Blueberries, Raspberries, and Strawberries

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These fertilizer guidelines, such as this one for berries, are based on soil/plant relationships established through research by the University of Idaho, Oregon State University, and Washington State University. Results and experience indicate that the guide rates suggested will produce above average yields if other factors are not limiting production. Thus, the fertilizer guide assumes good management.

The suggested fertilizer rates, which are based on a soil test, will be accurate for your field provided: (1) the soil samples represent the area to be fertilized, and (2) the crop history information supplied is complete and accurate. An analysis is only as good as the soil sample collected. These fertilizer guide rates and critical levels are subject to change as additional research information becomes available.

Blueberries

Blueberry production in northern Idaho will most likely require annual applications of nitrogen (N), phosphorus (P), sulfur (S), and occasional applications of potassium (K) and magnesium (Mg).

Nitrogen (N)—Blueberries have a greater need for N than other berry crops. Generally, no N fertilizer is used during the year blueberries are planted, although at the grower's discretion, 20 to 25 pounds of N per acre may be applied as the blueberries are set into the ground. On established blueberries, N is essential for optimum plant growth, production of fruiting wood, and desirable berry size.

After the first year, 75 to 100 pounds of N per acre are required for good blueberry yields. Amounts of N must be adjusted up or down in accordance with yearly plant growth, however, blueberry plants should produce enough strong, new unbranched shoots each year to replace old canes and the weak, "twiggy" growth removed during annual pruning. This would be at least three to five strong canes arising from the base of the plant or halfway up the old canes.

The N fertilizer should be applied in the ammonium form as ammonium sulfate (21-0-0-24) or urea (45-0-0). The total amount of N applied during the growing season should be split into three separate applications: 50 percent should be applied at bud break (along with all the P and K), 30 percent in late May, and the remaining 20 percent in early July. Winterkill can result from fertilizer applied too late in the season.

Phosphorus (P)—Blueberries will respond to P fertilizer if soil test levels are low. The soil test is based on extractable P present in a soil sample taken from the upper 12 inches of the soil profile. Table 1 shows the rates of P to apply for different soil test levels and for each of the berry types. On soils derived from volcanic ash

Table 1. Phosphorus fertilizer rates for blueberries, raspberries, and strawberries based on soil tests.

Soil test P (ppm) (0 to 12 inches)[1]			Application rate (lb/acre)[2]		
			Blue-berries	Rasp-berries	Straw-berries
NaOAc	Bray I	$NaHCO_3$	---------- P_2O_5 ----------		
0 to 1	0 to 10	0 to 4	100	135	90
1 to 2	10 to 20	4 to 8	80	100	70
2 to 3	20 to 30	9 to 11	60	80	50
3 to 4	30 to 40	12 to 14	30	70	25
4 to 5	40 to 50	15 to 17	10	50	0
5 to 10	50 to 100	18 to 25	0	40	0
over 10	over 100	over 25	0	0	0

[1] Soil test P can be determined by three different procedures: sodium acetate (NaOAc), Bray I method, or by sodium bicarbonate ($NaHCO_3$). Sodium bicarbonate should not be used on soils with pH values less than 6.2. Use the column indicated by your soil test report.

[2] P x 2.29 = P_2O_5, or P_2O_5 x 0.44 = P.

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Table 2. Potassium fertilizer rates for blueberries, raspberries, and strawberries based on soil tests.

Soil tests for K[1] (0- to 12-inch)	Application rates (lb/acre)[2] Blueberries	Raspberries	Strawberries
(ppm)	---------- K_2O ----------		
0 to 50	80	90	80
50 to 75	50	60	50
75 to 100	30	40	30
more than 100	0	0	0

[1] Soil extractant is sodium acetate.

[2] K x 1.20 = K_2O or K_2O x 0.83 = K.

parent material, the P should be applied as a band application due to the high capacity of those soils to fix P. The band should be 3 to 4 inches deep if possible.

Potassium (K) — Blueberries require adequate levels of K for maximum yields. The soil test for K is based on extractable K in a sample taken from the upper 12 inches of the soil profile. Table 2 shows the rates of K to be applied for different soil test levels and for each berry variety. When K is deficient in soils, the fertilizer source should be potassium sulfate (0-0-50-18), because research has shown that potassium chloride (muriate of potash) is toxic to blueberry plants.

Sulfur (S)—Apply sulfur to blueberries at the rate of 25 to 30 pounds S per acre on an annual basis. N or K fertilizers containing S will meet this need. Gypsum (0-0-0-17) can also be used as an S fertilizer source.

Magnesium (Mg)—Many ash-influenced soils in northern Idaho are Mg deficient. Soil test values (soluble Mg) less than 0.25 meq/100 g indicate a need for Mg fertilizer. Soils low in Mg should receive 500 pounds Mg per acre as an application of epsom salts (magnesium sulfate) or potassium-magnesium sulfate.

Soil pH—Blueberries grow best in soils with pH values between 4.5 and 5.5. If the soil pH is less than 4.5, dolomitic limestone should be applied to increase soil pH (see University of Idaho CIS 787, *Liming Materials)*. If the soil pH is greater than 5.5, elemental sulfur should be applied to reduce the soil pH.

Raspberries

Economic yields of red raspberries in northern Idaho will require good soil fertility management. Red raspberry production in this region will require annual applications of N, P, and S. In addition, the soil will need to be monitored for levels of K, boron (B), and Mg.

Establishing Raspberries

Nitrogen—An application of 50 to 60 pounds N per acre should be made to soils shortly after setting the plants. At establishment, the N may be applied to the soil surface, banded alone, or banded with the P fertilizer material. Rainfall or irrigation is needed to move the applied N fertilizer into the root zone.

Phosphorus—Phosphorus is critical in the establishment of raspberry plants. Shortly after planting, phosphorus should be applied in bands on each side of the row, 4 to 7 inches from the plants and 3 to 6 inches deep. At least 2 inches of soil must separate the fertilizer from the plant roots. Soils testing less than 4.0 ppm P should receive 90 pounds P_2O_5 per acre. On soil derived from volcanic ash, the P rate should be increased by about 25 percent.

Sulfur—Sulfur should be applied to soils at the rate of 30 pounds S per acre before planting or surface applied and moved into the root zone via irrigation or precipitation. Gypsum is an acceptable S fertilizer source.

Soil pH—Raspberries grow best on soils having pH values between 5.6 and 6.5. If the soil pH is less than 5.6, apply lime, preferably dolomitic limestone, to increase the soil pH. The lime should be applied to the soil and thoroughly incorporated before setting the plants.

Established Raspberries (Fruiting Years)

Nitrogen—Annual application of 50 to 65 pounds of N per acre are recommended for red raspberry production. The N should be applied to the soil surface along the row or banded with P in the spring (late March or early April). If cane growth is inadequate and internodal length less than 4 inches, more N can be used (65 to 75 pounds per acre). Remember that a 4-inch internodal length (distance between buds 2 to 3 feet above the soil surface) is desirable. Nitrogen is the most important factor controlling internodal length.

Phosphorus—Red raspberries will respond to applications of P if soil test values are low. The soil test is based on extractable P present in a soil sample taken from the upper 12 inches of the soil profile. Table 1 shows the rates of P to apply for different soil test levels for each berry variety. The P should be applied in a band on each side of the row about 1 foot from the edge of the crown and, if possible, 3 to 4 inches deep. Apply P in the spring.

Potassium—Red raspberries require adequate levels of soil K for maximum yields. Potassium fertilizer should be applied to soils in the spring. Table 2 shows the rates of K_2O to be applied for different soil test levels and each berry variety. Potassium fertilizers (potassium chloride or potassium sulfate) may be broadcast between the rows or banded with P and N fertilizers.

Sulfur—S fertilizers should be applied at the rate of 30 pounds per acre to any raspberry field testing less than 10 ppm S. This application is best accomplished with gypsum and should be made in the spring.

Boron—Boron should be applied to soils containing less than 0.5 ppm B in the surface 12 inches. Boron should be applied at the rate of 1 lb/acre in the spring and should never be applied in a band. For more information on B see University of Idaho CIS 1085, *Boron in Idaho*.

Magnesium—Soil test Mg values less than 0.25 meq/100 g (soluble extract) indicate a need for Mg. Deficient soils should receive an application of 500 pounds per acre of epsom salts (magnesium sulfate) or potassium-magnesium sulfate.

Strawberries

Strawberry production in northern Idaho will most likely require annual applications of N, P, and S and occasional applications of K, Mg, and B. Newly established strawberry plantings and established stands require different fertilization.

Establishing Strawberries

Nitrogen—From 35 to 50 pounds N per acre should be applied at or soon after planting to encourage development of large vigorous plants and early formation, rooting, and development of runner plants. An additional 30 to 40 pounds N per acre should be applied between August 15 and September 1 to aid in flower bud formation for the next year's crop.

Phosphorus—Phosphorus is important in establishing strawberry plants. A starter solution made with 1 gallon of 52 percent phosphoric acid added to 100 gallons of water helps give the plants early vigor. Apply at a rate of 1 cupful of this acid solution per plant at setting, regardless of soil P test value. Soils testing less than 3.0 ppm P in a soil sample taken from the top 12 inches should receive 100 pounds P_2O_5 per acre before planting.

Sulfur—Sulfur should be applied to soils at the rate of 30 pounds S per acre before planting. Gypsum is an acceptable S fertilizer source.

Established Strawberries (Fruiting Years)

Nitrogen—Nitrogen should be applied at rates between 35 and 50 pounds per acre between mid-August and early September. Nitrogen fertilizer should not be applied in the spring during a fruiting year as it will often cause excessive foliage, soft berries, and increased fruit rot. If the plants show a need for N in the spring, no more than 15 pounds per acre should be applied.

Phosphorus—Strawberries will respond to applications of P if soil test levels are low. The soil test is based on extractable P present in a soil sample from the upper 12 inches of the soil profile. Table 1 shows the rates of P_2O_5 to apply for different soil test levels and berry varieties. On soils derived from volcanic ash parent material, the P should be applied in a band application. P should only be applied to soils in the fall.

Potassium—Strawberries require adequate levels of soil K for maximum yields. The soil test for K is based on extractable K in a soil sample from the upper 12 inches of the soil profile. Table 2 shows the rates of K_2O to be applied for different soil test levels. When K is deficient, either potassium chloride or potassium sulfate are acceptable fertilizer materials. K fertilizers should be applied only in the fall.

Sulfur—Sulfur should be applied at a rate of 25 pounds per acre in the fall to all strawberry fields that have 12-inch soil samples testing less than 10 ppm S. Sulfur can be applied as ammonium sulfate or gypsum or as potassium sulfate if K is needed.

Other Nutrients—If a soil sample from the surface 12 inches of the soil profile tests less than 0.5 ppm B, fertilization with B is necessary. Boron should be uniformly broadcast on the soil surface at a rate of 0.5 to 1.0 pounds B per acre. Borated gypsum, which contains both B and S, is an excellent fertilizer material when both B and S applications are needed. For more information on boron fertilizers, application rates and boron deficiencies, see University of Idaho CIS 1085, *Boron in Idaho*.

Many ash-influenced soils in northern Idaho are deficient in Mg. When a soil sample shows a soil test value less than 0.25 meq/100 g (soluble extract), an Mg fertilizer is needed. Deficient soils should receive 500 pounds per acre application of epsom salts (magnesium sulfate) or potassium-magnesium sulfate.

Soil pH—Strawberries tolerate a wide range of soil pH values as good plant growth will occur between 5.0 and 6.5. If the soil pH is less than 5.0, an application of lime, preferably dolomitic limestone, should be used as an amendment to increase the soil pH. Conversely, if the soil pH is greater than 6.5, elemental S should be used to reduce soil pH.

General Comments

1. Select the varieties best suited for local conditions. Obtain certified virus-free plants from reputable nurseries. The time of planting and plant spacing will vary depending on the variety and your area.
2. Remember that soil pH is an important factor in site selection. Blueberries grow best on soils with pH values between 4.5 and 5.5; raspberries grow best between pH 5.6 and 6.5; strawberries grow best between pH 5.0 and 6.5.
3. Good drainage is important for all berry crops. At the same time adequate water is needed to promote optimum growth.
4. Blueberries and raspberries should be fertilized in the spring. Conversely, strawberries require late summer fertilization. When N is applied too late in the summer, tender growth may be subject to winterkill.
5. Good insect, disease, and weed control will help ensure maximum yields.
6. Fertilization regimes for establishing plants are different from those for fruit-producing plants.
7. Annual applications of nitrogen, phosphorus, and

sulfur will be required to produce maximum yields and promote stand longevity. Soil levels of magnesium, potassium, and boron should be monitored.

Contact the extension educator in your county if you have questions regarding the interpretation of this information.

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