GROWING DRY BEANS
A VERMONT TRADITION

Winston A. Way, UVM Extension Agronomist

Members of the older generation will remember baked beans and hot dogs on many a Saturday night (they were eaten on other days for reasons of economy, too). More recently, home baked beans have regained some of their popularity as an epicurean treat or party fare. And of course they have always been well received at church suppers.

Most of the younger generation are only familiar with canned beans, never having tasted the more delicious home product. The delightful blend of odors and tastes from maple syrup and molasses used as sweeteners, the bacon or ham used for smokiness, plus the mustard, ketchup, and onion used for accent, is unequaled by most inexpensive foods.

Good baked beans are a treat as well as an economy food in today's world of protein scarcity. Soybeans, which seem to get all the publicity, are just one kind of bean. You have a wide choice of shapes, colors, and sizes. All of them are inexpensive compared to meat, milk, eggs, or fish. But to make the comparison, remember that the price of dry beans reflects a product with only 10 to 15 percent water whereas milk has more than 85 percent water and meat or eggs more than 50 percent.

Many jokes have been made about beans and their effects on the human digestive system. In fact, some people claim they suffer so much distress from eating beans that they prefer not to eat them. To avoid unpleasantries, you might try the old fashioned gold drop variety, if you are lucky enough to find seed, or the non flatulent variety developed at the University of New Hampshire.

Beans are ecologically sound in today's energy-short world. Being a member of the legume family they produce at least a part of their own nitrogen supply with the help of symbiotic bacteria, which live in nodules on the roots. Far less fertilizer is required for beans in comparison to most other food crops. In addition, if enough organic matter is used, or if beans follow a legume sod crop, it is possible to have a good yield with no added fertilizer. However, a small amount of phosphorus near the seeds will usually enhance early growth. Dry beans are one of the easiest crops to produce organically.

ENVIRONMENTAL FACTORS

Temperature:

Dry beans are easy to grow in the warmer parts of Vermont where frost during the growing season won't nip them. Beans are easily injured and killed by frost, so delay planting until all danger of frost is past. For the Champlain Valley and Connecticut Valley areas of the state, this means May 10 to June 1. Check local weather advice for higher elevations.

Most dry beans require at least 90 to 100 days to mature, provided limiting factors don't impede growth. A May 15 planting should be ready to harvest in September, a June 15 planting in mid-October. Once the beans have matured and the leaves are well yellowed, a light frost won't hurt them but a hard freeze will damage beans which still have too high a water content.

Areas adjacent to Lake Champlain are especially adapted to beans. Here, planting in some years may be as early as May 1 and as late as July 1. Rarely can planting be done as late as July 15. If July plantings do mature, the plants will be stunted, the yields less, and the beans will be smaller in size with more defects. Obviously a growing season with average or above average temperatures will enhance growth and yield Beans grow slowly at temperatures below 60 and perform best in the range of 75 to 85.

Water:

Beans don't demand a lot of water but neither should they be subjected to drought. Rainfall distribution is adequate in most years. Too much water is a far greater hazard than too little water in Vermont.

Wet soils early in the season delay planting. Too much rain at any time, or poor soil drainage, will lead to root rots. Hot humid weather will lead to the devastating leaf blight diseases. Rainy weather after the pods have dried or during harvest will cause serious molding problems.

The Champlain Valley—averaging 28 to 32 inches of precipitation a year with a month-long dry period in late July and early August and good drying weather in late September and early October—is best suited to beans. The long growing season allows beans to be planted late enough to avoid the wet spring weather, and even poorly drained soils will often produce a fair crop.

Fertility:

Beans have restricted root systems. They grow best in nearly neutral soils of good fertility and do not always respond well to fertilizer. High-lime soils of the Champlain Valley, such as Benson, Nellis, Stockbridge, Amenia, and Vergennes, are ideal for beans and may never need liming. Other more acid soils will require the addition of limestone (dolomitic preferred) to raise the pH to near 7 (neutral). The Calais soils found extensively in north central Vermont have some lime influence and should grow beans well.

Beans are sensitive to soil levels of zinc. Deficiencies have been experienced on these soils—especially where the pH is well above 7—due to their content of free lime and undigested clam shells. Use 10 pounds of zinc sulphate per acre in the starter fertilizer to prevent deficiency. It is not practical to broadcast zinc materials on these soils as it is too easily fixed into unavailable forms. Foliar applications also work if applied when the plants are young, well before blossoming.

Apply phosphorus as a banded starter fertilizer near the seed. Superphosphate may be used to supply 20 to 80 pounds of P2O depending on soil test. But usually a complete fertilizer such as 10-20-10, 5-20-10, 10-20-20, or 5-20-20 at 200 to 300 pounds per acre is desirable. Lower analysis grades containing sulfur may perform best. Use soil tests to match fertilizers to your fields.

Beans are sensitive to salt injury and ammonia burn. Avoid fertilizers containing urea or diammonium phosphate. Bulk-blended materials are most likely to contain these. This fertilizer band must be separated from the seed by 2 to 3 inches to the side and below. Most new corn planters place fertilizer correctly.

Potassium shows little response on the clay soils but it should be included in the fertilizer for all other soils, especially those of a sandy nature. The small amount of potassium removal—as contrasted to high tonnage crops such as corn and alfalfa—dictates only small amounts as included in bean fertilizers. Soils of low fertility may require up to 1, 000 pounds of fertilizer per acre. If so, the large amounts must be broadcast for safety. Because of restricted root systems, sidedressing beans is less satisfactory than sidedressing corn.

Nitrogen is best supplied from organic matter and from the nodule bacteria. Beans require nitrogen but only a little at any one time. Too much nitrogen from chemical fertilizers, or manure, may cause excessive vegetative growth, promote disease, and slow down natural production in the root nodules. In short, nitrogen will be wasted.

MANAGEMENT

Soil:

Beans grow best in a loose, friable, well-aerated soil. Avoid crusting of the surface especially at seedling emergence time because beans must push their big cotyledons through the soil (as opposed to corn which pushes through only a spear-pointed shoot).

Conventional tillage procedures are acceptable for beans. But even though the seeds are large, take care to have the seedbed reasonably free of large clods. Sandy soils present no problem and may be spring- or fall-plowed. Soils of higher clay or silt content should be fall-plowed to allow the action of freezing and thawing to create finer granules.

Avoid late spring plowing of clay soils, which are soon to be planted. An air gap will be created at the bottom of the plow layer. This prevents subsoil moisture from moving into the seedbed. Delayed germination will result and seedlings will suffer drought injury if rainfall is not frequent and adequate.

Wheel or disc harrows perform best in working up plowed land. If a sod has been plowed under, no other tillage tool is necessary. Double disc in two directions at right angles to each other and then disc both ways diagonally to smooth out depressions and dead furrows. A land plane (leveler) would perform this leveling task even better. Springtooth harrows and field cultivators should not be used on sod land because they drag pieces of sod to the surface, which interferes with, the planting equipment.

If nonsod land is being prepared and quackgrass is a problem, springtooth harrows and field cultivators will drag the stolons and roots to the surface where sunlight and desiccation can kill them. Rototilling appears to accomplish the same purpose except that it also replants some of the pieces and, if done repeatedly, may cause soil structure to become too fine.

Plan for each discing to follow 5 to 7 days after the previous one. Weed seeds germinated in the interim will be destroyed. Well-planned soil preparation is an effective method of weed control.

Rotations:

Beans should not be grown more than once, or twice at most, on the same land without other crops being grown in rotation. Rotations help control weeds, discourage diseases, protect soil from erosion, reduce insect populations, and rejuvenate soil organic matter—a valuable source of nitrogen. Beans may be rotated with most any kind of crop, but grass-legume combinations (sod crops) are the only ones that really accumulate much organic nitrogen. All row crops, including beans, cause destruction of organic matter. Three or more years of beans result in a serious soil deterioration.

Alfalfa is the best nitrogen-fixing legume and is first choice as a rotational crop. The alfalfa should be in mixture with timothy or brome grass for the maximum improvement in soil structure and reduced erosion hazard.

In some situations green manure or cover crops of clover, small grains, or ryegrass may be tried. However, beans are generally harvested so late in the fall that no growing time remains to even allow for establishment of winter rye before winter sets in.

Even though beans may be cultivated and treated with herbicides, their late removal usually allows certain weeds to grow enough for seed dissemination. Thus 2 years or more of continuous beans result in an accumulative build-up of weeds and weed seeds.

Continuous beans results in a breakdown of soil structure in nonsandy soils. The problem is greatest on Champlain Valley clays and silts. Loss of structure makes tillage more difficult; surface crusting interferes with seedling emergence and runoff is increased. Soil erosion is a greater hazard.

Some bean diseases are soil-borne and for this reason alone, a rotation should be practiced. Ideally beans should never be grown more than once or twice in a 4 to 5 year rotation.

Choosing seeds:

Bean seeds are relatively short-lived and tend to have a low germination, even in the spring following harvest. The Vermont Seed Law Standard is 70 percent. Good seed should germinate 85 to 90 percent but damage during threshing often causes damage to seed coats.

Purchase seeds from a reputable supplier who shows germination on the package or from a source known to be less than 3 years old. Vermont law permits the sale of seeds with unmarked germination if the seed is above standard (70 percent). But if below standard, the percent germination must be shown. When in doubt either test a sample yourself by putting 100 seeds in a damp rolled towel or have them tested at the UVM Regulatory Service Seed Laboratory.

The susceptibility of beans to several seed-borne virus diseases, for which there is no effective economical treatment, makes it imperative that you purchase the best seed possible. Ideally, this is produced in an arid climate where diseases are less common. Such seeds are apt to be smaller in size but free of imperfections and disease.

Seed produced in the humid east may carry visible and invisible diseases. Look for plump, blemish-free seeds. Avoid shrunken, shriveled, moldy smelling, discolored, and dirty seed. Don't buy seed with cracked seed coats, split seed, or mixed varieties.

Cultivars (varieties):

Bean cultivars are almost endless, some having no name and being perpetuated only within a family or circle of close friends. Such heirloom beans are passed from generation to generation. Beans are self-pollinating and thus two cultivars can be grown side by side without danger of cross pollination. (A cultivar is a man-perpetuated strain of seed, as opposed to a botanical variety.)

Dry beans can be produced from any species or cultivar of bean. Color, size, texture after ranking, toughness of seed coat, taste, and gastronomic qualities dictate certain types for certain purposes. Beans for sprouting should be as small as possible. Thus, the mung bean is best for that purpose as the Chinese discovered long ago. Soybeans sprout less easily, but are noted for their nutritional quality. Fava beans are also interesting.

Shell beans, before becoming dry, require hand removal from the pod. Large sizes are preferable, as is a red color. The dark red Vermont cranberry beans were once very popular for stewing as a vegetable. However, like red kidney beans, they bake up to a dark-colored product.

Variegated beans showing tawny and reddish streaks or swirls—such as pinto and horticultural beans—are popular for chili. Red kidney beans remain whole when cooked, and are used with green and yellow snap beans (pods) to make a three bean salad, flavored with onion, vinegar, oil, and sugar.

Beans for baking are generally of a light color, such as the yellowish golddrop (sulphur bean) about pea bean size. More commonly, beans for baking are all white such as the small pea bean, the larger navy bean, or the large, flat Great Northern. Michelite is a popular pea bean variety produced on a large scale in Michigan.

The yellow-eye of commerce outside New England is a white bean of intermediate size with a large, oval, reddish-brown patch around the eye which covers about a fourth of the bean. Being raised afar and usually in surplus, it may often be several years old before baking. This results in poor baking quality. Beans more typical of New England, and considered superior for baking, include the Maine Improved

Yellow-eye and soldier bean cultivars. These are grown only in New England and are usually produced in keeping with demand. There is little carryover from year to year, thus quality is generally excellent. The yellow-eye is a fairly large all-white bean except for a yellowish-orange marking of irregular shape around the eye. Yellow-eyes bake to a lovely light golden color when sweetened with Vermont maple syrup. Molasses darkens them somewhat.

Soldier beans are in shorter supply and usually higher in price than yellow-eyes. They are a bit larger and tend to be kidney-shaped. A reddish mahogany marking around the eye in the configuration of a soldier probably determined the name. Sometimes two or more small spots appear elsewhere on the bean. Several variations in color, shape, and size are available from seed suppliers, the more popular being a round-shaped bean with reddish markings rather than flat with brownish marking.

Many old-timers no doubt remember the dalmatian or coach dog bean. It is very similar to the soldier bean except that it also has many reddish spots scattered over the bean as though someone had splashed paint on it. The markings are thickest on the eye side. This type is grown to a limited extent in Maine as Jacob's Cattle Bean. Another similar cultivar with even more numerous markings is sold by one seed supplier as Trout Bean.

Anyone marketing beans for profit in Vermont should be mindful that soldier beans are preferred in the central and eastern parts of the state. Maine Improved Yellow-eyes are more popular in the Champlain Valley region.

Soldier beans cook to a softer texture for those who like them slightly mushy. New England yellow-eyes are tender but are more apt to remain whole during cooking. Pea beans stand the most punishment without falling apart. Of course cooking time, as well as freshness of the beans and the extent of parboiling with baking soda and soaking, all affects hardness and softness.

GROWING THE CROP

Inoculation:

In spite of the symbiotic fixation by bacteria in the root nodules, there is often little evidence that inoculation of the seed with bacteria is supplying much nitrogen. Nevertheless, inoculate the seed you plant, especially if you are growing beans without chemical fertilizer and for the first time.

To inoculate seeds with the commercial preparation "specific to beans," which you buy at the seed store, first coat the seed with pancake syrup. Use about 2 tablespoons of syrup to 15 pounds of seed. When all seeds are sticky, add the suggested amount of inoculum and continue stirring until the stickiness disappears. The black inoculum will be imbedded in a candy coating. Plant seeds at once. Or if you must delay, store seeds out of sunlight in a cool place. If you can't plant for 3 days, then reinoculate by the same procedure.

Seed treatment:

Beans are susceptible to a number of seedling diseases and insects before and during emergence. The longer the period from planting until true leaves form, the greater the exposure to attack. For this reason, soil temperatures of 60 to 70 and optimum moisture are helpful in shortening this interval.

Seed treatment, although not approved by some people of organic persuasion, it's a most worthwhile insurance. A fungicide is mixed with an insecticide. Both powders are dusted on the seed before planting or in the seedbox during planting. Seed treatment is hardly enough chemical to cause environmental concern or residues in the final crop. (Consult your county Extension agent or dealer for approved

chemicals.)
The penalty for not using seed protectants is a spotty stand or a waste of seed. You must overplant to get a productive population. With seed costs at 30 to 50 dollars per acre, you can't afford to waste seed or sacrifice yield. Watch out for other pests later. Woodchucks eat young bean shoots and deer eat bean plants, too.

Planting rate :
The official weight of beans is 60 pounds per bushel. Different sized beans do, of course, have varying volume weights but the 60 is constant. Thus smaller seeds provide a greater number of plants per acre than larger seeds if the weight or bushel measure is kept constant. Figure on planting about a bushel per acre of the commonly grown varieties. However, you may plant 3/4 bushel of pea beans or 14 bushels of soldier beans. Plant sizes also vary but not necessarily in proportion to seed size.
A 72-pound-per-acre planting rate of Maine Improved Yellow-eyes (2 pound per 100 feet of 36-inch row) will result in a seed spacing of about 3 inches, or 40 seeds per each 10 feet of row. If dead seeds and seedling mortality total 25 to 30 percent, then the harvestable plants will average three to each foot of row.

Planting techniques:
Dry beans are grown in rows to match the type of equipment available for planting, cultivation, and harvest. Maximum yields are obtained from broadcast planting where the ground is completely covered by the crop. But the problem of harvesting low-hanging pods has not been mechanically solved. Some nearly touch the ground and will be damaged by any kind of cutting machine. Broadcast plantings demand the use of herbicides because cultivation is impossible. Also seeds are more difficult to cover with soil when broadcast.
Row planting, generally 14 to 36 inches, is possible with tool bar planters or grain drill planting. Planters, such as a farmer uses for corn, are best because they permit band application of fertilizer simultaneously. Grain drills have no provision for side banding and actually mix seed with fertilizer in a common soil slit. This is all right for superphosphate but deadly with mixed fertilizer.
A 36-inch spacing seems wasteful of space especially after leaves have dropped off, yet it is the narrowest width possible with single row equipment and a 10-horsepower tractor. Cultivation is difficult at row spacings closer than 24 inches, but herbicides make cultivation unnecessary. Tractor-mounted pullers (single or double) require some ingenuity to avoid running on rows.
Bean rows should be on the contour or at least generally parallel to the slope (as in strip cropping) to reduce erosion. Like corn, it should be possible, on large fields, to plant in a spiral pattern from outside to inside except that cultivators and especially pullers work less well on curved rows.
Choose the correct planter seed plate to conform to the size of seeds. Be sure seeds fit the cells without having to be crowded and cracked as they pass through. Adjust chains and sprockets to deliver the seed count you seek. Remember that 75 percent germination means that 25 percent (1 out of 4 seeds) won't grow a plant. Try the planter out on a roadway so you can observe seed drop and make easy counts. Keep ground speed down to 3 or 4 miles per hour when planting. Never bury bean seeds too deep. Shallow covering of 1 to 12 inches is ideal. This ensures a quicker and easier emergence.

Weed control:
Weeds are a problem in bean fields, particularly at harvest time. Red root pigweed, lambsquarter,

ragweed, foxtails and quackgrass are among the more common species. Chemical control is possible, but not easy, because beans are sensitive to many herbicides, such as atrazine residue from a previous corn crop.

Quackgrass is a special problem weed; fields must be free of seeds and stolons before planting. Good seedbed preparation—starting early in the spring and continuing until planting time—will eliminate a lot of quackgrass and weed seedlings. This amounts to a spring fallowing.

If you aren't going to use herbicides, cultivate three to four times before blossoming. Be especially careful to cultivate only when the leaves are turned up in the driest and lightest part of the day. Soil can then flow under the leaves and around the stem. As evening approaches, the leaves get damp and droop down where they can be damaged. Never cultivate while dew or rain are on the leaves since this spreads diseases from one leaf to another. Cultivator types are a matter of opinion, soil type, weed problem, row spacing, and plant size. Choose discs, sweeps, spring teeth, or rotary hoes (between rows).

Make the first cultivation about the time two full leaves are out, the second and third as weeds become obvious and the last before runners appear and growth becomes too dense for safe tractor passage. Never cultivate after pods are formed because you'll cover them with soil and induce rot.

Several herbicides are approved for use on dry beans. They may be applied before planting, before emergence, or during the crooked neck stage of emergence—depending on the chemical. Sprays are more effective than dry formulations. Consult your county Extension agent or dealer about specific chemicals for specific problems. These change each year.

Insects:

The Mexican bean beetle is a common insect found on beans. But it almost never destroys a crop. Proper and prompt identification of insect pests is important. Other possible insects include the tarnished plant bug, black bean aphid, alfalfa caterpillar, alfalfa looper, corn borer, potato leaf hopper. And of course the bean weevil, a storage insect, must be avoided at all cost. Freezing is a natural form of control; carbon dioxide may be used in storage bins. Try not to leave any unprotected beans around over summer. Consult your county Extension agent for help. He can offer a choice of approved insecticides for specific problems.

Diseases:

Beans are subject to a number of bacterial and viral diseases especially in years of high temperature, high humidity, and high rainfall. Dry beans are more vulnerable than snap beans because they are permitted to grow to maturity and because of the larger acreage involved. No attempt will be made to delineate the diseases one by one. It is sufficient to say that both leaves and pods may be affected. Early stages look like watery spots, then leaves yellow, die, and drop prematurely. Beans dry up and appear to mature but remain small in size and show shrunken yellow seedcoat abnormalities.

Treatment of bean diseases is not very practical. Some antibiotics, such as streptomycin (Agrimycin), have been effective but the cost per application is high and several weekly treatments are necessary. Use western-grown seed, if possible. Consult your county Extension agent for disease information.