

2. The general field practices need to be carefully and accurately done to secure good results.

3. The hoeing job should reduce the number of beets per hill to leave 2 to 4 plants.

4. The cross-cultivating, particularly if it includes deep chiseling, will definitely improve the penetration of irrigation water in tight soils.

5. Cross cultivation completed early will improve soil moisture by creating a more complete mulch, and will save moisture and soil fertility by preventing the early, heavy growth of the beets which are not needed, and weeds which are otherwise left in the row until thinning is done.

It is expected that there will be a substantial increase in the sugar-beet acreage handled by the cross-cultivating method in the Hamilton City District in 1942 with the view of reducing labor problems and costs.

## Methods and Equipment for Fertilizing Row Crops

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There are three distinct methods of fertilizing row crops: (1) Broadcasting before planting, (2) fertilization at planting time, and (3) side-dressing after the crop is planted.

With the first method, the fertilizer is usually applied to the soil just prior to planting. A combination grain and fertilizer drill is the implement most commonly used, since with this implement the fertilizer can be drilled into the soil at any desired depth. Other implements, such as fertilizer-broadcasting machines manufactured by all implement companies, end-gate lime and fertilizer spreaders, and home-made cylinder spreaders such as the water-tank spreader, can be used to distribute the fertilizer evenly over the soil. With the broadcasting equipment, the fertilizer is usually distributed just prior to final preparation of the seedbed, as through preparation of the seedbed, the fertilizer becomes mixed with the top soil.

### Advantages of Broadcast Method

The broadcast method of fertilization has a number of advantages: (1) It permits the use of heavier applications of fertilizer at planting time without the danger of seed germination injury; (2)

the heavier amounts applied furnish a steady supply of plant food throughout the growing period; (3) residual effect on succeeding crop is more uniform.

With the broadcast method of fertilization it is advisable and profitable to use heavier rates per acre than is the case with other methods of fertilization. The main factor favoring broadcast application to row crops is the elimination of any danger to seed germination.

### **Method of Fertilization at Planting Time**

Fertilization at planting time is one of the most common methods of fertilizing row crops. This method conserves labor, since fertilization is accomplished along with the seeding operations. With this method the fertilizer is placed in close proximity to the seed. Accordingly, this furnishes the tiny plants with a supply of available plant food during the initial growth period. This is quite beneficial, since it causes more rapid growth and in the case of sugar beets permits thinning to start a few days earlier. This method of fertilization permits maximum results from a minimum amount of fertilizer. In fact, it is not advisable to apply very large amounts of fertilizer per acre when applied at planting time due to possible seed germination injury.

Fertilization at planting time is accomplished by use of fertilizer attachments on the seed planter. Most implement concerns manufacture fertilizer attachments for the various planters.

### **Side-dressing Method**

The third method, side-dressing, is growing in popularity. This method of fertilization has several advantages.

**Advantages.**—1. The fertilizer is applied at the side of the plants and at a depth most advantageous for maximum utilization by the plants. With phosphates it is near enough to the roots to be kept in a soluble state by the carbon-dioxide given off by the roots.

2. The fertilizer is applied deep enough in moist soil that it becomes quickly available; also, it is not hoed out on top of the soil and away from the roots during thinning as is the case when applied directly with the seed.

3. Side-dressing provides an easy method of fertilization at any time after the crop is planted. Since side-dressing equipment is usually attached to the cultivator, fertilization can be accomplished during any cultivation.

4. Side-dressing permits correcting plant-food deficiency symptoms at any time these symptoms show up in a crop.

A number of the larger implement concerns such as John Deere, International, and Oliver have side-dressing equipment available for their cultivators. The **Self** Manufacturing Company of Twin Falls, Idaho, and the Lang Company of Salt Lake City also manufacture side-dressing equipment which can be used on any make cultivator.

The principal difficulty in side-dressing equipment has been in the design of a satisfactory furrow opener. For several years the Anaconda Company has been perfecting a furrow opener that has the following advantages: 1. Simplicity, 2. it can be operated close to the row without injury to the crop, 3. it will apply fertilizer at good depth and will not clog or stop up. A detailed drawing of this tool may be obtained upon request.

**Results.**—Some results of side-dressing tests on sugar beets conducted by the Anaconda Sales Company in cooperation with sugar-company fieldmen, are as follows:

Colorado—1938—Four fields side-dressed with 85 pounds of phosphate made an average increase of 4,437 pounds of beets per acre.

A field showing the symptoms of black heart blight was side-dressed in August and made an increase of 5,990 pounds of beets per acre.

Montana—1940—A field showing black heart blight was side-dressed in August and made an increase of 3,499 pounds of beets and 6,281 pounds of green tops per acre.

Wyoming—1939—Two fields side-dressed with 150 pounds of 6-30-0 made an increase of 5,410 pounds of beets per acre.

Wyoming—1940—One field side-dressed with 150 pounds of 10-20-0 made an increase of 6,105 pounds of beets per acre.

Idaho and Northern Utah—1939—Six fields side-dressed with 100 pounds of phosphate only made an average increase of 7,280 pounds of beets per acre.

Idaho—1939—Burley District—Seven fields side-dressed with 100 pounds of phosphate made an average increase of 4,520 pounds of beets per acre.

Twin Falls District—1939—Nine fields side-dressed made an average increase of 5,100 pounds of beets per acre.

Western Idaho and Eastern Oregon—1939—Nine fields made an average increase of 3,840 pounds of beets per acre. All the fields in the 3 districts last mentioned were treated with 100 pounds of phosphate at planting time. The increase stated is that due to the side-dressing only.

### Conclusions

While any one of the described methods of fertilizing row crops is effective, numerous tests during recent years indicate that possibly the most effective method of fertilization is a combination of two of these methods. This combination method is the application of a small amount of fertilizer with the seed at planting time followed by side-dressing with heavier amounts after thinning. To be specific, in numerous tests in the Intermountain Territory using various methods of fertilizing the sugar-beet crop, some of the best results were obtained when 50 to 75 pounds of treble superphosphate were applied with the seed at planting time using a fertilizer attachment on the planter, followed by side-dressing the beets after thinning with approximately 100 pounds more treble superphosphate per acre.

A limited amount of fertilizer with the seed at planting time gives the tiny plants the needed quick kick, improves the stand, permits earlier thinning, and makes thriftier plants. Through side-dressing, the plant foods are supplied at the proper depth and position and in sufficient amounts to feed the crop throughout the growing period.

During the past year a number of tests have been made in dusting or treating sugar-beet seed with a product known as fume phosphate. This fume phosphate, manufactured by the Anaconda Copper Mining Company, is in an extremely fine slate of subdivision, or about the screen mesh of talcum powder. In this form it adheres to the seed quite readily. It contains approximately 45 percent available P<sub>2</sub>O<sub>5</sub>, about 40 percent of which is in the water-soluble form.

Tests indicate that about 2 pounds of fume per 100 pounds of beet seed is about the proper ratio to use. Results from fume-treated beet seed indicate that the treated seed was much more resistant to disease, the plants emerged from the soil 1 to 3 days earlier, and yields were increased as much as 1 to 3 tons per acre from this inexpensive treatment. Preliminary results indicate that more experimental work might well be conducted with fume-treated beet seed.