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Texas Commercial Vegetable Growers Guide

PINTO BEANS

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The popular pinto bean (Phaseolis vulgaris L.) is grown throughout Texas. Highest quality and yield are produced on the High Plains of northwest Texas. Texas pinto bean acreage increased to 4,928 in 1989 and to 18,351 in 1990. Pinto beans can be fitted into rotations with traditional crops. Estimated yields for irrigated pintos have ranged between 900 and 2,200 pounds of marketable beans per acre in recent years.

Pinto beans can be profitable for growers who obtain good contracts and control costs. Top prices are paid only for clean, smooth beans that are attractive, bright and free of cracks (check-coat, hairline cracks and chips) and stains. Cultural practices should be geared toward optimum net profit while sustaining soil quality.

Marketing

Texas annually imports more than 100 million pounds of pinto beans. Processors, institutional users, repackers and supermarkets pay top prices for clean, smooth beans that are free of stains, cracks and splits. Texas growers historically enter into contracts with buyers who arrange for cleaning, grading, storage and marketing. Growers who arrange for sale of part of their crop at market prices have netted higher profit than those who agree on a set value for their entire crop before planting.

Pinto bean prices (f.o.b.) have ranged from about $20 to $48 per hundredweight (cwt) since 1985. In the same time most growers have signed contracts ranging from $14 to $22 per cwt. Total charges for custom cleaning, grading and marketing range from $3 to $5 per cwt. Storage costs are not firmly established in Texas but are estimated to be less than $1 per cwt per year for large volumes. Trucking costs vary widely depending on carrier, distance and state of origin but range from $1.75 to more than $3 for beans shipped from northwestern states to Texas receivers. Hauling charges inside Texas range from about $0.75 to $1.50 per cwt.

Roughly a quarter of the pinto beans produced in the United States are transported through Texas to buyers in the southwestern United States and for export to Mexico, Central America, Caribbean nations and markets worldwide.

Busy consumers know that preparing pinto beans for the table is time consuming. Many, however, appreciate the nutritional value and flavor of pinto beans. Consumers are aware of food quality and the value of high-quality protein. Pinto beans also provide a low-cost protein source. Pinto beans also offer many opportunities for value-added processing.

Every popular vegetable in the United States is aggressively marketed through a well-organized program funded by growers of that vegetable. The Texas pinto bean offers this kind of opportunity to its Texas growers. Successful pinto bean marketing requires strong will, extensive knowledge, patience and hard work.

Cost and Return Budget

Table 1 shows a cost and return budget developed from grower estimates. The important parts of this budget for prospective growers to use are the operations list (for a menu of production inputs) and the estimate column to add in your costs. Operation costs are averages.

From average estimated costs and returns of this budget, a graph (Figure 1) was developed to aid in determining the potential of pinto beans for an alternative crop in any agricultural enterprise.

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Cost and Return Budget

Table 1. Projected costs and returns per acre for Texas pinto beans (1990).

Income	Quantity	Unit	$/Unit	Your Total	Estimate
Pinto Beans	**18.00**	**cwt**	**20.00**	**$360.00**	
Total				**$360.00**	
Variable Expenses					
Seed	80.00	lb	0.60	48.00	
Nitrogen	40.00	lb	0.24	9.60	
Phosphate	60.00	lb	0.22	13.20	
Trace Elements	1.00	appl	4.00	4.00	
Fertilizer Application	1.00	acre	3.00	3.00	
Herbicide and Application	1.00	acre	10.00	10.00	
Inoculant	1.00	acre	6.00	6.00	
Insecticide and Application	1.00	appl	6.00	6.00	
Hoeing	1.00	appl	10.00	10.00	
Other Chemical and Application	1.00	acre	0.00	0.00	
Fuel, Labor, Repairs for Operations Performed					
Shred	1.00	trips	4.00	4.00	
Chisel	1.00	trips	5.00	5.00	
Disk	2.00	trips	4.00	8.00	
List	1.00	trips	5.00	5.00	
Rodweed	1.00	trips	5.00	5.00	
Plant	1.00	trips	6.00	6.00	
Rotary Hoe	2.00	trips	3.00	6.00	
Sand Fighter	1.00	trips	2.00	2.00	
Cultivate	2.00	trips	4.00	8.00	
Spot Spray	1.00	trips	10.00	0.00	
Other	1.00	trips	5.00	0.00	
Irrigation					
Fuel	12.00	acin	3.00	36.00	
Labor	12.00	acin	1.00	12.00	
Repairs	12.00	acin	0.50	6.00	
Interest On Operating Capital	104.40	dol	0.10	10.44	
Total Pre-harvest Costs				$223.24	
Harvest Costs					
Custom Combine	1.00	acre	16.00	16.00	
Custom Haul	18.00	cwt	0.75	13.50	
Dry, Clean	18.00	cwt	0.75	13.50	
Marketing Costs	18.00	cwt	0.25	4.50	
Total Harvest Costs				$47.50	
Total Variable Costs				$270.74	
Net Income Above Variable Costs				$89.26	
Fixed Costs					
Tractor	1.00	acre	18.00	18.00	
Machinery	1.00	acre	7.50	7.50	
Irrigation Equipment	1.00	acre	15.00	15.00	
Interest on Fixed Investment	40.50	dol	0.08	3.24	
Land (Cash Rent)	1.00	acre	25.00	25.00	
Other Overhead	1.00	acre	0.00	0.00	
Total Fixed Costs				$68.74	
Total Costs				$339.48	
Net Income Above All Costs				$20.52	

Break-Even Prices at Various Yeilds

Yield	Break-Even Price
-20%	14.40 cwt $23.56/cwt
-10%	16.20 cwt $20.00/cwt
*	18.00 cwt $18.86/cwt
+10%	19.80 cwt $17.15/cwt
+20%	21.60 cwt $15.72/cwt

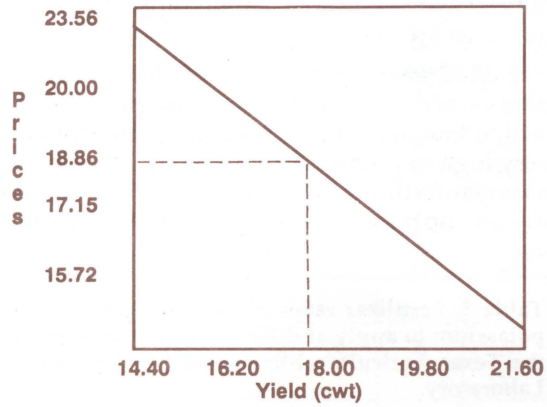

Figure 1. Pinto bean break-even prices at various yields.

Crop Rotation

The most vigorous pinto beans are produced in a 3- to 4-year rotation with cotton, grain sorghum, corn, wheat and vegetables. Previous crop debris must be well incorporated after harvest and well decomposed before bean planting. Pinto beans should not be planted after bean, pea, potato or sugar beet crops affected by Rhizoctonia root and crown rots, or after irrigated sunflowers because of white mold susceptibility in both crops. Straw residue from a wheat crop can aggravate Fusarium root rot and tie up soil nitrogen, causing temporary nitrogen deficiency in bean plants unless the wheat straw is well decomposed before bean-planting time.

Short rotations and continuous cropping to beans causes buildup of bean disease organisms in soil. Sclerotinia fungus, which causes white mold of beans, produces resting bodies known as sclerotia, which stay alive for many years in soil. Prevent trouble by having long rotation periods.

Varieties and Variety Performance

Pinto bean varieties currently grown in Texas include: Agate, Bill Z, Cinnabar (D81125), Flint, Olathe, Othello, Pindak, Pinray, UI 114 and UI 126. Characteristics of these varieties appear in Table 2.

Yields of irrigated pinto beans in Texas have ranged from less than 10 cwt to more than 16 cwt. Higher yields of 12 cwt to 22 cwt have been harvested from High Plains farms using more intensive management. Research by the High Plains Research Foundation in 1973 revealed yield potentials between 24 cwt and 35 cwt (Reference 2). Yield potential decreases in warmer areas of Texas with higher rainfall than the High Plains (Reference 3). Actual combine-harvested yields are always somewhat less than the yield produced. A percentage of pods shatter and spill the seeds on the ground during mechanical harvest, and the combine splits seed coats unless the operator exercises extreme care.

Table 2. Characteristics of some pinto bean varieties grown in Texas.

Variety	Growth Habit*	Days to Mature	Seed/ lb.	Disease Reaction**			
				Blight	Mosaic	Root Rot	Rust
Agate	I	85	1217	S	R	S	R
Bill Z	III	90	1388	S	R	S	R
Cinnabar	II	85	1240	S	R	S	S
Flint	II	85	1186	T	R	S	S
Olathe	III	90	1344	S	R	S	R
Othello	II	85	1328	S	R	R	R
Pindak	II	85	1450	S	R	T	R
Pinray	II	92	1180	S	R	S	S
U.I. 114	III	100	1305	S	R	S	S
U.I. 126	III	95	1343	S	R	S	S

*Growth Habit
I = Bush; determinate growth; upright architecture; short period of flowering.
II = Upright vine; indeterminate growth; upright architecture; longer period of flowering than type I.
III = Prostrate vine; indeterminate growth; prostrate architecture, long flowering period.
** = Disease Reaction
S = Susceptible
R = Resistant
T = Tolerant

In 1989, Cinnabar, Olathe, Pinray and UI 126 averaged more than 23 cwt per acre in a hand-harvested replicated trial in Crosby County. Individual yields ranged from 22 cwt to 25 cwt. We know that the better varieties have strong potential here. More trials are needed to assess variety performance.

Colorado trials of five leading varieties, spanning 10 years, averaged 23 cwt per acre. Yields ranged from 22 to 25 cwt per acre (UI 114 = 22, Olathe = 23, Bill Z = 24, UI 126 = 24 and Othello = 25 cwt).

Dryland production rarely returns a profit to the grower. In a year when high rainfall has recharged the root zone and planting is timed to exploit available moisture, dryland beans or beans on limited water can be successful. Be cautious. Cahone, the most successful variety grown dryland in Colorado, consistently out-yields San Juan Select by 15 percent in Colorado and is better adapted to prevalent moisture and disease (Fusarium root rot and mosaic virus) stresses. Try only a small trial planting of Cahone or any new variety in first time use in your county.

Seed Quality and Sources

Plant high-quality certified seed. Look for the official state seal on each bag. For best results, buy seed that is true to variety name, free of seedborne diseases and not contaminated with weed seed. Germination should be at least 85 percent. Seedborne diseases include bacterial bean blight, common bean mosaic and anthracnose. Obtain high-quality seed from California, Colorado and Idaho. Get names of

seed companies offering certified pinto bean seed from the American Seed Trade Association, Inc., Suite 964, Executive Building, 1030 15th St., N.W., Washington, DC 20005; telephone 202/223-4080.

Land Selection and Preparation

Pinto beans are susceptible to iron deficiency on highly alkaline soils (pH over 8.0 and high free carbonates) and soils containing excessively high phosphorus. Avoid fields with these conditions and any other limitation such as poor drainage or excessive slope.

Windbreak Crops

Windbreak strips protect young bean seedlings from wind and sand damage and reduce moisture loss. Blossoming, pod-set and pod-fill are more successful when wind speed is under 10 mph near peas and beans. Try to have 50 percent open space in each windbreak row to slow the wind but not block it completely.

Fall land preparation permits seeding of Elbon rye in narrow lines every eight rows. This pattern will give good wind protection for early-planted beans.

A single row of early spring-planted, tall-growing, sterile grain sorghum such as Funk G-1990 or a similar strong-stemmed variety, planted every 40 to 50 feet or closer with plants standing about 9 to 12 inches apart in the row, shields the crop well.

Two rows of cold-tolerant grain corn, sweet corn or shorter-growing grain sorghum, planted 30 to 45 days before seeding beans, with plants 6 to 8 inches apart in the row, provide good protection. The windbreak crop sown in early to mid-April will provide some protection even by late May to early June.

Soil Fertility Requirements

Fertile soils produce highest yields and highest quality pinto beans. Beans grown on soils that contain low to medium levels of nitrogen and/or phosphorus respond to fertilization. Excessive soil nitrogen causes succulent vine growth, delays maturity and favors disease. Excessive soil phosphorus interferes with uptake of iron, which often results in iron deficiency. Careful fertilization pays ample dividends.

Samples of soil taken long before planting from fields intended for beans can be sent to your Extension Soil Testing Laboratory (in Lubbock or College Station) or to a reliable private laboratory. Your county Extension agent has soil sample preparation instructions, information sheets and plastic lined containers. The soil test will reveal an iron or zinc deficiency and show whether applications of major nutrients are needed.

Table 3 gives application rates for nitrogen, phosphorus and potassium. For example, a typical soil testing low in nitrogen, medium in phosphorus and very high in potassium would require 50 pounds of nitrogen fertilizer, 40 pounds of phosphorus fertilizer and no potassium fertilizer per acre before planting.

Table 3. Fertilizer rates of nitrogen, phosphorus and potassium to apply at different soil levels reported by the Texas Agricultural Extension Service Soil Testing Laboratory.

	Pounds Per Acre of Fertilizer		
Soil Test Level	N	PV>2OV>5	KV>2O
VL	60	80	100
L	50	80	80
M	20	80	80
H	0	0	0
VH	0	0	0

Soil Test Levels:
VL = very low; L = low; M = medium; H = high;
VH = very high

Fertilizer equivalents:
N = Nitrogen; PV>2OV>5 = Phosphorus; KV>2O = Potassium

Weed Control

An effective pre-emergence herbicide is essential for good broadleaf weed control. Failure to apply a pre-emergence herbicide can lead to a serious weed problem because the number of herbicides labelled for broadleaf weed control in pinto beans is limited.

Yield losses from weeds were estimated to range from 14 to 25 percent in a Rocky Mountain states survey. Presence of broadleaf weeds lowered yields by 40 to 50 percent in field research at Colorado State University. Texas conditions are similar.

Effective weed management is imperative, especially early in the growing season. Pinto bean is not competitive with weeds in the first month after emergence.

Herbicides control weeds economically and safely when applied according to label directions. Weed management strategies using herbicides plus shallow post-emergence tillage and timing of planting provide effective weed control from crop emergence to harvest in most cases.

Table 4 lists common weeds and chemical control options. Timely shallow cultivation and irrigation activate herbicide action and enhance effectiveness. References 1, 5 and 6 discuss weed control methods in detail.

Table 4. Common weeds and labelled herbicides for Texas pinto beans.

Weed	Pre-plant Incorporated					Pre-Emergence				Post-Emergence		
	CANNON	EPTAM	TREFLAN	SONALAN	PROWL	DACTHAL	DUAL	LASSO	ROUNDUP[1]	BASAGRAN	POAST	EPTAM[2]
Barnyardgrass	X	X	X	X	X	X	X	X	X		X	X
Bindweed, Field				X					X			
Buffalobur									X			
Canada Thistle									X	X		
Carelessweed (Red Root Pigweed)	X	X	X	X	X		X	X	X			X
Cocklebur									X	X		
Foxtail, Green	X	X	X	X		X	X	X	X		X	X
Groundcherry	X		X					X	X			
Johnsongrass (seedling)	X	X	X	X		X	X	X	X[3]		X[3]	
Kochia	X		X	X	X		X		X			
Lambsquarters	X	X	X	X	X	X	X	X	X	X		X
Lanceleaf Sage									X			
Mallow									X			
Nightshade, Black	X	X	X				X	X	X			X
Nutsedge, Yellow		X					X	X	X	X		X
Purslane	X	X	X				X	X	X			
Ragweed	X						X	X	X	X		
Redroot Pigweed (Carelessweed)	X	X	X	X	X		X	X	X			X
Russian Thistle			X	X					X			
Smartweed	X		X		X		X	X	X			
Toothed Spurge									X			
Velvetleaf					X		X		X	X		
Venice Mallow									X			
Volunteer Grains (barley, oats, wheat)		X							X		X	X
Wild Sunflower									X		X	

1 = Will control emerged weeds but must be applied before crop emergence
2 = Eptam, incorporated post-emergence to crop
3 = Will control rhizome Johnsongrass in addition to seedling Johnsongrass

Planting Dates

Optimum planting dates for Texas pinto beans occur when seed bed soil temperature does not fall below 60°F.

Research and grower experience will soon define optimum planting dates for pinto bean varieties. Planting periods for good results are estimated to be from May 15 to 30 in South Plains counties and May 22 to June 7 in Panhandle Counties. Beans are planted in late March in South Texas and in April in Central and East Texas. North Central and Rolling Plains regions plant from mid-April to early May. Summer planting after wheat harvest is feasible in Central Texas and in the High and Rolling Plains.

Research has not established optimum planting dates for specified varieties in specific Texas regions. Growers can be guided by knowing that pinto bean seed will germinate at soil temperatures between 60o and 95oF. Field germination and early growth is most successful at soil temperatures between 70o and 80oF. Blossoms do not set pods at temperatures above 93oF.

Seed Inoculation and Treatment

Pinto beans supply part of their nitrogen requirement from symbiotic nitrogen-fixing bacteria that attach to bean roots and form nodules. Nitrogen strain D inoculum in granular form, banded along side the seed at planting time, is sometimes helpful.

Effectiveness varies with many factors including population and kind of nitrogen-fixing bacteria in the soil, cropping pattern, weather conditions and the amount of applied nitrogen. Inoculation with nitrogen-fixing bacteria is important on land where beans have not been planted recently and Rhizobia bacteria of strain D are not present.

Seed should be treated with a fungicide to prevent seed rot and with an insecticide to prevent damage to seed by the seedcorn maggot.

Row and Plant Spacing Alternatives

Seed should be placed close enough to produce plants that support each other in an upright growth habit while producing high yields. Growers who can plant flat under center pivot systems can space the rows evenly from 20 to 30 inches apart to obtain the upright growth that is necessary for direct combine harvest. Three to four plants per foot of row usually result in maximum yield per acre.

Seeding Rates and Depth

Seeding rates for irrigated beans vary between 60 and 80 pounds per acre, assuming high-quality seed are used. Upright and bush varieties usually yield higher at higher seeding rates. Seeding rates for dryland bean production average about 25 percent of the seeding rate used for irrigated beans to obtain highest net return. Pinto bean seed size varies from 1,100 to 1,400 seeds per pound. See reference 1 for discussion on plant populations.

Seeding depth varies with soil texture. In loamy sands, plant seed 3 inches deep. In sandy loam, plant 2 to 2 1/2 inches deep. Deeper planting can increase survival under dryland conditions. Avoid planting deeper than 4 inches even in sandy soils.

Plant Development Stages

Stage 1, germination to a stand, occurs in about 4 to 8 days in warm soil. Stage 2, rapid vegetative growth, continues from emergence to about 28 to 32 days after planting. Stage 3, flowering and pod development, begins with the appearance of the first blossom at about 32 to 40 days after planting (28 to 32 days after emergence). Flowering and development of pods continues for the next 10 to 14 days to produce the seeds that will reach prime maturity. Stage 4, pod fill and maturation, occurs about 40 to 50 days after seeding and continues until 60 to 70 days after planting.

Drying of pods and foliage usually occurs between 70 and 90 days after planting on the High Plains. Time required for maturation and dry down depends on variety and weather.

Irrigation

Pinto bean plants extract 85 percent of water from the top 18 inches of soil. Rainfall varies from 6 inches in Far West Texas to 50 inches in East Texas. Irrigation requirements can vary from none to more than 20 inches where little or no rainfall occurs during growth. In drier areas of Texas, pre-watering brings soil moisture to field capacity. Despite this, "watering up" a crop with a light irrigation after seeding is often advantageous. "Water up" with as little water as possible to avoid excessive seedbed soil cooling. Equal moistening of all seed assures uniform emergence and uniform crop maturity. Uniformity assures efficient combining and high turnout of clean beans.

A soil profile with full moisture at planting time can satisfy plant moisture requirements for 2 to 3 weeks. Watch your plants closely to be sure that the growth rate continues rapidly up to blooming time. A second irrigation is often needed 14 to 30 days after emergence to assure continued vigorous leaf growth, healthy blossoms and good pod set. A third irrigation is usually required 7 to 10 days later to assure complete pod fill with well-developed plump beans. A fourth irrigation is often required for some later varieties.

Sprinkler irrigation must be cut off between 2 and 3 p.m. to allow time for foliage to dry before sunset. Bean foliage wet at night is more easily infected with bacterial blight.

Disease Control

Pinto bean yields can be reduced by many diseases. The most common of these in Texas are seedling disease caused by various fungi, root rots caused by Fusarium and Rhizoctonia rust, bacterial blights and nematodes. Seedling diseases can be controlled

to some degree by fungicide seed treatments. Fusarium root rot can be avoided by 4- to 5-year rotation with non-host crops such as alfalfa, barley, corn and wheat; using tolerant or resistant varieties; avoiding moisture stress; planting after soil temperatures reach 60oF; and using fungicide seed treatment to delay infection of the seedling. Rhizoctonia can be controlled by fungicide seed treatment, rotation with non-hose crops, deep incorporation of previous bean crop residue and shallow planting at a soil temperature above 69oF. Rust is common on beans. Rust infection is favored by frequent rains or frequent center pivot sprinkler irrigation. Management includes planting varieties with resistance to the races of rust in the area, incorporation of bean trash into the soil, rotation with non-host crops for a minimum of 2 years and fungicide application at the first sign of rust.

Bacterial blights have been a problem on beans in Texas. Halo blight occurs but common bacterial blight is more prevalent. To control these diseases, plant certified seed of blight-tolerant varieties, use seed produced in blight-free areas, treat seed with streptomycin to kill bacteria on the seed surface, plow in bean trash from previous crops, rotate with other crops for 3 years, avoid entering the field when plants are wet, avoid frequent sprinkler irrigation which splashes bacteria from plant to plant and apply copper fungicides.

Poor root development, the appearance of root galls, stunting and yellowing of plants indicate infection by root knot nematode. Control nematodes with preplant fumigation applied at least 14 days before planting or with nematocides applied at planting.

Detailed symptoms of these diseases and control management are discussed in publications 1, 2, 6 and 8 in References.

Insect Management

Insects feeding on roots, stems, leaves, pods and bean seed can permanently damage the crop. Frequent scouting for insect activity is necessary to maintain adequate insect control. Insects include seedcorn maggot, thrips, cutworms, spider mites, Mexican bean beetle, grasshopper, armyworms and aphids. Illustrations and descriptions of these insects and controls are presented in publications cited in references 1, 2, 5 and 6.

Read insecticide labels carefully for registration status and important use instructions, such as timing of pre-harvest intervals.

Harvest Aid Chemicals

Defol-6 Gramoxone Extra and Gramoxone Super are labelled as harvest aid chemicals for dry beans. These foliage desiccants should be applied when at least 70 percent of the pods are yellowing, which shows they are ripe. Wait at least 7 to 10 days after application to allow enough drying before harvesting.

Read harvest aid chemical labels carefully. Check with suppliers and the Texas Department of Agriculture to be sure intended use is still legal.

Harvest

Direct combine harvest of bush and upright-vine varieties can give highest quality, yields and efficiency of machine operation. Traditional harvest that includes undercutting, rodding, wind-rowing and pick-up combining exposes beans to more weather damage and increases probability of field losses. Compared with direct combine harvest, the traditional method is relatively time inefficient, expensive and detrimental to bean quality. New growers are advised to design their bean production system to enable direct harvest.

To tailor a bean crop for direct combine harvest, carefully prepare firm, well-shaped beds where the crop will be furrow irrigated. Flat culture for a sprinkler irrigated crop should be started on a well-granulated, firm seed bed. Select an upright bush-type variety if available. Plant a relatively high plant population to encourage erect plant growth. Restrict availability of nitrogen by soil testing and applying no more than about 60 pounds per acre. Harvest the crop at 14.5 to 16 percent seed moisture. Have drying units available to dry down loads having seed moisture higher than 16 percent.

Most combines can be modified and adjusted to provide gentle, direct-combine harvesting of a pinto bean crop. The ideal bean combine has a floating flex head with down pressure and tilting capability. Floating "fingers" extending in front of knife guides pick up and guide vines up and over the cutting head. Plastic reel fingers prevent damage to cutter bar knives on the flex head. A cylinder slow-down kit permits cylinder speeds as slow as about 200 rpm. Rubber-coated cylinder bars cushion the beans. Perforated screens under clean-grain elevator, return auger and feederhouse help eliminate dirt before it reaches the grain tank. Finally, a straw chopper cuts straw into pieces that can be easily plowed under.

Combines can be operated to prevent bean damage and minimize field losses. Concave cylinder speeds of about 200 rpm prevent cracking and abrasive injuries to the seed coat. Adjust combine ground speed so that volume equals capacity. Run combine fast enough to keep it fully loaded without either overloading or underloading the machine. To reduce bean damage, try removing every other concave bar to allow beans to exit the concave faster. Try removing every other cylinder bar if the cylinder is working the seeds too vigorously. Keep all screens clear of trash. Run your combine when bean seed moisture

ranges between 14.5 and 16 percent. A concave-cylinder clearance of 5/16 to 3/4 inch allows seed to pass through without damage.

Adjustments to cylinder speed and ground speed may be necessary during harvesting to determine if your combine is damaging the seed. Remove a 100-bean sample from grain tank and soak it in water for 5 to 10 minutes. Cracked seeds absorb water faster than do intact beans, and seed coats will peel back exposing cotyledons. If more than 3 or 4 out of 100 seeds start to swell up or peel, stop the combine and determine where damage is occurring.

Post-Harvest Handling

The pinto bean seed coat is easily cracked. Choose a handler who will treat beans gently. Rubber-coated belt conveyers, rubber padded surfaces and rubber coated baffles where ever seed is transported, elevated or dropped assure safe seed cleaning and grading. Keep seed free-fall to less than a foot.

Storage

Bean storage must protect seed from moisture, temperature extremes and contamination by other crops, insects and rodents. A positive flow aeration system is necessary to keep bean seed moisture content between 14 and 16 percent for short-term storage and 11 and 14 percent for long-term storage.

Fumigation may be necessary to prevent damage by storage insects. Employ a licensed, restricted use pesticide applicator to fumigate stored beans. Beans that have been dried properly and are free of storage insects can be held in good condition for months.

References

Detailed discussions of pinto bean production, harvesting, handling, storage and integrated pest management strategies along with color pictures which aid growers and consultants in field diagnosis of disease, insect and nutrient problems are presented in the following publications:

1. Colorado Dry Bean Production and IPM (Bulletin 548A), available from the Colorado Dry Bean Advisory Board, P.O. Box 8055, Fort Collins, CO 80522.
2. Recognition and Management of Dry Bean Production Problems, (North Central Regional Extension Publication 198), available from Colorado State University Bulletin Room, 171 Aylesworth Hall-SW, Fort Collins, CO 80523.

The following publications contain current recommended controls for insects, diseases and seeds and Texas variety trial results.

3. Dry Bean Yields on The High Plains of West Texas, PR-2532, TAES.
4. Evaluation of Dry Edible Beans for Southwest Texas, PR-3755, TAES.
5. Insect and Weed Control Manuals, published by Ag-Consultant, a Meister Publication, 3781 Euclid Avenue, Willoughby, OH 44094.
6. Quick Guide by Thomson Publications, P.O. Box 9335, Fresno, CA 93791.
7. Texas Guide for Controlling Insects on Commercial Vegetable Crops, TAEX (Bulletin-1305).
8. The Texas Plant Disease Handbook and Chemical Control Supplement, TAEX (Bulletin-1140 and 1140A).

While these guides are helpful, an up-to-date product label is the legal authority for applications of any chemical to a vegetable crop in Texas.

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