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Edible Beans

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Edible Beans

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A market for field beans (dry beans, edible beans) has developed in South Dakota.

The principal production area is between Interstate 29 and the Missouri River, although varieties have been grown in the western part of the state for many years.

Among the many field beans available, the three most popular in South Dakota are the navy (pea), the pinto, and the red kidney. Most are produced for canning; the rest are sold as dried beans for home preparation.

The market demands top quality beans that are well developed. They must not be damaged by weather, insects or diseases, harvesting or handling equipment, or by improper storage.

Growing field beans is not hard. Marketing can be.

Marketing can not be left to chance after the bins are full. You must study prices, outlets, and the accessibility of those outlets before you decide to go into field bean production. At least one company in the area, for example, offers year-round bean marketing and receiving services.

You need to know your marketing options before you even consider cultural practices.

Adaption and Seed

Beans require a frost-free period of about 120 days. Excessive drought, high temperatures, or hot, dry winds especially during pod setting lower yield. Hot, dry winds may also cause severe blossom drop. The flowers that replace these aborted blossoms will mature later than the rest of the crop, and harvest will not be uniform.

Use certified seed grown in the western part of the United States where strict blight quarantine and prevention programs reduce the chances of infestation by bacterial blight organisms.

Using certified seed means that you are getting seed from stock that has been closely watched for disease. If you use local seed you run the risk of getting some seed-borne organisms that you are unable to detect.

Bean seeds should have high germination percentage, be true to variety, be uniform in size, and have a minimum of mechanical damage. Don't drop the bags and always handle the seed very carefully. Bean seeds are extremely prone to seed coat damage and internal injuries which reduce germination and seedling vigor.

Consider maturity, disease resistance, yield, market quality, and market demand when choosing varieties.

Buy seed treated with a fungicide to protect from seed decay and damping off of seedlings which are caused by soil organisms. An insecticide should also be applied to control insects such as the seed corn maggot which can reduce stand.

It is better to buy treated seed than to treat it on the farm.

Popular navy beans

Snow Bunting. Medium sized bush. Medium yield. Early. Reported resistant to common mosaic and root rot. Susceptible to white mold and common and fuscous blights.

Snow Flake. Small, erect bush. Medium yield. Early. Reported resistant to common mosaic and fuscous blight. Susceptible to white mold and common blight.

Upland. Medium sized bush. Medium yield. Medium maturity. Reported resistant to common mosaic and root rot. Susceptible to white mold and common and fuscous blights.

Seafarer. Erect bush. Medium yield. Early. Resistant to anthracnose and mosaic V1, V1A, V15. Tolerant of halo blight. Susceptible to white mold and common and fuscous blights.

Fleetwood. A new mid season bush bean that appears to be well adapted. Not yet fully evaluated in South Dakota.

Common pintos

UI-111. Vine type. Early. Resistant to curly top and common (VB1) mosaic. Susceptible to New York strain (BV1A) of common mosaic.

UI-114. Vine type. Early. Resistant to curly top, common (VB1) and New York strain (BV1A) of bean common mosaic.

Kidney beans

Charlevoix. Early maturing, dark red, purple flowers. Resistant to anthracnose (alpha beta races). Susceptible to mosaic and to both common and halo blight.

Montcalm. Early maturing, dark red, white flowers. Resistant to alpha and susceptible to beta race of anthracnose. Resistant to V1 and V15 mosaic. Resistant to halo blight and susceptible to common blight.

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Soil

Good drainage is the first thing to look for when choosing a field for dry beans. Heavy soil increases the water holding capacity and produces a better yield.

A bean field should be uniform; otherwise, slow growth in spotty areas will give problems at harvest.

Beans grow best if the soil pH is just below neutral (7.0). Use soil tests to determine pH and fertility needs. If the soil pH is towards the alkaline side, test for zinc deficiency before planting.

If zinc is low, the best corrective measure is a broadcast application of about 5 lb/A of actual zinc in the form of zinc sulfate. This will last 4-5 years.

If the deficiency is borderline, a maximum of 2 lb of zinc sulfate can be applied with the starter fertilizer as a preventive measure.

You can see a zinc deficiency after the beans are growing; there'll be a bronze haze over the field. Emergency zinc chelate, at the rate of 0.2 lb zinc, is imperative at this point. It can bring a field back to normal in a very short time.

Seedbed Preparation

You may have to fall plow on heavy or compacted soil, but spring plowing reduces wind erosion on lighter soil. A clean and firm seedbed is essential; but there's a fine line between this condition and over-working which will produce compaction.

The seedbed should be level; don't hill as you plant or cultivate unless you will use a cutter at harvest. Then a small hill is desirable.

If you use no chemical weed control, plow early. This gives you a chance to cultivate before planting to destroy germinated weeds. Make the cultivation shallow; you don't want to bring more weed seeds to the surface to germinate later.

Fertilizer

Bean plants have a shallower root system than corn, which means you have to keep fertility levels up.

Since they are legumes, beans are equipped to fix their own nitrogen, but not in sufficient quantities for maximum yield. So they respond well to nitrogen fertilizer, especially a starter nitrogen.

It is not recommended that beans be inoculated at planting.

Nitrogen deficiency often shows up on poorly drained, fine textured soils where nitrogen fixing bacteria are not functioning at full capacity because of insufficient air.

Beans are heavy users of P_2O_5 and K_2O. Fertilize according to soil test.

When the soil already has high fertility, starter fertilizer alone will be sufficient. Starter fertilizer generally contains 15 lb of nitrogen, 35 lb of phosphorus, and 20 lb of potassium.

You can apply it either as a band or broadcast. As a band, apply 1-1¼ inch to the side and 2 inches below the seed level. The beans may be damaged if fertilizer is placed too close or in contact with the seed.

Broadcasting is generally preferred by growers, but this calls for larger amounts of fertilizer than when banding. Work down fertilizer before planting.

The vines and beans of a 30-bu bean crop contain about 90 lb of nitrogen, 12 lb of phosphorus, and 50 lb of potassium.

Planting

Best yields are achieved by planting as early as possible, because flowering should be completed before the hot, dry weather of July sets in. Seeds should be in the soil after soil temperature has reached somewhere between 50-60 degrees F.

Planting later than June 10 may decrease the yield slightly, but normally most yields don't decrease until after June 15 if other growing conditions are favorable. Plant 1-1½ inches deep in heavy soil, and 2 inches deep in sandy soil; never plant deeper than 3 inches.

Pounds of fertilizer to apply for various yield goals and soil tests (SDSU soil testing lab).

Yield goal, pinto & navy beans, lbs/A	Soil test values: P, lbs/A					K, lbs/A					$N(NO_3-N)$, lbs/A
	VL	L	M	H	VH	VL	L	M	H	VH	
	<6	6-15	16-25	26-35	>35	<50	51-120	121-210	211-300	>300	Top 2 ft
	Plant food element recommendations: P_2O_5/A, lb					K_2O/A, lb					
750	25	15	10	0	0	40	25	15	0	0	10
1000	30	20	10	0	0	50	30	15	0	0	20
1250	35	25	10	0	0	60	35	20	0	0	30
1500	40	30	15	10	0	70	40	25	0	0	40
1750	45	35	15	10	0	80	50	30	0	0	50
2000	50	40	20	10	0	90	60	35	15	0	55
2250	55	45	20	10	0	100	70	40	20	0	60
2500	60	50	25	15	0	110	80	45	25	0	70
2750	65	55	25	15	0	120	90	50	30	0	75
3000	70	60	30	20	0	130	100	55	35	0	85
3250	75	65	30	20	0	140	110	60	40	0	90

Test the planter on a hard surface at normal planting speed and again in the field to be sure of proper spacing.

Beans adjust to various planting rates by producing more seeds per plant in thin populations and fewer seeds per plant in thick populations. A practical rate of planting is about 100,000 seeds per acre.

Because of this natural plant adjustment to varying populations, expensive seed can be planted at low rates with little loss in yield. With scarce and expensive seed, the planting rate can be reduced to about 40 lb/A for vine type pinto varieties with practically no yield loss and to 20 lb/A for bush type varieties with 10% loss in yield. There is probably more loss with larger vine varieties.

Very low populations run the risk of being wiped out if the soil crusts and the field is not rotary hoed. Weeds will be more of a problem at very low populations.

Pinto beans planted in rows 22 inches apart yield 7% more than those planted in 30-inch rows and 14% more than beans in 38-inch rows. Navy beans are usually planted in 30- to 38-inch rows.

Drilling navy beans is becoming more common for ease of harvest and higher yields. Trials show a yield increase from 1900 lb/A in 30-inch rows to 2400 lb/A in 6-inch rows.

Wider row spacing on irrigated land is recommended for good air circulation and less disease loss. Planting rate has no effect on average weight per seed.

You may want to consider planting a strip of corn in a field where wind could become a problem at harvest time.

Rotation

Dry beans are a short-season crop and will fit into a variety of crop rotation plans. Beans are generally grown following alfalfa, corn, potatoes, soybeans, or small grain crops.

Beans are not good weed competitors; they should not follow sunflowers or sugarbeets.

Follow at least a 3-year crop rotation—disease organisms may live in the soil or on plant residue for one or more years.

Beans do best following corn on farms that use a corn-oat-forage rotation. The herbicides and cultivation accompanying corn provide an opportunity to reduce weed competition. A good fertility program on the corn provides some residual fertility for the beans.

Be careful; some chemicals such as atrazine may damage beans the following year.

Planting rates for various yields.

Row width, inches	Seeds per foot	Plants per foot	Yield, lb/A (in 100's)
	Navy beans		
38	8	6-7	35-37
30	6-7	5-6	38-40
20	4-5	4-5	45-47
12	3-4	3-4	50-60
6	2	2	60
	Kidney beans		
38	5-6	5	74-77
30	4½-5½	4-5	79-81
	Pinto beans		
38	4½-4¾	3¾-4½	54-56
30	3¾-4¼	3¼-3¾	59-61
20	2¾-3¼	2¼-2¾	64-66

Four or five seeds per square foot in a picked field equal a 1 bu/A field loss in yield. Reduce shatter by harvesting as soon as possible after beans are ready to cut and by handling gently.

Weed control

Dry beans are more sensitive to weed complications than soybeans. Do not plant beans where perennial weeds are a problem. (Roundup would be the only possibility of controlling perennials before planting. It is expensive, not labeled, and does not completely control perennial weeds.)

Good weed control the preceding year minimizes weed seed production.

Herbicide treatments combined with supplementary post-plant tillage generally provide good annual weed control. Cultivate field beans at least twice before the beans cover the middle of the row and when weeds are small. Do not cultivate when plants are wet from rain or dew as this may transmit blight and other diseases from plant to plant.

Cultivation should be shallow. Be careful of pruning roots, especially during blooming.

If beans are going to be pulled, the rows should be hilled approximately 2 inches. Leave the area between rows level. If you plan to direct harvest, the field should be kept level. Weeds which are not destroyed by herbicides or cultivation should be rogued by hand.

Suggestions for chemical control of weeds in dry edible beans. Application rates are on a broadcast basis and refer to acid equivalent or **active ingredients** rather than amount of commercial product. Avoid repeated and prolonged contact with herbicides, especially direct contact with the skin and eyes. Check label restrictions for use of crops for food or feed.

Chemical	lb/A of active ingred. or acid equivalent broadcast	Time	Remarks
Amiben	3	Preemergence	
Basagran	¾ to 1	Early post-emergence	After first trifoliate is fully expanded.
Chloro IPC or Furloe	3	Preemergence	
Cobex	⅓ to ⅔	Preplant	Incorporation may be delayed up to 4 hours
Dynamyte 3 or Dynamyte 5	3 to 4½	Early post-emergence, not later than crook stage	
Eptam	3	Preplant	Incorporate immediately
Lasso	2½ to 3	Preplant	Incorporated within 8 hours and 7 days prior to planting
Tolban	¾ to 1	Preplant	Must be incorporated within 4 hours
Treflan	½ to 1	Preplant	Must be well incorporated
Treflan + Amiben	¾ + 2	Preplant Preemergence	Must be well incorporated
Treflan + Eptam	½ to 1 + 2 to 3	Preplant	Incorporate immediately

Irrigation

For maximum production beans require about 15 inches of water, well distributed during the growing season. The field should be dry towards harvest.

If the soil is not well prepared or is dry, the first irrigation should be right after planting for uniform emergence. The second most critical irrigation is at flowering.

Irrigation effect on bean maturity depends on the variety. Generally, irrigation delays maturity of vine types, but does not affect maturity of bush types.

Irrigating sandy soil may produce beans with undesirably low proteins. The clue to this is that plants start turning yellow. Give special attention to irrigated beans on sandy soil; make sure they are nodulated or well supplied with nitrogen.

Harvesting

Beans mature just about the time of first frost or earlier. This means they can be harvested before corn and soybeans. Harvest dry beans before killing frost. Frozen immature bean seeds will shrink when drying and can be separated.

Dry beans are ready for harvest when some of the pods are dry and when the majority of them have turned yellow. The nearly mature dry beans in the yellow pods will continue to ripen after they are cut. Too many dry pods at harvest will result in heavy shattering.

Around 70% of the navy beans in the Dakotas and Minnesota are direct harvested when 80-90% of the beans reach 17-18% moisture. The rest are pulled, windrowed, and combined. Do not pull and windrow any more than can be combined that same day, or you risk wind and rain damage in the windrow.

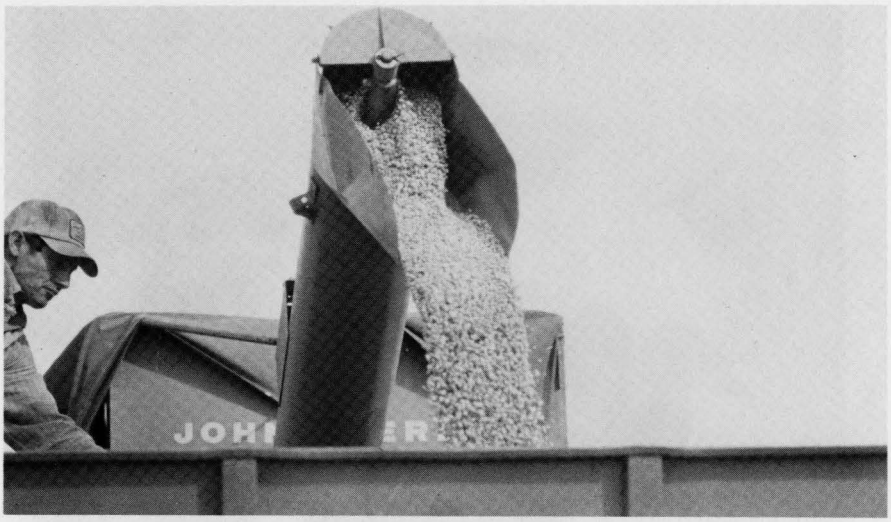
Make bean windrows as large as can be threshed efficiently. The larger windrows offer the seed more protection from injury, wind, and shattering.

Navy and kidney beans should be harvested and handled at the 17-18% moisture level to hold splitting and seed coat damage to a minimum. In both field and in the windrow, navy beans tend to lose moisture more rapidly than pinto beans.

Pinto beans are harvested at 14% moisture. Harvesting at any lower moisture may result in an excessive percentage of split beans and cracked seed coats.

Bean attachments for the grain combine usually include kits for cylinder speed reduction and seed and dirt screens. Parts vary with make and model.

In combining beans, use only enough cylinder speed to do a good job of threshing. It is usually wise to reduce the cylinder speed as the day progresses to compensate for additional drying. Or harvest only in the morning and evening when the pods are tough.



Most beans are direct harvested; losses that go with pulling, windrowing, and leaving the crop on the ground for a day can be eliminated. On the other hand, you can pull and windrow when pods are tougher, thus reducing shattering. Fluffy windrows will give some protection to the pods. Only pull and windrow as much as you can combine in a day.

Beans with less than 5% shucked seed coats may be marketed at a premium.

Disease

Loss in yield to disease is determined by temperature, rainfall, and quality of seed. In dry climates and in dry years, disease development is restricted. In years of abundant rainfall or when sprinkler irrigation is practiced, certain diseases are worse.

Sometime during every season, environmental conditions favor the infection and spread of certain organisms. In any locality, not all diseases occur each year. Some years a disease may be present and destructive, but the next it may not occur or be of little consequence.

Bacteria

Common blight and halo blight are the most common bacterial diseases of beans.

The symptoms of both are very similar; often it is impossible to tell which disease is present by field inspection. The first symptoms are small, water soaked spots on the undersides of the leaves. The spots merge and form larger, but similar, infected areas.

Halo blight can be identified sometimes by the formation of a zone of greenish yellow tissue outside the water soaked spot. Common blight produces larger, brown, necrotic areas surrounded by a narrow band of yellow tissue. These brown areas of dead tissue drop out and the leaves become tattered. Extensive leaf drop may occur.

Water soaked or brown lesions are formed on the stems and pods by both diseases. The characteristic bacterial ooze that can be seen on the infected leaves, stem, and pods during wet weather is different for common blight and halo blight. The ooze associated with common blight is yellow. For halo blight, the ooze is cream colored. Seeds become infected, but may not appear different from non-infected seed. Occasionally, infected seed may be shriveled and discolored.

The bacteria overwinter in or on the seed and in infected bean straw. Bacteria are spread by seed, or within fields by rain, wind, hail, sprinkler irrigation, man, and farm machinery.

Fuscous bacterial blight symptoms develop first on the leaves as brown necrotic lesions surrounded by a bright yellow zone; the lesions develop along the leaf margin and in the interveinal areas of the leaf. Under moist, warm conditions, lesions enlarge rapidly to cover most of the leaf, giving the plants a "burned" appearance. Pod lesions generally appear as small, brown, "scabby" spots.

Generally, the disease becomes visible in the field at or following the blossom period. Spread is then rapid, particularly in warm, humid weather.

Internal seed infection occurs primarily when the upper pod suture becomes infected.

These bacterial diseases are usually controlled by planting

disease-free seed, rotating the fields at least every 3 years, and not working the fields when they are wet.

All varieties of beans are more or less susceptible to common bacterial blight. Some pea bean varieties are resistant to halo blight.

Fungi

Root rots of beans occur wherever beans are grown, but are variable in occurrence and severity.

Dry rot caused by a Fusarium fungus is common and can be destructive. Above ground symptoms are stunting, yellowing, and sometimes wilting; but the disease is characterized by a reddish discoloration of the tap root. The lower root system is destroyed. If there is plenty of moisture and the soil is ridged around the stem, new roots can develop above the injury, enabling the plant to survive. Yield will be greatly reduced.

Seedling blight caused by Rhizoctonia and Pythium species can occur early in the season, causing reduced stands. Infected seedlings have reddish lesions or a soft, brownish rot of the stem at or below the ground line.

Control of bean root rot is difficult; crop rotation can help reduce damage.

When root rot is a problem, frequent, light irrigations instead of infrequent, heavy ones often produce better yields.

Seed treatment can help improve stands.

No bean varieties are resistant to root rot or seedling blight.

Rust

Bean rust is greatly influenced by weather conditions. It is favored by cool nights and damp, rainy weather. Rust can be a problem on dry beans under irrigation. It will develop near the end of the growing season.

Bean rust is caused by a fungus. The first symptoms are pinhead sized lesions on both sides of the leaves. When infection is heavy, the leaf turns yellow within a week, then browns and falls off the plant. A heavily infected field appears to have been scorched.

A rainy season or prolonged irrigation will enhance infection by the spores of bean rust. The fungus overwinters on plant debris in the field, so beans should not be planted consecutively, nor even adjacent to fields which were heavily rust infected the previous year. Incorporate refuse into the soil, preferably in the fall. Use of sprays depends on degree of infection and number of weeks until crop maturity.

The black spores which are produced late are able to survive the winter in infected bean straw. It is from these overwintered spores that infection starts again in the spring. Beans planted on ground that produced a heavily rusted bean crop the year before will become infected. But spores will not live more than a year if beans are rotated.

All common dry bean varieties are susceptible to rust.

Crop rotation and sprays will control the disease.

Sclerotinia wilt

Sclerotinia wilt, or white rot, is usually more severe in areas where beans have been grown for a long time. The fungus that causes the disease is soil-borne and attacks many crops and weeds.

The sclerotinia wilt fungus attacks any part of the plant, causing a soft, watery rot. The infected area becomes covered with a cottony white growth which gradually darkens and turns into an irregularly shaped black resting body called a sclerotium.

Sclerotia enable the fungus to survive unfavorable periods. When favorable conditions return, the sclerotia begin to grow and either produce

infection directly or form tiny mushroom-like bodies that produce spores. These spores can be carried by wind or rain to plants and can cause widespread disease in the field.

Sclerotinia wilt usually begins to develop in August, as the beans are maturing.

No adequate control is known.

All bean varieties are susceptible, although it is claimed that some are more tolerant than others.

A 2- to 3-year rotation with small grain, corn or hay should be used when possible.

Since a wet soil surface favors the disease, cultural practices that will reduce the surface moisture will aid in controlling the disease. Irrigate no more than necessary, use wider row spacings, reduce seeding rates.

Viruses

Viruses are apt to be overlooked even when the disease is severe, because they may produce no noticeable symptoms. A virus may infect all plants, reducing yield but seldom killing them.

The most frequent bean virus is common bean mosaic, and the characteristic symptom is the mottling pattern on the leaves. The mottling is composed of irregularly shaped light and dark green areas of various size. Sometimes this pattern on the leaves is the only symptom seen.

Stunting and malformation of the leaves can occur. The leaf distortion is a puckering or a cupping downward. Leaves may be longer than normal. Plants infected early are dwarfed, spindly, yellow, and produce few beans. Late infection causes little effect on yield.

Yellow mosaic produces an intense mottling of yellow and green areas, but is sometimes difficult to distinguish from common mosaic in the field. Infected plants may be dwarfed and bunchy. Pods sometimes are deformed, rough, and shiny.

Aphids carry and spread these virus diseases to healthy plants.

The use of resistant varieties is the only effective control for common bean mosaic and its variant strain. A number of field beans are resistant to common bean mosaic and the variant strain, but several of the varieties resistant to common mosaic are susceptible to the variant strain.

There is no satisfactory control for yellow bean mosaic. Since it is not seed-borne, isolated fields might escape infection. Some varieties of dry beans seem to be more tolerant of yellow mosaic than others.

Nematodes

Nematodes, especially the root lesion nematode, are frequently found in great numbers associated with bean roots. There is an indication that these nematodes can cause a significant reduction in yield.

The attack by the lesion nematode produces no distinctive field symptoms. There is no indication of root feeding unless secondary organisms invade the roots.

Stunting, and occasionally yellowing, are the only symptoms produced. The only way to determine the presence of lesion nematodes is to have an assay of the roots and soil made by a nemotologist.

The use of soil fumigants or other nematocides is economically practical only where the infestation is so great

Bald head occurs when the primary growing point is dead or broken off. The plant will seldom survive past the seedling stage; if leaves do develop from secondary buds, the plant will mature too late to contribute substantially to yield. A cracked seed coat is the reason for bald head; handle seed carefully at all times.

that yield increase from treatment will offset the investment.

Non-parasitic disorders

Many disorders that are disease-like are not caused by pathogens. Sometimes they can be important.

Bald head

Bald heads occur when the plants emerge and have no growing point. The main cause of this is injury to the growing point of the seed during threshing or handling.

Do not plant beans with a high percentage of cracked seed. Operate the thresher at the proper cylinder speed. Use care in moving and handling harvested and bagged seed.

Heat injury

A heat injured plant shows a sunken lesion at the ground line. This injury occurs most frequently on light, sandy soil.

Severely injured beans seldom recover enough to produce a crop. They usually die.

Sunscald

Sunscald is the result of intense, direct or reflected sunlight, not heat. The injury is recognized by small, brown patches between the veins of the leaves, which often enlarge. The injured tissue becomes thin and brittle and crumbles readily when dry.

Tiny red or brown spots occur on the pods that are directly exposed to sunlight. the spots enlarge and become slightly sunken. Light infection on young pods may be mistaken for bacterial blight.

No varieties are known to be immune.

Blossom Drop

Blossom drop is related to temperature. Blossoms fail to set when the daytime temperature is 97 degrees F or above. The optimum temperature for fruit set is 85 degrees F daytime and 70 degrees F at night.

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