of the reproductive growth.

Using modern methods and new materials in an intelligent manner, insects can usually be controlled well enough to avoid economic loss.

## LETTUCE BREEDING

Occasionally, a grower may find an exceptionally valuable plant in his field. He may wish to propagate this through breeding methods for the possible establishment of a new strain or variety. To take advantage of any such new material, the grower may apply for assistance to the Horticulture Department of the University of Arizona. There trained personnel and adequate facilities are available for cooperation on projects of merit.

The grower may wish to experiment with new strains himself. In this case it is advised that the new type be planted along with comparable commercial varieties in a field and grown to crop maturity. When mature, desirable individuals may be selected and either continued in growth in the same place or transplanted to a more convenient location. The plants can then be carried on to seed as indicated in the sections above. Just before blossoming time, seeding plants can be covered with a muslin bag supported on a stake so that the seed produced will result from self-pollination of the desired plant. This process may be repeated so the seed and the population of the desired strain can be increased and further selected. Finally, seed may be increased to the desired quantity following the methods outlined in this bulletin.



## BOARD OF REGENTS

### of the University and State Colleges of Arizona

ERNEST W. MCFARLAND A.B., M.A., J.D., LL.D. (ex officio).....	Governor of Arizona
MARION L. BROOKS, B.S., M.A. (ex officio).....	State Supt. of Public Instruction
JOHN M. JACOBS, President.....	Term expires Jan., 1959
EVELYN JONES KIRMSE, A.B., A.M., Treasurer.....	Term expires Jan., 1959
ALEXANDER G. JACOME, B.S.....	Term expires Jan., 1961
WILLIAM R. MATHEWS, A.B.....	Term expires Jan., 1961
LYNN M. LANEY, B.S., J.D., Secretary.....	Term expires Jan., 1963
SAMUEL H. MORRIS, A.B., J.D., LL.D.....	Term expires Jan., 1963
JOHN G. BABBITT, B.S.....	Term expires Jan., 1965
ELWOOD W. BRADFORD.....	Term expires Jan., 1965
RICHARD A. HARVILL, Ph.D.....	President of the University
ROBERT L. NUGENT, Ph.D.....	Vice President of the University

### Experiment Station Administration

HAROLD E. MYERS, Ph.D.....	Dean
RALPH S. HAWKINS, Ph.D.....	Director
JOHN BURNHAM, B.A.....	Editor

## Many Publications Available

This bulletin is available free from your County Agricultural Agent. The Agricultural Experiment Station and Agricultural Extension Service, both part of the College of Agriculture of the University of Arizona, publish many circulars, bulletins and reports dealing with all phases of agriculture and homemaking.

If you want information on any particular subject, go to your County Extension Office and ask your local County Agricultural Agent or County Home Agent for a publication helpful in solving your particular problem. This is a free service and you are urged to use it whenever it can be helpful to you.

*Harold E. Myers*

Dean  
College of Agriculture  
University of Arizona

## Table of Contents

Summary . . . . .	2
Choice & Preparation of Field . . . . .	3
Planting Seed . . . . .	3
Varieties . . . . .	4
General Culture . . . . .	4
Insects & Diseases . . . . .	5
Host Plants of Mosaic Virus . . . . .	6
Noxious Weeds of Arizona . . . . .	6
Roguing . . . . .	7
Harvesting of the Head Crop . . . . .	17
Culture of the Seed Plants . . . . .	19
Harvesting of the Seed Crop . . . . .	19
Lettuce Seed Certification . . . . .	20
Hazards . . . . .	22
Lettuce Breeding . . . . .	22