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Onion Seed Production In Idaho

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Summary

1. Production of onion seed in southern Idaho has increased markedly in the past 10 years. At the present time California and Idaho produce about 80 per cent of the onion seed grown in the United States.

2. Practically all onion seed grown is produced under contract between the grower and the seedsman. Unless shortages prevail, it usually is not advisable to grow seed for an open market.

3. The chief problems confronting the grower of onion seed are: (1) producing the bulbs, (2) overwintering the bulbs, and (3) growing and harvesting the seed crop. Bulb production for seed does not differ materially from commercial onion production with the exception that by planting somewhat more heavily, more bulbs are produced per acre with small sacrifice in size.

4. In many places in Idaho onion bulbs may be planted in the fall without winter injury. Fall planting is recommended for the hardier varieties such as Ebenezer, White Portugal, and Yellow Globe. Sweet Spanish, while not as hardy, survives most seasons well, but some chance is taken by fall planting. Consistent and significant increases in seed yields have been realized in most instances where fall planting has been practiced.

5. Bulb storages should maintain dry, cool conditions—best obtained by careful ventilation.

6. Bulb stock for seed purposes is selected for elimination of diseased, off-type, and otherwise undesirable bulbs.

7. Seed harvest should begin when the first fruits open, exposing black seed. Cutting before this time will result in many immature seed even though they appear black from the outside. Seed will shatter if allowed to go by this stage. Proper drying is necessary before threshing.

8. A second crop of seed sometimes may be secured if a sufficient number of bulbs show signs of growth.

9. The grower interested in seed for his own use may find it to his advantage to isolate or develop his own particular strain. Otherwise any breeding program should not be attempted by the grower.

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Introduction

SOME 200,000 pounds of onion seed were imported into the United States for the 1941 season. In addition to this, an estimated crop of approximately 600,000 pounds was grown in this country on some 3500 acres.

There are two important areas in the United States where onion seed is grown extensively—one in California, the other in Idaho. About 80 per cent of all domestic onion seed is grown in these two states. Oregon, Connecticut, Maryland, Colorado, and Arizona produce most of the remainder, although small lots of onion seed may be found growing elsewhere, especially in the northern states.

In Idaho, the onion seed industry had its beginning 20 to 25 years ago. With a gradual influx of contracting seed companies, acreages have increased until today onion seed production is one of the largest phases of the small vegetable seed business within the State. As early as 1925 Vincent and Longley[1] experimented with onion seed production in the northern part of the State. However, the dry climate in irrigated sections of southern Idaho is not only more favorable for seed setting and development, but also makes harvesting possible with but small chance of loss.

Most of Idaho's onion seed is produced in the Boise River valley —notably in Canyon county. In this region, as in most places where seed is grown, acreages are contracted by seed companies. Under these conditions the matter of variety and, to a certain extent, actual management of the crop is directed by a representative of the seed company. Some explanation as to the relationship between the onion seed grower and the seedsman might be helpful at this point—such explanation being pertinent to seed production generally.

In the first place, it probably is inadvisable to attempt independently to produce onion seed. Except under conditions of shortage, there are usually no satisfactory open markets for this type of agricultural crop. While contract prices sometimes may be disappointing to a prospective seed grower, it should be borne in mind that the seedsman also accepts a great part of the risk. On the other hand, with assurance of an outlet for his crop, the grower may produce without the uncertainty of markets which frequently become unstable when surpluses are produced. In brief, here is an opportunity for a relatively sure, and, at present prices, a satis-

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[1]Vincent, C. C., and Longley, L. E. *Vegetable seed production in Idaho.* Idaho Agr. Expt. Sta. Bul. 140, 1925.

factory margin of profit. Obviously, from the above explanation one may gather that seed production offers nothing unless one is willing to pursue the enterprise long enough to become familiar with its problems.

Seed production is a specialized type of agriculture. While such a statement applies more to some seed crops than to others, it follows that a thorough knowledge of the crop in question, its life cycle, habits of pollination, cultural requirements, etc., is necessary if the grower is to succeed. Considerable work has been done at Parma—the object being to determine the best practices regarding (1) growing the bulbs, (2) storage and handling of bulbs for seed use, (3) size of bulbs desirable for growing onion seed, and (4) time of planting. Several years' results on these phases of onion seed production have given bases from which recommendations may be made.

Growing Onion Bulbs

All types of onion grown in Idaho for seed purposes are biennial; that is, a bulb is produced the first year from seed; this bulb serves as a storage organ, growth is resumed the following year and seed is produced, after which the plant may die.

To produce seed it is necessary to provide some means of perpetuating the bulb over winter or until such a time as it may again resume growth. Methods involved in over-wintering and their relative merits will be discussed.

The seed grower is confronted first with the problem of growing the bulbs—or onions, then of carrying them satisfactorily over winter, and, finally, producing the seed crop the second year. Each is an important step in the successful production of onion seed. Besides the actual cultural requirements of the crop, some information concerning flowering habit and pollination is necessary.

Most of the pollen of the anthers is shed between 9 A. M. and 5 P. M. Due to the fact that pollen is released before the pistil becomes receptive, on the same blossom cross pollination is the rule. Pollination between flowers on the same stalk undoubtedly is very common. Insects visiting the nectaries on the inner stamens are the chief agents in pollination. Growing different varieties at distances of less than one-eight mile results in considerable cross pollination. Although the pollen grains are heavy, there is evidence that some of the pollination is carried on by wind.

Soils

Growing onion bulbs for seed production is essentially the same as growing dry bulbs for market. However, a variety such as Sweet Spanish, the size of which often demands a premium on the market, may be grown more profitably slightly smaller for seed purposes than for table stock. Soil on which the bulbs are grown should be retentive of moisture, of high fertility, and of a loose or porous nature. Poor germination results if the soil is inclined to bake. Without sufficient fertility small, inferior bulbs will be obtained.

It should be remembered also that, with onions needing considerable cultivation and hand weeding, a loose friable soil is of great importance. Neither do hard or firmly packed soils permit of normal development of the onion bulbs. If soils are inclined to pack slightly, such a tendency may be corrected with stable manure. Thorough preplanting preparation of the field is necessary to kill weeds and reduce hand labor.

Manures and fertilizers

The opinion of many growers is that excessive nitrogen fertilization results in bulbs of poor keeping quality by preventing proper ripening. For this reason these growers have refrained from heavy nitrogen applications in growing bulbs for seed production. In certain instances where commercial fertilizers have been used on seed fields in Idaho, increased yields have been claimed from the use of combinations of nitrogen and phosphate. Data on fertilization are lacking, however, and no specific recommendations can be made.

Organic matter is very important on mineral soils both in the production of the bulbs and the production of the seed crop the second year. Where manure is used to replenish the organic matter supply, it is advisable to apply it to the crop preceding onions—particularly where seed is planted. Applications of 15 to 20 tons per acre are not in excess and lighter applications are of value. Organic matter content of the soil also may be replenished by the use of green manure crops.

Seeding

Seed should be planted in early spring as soon as the soil can be prepared for seeding. The seeding usually is done with 4-row drill planters. The onions are planted in rows 14 to 16 inches apart in beds which, in turn, are 20 to 24 inches apart. About 4 to 6 pounds of seed are planted per acre which is somewhat more than for production of table onions. There is some sacrifice in size by this heavier planting, but the extra number of bulbs per acre will more than compensate for any loss due to size. Depth of planting is governed somewhat by soil conditions. In dry seasons, particularly on light soils, depths of 1 inch or slightly deeper might be advisable; shallow planting—½ inch—is recommended on heavy soils where there is sufficient moisture.

Harvesting

Harvesting bulbs which are to be used for seed production does not differ materially from harvesting commercial stock. It is of great importance that bulbs be well-matured and carefully cured, for the crop if kept inside and not planted will be stored throughout the winter whereas a part of the table stock is sold at once, or, at most, stored for a relatively short period. If the onions are ripening properly for best seed production, the neck shrivels first and the tops fall over while still green. Shortly after the tops fall over, the bulbs should be lifted and placed in windrows in the field

to cure. The leaves are arranged to protect the bulbs from the sun. Another method of handling is to lift and top the onions and then cure them in field crates. Harvesting in either manner insures onions of good condition, and avoids second growth in case of heavy rains. Second growth may be very detrimental to seed production because it results in a poor keeping onion.

Storage

Many of the storage cellars used for onions are unsuited for this purpose. Cellars or warehouses which have been designed for storage of potatoes or apples should not be used. It should be borne in mind that while potatoes prefer a cool, moist storage, onions keep best where conditions are cool and dry. Storage as low as 35° F. or nearly freezing is desirable if it can be attained. An average temperature of around 40° F. can be maintained in a good common storage. A dry atmosphere is much more important as the temperature rises. Frequent and thorough ventilation to obtain a uniform temperature is of considerable value in maintaining suitable conditions. Attention to the storage is important at all times. Severe losses sometimes may be prevented by locating and correcting the trouble. Varities are not alike in keeping quality; Sweet Spanish is a notably poor keeper, while Ebenezer usually stands up well under good storage conditions.

Seed Production

Selection

Among the many varieties of onions appearing on our markets are a considerable number of types: flat, round, red, white, yellow, etc. Characteristics of these types are, for the most part, varietal. They are transmitted from one generation to the next. There is frequently a lack of uniformity in a lot of bulbs from the same variety. In a crop such as the onion, where considerable cross-pollination takes place, selection is of importance in developing and maintaining a uniform strain. Whether a grower is interested in improving a variety for his own use or in growing seed under contract, it is important that attention be given to this matter of selection.

In order to select intelligently, the grower needs to be familiar with the variety at hand. Off-type bulbs should be discarded. These include thick necked ones, those with poor color, bottle shaped bulbs, etc. Selection need not be tedious nor expensive; much of it is done during harvest or in the field while the seed bulbs are being planted, care being taken to remove discards from the field. If larger sizes are removed for table stock, any undesirable seed stock may be removed and discarded at the same time.

When to plant—Fall and Spring planting

In many parts of the State where seed is grown, it is necessary to put the bulbs in storage over winter. In other instances the seed producer may find it possible to make a choice between leaving his bulbs in the ground over winter or storing them.

Over the 4-year period (1938-1941, inclusive) at Parma, bulbs have been wintered over in the ground. When wintering over in the ground is mentioned, it means that bulbs are harvested, sorted, and selected; and then planted in the seed field. Leaving the bulbs where they have grown never is recommended. In considering the advisability of planting bulbs in the fall, probably one thing—damage due to winter injury—may be weighed against storage costs and the possibility of increased yields.

Table 1.—Seed yields as influenced by time of planting. 1938-1941 inclusive.

Variety	Yields in pounds per acre from different dates of planting				
	Year	Sept. 15	Oct. 15	Nov. 15	March 15
	1941	405	380	192	168
	1940			540*	338
	1939			859	698
White Portugal	1938			984	468
	1941	635	495	308	375
	1940			608	451
	1939			583	664
Ebenezer	1938			880	720
	1941	480	375	300	
	1940			574	444
	1939			676	656
Red Wethersfield	1938			1065	485

*Statistical analysis applied only to black face figures. Least difference required for significance at odds of 19:1, 156.26 pounds.

The data in Table 1 with very few exceptions show highly significant differences in favor of fall planting particularly in the two varieties, White Portugal and Ebenezer. The greatest differences between fall and spring planting occurred in 1938. During none of these four seasons was the winter sufficiently cold to bring out differences between varieties; in other words, all varieties used survived the winter in good shape, and, as is shown by the data in most instances, exhibited differences in favor of fall planting.

However, results of preliminary work done in 1942 indicate that there is much varietal difference in ability to withstand low temperatures. During this period more cold weather was encountered than during any previous year in which the tests were conducted. Consequently Sweet Spanish, for the most part, failed to survive. White Sweet Spanish was little better, while Ebenezer and White Portugal exhibited marked resistance to injury resulting from cold. Commercial plantings of the Yellow Globe type, observed in the vicinity of Parma, survived in fine shape.

It seems safe to say, as a result of these findings, that varieties such as Ebenezer and White Portugal will give greater yields if planted in the fall. Sweet Spanish or any other rather tender variety may be wintered over only with some risk.

If fall planting is practiced, there is some choice as to the proper date for setting the bulbs. For the three years 1938, 1939, and 1940, all fall planting was done about November 15. Planting as late as this, however, may not be as satisfactory as earlier plant-

ing; the main reason being that, with the immediate onset of winter, the bulbs have no opportunity to become established, a factor of importance. The 1941 planting, therefore, was made at three different dates throughout the previous fall—September 15, October 15, and November 15, 1940.

Referring again to Table 1, it will be seen that there is a marked response due to early planting. These figures are significant for the single year's growth. A repetition of this work done in 1941-1942, while not being completed as to yields of seed, appears to bear out the results obtained in 1940-1941. These figures bring out the importance of planting not later than October 15, if at all possible.

Figure 1.—Planting the bulbs.

Spring planting is best done as soon as the ground can be prepared. In most places in Idaho where seed is produced, onion bulbs are placed in the ground in March or early April.

Planting the Bulbs

Medium sized (2¼" - 3" diam.) Sweet Spanish bulbs will run slightly less than three bulbs per pound. Ebenezer of the same diameter will average about one-half the weight of Sweet Spanish. From a practical standpoint smaller bulbs may be spaced closer together than larger bulbs. For the Sweet Spanish mentioned above, if spaced 6 inches in rows 3 feet apart, something like 8,000 pounds would be needed. Generally speaking, it probably is safe to estimate that from 7,500 to 10,000 pounds are needed to plant an acre. For smaller or larger bulbs, fairly accurate estimates may be made.

The bulbs are dropped from sleds into furrows 3 feet apart. They are set upright in the furrow; any extras are tossed into an adjacent furrow. Figure 1 shows the use of a hopper-like affair mounted on wheels. Bulbs are released at the bottom and operators see that they are properly spaced in the furrows. Planting depth is of importance in that considerable lodging or breaking over of the seed stalk may result when bulbs are set too deep. Ordinarily the top of the bulb should not be much less than even with the

surface of the soil, necessitating a furrow 3 or 4 inches deep. The practice of gradually filling the furrow after the onions have been placed is followed in some sections. No evidence at hand, however, indicates any disadvantage in completely filling the furrow as soon as the bulbs are set.

Size of bulbs

When the work at Parma was initiated, it was thought possible by proper manipulation of planting dates (for seed bulbs) and bulb sizes a schedule might be devised for producing satisfactory yields from relatively small bulbs.

The bulbs were graded into three sizes: (1) large, 3 inches in diameter and above; (2) medium, 2¼" - 3"; and (3) small, 1¼" - 2¼". These were spaced the same distance apart in the field. Plantings were made both in the fall and in the spring. Three varieties were used in the main experiment which extended over a period of 4 years. Table 2 shows data for all the varieties used. It is impossible to compare all of the varieties in the three sizes over the 4-year period, because of changes made during the course of the experiment. However, the three varieties, White Portugal, Ebenezer, and Red Wethersfield, were each grown during the years 1938, 1939, and 1940.

Table 2.—Relation of bulb size to yield of seed.

Variety	Year	Yields in pounds of seed per acre from bulbs of different sizes		
		Large	Medium	Small
	1941	223.0	182.0	135.0
	1940	609.7*	512.5	194.7
	1939	1157.0	797.0	381.5
White Portugal	1938	984.0	468.0	388.0
	1941	443.0	380.0	200.0
	1940	666.2	594.5	328.0
	1939	937.5	641.0	293.0
Ebenezer	1938	720.0	620.0	277.5
	1940	656.0	533.0	338.2
	1939	832.0	774.5	391.5
Red Wethersfield	1938	804.0	549.5	294.0
	1941	208.0	65.0	27.0
	1940	338.2	389.5	235.8
Utah Sweet Spanish	1939	842.5	519.0	221.5
Riverside Sweet Spanish	1938	1187.5	1005.0	
	1941	190.0	173.0	70.0
White Sweet Spanish	1940	143.5	133.2	66.4
Early Yellow Globe	1940	217.5	332.0	143.0
Golden Globe	1940	590.0	535.5	420.3
Brigham Yellow Globe	1940	552.0	512.5	275.0

*Statistical analysis applies only to black face figures. Least difference for significance for odds of 19:1, 90.92 pounds.

While these data are convincing as to the importance of planting a good sized bulb, there are circumstances involved which are not adequately brought out by the experiment, nor is the complete picture set forth in the data—namely, the tonnage of large and

medium bulbs was greater than that for the small bulbs, inasmuch as the row spacing was the same in all cases. Recommendations, consequently, must be based not alone on that data, but to some extent on observations made from actual practices.

In the first place the size of seed onions indicated as "medium" in the table is a good practical size to produce; that is, no greater amount of effort is required to produce this size onion than would be necessary to grow smaller ones. A larger onion—above 3 inches in diameter—is somewhat above the range in many onion fields, even when large-bulbed varieties are grown.

Secondly, within any given variety, the tonnage of bulbs per acre will not vary greatly with ordinary management. That is to say, one might get 250 sacks of 2-inch onions when seed are sown at one rate per acre. If more seed is sown, this yield in pounds is not wholly different, but a greater number of bulbs is produced. In a like manner, the number of bulbs will be reduced when less seed is used, but the added size will make up to about the same yield per acre.

While it is unfortunate that no yield records are available which are based on equal weights of different size bulbs planted per acre, it seems safe to make recommendations somewhat as follows: (1) A bulb 2½″ - 3″ in diameter has proved satisfactory and if spaced properly will give a satisfactory yield; (2) an attempt to

Table 3.—Relation of time of planting date, variety, and bulb size to number of seed stalks produced.

	Size	Seed stalks per bulb	
		Fall*	Spring**
White Portugal	Large	3.49	4.34
	Medium	2.57	2.80
	Small	1.73	1.62
Red Wethersfield	Large	3.22	4.38
	Medium	2.58	3.45
	Small	1.58	2.15
Ebenezer	Large	3.08	3.16
	Medium	2.25	2.28
	Small	1.46	1.35
Sweet Spanish	Large	4.90	2.70
	Medium	2.90	1.97
	Small	1.70	1.13

* November 15. Least difference required for odds of 19:1, .58.
**March 15. Seed stalks.

produce bulbs over 3″ in diameter for seed purposes probably is not profitable; (3) data from experiments and observations made in southern Idaho do not justify recommending bulbs much less than 1½″ in diameter, and (4) where smaller bulbs must be used, spacing may be less between bulbs, keeping the tonnage of bulbs used per acre uniform regardless of bulb size.

The data in Table 3 indicate very clearly that bulb size is related directly to number of flower stalks produced. Although these data are for 1939 only, it seems safe to predict that notable

changes would not appear over a period of years. It also will be seen from these data that time of planting has no effect with regard to number of seed stalks produced.

Irrigation

There is some misunderstanding as regards irrigation for seed production. Contrary to the opinion of some growers, it is neither necessary nor advisable to withhold water in order to mature seed. It is much better to delay watering early in the season until the bulbs are well established and starting to grow, continuing at regular intervals until the crop is ready to harvest. When the mother bulbs are being grown, much the same practice is recommended. More tonnage per acre, resulting from larger bulbs, will be realized if water is applied regularly up until harvest.

Harvesting Seed

The proper time to gather the seed is when the first fruits open and expose the black seeds. At this time even the youngest of the

Figure 2.—Cutting seed heads.

seeds in the head are in a dough stage and will ripen properly. The seed shows a black color even before the milk stage, while the grain is still watery. For this reason color will not indicate the ripeness of the seed. In most areas of production harvesting is done some time from the middle of July to the middle of August.

The seed heads are cut one at a time by hand with a short piece of stem attached and dropped into a burlap sack supported around the waist of the cutter. The sacks are hauled out of the field within 3 or 4 hours after cutting, and the heads are transferred to large canvas sheets, to slatted crates in the open air, or to curing sheds. When canvas is used, the heads should not be stacked over 10 inches deep. When slatted crates are used, they are stacked staggered to insure complete ventilation. The heads are stirred daily both on the canvas and in the crates. In curing sheds the seed heads are handled as if they were on canvas. The sheds should be well ventilated. During wet seasons and in areas where natural drying is very slow, seed heads may be dried artifically in corn dryers. If the seed remains damp or wet for more than 2 to 3 weeks, considerable sprouting will result.

Threshing

Threshing and cleaning the seed should be done as soon as the seed heads are sufficiently dry. The seed is threshed out by means

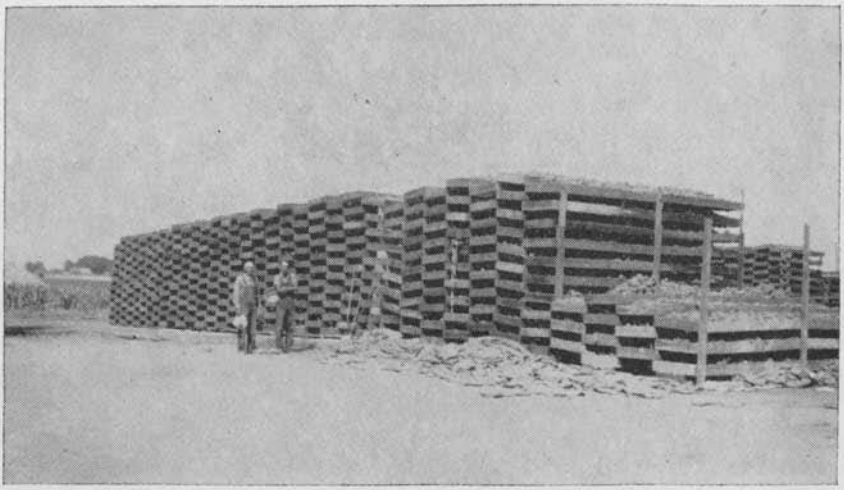

Figure 3.—Drying seed heads in racks prior to threshing.

of special machines or beaten out with flails. Probably the most important consideration in threshing onion seed is to prevent undue breakage of the "button" to which the stems of the flowers are attached. This button has the same specific gravity as the seed and cannot be separated easily from the seed if it is broken up into pieces the same size as the seed. Any method of threshing must take this into consideration.

The most common method of threshing other than by the use of special threshing machines is to roll over the seed heads on a canvas with wooden or rubber rollers. A portion of the trash is removed from the seed by fanning and screening. In the next operation much of the seed can be cleaned completely by the use

of gravity separators; however, a portion of good seed still remains in the litter. This seed can now be separated from trash and light seed by floating in a trough or in tubs, where the heavy seed sinks to the bottom and the lighter seed and trash float off. The heavier seed is lifted out immediately and spread out to dry, preferably on drying racks. A drying rack consists of a suspended canvas which has a continual draft of air blown through it and the seed. The seed should not remain wet for more than 3 to 6 hours. Seed should not be bagged in large amounts after threshing, cleaning, or washing unless it is thoroughly dry.

Second-Year Seed

It frequently happens that a second crop of seed will be produced from a single "setting" of bulbs. While it probably is not advisable to make a general practice of such a procedure, there are instances where a profitable crop may be obtained by having bulbs in the ground for an additional year.

Final evaluation of the field for a crop of seed the second year is best made before work begins the spring following harvest of the first crop of seed. At that time it is possible to determine the condition of the stand and to make a rather accurate estimate of the possibility for obtaining a satisfactory crop. It usually is recommended that, unless prospects are for at least a 60 per cent stand, the field be put to other use.

With a good stand of bulbs as described above, it is possible to allow the material to remain undisturbed, no replanting being necessary. Varietal differences will be noted with regard to ability to produce a second crop of seed; Ebenezer and Yellow Globe usually are especially satisfactory in this respect.

Varieties

In this discussion of varieties no attempt has been made to list the varieties in order of their importance in seed production. The list must not be considered complete, but merely representative of most of the varieties which are grown for seed purposes within the state. Practically all of the following varieties are commercially important at one place or another throughout the United States.

Brown skinned
: Australian Brown.

Yellow skinned
: Ohio Yellow Globe, Danvers, Yellow Globe Danvers, Southport Yellow Globe, Ebenezer, Sweet Spanish, Yellow Bermuda.

White skinned
: Southport White Globe, White Portugal (Silver Skin) White Sweet Spanish, Crystal White Wax (White Bermuda)

Red skinned
: Red Wethersfield, Southport Red Globe, Red Italian, California Early Red.

Crystal White Wax frequently called White Bermuda and Yellow Bermuda (also confused with White Bermuda and frequently so called) are better adapted to southern conditions. A large proportion of these commercial bulbs are produced in Texas. Seed of these two varieties previously has been imported since satisfactory yields have not been acquired in the United States. In Idaho and other seed producing sections of the United States, satisfactory yields have been obtained from most of the other varieties listed above.

Unless the grower is producing seed for his own use, varietal problems are not likely to arise in seed production. It should be remembered, however, that varieties differ in respect to storage quality and yield of viable seeds. In making a contact, therefore, these factors need be considered.

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