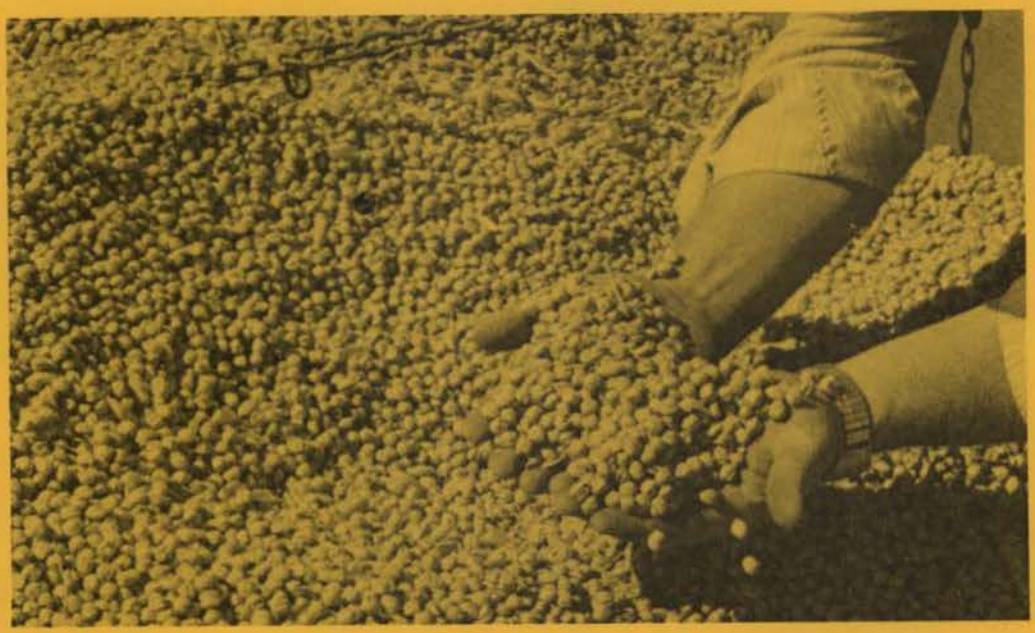
Bulletin No. 615

Garbanzo Beans —

A Potential New Pulse Crop for Idaho



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Chemical Controls

The recommendations in this publication are based on the best information currently available for each chemical listed. If followed carefully, residues should not exceed the tolerance established for any particular chemical. To avoid excessive residues, follow recommendations carefully with respect to dosage levels, number of applications and minimum interval between application and harvest.

The grower is responsible for residues on his crops as well as for any problems caused by drift from his property to adjacent properties or crops.

Trade Names

Trade names are used to simplify the information presented. Use of these names neither implies endorsement of products nor criticisim of similar products not mentioned.

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Garbanzo beans (*Cicer arietinum* L.), also called chickpeas, are a large-seeded legume crop currently produced in India, Pakistan, Spain, Algeria, Mexico and the U.S. Most of the 3,500 tons of garbanzo beans produced in this country are grown in California.

Each year the U.S. imports more than 10,000 metric tons of garbanzo beans from Mexico. The Mexican government recently initiated a program to encourage the domestic production of dried pinto beans, decreasing the amount of garbanzo beans available for export to the U.S. and other countries. This move combined with decreasing production trends in California indicates that both domestic and export markets should exist for this crop for the next several years.

Trials conducted in 1980 indicated that garbanzo beans were adapted to the Palouse region of northern Idaho (University of Idaho CIS No. 570, *Chickpeas — A Potential New Pulse Crop for Northern Idaho*). This research developed the cultural practices necessary to commercially produce this crop.

Varietal Evaluation

Garbanzo beans refer to the seed harvest from chickpea varieties which produce large seed. Market quality and price are determined by seed size, with the larger sized seed receiving a premium. Four large-seeded garbanzo bean varieties currently produced in California and two smaller-seeded lines were evaluated at Moscow in 1980 and at Moscow, Grangeville and southeast of Moscow near Tomer Butte in 1981.

The variety 'UC-5' developed by the University of California has consistently produced high seed yields (Table 1). This variety produced an average of 2,180 pounds of seed per acre compared to 2,025, 1,940 and 1,525 for the varieties 'Mission,' 'Spanish Common' and 'SVM-1G' respectively. The small-seeded lines 'Weyen' and 'Lyon' obtained from farmers near Kendrick, Idaho, produced 2,300 and 2,370 pounds of seed per acre respectively. However, because of their small seed size, these lines could not be marketed as garbanzo beans. The variety SVM-1G obtained from Sacramento Valley Milling Co. in California produced the largest size seed,

Table 1. Seed yield and seed size of six varieties of garbanzo beans grown in northern Idaho.

Variety	Moscow 1980	Moscow 1981	Tomer Butte 1981	Grangeville 1981	Average
			(Seed yield in lb/acre)		
Large seeded					
Spanish Common	3,180 a*	1,620 c*	1,330 d*	1,630 ab*	1,940
UC-5	3,020 a	1,930 bc	1,700 c	2,080 a	2,180
Mission	2,820 ab	1,890 bc	1,480 cd	1,910 a	2,025
SVM-1G	2,300 c	1,480 c	1,040 e	1,280 b	1,525
Small seeded					
Weyen	2,450 bc	2,390 b	2,070 b	-	2,300
Lyon	-	3,020 a	2,380 a	1,720 a	2,370
			(Seed size in seeds/lb)		
Large seeded					
Common	870 c*	1,080 c*	1,090 c*	950 a	1,000
UC-5	830 b	900 b	900 b	840 ab	870
Mission	820 b	980 bc	1,020 c	900 b	930
SVM-1G	710 a	790 a	770 a	760 a	760
Small seeded					
Weyen	1,240 d	1,520 e	1,570 d	-	1,440
Lyon	-	1,380 d	1,520 d	1,550 c	1,480

*Means within a column not followed by the same letter differ at the 0.05 level of probability by Duncan's new multiple range test.

and the variety UC-5 produced the second largest size seed. In northern Idaho, the variety UC-5 offers the growers the highest seed yield while producing commercially acceptable seed size.

Seed of large-seeded varieties were evaluated for cooking quality by J. M. Rodriguez and Co., Inc., a major exporter of garbanzo beans. The variety SVM-1G had the shortest cooking time and produced an excellent quality product (Table 2). Spanish Common, Mission and UC-5 required a longer cooking time than SVM-1G to obtain the desired degree of tenderness. The production location of garbanzo beans influenced cooking time. The UC-5 seed produced at Grangeville required only 2.8 hours of cooking, but seed produced at Moscow, Tomer Butte and in California remained firm after 3 or more hours of cooking. A significant proportion of the garbanzo bean crop grown in California is the variety UC-5 which has been processed for several years without any problem. Because of the extended soaking period used by most domestic producers, the increased length of the cooking period does not affect crop quality.

Growers should consider producing a cultivar such as SVM-1G only when a sufficient premium is paid for seed size or cooking time to defer the loss in seed yield expected with this variety.

Table 2. Quality evaluation of garbanzo bean varieties and the location where the beans were grown (courtesy of J. M. Rodriguez and Co., Inc.).

Variety	Production location	Seed size	Cooking time	Cooked product		
				Color	Taste	Tenderness
		(seed/lb)	(hr.)		(rating)	
Spanish Common	Tomer Butte	1,070	3	good	good	firm
Mission	Tomer Butte	980	3	good	good	irregular
SVM-IG	Tomer Butte	880	2.5	excell.	excell.	tender
UC-5	Tomer Butte	912	3	good	good	firm
UC-5	Grangeville	848	2.8	good	good	tender
UC-5	Moscow	900	3	good	good	firm
UC-5	California	912	3+	good	good	firm

Seed Size

A 60-pound lot of registered UC-5 seed was sieved through a series of seed screens to get three samples that differed in seed size. Evaluation of these seed lots indicated that seed size did not influence yield or the size of the seed produced by the subsequent crop (Table 3).

Seed of a pure line variety could be sized, and the larger seed sold for a premium while saving the smaller seed to reseed the following crop. To obtain a stand of 100,000 plants per acre, a minimum of 134 pounds per acre of the larger size seed would be required while only 86 pounds of smaller sized seed would establish the same plant population. This could result in lower seeding costs and less seed breakage during seeding operations. However, sizing a seed lot for several years could eventually reduce the seed size. If commercial lots of seed are sized, new certified seed should be obtained every second or third year to avoid reducing seed size.

Table 3. Yield and seed size produced by three sizes of UC-5 garbanzo bean seed grown at Tomer Butte in 1981.

Seed size planted[1]	Seed yield	Seed size
	(lb/acre)	(seed/lb)
Large (750 seeds/lb)	2,170 a[2]	920 a[2]
Medium (890 seeds/lb)	2,080 a	930 a
Small (1,160 seeds/lb)	2,190 a	930 a

[1]Large size seed remained on top of a 24/64 inch round hole seed screen; medium size passed through a 24/64 inch round hole screen but remained on top of a 22/64 inch round hole screen; small size seed passed through a 22/64 inch round hole screen.

[2]Means within a column not followed by the same letter differ at the 0.05 level of probability by Duncan's new multiple range test.

Planting Date

The seed yield of both Spanish Common and SVM-1G was reduced during 1980 by more than 40 percent when planting was delayed from April 16 to May 10 (Fig. 1). Seed size was not significantly reduced by later planting. Garbanzo beans are frost tolerant (28°F) and require the entire growing season to mature properly. Early planting increases seed yield and allows the crop to be harvested in late August or early September.

Seeding Rates and Row Spacings

Garbanzo bean seed is about three times larger than regular sized spring pea seed and costs $30 to $40 more per hundredweight. These factors make seeding costs the single largest expense involved with garbanzo bean production.

Trials were established at Tomer Butte and Grangeville in 1981 to determine seeding rates and row spacings for optimum yield and seeding costs. Seed size was measured to determine if this trait was affected by plant population. Additional data were taken on plant establishment, maturity and seeding costs.

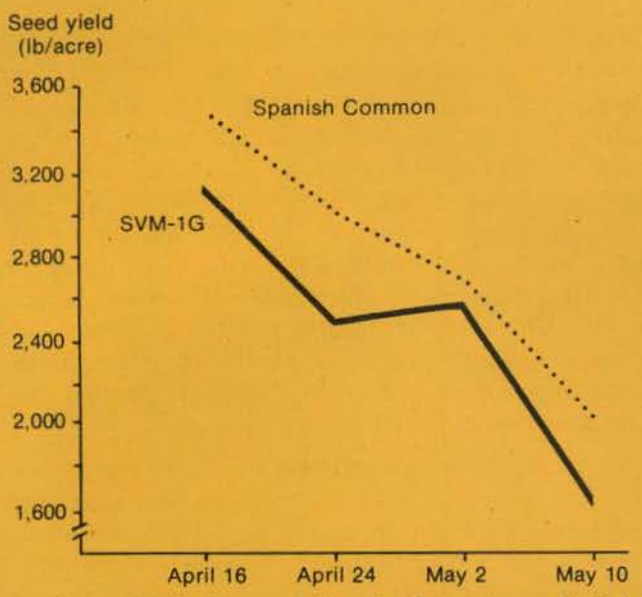

Fig. 1. Seed yield of two varieties of garbanzo beans planted at four dates at Moscow, Idaho, in the spring of 1980.

The variety UC-5 was planted at Tomer Butte with an International 5100 drill at rates ranging from 1.3 to 2.7 seeds per foot of row with 6 inches between rows. After emergence, selected rows were mechanically removed to provide row spacings of 6, 12 and 18 inches. Stand counts were made from 9-square foot areas in each plot on June 15.

The highest seed yields at Tomer Butte were obtained with garbanzo beans planted in rows 6 inches apart (Table 4). The within-row seeding rate varied from 1.0 to 1.4 plants per foot of row and did not significantly affect yield. The small difference in yield probably resulted from the narrow range of within-row plant population actually established at each seeding rate. Apparently the seeding rates under field conditions were different from those measured when the drill was calibrated. Average seed yield at Tomer Butte was 1,991 pounds per acre.

Table 4. Effect of row spacing and within-row seeding rate on yield and seed size of UC-5 garbanzo beans grown at Tomer Butte in 1981.

	Plants established	Seed yield	Seed size
	(no/ft)	(lb/acre)	(seeds/lb)
Row spacing			
6 inches	-	2,350 a*	935 a*
12 inches	-	2,038 b	939 a
18 inches	-	1,585 c	949 a
Average		1,991	941
Within-row seeding rate			
1.3 seeds/foot	1.2 ab*	1,909 a*	949 b*
1.8 seeds/foot	1.0 b	2,001 a	947 b
2.3 seeds/foot	1.4 a	2,027 a	943 ab
2.7 seeds/foot	1.3 ab	2,027 a	928 a

*Means within a column followed by the same letter are not significantly different at the 0.05 level by Duncan's new multiple range test.

Seed size significantly increased as row spacing decreased and plants per foot of row increased (Table 4). Competition for nutrients and water usually reduces seed size as plant populations increase, but this was not observed in these trials. The fact that seed yields increased as spacing between rows decreased indicated that competition between plants for nutrients and water was not limiting at the populations tested.

At Grangeville, UC-5 was planted at rates of 1, 2 and 3 seeds per foot in rows 7 or 14 inches apart. Stand counts were made June 2 from 9-square foot areas in each plot.

The highest seed yields were attained with plant populations of 2 or 3 seeds per foot of row with rows 7 inches apart (Table 5). Yields of garbanzo beans planted in rows 14 inches apart were nearly 600 pounds per acre less than yields in rows 7 inches apart. Increased weed problems and delayed maturity were also observed at wider row spacings. Average seed yield was 2,355 pounds per acre. Seed size significantly increased as plant population within the row increased and row spacing decreased. These data agreed with the trends observed at the trial at Tomer Butte.

Table 5. Effect of row spacing and within-row seeding rate on yield and seed size of UC-5 garbanzo beans grown at Grangeville in 1981.

	Plant established	Seed yield	Seed size
	(no/ft)	(lb/acre)	(seeds/lb)
Row spacing			
7 inches	-	2,628 a*	904 a*
14 inches	-	2,082 b	922 b
Average		2,355	913
Within-row seeding rate			
3 seeds/foot	2.5 a*	2,712 a*	905 a*
2 seeds/foot	2.1 b	2,582 a	904 a
1 seed/foot	1.0 c	1,772 b	924 b

*Means within a column followed by the same letter are not significantly different at the 0.05 level according to Duncan's new multiple range test.

Garbanzo beans should be planted in rows 6 or 7 inches apart. Plant population within rows should be 1 to 2 seeds per foot of row. Plant density within rows will probably vary with the potential productivity of each location. As potential productivity increases, planting density within rows should probably increase. Narrower row spacings enhance maturity and weed control.

Insect Pests

Garbanzo beans grown in the Northwest are not expected to have serious insect problems. Only a few insect species attack garbanzo beans. The four insects which are major pests of garbanzo beans in

warmer production areas do not occur in the Palouse and probably could not survive the winter if introduced into this area. However, garbanzo beans are potential hosts for the cowpea aphid which may cause some damage by introducing viral diseases into the crop. This aphid commonly attacks lentils grown in our region but was not observed feeding on garbanzo beans in 1980 and 1981. High populations of wireworms are likely to reduce stands of garbanzo beans. The western yellowstriped armyworm is a minor pest of lentils and may cause some damage on this crop where large populations occur.

Weed Control

Garbanzo beans are not strong competitors with weeds. At Moscow in 1980 and Grangeville in 1981, weed competition severely reduced seed yields (Table 6). Lambsquarter, wild oats, volunteer grain, henbit, field pennycress, mayweed and other weeds will destroy a garbanzo bean crop if not controlled. Weed control in this crop requires both herbicides and planting on fields which have low weed populations.

New EPA regulations have recently changed the garbanzo bean classification to a bean instead of a pea for pesticide registration. Although there are several good herbicides registered for use on beans, the weed control research on garbanzo beans during the past 2 years has concentrated on those herbicides currently registered on peas.

Garbanzos will tolerate the labeled rates of dinoseb applied before crop emergence. This herbicide will provide good control of most annual broadleaf weeds but will not control wild oats. Garbanzos are tolerant to trifluralin which has been mechanically incorporated before planting. This chemical provides good control of shallow germinating grasses and some broadleaf weeds such as wild buckwheat, knotweed, lambsquarter and henbit. It is ineffective on mayweed, prickly lettuce, sow thistle, field pennycress or other mustards and nightshade and will only control those wild oats and volunteer cereals that germinate in the upper layers of soil where the trifluralin has been thoroughly incorporated. Profluralin is similar to trifluralin in weed control and has not caused damage to garbanzo beans grown in our area.

Other herbicides registered on beans that have not been tested on garbanzo beans by the University of Idaho include dalapon, EPTC, DCPA, alachlor, dinitramine and glyphosate. Several other herbicides have been tested on garbanzo beans that are not currently registered on beans.

The primary weakness in weed control is the lack of registered herbicides that control wild oats and volunteer cereal grains while not damaging the garbanzo beans. Table 6 gives test results of three herbicides registered on garbanzo beans. Table 7 shows how effective these herbicides are on several various weed species commonly found in northern Idaho.

Harvest Methods

Garbanzo bean plants are usually from 18 to 24 inches in height with the nonshattering pods held several inches above the ground surface. This crop can be harvested by direct combining in years when the plants mature by late August. In late maturing

Table 6. The effect on crop damage, weed control and seed yield of three registered herbicides applied to garbanzo beans in northern Idaho.

Herbicide	Application[1]	Rate	Crop damage[2]	Weed species[3]						Seed yield
				Mayweed	Field pennycress	Henbit	Wild buckwheat	Lambs-quarter	Wild oats	
		(a.i. lb/acre)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(lb/acre)
Moscow - 1980										
No herbicides	-	-	0	0	0	-	-	0	-	420 c*
Trifluralin	PPI	½	8	0	0	-	-	42	-	600 bc
Profluralin	PPI	½	5	10	0	-	-	0	-	920 bc
Dinoseb Amine	PES	9	3	100	100	-	-	100	-	3,200 a
Tomer Butte - 1981										
No herbicides	-	-	0	-	-	0	-	-	0	1,190 a*
Profluralin	PPI	1	0	-	-	63	-	-	0	1,040 a
Dinoseb Amine	PES	9	0	-	-	93	-	-	0	1,240 a
Grangeville - 1981										
No herbicides	-	-	0	0	0	0	0	-	0	1,320 b*
Profluralin	PPI	1	0	18	22	100	100	-	30	1,240 b
Dinoseb Amine	PES	9	8	95	90	69	44	-	0	2,580 a

[1]PPI = applied preplant, mechanically incorporated. PES = applied before garbanzo seedlings emerged.

[2]Vigor reduction = percent stunting compared to the untreated check. 0 = no crop injury, 100 = complete crop kill.

[3]Percent weed control based on weed number and vigor in the untreated check. 0 = no weed control, 100 = complete weed control.

*Seed yield means within a location not followed by the same letter differ at the 0.05 level of probability by Duncan's new multiple range test.

Table 7. Control of several weed species for herbicides currently registered for weed control in garbanzo beans.

Weeds	Dinoseb	Trifluralin (Treflan)	Profluralin (Tolban)
	Control		
Grasses			
volunteer grain	fair	fair	fair
wild oats	poor	poor	poor
quackgrass	poor	poor	poor
field pennycress	excellent	poor	poor
Broadleaves			
buckwheat	excellent	good	good
cocklebur	-	poor	poor
knotweed	good	good	good
kochia	good	good	poor
lambsquarter	excellent	good	fair
mallow	fair	poor	poor
mustards	excellent	poor	poor
nightshade	good	poor	poor
pigweed	excellent	excellent	excellent
Russian thistle	fair	fair	fair
sunflower	fair	poor	poor
Canada thistle	poor	poor	poor
field bindweed	poor	poor	poor
mayweed	good	poor	poor
henbit	good	fair	fair
Crop Tolerance	excellent	excellent	excellent

fields or if green weeds delay harvest, garbanzo beans can not be harvested until late September.

Swathing and defoliation could hasten maturity and allow the earlier harvest of a crop. Swathing and defoliation when the garbanzo bean plants contained about 40 percent moisture did not reduce either yield or seed size (Table 8). This indicates that either method could be used to hasten drying and allow an earlier harvest. However, plants should not be either swathed or defoliated until most of the leaves have fallen from the plant and the pods are straw colored. Care should be taken during harvest, handling and storage of this crop to avoid damaging the exposed seed embryo and reducing germination.

Commercial Production

During the 1981 growing season, Bill Haxton, in cooperation with the University of Idaho, seeded 4 acres of UC-5 garbanzo beans on his farm about 8 miles southeast of Moscow near Tomer Butte. A profluralin-triallate tank mix application of herbicide was incorporated into the soil before planting. The field was seeded May 3 with an International Harvester 5100 Drill modified to seed soybeans. Registered UC-5 seed obtained from Santa Maria, California, was seeded at 100 pounds per acre in rows 12 inches apart. Approximately 5 percent of the seeds were cracked during seeding. The field was rolled immediately after planting and sprayed with 6 pounds of dinoseb amine salt before crop emergence. The herbicide treatments gave season-long weed control. No serious insect or disease problems developed in the garbanzo beans while the adjacent field of spring peas was sprayed once for pea leaf weevil and again for an aphid infestation.

Table 8. Yield and seed size of UC-5 garbanzo beans harvested by three methods at Tomer Butte in 1981.

Harvest treatment[1]	Seed yield	Seed size
	(lb/acre)	(seed/lb)
Direct harvest	1,710 a[2]	890 a[2]
Swathed	1,750 a	880 a
Defoliation[3]	1,928 a	900 a

[1]Swathing and defoliation treatments were applied when plants contained 38.4% moisture.

[2]Means within a column not followed by the same letter differ at the 0.05 level of probability by Duncan's new multiple range test.

[3]Paraquat (0.25 lb ai/acre) was used as a defoliant. This compound is not registered for use on garbanzo beans.

The plants flowered in early July and began to dry in mid-August. When the plant contained approximately 40 percent moisture Aug. 23, the field was swathed. The field was harvested Aug. 31 with a MH-2 combine with a spike tooth cylinder set at 460 rpm and equipped with a pea bar. A small portion of the field that had not been swathed was cut standing with no difficulty. About 5 percent of the garbanzo beans were cracked during harvest. Harvest losses from shattering were minimal. The 4-acre field produced 1,655 pounds of uncleaned seed per acre. The adjacent pea field yielded 2,600 pounds of seed per acre. A weather station 4 miles north of the site reported 27.8 inches of moisture for the crop year (Sept. 1, 1980 through Sept. 1, 1981). However, no significant rainfall occurred from July 7 until harvest, and the moisture stressed garbanzo bean plants failed to fill the top six to eight pods on each branch. Higher yields would have occurred if more rain had fallen during late July and early August, but harvest would probably have been delayed until mid-September.

Trial Information

All trials were treated with 0.5 a.i. pounds trifluralin and 1¼ a.i. pounds of triallate per acre as preplant incorporated herbicides. (Current EPA regulations prevent the use of triallate on garbanzo beans.) Plots were sprayed with 6 pounds per acre of dinoseb amine before seedling emergence for additional broadleaf weed control. All seed were treated with captan to prevent seed decay and inoculated with a specialized *Rhizobium* strain obtained from Nitragin Company to insure nodulation. All plots were seeded with either an experimental cone planter or an International Harvester 5100 grain drill equipped with soybean cups.

The 1980 Moscow variety trial was planted May 1 and harvested Sept. 9. The Moscow weed control trial was planted May 9 and harvested Sept. 17. The 1981 Moscow trials were seeded May 8 and harvested Sept. 2. The trials at Tomer Butte were

seeded May 4 and harvested Sept. 3 and 4. The trials at Grangeville were seeded April 30 and harvested Sept. 1. All trials were harvested with a small plot combine with the exception of the 1980 Moscow variety trial which was hand-harvested and dried before thrashing.

Summary

The cost of producing garbanzo beans is more than the cost of producing a dry pea or lentil crop because of the increased cost of seed and weed control. This crop will be most profitable to those growers able to give this crop the intensive management that it requires. Here are the recommended practices for producing this crop:

1. Obtain certified seed of a variety such as UC-5 or Mission which has satisfactory yield and seed size to be marketed as a garbanzo bean. Growers may consider the production of varieties such as SVM-1G under a contract price which would offset the loss of seed yield.

2. Treat the seed with a fungicide such as captan to prevent seed decay.

3. The seed will need to be inoculated with a specialized strain of *Rhizobium* to allow nodulation to occur. The *Rhizobium* which nodulates peas, lentils, alfalfa and clover will not nodulate garbanzo beans. The inoculum should be applied immediately before seeding to insure good nodulation.

4. Garbanzo bean seed should be planted with a drill adapted to seed soybeans. Seeding must be closely monitored to avoid excessive seed breakage and to insure uniform stands.

5. Garbanzo beans should be seeded in 6- or 7-inch rows at a rate sufficient to establish two plants per foot of row. Seeding rate will vary, depending upon germination, seed size and the amount of seed breakage occurring in the seeding operations. For varieties such as UC-5, this would range from 120 to 150 pounds of seed per acre.

6. Garbanzo beans should be seeded in the early spring as soon as a good seedbed can be prepared and the soil temperatures are more than 43° F.

7. Good weed control is essential to successful garbanzo bean production. Good results have been obtained with a trifluralin preplant incorporated herbicide combined with a preemergent application of dinoseb amine. **Always read and carefully follow label directions before applying any agricultural chemical.**

8. Garbanzo beans grown in northern Idaho will probably mature in late August or early September. Swathing or defoliation can be used to hasten maturity and allow an earlier harvest. Garbanzo beans should not be swathed until the entire plant contains less than 40 percent moisture.

9. Garbanzo beans can be harvested using a cereal combine equipped with a pea bar by either direct cutting or picking up windrows. Cylinder speed and concave clearance should be adjusted to minimize seed breakage. Setting the clearance at ¾ inch in front and ½ inch in the rear combined with 450 rpm cylinder speed would be good initial adjustments.

10. Garbanzo beans should be stored at less than 12 percent moisture to avoid problems with seed rot. Garbanzo beans can be marketed under a contract or sold to several brokerage firms on quoted prices. Growers should expect $30 per hundredweight as a minimum price for number one quality garbanzo beans.

To insure successful production of this crop, growers are encouraged to plant a relatively small acreage initially to determine crop compatibility with their operation. Growers should carefully follow the cultural practices recommended in this publication or contact their local Extension agricultural agent for specific information. Arrangements should be made before planting to store, clean and market the garbanzo beans.

Acknowledgments

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