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Producing Sugar Beets : Extension Circular 1-61-2

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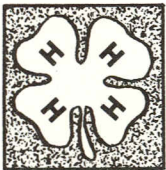
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1956

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producing...

Sugar Beets



... a manual for nebraska 4-H clubs

EXTENSION SERVICE
 UNIVERSITY OF NEBRASKA COLLEGE OF AGRICULTURE
 AND U. S. DEPARTMENT OF AGRICULTURE
 COOPERATING
 W. V. LAMBERT, DIRECTOR

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Your 4-H Sugar Beet Project

Sugar beets are an excellent crop for a 4-H club project in areas where they can be grown. They provide an important cash income, furnish feed for livestock and fit into the crop rotation on irrigated farms. Sugar beets return high yields and are seldom a complete failure. This project can help you learn about farming and at the same time help you earn money for future needs such as paying for a college education or starting a business of your own.

Requirements of project: You will be expected to plant, maintain and harvest one acre or more of sugar beets. For efficiency in production your field may be a part of a larger field; but be sure to mark your area and contract it in your name. During the year you will be expected to record all costs of production, operations performed and income.

Club program suggestions: This manual is divided into sections; each describing a job to be done. Following each section are three suggestions for club activities. If properly used, the suggestions can make for an interesting and educational club year.

Four-H Sugar Beet Clubs should be organized on a year-round basis. One or more of the topics can be discussed at each club meeting. Try to discuss the job before it is to be done in the field. Plan your year's program - with your leader - as soon as the club is organized. Besides discussions, you may be able to use some of the following suggested activities.

- (1) Invite someone to talk to your group on sugar beet production or some topic related to it.
- (2) Show films and slides about the production, marketing and use of sugar beets.
- (3) Have demonstrations, by members, on approved methods of sugar beet production.
- (4) Have judging and identification sessions.
- (5) Tour club members' projects, a University of Nebraska experiment station, demonstration plots and sugar factories.
- (6) Take part in field trips to study insect pests and diseases or to inspect some good field management practice.

Selecting the Field



As soon as the field is selected, take soil samples and have them tested.

Your first job is to decide where to plant the sugar beets. Be sure to consider the lay of the land, the soil type, the physical condition of the soil, the fertility and previous cropping system.

The best field for sugar beets has: (1) a gentle, uniform slope that drains well; (2) a fine sandy loam or silt loam soil that is high in fertility and organic matter; and (3) a crop rotation as suggested in "Rotating Crops." Keep in mind that sandy soils (light soils) will need to be irrigated more often; that clay type soils (heavy soils) often crust over after a rain; and that beets can stand more alkali than most crops.

You and your father or landlord will select the field. Immediately after choosing the field, make a rental agreement. A record of the location, rental fee and other agreements at the time of field selection will avoid misunderstandings. As soon as the field is selected, take a sample of the soil and have it tested as discussed under "Fertilizing."

SUGGESTED ACTIVITIES

1. Study soil maps, types of soils and fields. Judge fields and soils as to the best kind for growing sugar beets.
2. Demonstrate or have a demonstration on how to take a soil sample.
3. Discuss the different kinds of rental agreements.

Contracting the Crop

You will need to see your sugar company fieldman and make a contract for your crop. Beets are usually raised by contract with the company that agrees to pay you a price for all you raise. The price paid will depend upon the sugar content of the beets and the price of sugar.



The 4-H sugar beet project should be contracted in the club member's name.

After the contract is signed, the service of your sugar company's fieldman is available to you. He will be glad to advise you on how to grow the best sugar beets.

In most beet producing areas the growers are members of a Beet Growers Association. This Association represents the grower in his dealing with the company and tries to get the best possible contract for the grower. The Association also works with the company on improving delivery facilities, promoting the sugar beet industry, obtaining labor and improving production methods.

SUGGESTED ACTIVITIES

1. Have a sugar company fieldman, or someone else who is familiar with contracts, explain how sugar beet production contracts work.
2. Have a sugar company fieldman, or someone else who is familiar with the price of beets, explain how the price of the sugar beets is determined.
3. Have a member of the Beet Growers Association explain the purpose of the Association; and have him give suggestions on how your club can help the association. Your club may want to sponsor some activity in cooperation with the association.

Rotating Crops

Crop rotation means growing different crops on the same land in successive years. Growing the same crop on a piece of land year after year is called continuous cropping. A good crop rotation will help to (1) maintain soil fertility, (2) improve organic matter content of the soil, (3) control diseases, weeds and pests, (4) improve soil tilth and (5) control erosion.

Your crop rotation or cropping system will depend upon the type of soil, the size of your farming operations, amount and kind of livestock you raise, availability of irrigation water and markets and your personal interest in certain crops. Every crop rotation should include a legume, such as alfalfa or sweetclover, to provide nitrogen and organic matter.

Following are some rotations that farmers who raise sugar beets have found to be practical:

I. 4-year rotation

Barley and sweetclover -- 1 year
 Corn -- 1 year
 Beans -- 1 year
 Sugar beets -- 1 year

II. 7-year rotation

Alfalfa -- 3 years
 Potatoes -- 1 year
 Beans -- 1 year
 Sugar beets -- 1 year
 Barley (alfalfa seeding) -- 1 year

III. 8-year rotation (double legume)

Grain - alfalfa
 Alfalfa
 Alfalfa
 Potatoes
 Sugar beets
 Grain - sweetclover
 Corn or beans
 Sugar beets

IV. 7- or 8-year rotation

Alfalfa and brome pasture -- 3 or 4 years
 Potatoes -- 1 year
 Sugar beets -- 1 year
 Corn -- 1 year
 Barley, followed by fall seeding of brome and alfalfa -- 1 year

Note: Recent experiments in Michigan indicate that sugar beet yields are highest when following a bean crop. If you are growing both beans and sugar beets, try to plan the rotation so that sugar beets follow beans. Thus, if beans instead of corn are grown in rotation number IV change the rotation to potatoes, beans and then sugar beets.

SUGGESTED ACTIVITIES

1. Compare the rotations on each members' farm, and in each members' field, and look for ways to improve the rotations.
2. Dig up the roots of a legume and observe the number and shape of the nodules in which the nitrogen fixing bacteria live.
3. Have a member prepare and give a report on how legumes add nitrogen to the soil.

Fertilizing

If your crop is to grow normally and yield well, it needs 12 plant nutrient elements in proper amounts and forms. The plant nutrients used in the largest amounts are nitrogen, phosphate and potash. For example, a ton of sugar beets (roots and tops) contains about 7 pounds of nitrogen, 2 pounds of phosphate and 9.6 pounds of potash. Thus, if you harvested an 18-ton beet crop and take the tops from the field you are removing the following amounts of plant nutrient elements from the soil; 126 pounds of nitrogen, 36 pounds of phosphate and 173 pounds of potash as well as considerable amounts of calcium (lime), magnesium, sulphur and trace elements. Unless the plant nutrients taken from the soil are replaced, the soil will eventually become depleted of these elements.

The nitrogen that your crop needs can be maintained in the soil by growing a legume in the crop rotation, by returning manure and crop residues to the soil, by applying nitrogen fertilizers or by a combination of these methods. Returning manure and crop residues to the soil puts back a part of the phosphorus and other mineral elements taken from the soil by growing crops. If your soil is lacking in phosphorus, it usually pays to apply superphosphate or mixed fertilizer containing phosphorus.

To find out if your soil is lacking in phosphorus and other plant nutrients, take soil samples and have them tested. Your county agent or your sugar company fieldman will be glad to furnish soil sample boxes and information sheets. They will show you how to take the soil samples, draw a sketch map of the field and fill out the information sheet. Your county agent will send the soil samples to the Soil Testing Service, College of Agriculture. Three to four weeks are needed to complete the tests. A charge is made for this service.

Barnyard manure is a good nitrogen fertilizer. It also carries some phosphorus and all the other nutrient elements, and supplies organic matter for maintaining soil structure and tilth. If the soil is deficient in nitrogen, 10 to 12 tons of manure per acre will increase the yield of beets and other crops. Because excessive amounts of available nitrogen reduce the sugar content of beets, you should not use greater amounts of manure than recommended. For this reason, alfalfa ground that has just been broken should not be manured.

If the manure is rich and wet and gives off an odor of ammonia, disk or plow it under immediately after spreading. By working the manure into the ground you are saving the nitrogen for your crop.

If the manure does not smell like ammonia, drying or freezing will cause little loss of nitrogen. Early disking or plowing will hasten decay which in turn makes the plant nutrients in the manure more quickly available.

Commercial fertilizer. If the land has had no legume or manure in the past year, you will probably need to apply some commercial nitrogen fertilizer. Also, because manure and legume residues do not replace as much phosphorus as is taken from the soil, you may need to apply a commercial phosphorus fertilizer. If only one of these elements is needed, a straight nitrogen fertilizer or a straight phosphorus fertilizer may be applied. If both are needed, both nitrogen and phosphorus fertilizers may be used or a mixed fertilizer containing both nitrogen and phosphorus may be applied.

The state law requires that all fertilizers sold in Nebraska must carry a label or tag showing the net weight of the package in pounds and the guaranteed chemical analysis. The guaranteed analysis shows the per cent of nitrogen, the per cent of available phosphate (P_2O_5) and the per cent of soluble potash. Thus a fertilizer containing 8 per cent nitrogen, 32 per cent available phosphate and no potash is commonly referred to as 8-32-0. Trace elements such as boron, zinc and iron may be listed by name on the label.

When buying fertilizers, consider the value you get for your money. A 10-20-0 fertilizer is worth exactly twice as much per pound as a 5-10-0 fertilizer. If no potash is needed, it is also worth twice as much as a 5-10-5 fertilizer. Low analysis fertilizers, such as 3-8-3, often cost as much per hundred pounds as a high analysis fertilizer, such as 15-30-0. Use your pencil and find out the cost per pound of the nutrients you need. Then buy the cheapest.

SUGGESTED ACTIVITIES

1. Discuss the soil fertility needs of sugar beets and how best to meet the needs.
2. Bring a variety of fertilizer tags and information about cost. Have those present determine which is the cheapest and which is the most expensive. (This can be a judging activity with members judging the fertilizer for a specific condition)
3. If demonstration has not been given, show the step by step procedure in taking of a soil sample.

Preparing the Seedbed

Seedbed preparation is an important step to the success of your beet crop. The first step is plowing at a depth of 8 to 12 inches, being sure all crop residue and manure is plowed under. Then double disk and harrow the land to get a fine and firm seedbed. Next float the ground to further pack it and to "level" it so water will flow evenly. Floating the land makes it easier to cultivate and easier to use mechanical thinning machines. This is usually followed by a final harrowing. Harrowing helps to distribute soil left in ridges by the float and brings small clods to the surface to protect the land against wind erosion. The entire seedbed preparation should be completed in time for planting. If your soil is sandy, you will find it desirable to eliminate the practice of floating. This is because floating does increase the chances of soil blowing.

SUGGESTED ACTIVITIES

1. Discuss the steps necessary for seedbed preparation.
2. Have a demonstration on proper seedbed preparation. (Miniature farm machinery and a model field can be used.)
3. Discuss ways to protect the land from wind erosion.



During the year, the project record book should be brought up to date.

Planting

Time of Seeding: During most years, the best time to plant is during the first half of April (April 1st to 10th). Earlier plantings increase the freezing hazard while later plantings have a tendency to result in lower yields.

Rate of Seeding: Sugar beet seed used in Nebraska is provided by the sugar beet company with whom you have signed a contract. The varieties used are the best ones available for the area. All seed is now segmented. This means that the seed ball of the sugar beet plant, which contains six or eight germs, has been broken up into "parts" or "segments." A high percentage of the segments contain only a single germ. Planting segmented seed instead of whole seed requires less seed per acre and greatly reduces the time and labor involved in thinning.

Most growers plant at the rate of 5 or 6 pounds per acre to insure an adequate stand.

Depth of Seeding: Plant the seed 1 to 1 1/2 inches deep. Early plantings are usually made at a depth of 1 inch; and late plantings at a depth of 1 1/2 inches. The seed should never be planted deeper than 1 1/2 inches.

Procedure for Planting: Once the seedbed is prepared, plant the crop promptly before the moisture dries out. Plant slow enough (not over 3 miles per hour) to insure uniform dropping of the seed and good seed coverage. By doing this you will reduce the amount of labor required for blocking and thinning.

Be sure the pressure wheels are properly adjusted for the soil condition. Too much pressure may cause the development of crusts on the soil which make it difficult for the beets to come up. The crust can be broken by rolling or cultivating, or by the use of other equipment that has been designed for that purpose.

SUGGESTED ACTIVITIES

1. Discuss proper planting methods.
2. Study planting equipment and have a demonstration on how to properly adjust one for planting.
3. Have a cross judging session.

Blocking and Thinning

A uniform stand of one beet plant every 10 to 12 inches in rows that are 20 inches apart is desired. If the rows are wider apart, the plants should be closer together. For example, 22-inch rows should have a single beet plant every 8 to 10 inches in the row.

Block and thin your sugar beet plants, when they reach the 4 true-leaf stage. If you wait until the beets have 10 or 12 leaves, your yields will be reduced.

Mechanical thinning of sugar beets requires much less labor than hand thinning methods. The usual practice is to use the machine on thick and medium stands when the beets are well rooted and in the 4 leaf stage. This operation is followed with hand thinning on thick stands; or some trimming at first hoeing on medium stands. On thin stands, a long-handled hoe is used for plant thinning and spacing.

SUGGESTED ACTIVITIES

1. Have a demonstration on the proper way to block and thin beets.
2. Discuss the purpose of blocking and thinning.
3. Study the working principles of a mechanical thinner.

Irrigating

Timely and uniform irrigation is important. You should never allow the top 3 feet of soil to become drier than 50 per cent readily available moisture. Irrigate before the soil moisture content reaches this point. Your first few irrigations will be light, because you will want to keep the top foot of soil wet enough for proper beet development.

The term readily available moisture (RAM) means the amount of moisture the soil will hold for plant use. It has been determined that

Light soils (loamy sands and sandy loams) hold 0.75 to 1.25 inches of water per foot of soil,

Medium soils (very fine sand loams and silt loams) hold 1.50 to 2.00 inches of water per foot of soil, and

Heavy soils (silty clay loams and clay loams) hold 2.00 to 2.20 inches of water per foot of soil.

You can quickly determine the soil's RAM by squeezing a sample of the soil and then comparing its characteristics to those given in the table "Texture Guide for RAM." For more information on how to determine RAM see E.C. 55-700, "Field Moisture Test for Determining When to Irrigate."

When you apply water, spread it over the field as uniformly as possible. Avoid excessive irrigation -- application of more water than is needed to bring the RAM up to 100 per cent. Over irrigation is wasteful of water and may result in leaching. As water moves downward through the soil it takes plant nutrients with it. This is called leaching. The water and plant nutrients that are carried below the plant's root zone are lost for crop production.

Because of the great number of problems in connection with irrigation, this manual will not attempt to discuss them. Rather you are referred to your Soil Conservation Service and your Extension Service for help and information.

SUGGESTED ACTIVITIES

1. Discuss proper methods of irrigating. (A field trip or irrigation tour would be helpful.)
2. Invite the local soil conservationist to talk to the group about how to plan, lay-out and operate an irrigation system.
3. Have a demonstration on how to make a field moisture test.

TEXTURE GUIDE FOR RAM (Readily Available Moisture)

Feel or appearance of soils

Per cent of R. A. M. remaining in soil	Loamy sands and sandy loams (light)	Very fine sandy loam and silt loams (medium)	Silty clay loams and clay loams (heavy)
0	Dry, loose, flows through fingers.	Powdery, some- times slightly crusted but easily broken down into powdery condition.	Hard, baked, cracked; difficult to break down into powdery condition.
50 or less	Appears to be dry, will not form a ball with pressure.	Somewhat crumbly but will hold together from pressure.	Somewhat pliable, will ball under pressure.
50 to 75	Tends to ball under pressure but seldom will hold together when bounced in the hand.	Forms a ball, somewhat plastic, will slick slightly with pressure.	Forms a ball, will ribbon out between thumb and forefinger, has a slick feeling
75 to 100	Forms a weak ball, breaks easily when bounced in the hand, will not slick.	Forms a ball, very pliable, slicks readily.	Easily ribbons out between thumb and fore- finger, has a slick feeling.
100 per cent (field capacity)	Upon squeezing no free water appears on soil, but wet outline of ball is left on hand, soil will stick to thumb when rolled between thumb and forefinger.	Same as sandy loam.	Same as sandy loam.

Weeding and Cultivating

Mechanical Methods: The main purpose for cultivating is to destroy weeds. For this reason, cultivate only as often and as deep as is necessary to control weed growth.

Be sure the cultivation tools are properly spaced for the rows, and cultivate as shallow as possible. For early cultivations, set disks or knives as close to the row as practicable without cutting out or covering the beets. Most operators leave 3 to 4 inches of uncultivated soil in each beet row.

Pre-cultivating, weeding and thinning can sometimes be done to advantage by using implements such as the harrow, pencil weeder or thinning machine with spring-tines. If used when annual weeds and grasses are very small, machinery of this kind will effectively destroy weeds without injuring the beet crop. Care should be taken not to cover the small beets.

Chemical Methods: Chemical control of weeds in sugar beets is still new, but experiments and field trials in recent years promise great possibilities for its future success. IPC, TCA and DCU are being used by some beet growers.

IPC, applied at the rate of 3 to 5 pounds per acre, has effectively controlled wild oats and volunteer grain. It should be disked in to a depth of 3 inches immediately before planting. IPC does not control shallow rooted grasses.

If ample spring rain is received, good control of shallow-rooted grasses has been obtained by the application of sodium TCA. It is sprayed on the soil at the rate of 5 to 8 pounds per acre just before the beets come up. If there is not enough rainfall to carry the TCA down into the soil, irrigation will supply the needed moisture.

DCU, a newer chemical, has given very good results in the short period it has been tested. DCU is applied in a 6-inch band treatment at the rate of 2 1/2 pounds per acre and worked into the soil to a depth of 2 to 3 inches before the beets are planted.

Your sugar beet fieldman and county agent can give you up-to-date information about the better weed killing chemicals for your locality. Be sure to follow the manufacturer's directions.

SUGGESTED ACTIVITIES

1. Discuss proper methods of cultivation and weed control.
2. Have a weed, crop and grass identification session.
3. Have a demonstration on chemical treatments of weeds and grasses.

Note: For the safety of those present, water or colored water rather than the real chemical can be used to show how to apply the spray. Older members might like to try different chemicals at different rates of application on weeds and grasses and observe the effects at the following meeting.

Controlling Diseases and Insects

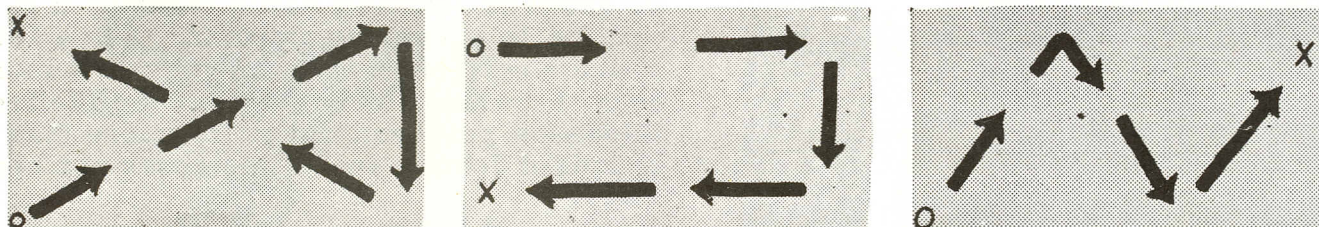
Diseases: The most common disease of sugar beets are root knot nematode, sugar beet nematode and root rot. The best known way to prevent these diseases is to use rotations, 4 or more years in length. Farm manure or commercial fertilizer in 2-year rotations will reduce the damage caused by root knot nematode disease.

A virus disease known as curly top is known to be present in Nebraska, but as yet is not serious.

Insects: The beet webworm is the most serious insect pest of sugar beets in Nebraska. Occasionally webworms develop so rapidly that they may cause severe defoliation before you are aware of their presence.

Grasshoppers, pale-banded flea beetles, root aphids and certain kinds of leafhoppers occasionally injure beets. Periodic checks should be made to determine if insects are present. If they are present in serious numbers, control measures will be required. Your sugar factory fieldman and your county agent will be glad to advise you on how to control the insects.

There are several good ways to move through a sugar beet field to hunt for insects. Some of these are shown in the sketches below.



Suggested ways to move through a field for the purpose of finding insects.

SUGGESTED ACTIVITIES

1. Discuss insect pests and diseases of sugar beets and how to control them.
2. Have a field trip and identify insects and diseases or bring specimens to the club meeting. (Colored pictures and slides may also be used.)
3. Study spraying equipment and learn how to operate it.

Harvesting and Utilization



Most beets are now harvested mechanically.

Harvesting: Most sugar beets are now harvested mechanically. Mechanical harvesting saves at least \$1.00 per ton in costs and is a proven procedure.

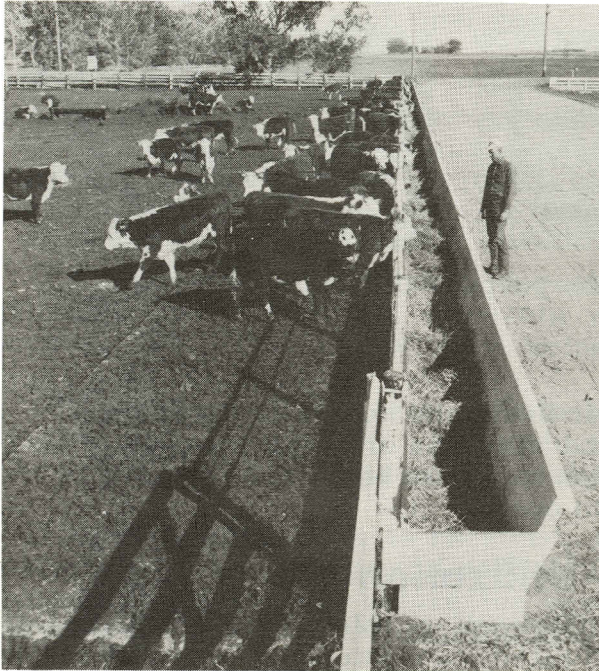
All beets are topped before being marketed. The properly topped beet is one that has had the leaves and crowns removed from the roots at the base of the lowest leaf scar.

Beet By-products: Beet tops, beet-top silage, beet molasses, liquid protein concentrate (L.P.C.), dried beet pulp and beet pulp pellets are all used successfully in feeding livestock. Sugar beet tops that are fed to livestock and returned to the fields in the form of manure are considered

to be worth three times as much as tops that are left in the field and plowed under as green manure. Every effort should be made to utilize beet tops.

Beet tops and beet-top silage have similar feed value. The cost of handling and using the feed and the possible loss of nutrients from the time of harvest to the time when the tops are used, should be considered. It costs more to ensile; but if the tops are to be fed over a long period of time, ensiling saves more of the feed and its nutritive value.

In recent years, harvesting of leaves has become popular. A forage chopper is used to chop the leaves from the beets. The leaves are then blown into a truck and hauled to a silo. Yields of beet leaf ensilage should be about equal to the beet tonnage. In other words, a field yielding 20 tons of beets per acre will yield from 10 to 20 tons of leaves. Beet leaves ensiled without the use of preservatives make an excellent feed. Their advantage over beet top ensilage is that they are free of dirt. Their advantage over beet tops is that all the leaves are saved.



An excellent way to use best by-products is through livestock.

Beet molasses may be used in the livestock feeding ration. One hundred pounds of beet molasses is equal to about 75 pounds of grain in fattening cattle rations, if it is not fed in excessive amounts. For a 1000 pound steer, excessive amounts are more than 4 pounds of non-Steffen or Steffens molasses per head daily, or more than 2 pounds of Johnstown "B" molasses per head daily.

Many sugar beet processors do not make beet molasses. They make a product known as liquid protein concentrate (L.P.C.). L.P.C. is a free-flowing, palatable, high-protein supplement that is used in the place of molasses on ground hay, ground ear corn, rolled barley and as a feed dressing.

Dried beet pulp and beet pulp pellets can satisfactorily replace as much as half of the corn in cattle fattening rations. Because of its bulk and nutritive qualities, dry beet pulp is an exceptionally good feed for dairy cattle. Some beet pulp is sold with L.P.C. mixed in it and is called L.P.C. pulp.

SUGGESTED ACTIVITIES

1. Have a demonstration on the proper way to hand-top and handle beets.
2. Tour feed lots and observe how beet by-products are utilized; or have a livestock feeder talk to the group and explain how he utilizes the by-products.
3. Tour a sugar factory.