***Table 4.*** *Relative soluble salt sensitivity levels.*

| mmhos/cm[1] | Description | Effect on crops |
|---|---|---|
| 0 to 2 | non-saline | none |
| 2.1 to 4 | very slightly saline | sensitive crops restricted |
| 4.1 to 8 | moderately saline | many crops restricted |
| 8.1 to 16 | strongly saline | most crops restricted |
| more than 16 | very strongly saline | few plants tolerant |

[1] *Based on saturated paste extract.*

therefore should be applied 1 year before planting. Test the pH of the soil 3 to 4 months after the initial application. If the soil pH is not in the desired range, reapply according to **Table 3**. In situations where irrigation water contains lime, additional annual applications of 300-400 lb/A elemental sulfur may be necessary to maintain pH in the desired range. Iron sulfate can also be used to acidify soils. This material reacts much faster than elemental sulfur, usually within 3 to 4 weeks. Multiply the rate of elemental sulfur recommended by 7 to determine the rate of iron sulfate needed. For high rates of iron sulfate, split applications are recommended. **Do not** apply more than 2 tons per acre of iron sulfate at a time. Use of ammonium sulfate as the nitrogen source will also help in maintaining a low soil pH. **Caution**—do not use more ammonium sulfate than that required for meeting the nitrogen requirements. Too much nitrogen can cause excessive vegetative growth, and may increase the potential for winter injury and reduce fruit quality. High lime soils with a pH greater than about 7.3 require higher rates of acidifying amendments and are not recommended for commercial blueberry production.

## Soluble Salts (electrical conductivity)

The term *soluble salts* refers to the inorganic soil constituents (ions) that are dissolved in the soil water. Pure water is a very poor conductor of electric current, whereas water containing dissolved salts conducts current approximately in proportion to the amount of salt present. Thus, the measurement of the electrical conductivity of a soil extract gives an indication of the total concentration of salts. The electrical conductivity measurement is reported in millimhos per centimeter (mmhos/cm). Crops differ in their sensitivity to soluble salts. High soluble salts can restrict root growth, cause burning of the foliage, and limit crop yields. The relative values for soluble salt sensitivity levels are described in **Table 4.**

Most soils in Minnesota are nonsaline (0 to 2 mmhos/cm); however, a few soils in western Minnesota have formed under high sodium/alkaline conditions and may be high in soluble salts. Other conditions where soluble salts may limit plant growth are when fertilizers are overapplied or placed too close to the roots.

The relative salt tolerance of various fruit and vegetable crops is presented in **Table 5.**

## Organic and Inorganic Fertilizers

Plant roots absorb the majority of their nutrients from the soil solution in the ionic (inorganic charged) form. Larger molecules can also be absorbed by roots, but their rate of absorption is slow. Thus, if a fertilizer (organic or inorganic) is applied, it must first be broken down to its simplest forms to be used efficiently by plants.

According to the Minnesota Department of Agriculture, a natural organic fertilizer has to be derived from either plant or animal materials containing one or more elements (other than carbon, oxygen, and hydrogen) that are essential for plant growth. Organic food production, however, allows for a broader definition that includes naturally occurring inorganic substances such as elemental sulfur and gypsum, and naturally occurring mineral materials that are not chemically modified.

***Table 5.*** *Soluble salt test[1] values and relative salt tolerance of fruit and vegetable crops.*

| 0-2 mmhos/cm* Nontolerant | 3-4 mmhos/cm* Slightly Tolerant | 5-7 mmhos/cm* Moderately Tolerant | 8-16 mmhos/cm* Tolerant |
|---|---|---|---|
| blueberries | apples | broccoli | asparagus |
| carrots | cabbage | beets, table | Swiss chard |
| green beans | celery | cucumbers | |
| onions | grapes | muskmelons | |
| radishes | lettuce | squash | |
| raspberries | peppers | tomatoes | |
| strawberries | potatoes | spinach | |
| | sweet corn | | |

[1] *Based on saturated paste extract.* *Plants can be successfully grown at these test levels or lower.