

COUNTY EXTENSION SERVICE

Old Court House
YAKIMA, WASHINGTON

Extension Bulletin 338

August, 1946

Fertilizer Recommendations for Washington

Agricultural Extension Service
Institute of Agricultural Sciences
The State College of Washington
Pullman, Washington

These recommendations are based on the best information that is available from experimental results with fertilizers in the field and from careful observations under field conditions.¹ Growers who are not familiar with local soil types or fertility are advised to consult their county agents.

METHODS OF APPLICATION

Commercial fertilizers are not a substitute for, but rather an aid to, other good soil-management practices and should be used as a supplement to manure, green manures, and other plant residues.

Placing fertilizers in contact with the seed should be avoided, particularly when the fertilizer contains nitrogen, potash, or both. Plowing under or disking in should be practiced if suitable fertilizer placement machinery is not available.

FERTILIZER TERMINOLOGY

Because soil fertility varies according to soil types and past cropping practices, different fertilizers are required for different soils and crops. The principal plant nutrients in fertilizers are nitrogen (N), phosphoric acid (P_2O_5), and potash (K_2O). These elements may occur in fertilizers singly, as in ammonium sulfate (21 per cent N), superphosphate (18 per cent P_2O_5), or muriate of potash (50 per cent K_2O). They may occur in combination, as in ammonium phosphate (11 per cent N and 48 per cent P_2O_5), or as in complete fertilizers containing all three elements.

¹ This bulletin was prepared by the following staff members of the Institute of Agricultural Sciences: S. C. Vandecaveye, soils scientist; J. L. Haddock, acting associate agronomist; E. L. Overholser, former horticulturist; C. L. Bedford, assistant horticulturist; and C. L. Vincent, associate horticulturist and acting chairman of the division of horticulture, Agricultural Experiment Station, Pullman; Carl Baur, associate agronomist, Western Washington Experiment Station, Puyallup; W. J. Clore, associate horticulturist, and C. O. Stanberry, assistant agronomist, Irrigation Branch Experiment Station, Prosser; F. L. Overley, horticulturist and superintendent of the Tree Fruit Branch Experiment Station, Wenatchee; John C. Snyder, extension horticulturist; John C. Dodge, assistant extension horticulturist; and the late I. M. Ingham, formerly extension agronomist, Agricultural Extension Service, Pullman.

A fertilizer formula refers to the composition of a mixed fertilizer. It is usually printed on the bag or tag and shows the percentages of N, P_2O_5 , and K_2O in the order named here. For example, in a 4-8-4 mixture, there are four pounds of N, eight pounds of P_2O_5 , and four pounds of K_2O in each 100 pounds of fertilizer. The proportion of the different elements in a fertilizer, or the ratio of each to the other, is usually expressed as (N)1 - (P_2O_5)2 - (K_2O)1, or simply as 1-2-1. In this instance, there would be twice as much P_2O_5 in the fertilizer as either N or K_2O .

The amounts of plant nutrients required as well as the ratios best suited for different soils and crops vary. Proper amounts as well as ratios must be used to give greatest returns for investment in fertilizers. A simple and convenient method of expressing the amounts of a particular fertilizer ratio needed, such as 1-2-1 for example, might be 20-40-20 pounds per acre. When the ratio and the pounds per acre needed have been determined, the grower can then figure the formula and the quantity of fertilizer to be used. If the acre requirements were 20-40-20, they could be supplied by using 500 pounds of a 4-8-4 fertilizer. The same requirements could be met, approximately, by using 200 pounds of a 3-10-10 plus 100 pounds of ammonium phosphate (16-20-0). One hundred and twenty-five pounds of nitrate of soda (16 per cent N), 90 pounds of treble superphosphate (45 per cent P_2O_5), and 80 pounds of sulfate of potash (50 per cent K_2O) would also furnish the same requirements.

The fertilizer recommendations given herein indicate: (1) the fertilizer ratios; (2) the amount of N, P_2O_5 , and K_2O in pounds per acre; (3) the fertilizer formulas; and (4) the amounts of any particular formula in pounds per acre.

FERTILIZERS FOR IRRIGATED SOILS IN EASTERN WASHINGTON

SECTION I—Vegetable Crops and Fruit Crops on Sandy Loam and Silt Loam Soils

No.	Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Pounds	Approximate Amount of Fertilizers per Acre* Grade	Fertilizer Placement, Time of Application, and Precautions
1	Asparagus	14 tons manure or Without manure	1-0-0 4-1-0	80-0-0 160-40-0	400 800 100 800	Ammonium sulfate Ammonium sulfate Treble superphosphate or 20-5-0	Broadcast and disk in with tops after tops turn brown and soil conditions permit.
2	Beans, lima and snap	10 tons manure	1-1-0	20-20-0	100 50	Ammonium sulfate Treble superphosphate	Broadcast and plow under fertilizer with or without manure . Where alfalfa preceded and manure is used, apply 100 lbs. of treble superphosphate only.
3	Leaf crops Cabbage Lettuce Broccoli Cauliflower	16 tons manure or Without manure	1-0-0 2-1-0	40-0-0 80-40-0	200 400 100 400	Ammonium sulfate Ammonium sulfate Treble superphosphate or 20-10-0	Broadcast and plow under fertilizer with or without manure . Where alfalfa preceded and manure is used, apply 100 lbs. of treble superphosphate only.
4	Peas, market	10 tons manure or Without manure	0-1-0 1-2-0	0-20-0 25-50-0	50 250	Treble superphosphate 10-20-0	Broadcast and plow under with or without manure.
5	Potatoes, early or late	No manure	1-2-0	40-80-0	200 175 400	Ammonium sulfate Treble superphosphate or 10-20-0	Side-dress with 100 lbs. ammonium sulfate when plants are 4-6 inches high and an additional 100 lbs. when plants begin to bloom. Where alfalfa precedes and manure is used, apply 100 lbs. of treble superphosphate only.

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

No.	Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Pounds	Approximate Amount of Fertilizers per Acre* Grade	Fertilizer Placement, Time of Application, and Precautions
6	Root crops Beets Carrots Parsnips	10 tons manure	1-2-0	20-40-0	100	Ammonium sulfate	Broadcast and plow under with or without manure. Follow alfalfa if possible, and where alfalfa preceded and manure is used, apply 100 lbs. of treble superphosphate only.
		or			100	Treble superphosphate	
		Without manure	1-1-0	80-80-0	400	Ammonium sulfate	
					175	Treble superphosphate or	
					550	15-15-0	
7	Tomatoes Cucumbers Squash Pumpkin Watermelon Muskmelon	10 tons manure	1-1-0	20-20-0	100	Ammonium sulfate	Broadcast and plow under with or without manure. Side-dress tomatoes, cucumbers, and summer squash with 100 lbs. ammonium sulfate when top growth is too slow. Side dressing should be applied when first fruits have set.
		or			50	Treble superphosphate	
		Without manure	2-1-0	80-40-0	400	Ammonium sulfate	
					100	Treble superphosphate or	
					400	20-10-0	
8	Brambles Raspberries Blackberries Grapes Strawberries	10 tons manure	1-1-0	20-20-0	100	Ammonium sulfate	For grapes, if rye is planted as green manure in the fall, apply 1/2 of fertilizer when rye is seeded; broadcast remainder and disk under with rye before rye is in bloom in the spring. For strawberries in established beds, broadcast 200 lbs. ammonium sulfate and cultivate in, each year following harvest; apply remainder in February or early March.
		or			50	Treble superphosphate	
		Without manure	2-1-0	80-40-0	400	Ammonium sulfate	
					100	Treble superphosphate or	
					400	20-10-0	

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

FERTILIZERS FOR NONIRRIGATED SOILS IN EASTERN WASHINGTON

SECTION 1—Vegetables on All Mineral Soils

No.	Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Pounds	Approximate Amount of Fertilizers per Acre* Grade	Fertilizer Placement, Time of Application, and Precautions
9	Mature pome fruit trees Apple Pear	10 tons manure†					Broadcast on cover crop or on the surface in December or February. Legume cover not recommended in young orchards (1 to 3 years old).
		Legume cover	0-1-0	0-20-0	50	Treble superphosphate	
					100	Ammonium sulfate	
		Rye cover	1-1-0	20-20-0	50	Treble superphosphate	
		or			135	15-15-0	
		Without manure			60	Treble superphosphate	
10	Mature stone fruits 108 trees to an acre Cherry Apricot Peach Plum Prune	Legume cover	0-1-0	0-20-0	50	Treble superphosphate	These amounts may be approximately doubled for trees low in vigor or on soils especially lacking in fertility where there is sod.
		Cereal cover	1-0-0	40-0-0	200	Ammonium sulfate	
		or					
		Without manure			60	Treble superphosphate	
		Legume cover	2-1-0	50-25-0	250	Ammonium sulfate	
		Cereal cover	1-0-0	80-0-0	400	Ammonium sulfate	

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

† Large applications (of 10 tons or more each year) of manure to fruit trees in irrigated orchards of central Washington, where leguminous cover crops are not grown, favor the development of the condition of "little leaf."

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

† Root crops include beets, carrots, parsnips, and radishes.

‡ Vine crops include cucumbers, squash, pumpkins, muskmelons, and ground cherry.

SECTION II—FIELD CROPS ON ALL MINERAL SOILS

No.	Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Approximate Amount of Fertilizers per Acre* Pounds	Fertilizer Placement, Time of Application, and Precautions
1	Hay or pasture Legumes	Without manure	0-1-0	0-55-0	125	Treble superphosphate
	Legume-grass mixtures	Without manure	1-1-0	40-45-0	200	Ammonium sulfate
	Grasses	Without manure	1-1-0	40-45-0	100 200 100	Treble superphosphate Ammonium sulfate Treble superphosphate
						Manure is best used on cultivated crops in the rotation. Broadcast superphosphate in winter or early spring, and harrow. Spread droppings in pasture.
						If ample manure is available, preference should be given: (1) to seeding down hay or pasture, (2) to top-dressing hay land, and (3) to top-dressing pasture.
2	Corn, field	12 tons manure or Without manure	1-0-0 1-0-0	20-0-0 40-0-0	100 200	Ammonium sulfate Ammonium sulfate
						If corn follows alfalfa, no manure or fertilizer is needed. If no alfalfa preceded and no manure is used, apply ½ ammonium sulfate with corn planter and ½ as side dressing after corn is up
3	Sugar beets	15 tons manure or Without manure	0-1-0 1-2-0	0-55-0 40-80-0	125 200 180 400	Treble superphosphate Ammonium sulfate Treble superphosphate or 10-20-0
						Broadcast with manure or broadcast and disk in before planting. May be applied as side dressing in two treatments.

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

FERTILIZERS FOR NONIRRIGATED SOILS IN EASTERN WASHINGTON

SECTION I—Vegetables on All Mineral Soils

No.	Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Approximate Amount of Fertilizers per Acre* Pounds	Fertilizer Placement, Time of Application, and Precautions	
1	Asparagus	10 tons manure or Without manure	1-1-0 3-2-0	45-45-0 90-60-0	215 100 450 135	Ammonium sulfate Treble superphosphate Ammonium sulfate Treble superphosphate	Broadcast after knocking over tops, and disk in.
2	Beans, snap	12 tons manure	1-1-0	20-20-0	100	Ammonium sulfate	Broadcast with manure before plowing.
	Leaf crops	or			50	Treble superphosphate	
	Cabbage	Without manure	2-1-0	80-40-0	400	Ammonium sulfate	Broadcast and disk in before planting.
	Lettuce				100	Treble superphosphate	
	Broccoli					or	
	Cauliflower				400	20-10-0	
3	Peas, market	10 tons manure	1-2-0	20-40-0	100	Ammonium sulfate	Broadcast and plow under with manure.
		or			100	Treble superphosphate	
	Tomatoes					or	
	Root crops†	Without manure	1-1-0	50-50-0	200	10-20-0	Broadcast and disk in before planting. Lesser
	Vine crops‡				250	Ammonium sulfate	amounts may be used with vine crops if placed
					115	Treble superphosphate	in hills to one side of and about 2 inches deeper
							than seed.
4	Potatoes, late	10 tons manure to previous crop or Without manure	1-1-0	30-45-0	150 100	Ammonium sulfate Treble superphosphate	Follow alfalfa if possible; broadcast fertilizer and plow or disk in.
		After alfalfa	2-3-0	30-45-0	150	Ammonium sulfate	
					100	Treble superphosphate	
		Without alfalfa	1-1-0	80-80-0	400	Ammonium sulfate	Broadcast and plow or disk in.
					175	Treble superphosphate	

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

† Root crops include beets, carrots, parsnips, and radishes.

‡ Vine crops include cucumbers, squash, pumpkins, muskmelons, and ground cherry.

SECTION II—SMALL FRUITS ON ALL MINERAL SOILS

No.	Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Approximate Amount of Fertilizers per Acre* Pounds	Fertilizer Placement, Time of Application, and Precautions
1	Brambles Raspberries Blackberries Etc. Grapes	10 tons manure	1-1-0	40-40-0	200 100	Broadcast fertilizer between rows and plow under or disk in before buds start to swell. If 60-80 lbs. of rye is planted as green manure in late August or early September, apply ½ of fertilizer when rye is planted, and broadcast remainder and plow under with rye in early spring.
		Without manure	3-2-0	90-60-0	450 135	
2	Strawberries	10 tons manure	2-1-0	40-20-0	200 50	Apply the manure or grow a green manure crop (rye or some legume) before planting the strawberries. For strawberries in established beds, broadcast ½ of fertilizer in February or early March when plants start growing, and ½ immediately after harvest.
		Without manure	2-1-0	50-25-0	200 250 60 250	

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

FERTILIZERS FOR WESTERN WASHINGTON

SECTION I—Vegetable Crops

Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Approximate Amount of Fertilizers per Acre* Pounds	Fertilizer Placement, Time of Application, and Precautions
Asparagus	Mineral soil	0-1-0	0-110-0	500-600	Apply manure over rows in early spring and work into soil. Apply commercial fertilizer over rows with grain drill with fertilizer attachment, or broadcast and work into soil just before plants start in the spring. Apply pulverized cyanamide 150 to 250 lbs. to an acre as dust over the rows when weeds are 2 inches tall after cutting starts. If needed to control weeds, make second application during growing period or immediately after harvest has been completed.
	10-15 tons manure			or 200-250	
	Without manure	1-2-2	50-100-100	800-1200	
Beans and peas, pole or bush for market (irrigation strongly recom- mended)	Mineral soils (with or without manure)	0-1-1	0-110-110	500-600	Apply fertilizer at time of planting in either single or double band 1-2 inches to side of seed and 2-3 inches deeper than the seed. If moisture supply is good and more growth is desired, side-dress with 100 pounds 11-48-0 at time of bloom. Place side dressing 2-3 inches deep and 3-6 inches from base of plants.
		1-3-2	25-75-50	500-600	
		1-4-2		600-800	
		1-3-3	25-100-50	500-600	
	Muck and peat soils (with or without manure)	1-3-4	25-75-100	500-600	
		1-3-7	18-54-126	500-700	

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Approximate Amount of Fertilizers per Acre* Pounds Grade		Fertilizer Placement, Time of Application, and Precautions	
Beets (red)	Mineral soils	1-3-2	25-75-50	400-600	5-15-10	Place fertilizer 1 inch to side and 2-3 inches deeper than seed at time of planting.	
	6-10 tons manure or Without Manure	1-3-2	35-105-70	500-700 600-800 or 700-900	4-12-8 5-15-10 4-12-8		
	Muck and peat (with or without manure)	1-3-4 or 1-3-7	50-75-100 20-55-125	500-600 500-800	5-15-20 3-10-20	Increase fertilizer application at least 25 per cent if band placement equipment is not available and broadcasting is necessary.	
	To control beet canker, apply 20 pounds borax to an acre with fertilizer in band application or broadcast and work into soil 50 pounds to each acre before planting.						
Beets (red) for seed	Mineral soils (with or without manure)	1-4-2 or 1-3-3 or 1-3-2	25-100-50 23-70-70 25-75-50	400-600 600-800 500-600 or 600-800	5-20-10 3-10-10 5-15-10 4-12-8	Place fertilizer in band 1 to 3 inches directly below beet at time of setting out. If fertilizer placement attachments are not available, broadcast fertilizer and disk into soil. If broadcasting is necessary, use fertilizer with high phosphorus content, such as 5-20-10. Part or all of fertilizer may be applied as side dressing at time of first cultivation.	
	To control beet canker, apply 20 pounds borax to an acre with fertilizer in band application or broadcast 50 pounds to an acre and work into soil before planting.						
	Cabbage Cauliflower Broccoli Brussels sprouts	Mineral soils	1-3-1	25-75-25	500-600 600-800	5-15-5 or 4-12-4	Place fertilizer in band or bands 2 inches to side of plants and 3 inches below soil surface when plants are set in field.
		10-15 tons manure or Without manure	1-2-2	45-90-90	800-1000	5-10-10	
Muck or peat		1-3-4	25-75-100	500-600	5-15-20	If fertilizer placement equipment is not available, increase rate of fertilizer application at least 25 per cent and broadcast and disk into soil before planting.	
10-15 tons manure		1-3-3 or 1-3-7	25-75-75 15-45-105	500-600 500-600	5-15-15 3-10-20		

*Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Pounds	Approximate Amount of Fertilizers per Acre* Grade	Fertilizer Placement, Time of Application, and Precautions
Cabbage Cauliflower Broccoli Brussels Sprouts	Without manure	1-3-4 or 1-3-7	35-105-140 20-60-140	600-800 600-800	5-15-20 3-10-20	
Carrots	Mineral soil 10-15 tons manure	1-3-3 or 1-3-2	35-105-105 30-90-60	600-800 700-800	5-15-15 4-12-8	Drill in with grain drill (fertilizer attachment) or broadcast with lime spreader and disk in before planting.
	Without manure	1-2-2	50-100-100	1000	5-10-10	
	Muck or peat (with or without manure)	1-4-4 or 1-3-7	35-140-140 20-60-140	600-800 600-800	5-20-20 3-10-20	Best placement (if placement machinery is available) would be 5 inches below seed.
Celery	Muck soils	1-2-2	125-250-250	2000-3000	5-10-10	Broadcast and disk into soil before transplanting. If moisture supply is ample and more growth needed, side-dress with 100-200 pounds sodium nitrate, ammonium sulfate, or equal amount of nitrogen in other fertilizer.
Sweet corn	Mineral soils Soils north of Lewis County but including Woodland, Longview, Montesano, and Kelso river bottoms	0-1-0	0-60-0	125-150 or 300	Treble super-phosphate 18 or 20 per cent superphosphate	Commercial corn planters that place fertilizer approximately 1 inch to one side and one inch below seed are satisfactory. (Placement of fertilizer in bands is important for high yields and early, uniform maturity of sweet corn.)
	6-10 tons manure (or previously heavily fertilized) or Without manure	1-4-2 or 1-3-2	20-80-40 20-55-35	400-500 400-500	11-48-0 5-15-10 4-12-8	
	Mineral soils Lewis County south, including soils of Chehalis, Newberg, and Wapato series (with or without manure)	1-3-2 or 1-2-2	20-60-40 20-40-40	400-500 400-500	5-15-10 5-10-10	

*Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

TABLE 1. Fertilizer Recommendations for Various Crops and Soil Conditions

Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Pounds	Approximate Amount of Fertilizers per Acre* Grade	Fertilizer Placement, Time of Application, and Precautions
Cucumbers	10-15 tons manure or	1-3-3	18-63-60	600	3-10-10	Place $\frac{3}{4}$ of fertilizer 2 inches to side of and 2 inches deeper than seed at time of planting; use $\frac{1}{4}$ as side dressing when plants are well established.
	Without manure	1-2-2	4-30-30	800-1000	5-10-10	
Lettuce	10-15 tons manure or	1-3-3	25-75-75	700-900	3-10-10	Broadcast $\frac{1}{2}$ of fertilizer and disk in at planting time. Use $\frac{1}{2}$ as side dressing when plants are $\frac{1}{2}$ grown.
	Without manure	1-2-2	55-110-110	1000-1200	5-10-10	
Onions	10-15 tons manure or	1-3-3	27-81-81	800-1000	3-10-10	Broadcast and disk in at planting time
	Without manure	1-2-2	50-100-100	800-1200	5-10-10	
Peas (processing)	Most mineral soils (with or without manure)	0-1-0	0-65-0	150 or 300-400	Treble superphosphate, 18 or 20 per cent superphosphate	Place fertilizer 1-2 inches directly below seed or $\frac{1}{2}$ inch to one side and 1 inch below. If placement drills are not available, fertilizers containing phosphates only may be drilled into same furrow as the seed. Fertilizers carrying potash or nitrogen should not be applied with the seed, but should be predrilled to avoid contact with the seed. Broadcasting fertilizer for peas is not efficient.
	Mineral soils deficient in potash, including soils of Chehalis Valley and muck soils (with or without manure)	0-1-1	0-70-70	300-400	0-20-20	
Potatoes (commercial)	Mineral (with or without manure to previous crop)	1-2-2	50-100-100 to 100-200-200	1000-2000	5-10-10	Modern potato planters are adjusted to place fertilizer just below level of seed piece and 2 inches to the side. This placement seems satisfactory for either table stock or seed.
	Muck soils (with or without manure to previous crop)	1-3-7 or 1-3-4	30-90-210 or 50-150-200	800-1200	3-10-20 or 5-15-20	

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Pounds	Approximate Amount of Fertilizers per Acre* Grade	Fertilizer Placement, Time of Application, and Precautions
Seed potatoes	Mineral soils (with or without manure to previous crop)	1-3-3	40-120-120	800-1600	3-10-10	The wide variation in grade is offered to meet variations in soil treatment due to previous treatments. On soils known to be low in nitrogen and to which no manures or green manures have been added, use a high nitrogen fertilizer such as 5-10-10. Use fertilizers containing relatively large amounts of potash (such as 3-10-20) on soils known to be deficient in that element. Where too much foliage is produced, use low nitrogen fertilizers such as 3-10-10 (or 3-10-20 if soil is low in potash).
		or 1-2-4	60-120-240	800-1600	5-10-20	
		or 1-3-7	40-120-240	800-1600	3-10-20	
		or 1-2-2	60-120-120	800-1600	5-10-10	
Spinach (soils for spinach should have a pH value greater than 5.8)	Mineral and muck (6 to 10 tons manure) or	1-2-2	30-60-60	600-700	5-10-10	Apply at time of seeding in band $\frac{1}{2}$ to 1 inch to the side and 2 to 3 inches deeper than the seed. If placement drill is not available, broadcast and disk into soil before planting. (Increase fertilizer 25 per cent if it is to be broadcast.)
	Without manure	1-2-2	40-80-80	800	5-10-10	
Spinach for seed	Mineral soils	1-4-0	15-60-0	100-125	11-48-0	Place fertilizer in band 1 inch to side and 2 to 3 inches deeper than the seed at time of planting. Fertilizers containing phosphorus only may be drilled into same furrow as the seed.
	6-8 tons manure or	0-1-0	0-60-0	125-150	Treble superphosphate	
	Without manure	1-4-2	15-60-30	300-400	5-20-10	
		or 1-3-2	20-60-40	400-600	4-12-8	
		or 1-3-3	20-60-60	500-700	3-10-10	
Tomatoes	Mineral	1-3-2	30-90-60	400-500	5-15-10	Disk in manure and about $\frac{3}{4}$ commercial fertilizer before setting plants. Apply $\frac{1}{4}$ as a side dressing when plants are $\frac{1}{2}$ grown.
	10 tons manure or	1-3-3	20-60-60	500-800	3-10-10	
	Without manure	1-3-2	35-105-70	600-800	5-15-10	
		or 1-3-3	30-90-90	800-1000	3-10-10	

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

FERTILIZERS FOR WESTERN WASHINGTON

SECTION II—FRUITS

Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Approximate Amount of Fertilizers per Acre* Pounds Grade		Fertilizer Placement, Time of Application, and Precautions
Blackberry Evergreen	Mineral soils	0-1-0	0-90-0	200	Treble super-phosphate,	Spread manure in early spring or before planting cover crop in fall. Phosphate may be applied with manure or placed in furrow nearest berries when plowing away in spring.
	8-12 tons manure			or 400-500	18 or 20 per cent superphosphate	
Boysenberry Youngberry Loganberry and similar brambles	or No manure	1-2-2	50-100-100	800-1200	5-10-10	
Blackberry Evergreen	Muck and peat	Use same program as when manures are used on mineral soils.				
	8-12 tons manure	1-4-4	30-120-120	500-800	5-20-20	Apply commercial fertilizer in furrow nearest berries when plowing away in spring.
	No manure	1-3-3 or 1-3-3	30-100-100	800-1000	3-10-10	Apply commercial fertilizer in furrow nearest berries when plowing away in spring.

NOTE: Annual fall-sown green manure crops (Extension Bulletin 23) are recommended for all berries except strawberries, which are given separately. Green manure crop may be fertilized either in the fall or spring or both. If manure is applied in the fall, this will be sufficient fertilizer for green manure crop. Ammonium phosphate (16-20) at 100 lbs. an acre may be applied either in the fall or spring to stimulate green manure crop when no manures are used. Phosphate and nitrogen from other materials may be substituted for the green manure. If it is available, more manure than recommended may be added for most crops. Poultry litter should be applied at about half the rates recommended for manure.

Raspberries Cuthbert	Mineral soils	0-1-0	0-90-0	200	Treble super-phosphate,	Apply manures in fall or early spring. Phosphates may be applied with manure or placed in furrow 12 to 18 inches from base of plants at time growth starts in spring.
	6-8 tons manure			or 400-500	18 to 20 per cent superphosphate	
	No manure	1-3-3	25-75-75	600-1000	3-10-10	
		1-3-2 or 1-3-2	25-75-50	400-600 or 500-800	5-15-10 4-12-8	

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Approximate Amount of Fertilizers per Acre* Pounds Grade		Fertilizer Placement, Time of Application, and Precautions
Raspberries Washington Tahoma and other hardy varieties	Mineral soils	0-1-0	0-90-0	200	Treble super-phosphate,	Commercial fertilizers may be applied in a band 2-4 inches deep in a furrow 12-18 inches from the base of the plant about the time growth starts in the spring.
	8-12 tons manure			or 400-500	18 to 20 per cent superphosphate	
	No manure	1-3-2	35-105-70	600-800 or 700-1000	5-15-10 4-12-8	
	If more cane growth is desired, use	1-2-2	50-100-100	800-1200	5-10-10	
Strawberries	Mineral soils	1-4-4	12-60-90	300-400	3-20-30	Apply ½ to ¾ in spring and remainder after harvest.
	10-15 tons manure or cover crop previous to plowing for strawberries	1-2-2	45-90-90	800-1000	5-10-10	
	If less foliage growth is desired	1-3-2	30-90-60	500-700 or 600-800	5-15-10 4-12-8	In starting beds, 500 lbs. may be placed in bands approximately 3 inches to the side of plants and 3 inches below surface of soil.
	8-10 tons manure	1-3-3 or 1-3-3	12-90-90	800-1000	3-10-10	

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

FIELD CROPS

FERTILIZERS FOR WESTERN WASHINGTON

FERTILIZERS FOR WESTERN WASHINGTON

FIELD CROPS

Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Pounds	Approximate Amount of Fertilizers per Acre* Grade	Fertilizer Placement, Time of Application, and Precautions
Alfalfa (to establish stands on well-drained river bottoms and upland soils of suitable texture. Avoid coarse gravelly or coarse sandy soils)†	8-10 tons manure or soils to which manure or applications of fertilizers containing potash have been made	1-4-0	15-60-0	100-150	11-48-0	Plow manure under in fall or early spring. Work commercial fertilizer into surface soil when preparing seedbed. Do not plow under.
		1-3-3	30-60-60	100	Sulfate of ammonia	
		1-3-3	30-60-60	100-200	Treble superphosphate	
		1-3-3	30-60-60	300-400	Sulfate of ammonia 18 or 20 per cent superphosphate	
Alfalfa (old stands)§	Without manure or soils to which commercial fertilizers have not been applied the previous season, or soils deficient in potash	1-4-4	15-60-60	300-400	5-20-20	Apply commercial fertilizers in fall or early spring. May be applied before renovating in spring.
		1-3-3	30-60-60	100-150	11-48-0	
		1-3-3	30-60-60	100	Muriate of potash (60 per cent K ₂ O)	
	LIME. Add 1½ to 2 tons of lime before seeding to soils in need of lime. Soils well supplied with potash or which have received applications of manure	0-1-0	0-60-0	300-400	18 or 20 per cent superphosphate	Apply in fall or early spring. May be applied before renovating in spring.
		0-1-1	0-60-60	100-200	Treble superphosphate	
		0-1-1	0-60-60	300-400	0-20-20	
	Soils deficient in potash	0-1-1	0-60-60	300-400	0-20-10	Apply in fall or early spring. May be applied before renovating in spring.
		0-1-1	0-60-60	100-200	Treble superphosphate Muriate of potash (60 per cent K ₂ O)	

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

† The use of nitrogen fertilizers is recommended as an aid in establishing stands of alfalfa.

§ Manure encourages the growth of grass in stands of alfalfa. It should be used on other crops or in preparation for alfalfa.

BORON. Apply 40 to 60 pounds of "Borax" per acre to soils deficient in boron.

Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Pounds	Approximate Amount of Fertilizers per Acre* Grade	Fertilizer Placement, Time of Application, and Precautions
Clovers and vetches (to establish stands)	Mineral soils (with or without manure) Potash deficient soils	1-4-0	15-60-0	150	11-48-0	In establishing stands, broadcast and work into soil lightly before seeding.
		1-4-2	15-60-40	300	5-20-10	
		1-4-4	15-60-60	300	5-20-20	
		1-3-3	15-60-50	400-600	3-10-10	
Clovers and vetches (old stands)	Mineral soils	0-1-0	0-60-0	200-300	18 or 20 per cent superphosphate	On established stands, broadcast fertilizer in early spring.
		0-1-1	0-60-60	100-150	Treble superphosphate	
		0-2-1	0-60-30	200-300	0-20-10	
		LIME	Vetches and clovers do not have such high lime requirements as alfalfa. If lime is needed, apply 1 to 2 tons per acre early in the spring.			
Grasses and grass-legume mixtures (to establish stands)	Mineral soils (with or without manure) Potash deficient soils	1-4-0	15-60-0	150	11-48-0	In establishing stands, work fertilizer into surface soil just before seeding.
		1-3-2	15-45-30	300-400	5-15-10	
		1-3-3	30-60-60	150	11-48-0	
		1-3-3	30-60-60	75-100	Muriate of potash (60 per cent K ₂ O)	
Grasses and grass-legume mixtures (old stands)	Mineral soils	0-1-0	0-60-0	300-400	18 or 20 per cent superphosphate	On established stands, apply fertilizer broadcast early in spring.
		1-3-1	20-60-20	150-200	Treble superphosphate	
		1-3-1	20-60-20	400	5-15-5	
		1-3-1	20-60-20			

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

FERTILIZERS FOR WESTERN WASHINGTON

FIELD CROPS

Crop	Modifying Conditions	Fertilizer Ratio N-P ₂ O ₅ -K ₂ O	Plant Nutrients, Pounds per Acre (Approximate) N-P ₂ O ₅ -K ₂ O	Pounds	Approximate Amount of Fertilizers per Acre* Grade	Fertilizer Placement, Time of Application, and Precautions
Grasses and legume mixtures (old stands)	Soils deficient in potash, to which no manure has been added	1-3-2	20-60-40	400	5-15-10	
		1-3-3	12-12-10	300-400	2-12-10	
	Muck or peat (with or without manure)	0-4-4	0-40-40	200-300	0-20-20	
		1-4-4	10-40-40	200-300	5-20-20	
Small grains for hay or grain	Upland mineral soils	0-1-0	0-40-0	200	18 to 20 per cent superphosphate	Apply phosphate with drill at time of seeding.
	6-8 tons manure	0-1-1	0-40-10	100	Treble superphosphate	
	Without manure	3-4-0	30-40-0	200	18 to 20 per cent superphosphate	Apply sodium nitrate or nitrogen equivalent broadcast in spring. See Extension Bulletin 324
				100	Sodium nitrate	
				200		
	Bottom lands	0-1-0	0-40-0	100	Treble superphosphate	Apply at time of seeding.
				200	Sodium nitrate	
				200	18 to 20 per cent superphosphate	
				100	Treble superphosphate	
Small grains for hay or grain	Soils deficient in potash	1-4-0	10-40-0	100	11-48-0	
		1-4-2	10-40-20	200	5-20-10	

* Other fertilizers that supply approximately the same quantities of N, P₂O₅, and K₂O can be used. The quantities for each acre may be varied by 100 pounds more or less, according to soil fertility conditions.

† The use of nitrogen fertilizers is recommended as an aid in establishing stands of alfalfa.

‡ Alfalfa encourages the growth of grass in mixtures of alfalfa. It should be used on other crops or in preparation for alfalfa.

BORON: Apply 10 to 50 pounds of "Borax" per acre to soil deficient in boron.

Published and distributed in furtherance of the
Acts of May 8 and June 30, 1914, by the State
College of Washington Extension Service, E. V.
Ellington, Director, and U. S. Department of
Agriculture co-operating.
8-46-10m-s2231
