Fertilizer Recommendations for 1945
Michigan State University Extension Service
Soil Science and Horticulture
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FERTILIZER RECOMMENDATIONS FOR 1945

Fertilizer Grades Authorized for Sale in Michigan

0-12-12	0- 6-18*	3-18-9
0-14-14	0- 9-27	4-12-8
0-20-20	2-16- 8	4-16-4
0-10-20	2-12- 6	4-12-4
0-14- 7	3- 9-18	10- 6-4
0-20-10	3-12-12	8- 8-8

Superphosphate—18% phosphoric acid or higher
Muriate of potash—50% potash or higher
Sulfate of potash—48% potash or higher
Mine-run potash or "manure salts" 22-26% potash. Also contains 50-56% salt.
Ammonium nitrate—32-35% nitrogen
Nitrate of soda—16% nitrogen
Some other materials carrying nitrogen, phosphoric acid, or potash may be sold.
Victory garden fertilizer 4-12-4

*0-6-18 containing 700 pounds of salt per ton.

PREPARED BY
DEPARTMENTS OF SOIL SCIENCE
AND HORTICULTURE

MICHIGAN STATE COLLEGE :: EXTENSION SERVICE
EAST LANSING

Michigan State College and U. S. Department of Agriculture cooperating, R. J. Baldwin, Director, Extension Service, Michigan State College, East Lansing. Printed and distributed under acts of Congress, May 8 and June 30, 1914.

FERTILIZER FACTS

1. FERTILIZER SUPPLIES

The fertilizer industry is putting forth every effort to produce as much fertilizer as possible to supply customers' requirements. Indications are that there will be slightly less mixed fertilizer this year than last year. Potash supplies will be increased somewhat, but indications point to a decrease in supplies of nitrogen and phosphoric acid available for fertilizers because of the demands of Ordnance for nitrogen and sulfuric acid both of which are used in the manufacture of ammunition as well as fertilizers.

2. USE FERTILIZER WISELY

It is essential that farmers use fertilizers wisely to produce the maximum benefits with the supplies available this year. It is advisable to use the bulk of the fertilizer on crops which respond especially well to applications of plant food, such as alfalfa, potatoes, sugar beets, wheat, barley, oats, vegetables, fruits and essential oils. Farmers are urged to use the fertilizer on these crops rather than on crops which do not give consistent increases in yield as a result of fertilization.

3. BUY FERTILIZER NOW! ACCEPT DELIVERY EARLY!

Fertilizer manufacturers are working under the same labor shortage as farmers. Transportation facilities are limited, trucking facilities are decreased, and storage facilities are overtaxed. Some raw materials must be received by the manufacturers in monthly allotments as released by the War Production Board and others when they can get them, not just when they are needed. Farmers cannot get the supplies they need unless the fertilizers can be produced, packaged and shipped on time. Only by placing his order as far as possible ahead of the season of use can the individual farmer assure himself of sufficient fertilizer for his needs.

4. STORE FERTILIZERS IN A DRY PLACE

Farmers should provide a dry, well ventilated place for the storage of the fertilizer from the time it is delivered to the farm until it is applied to the soil. There should be a good circulation of air around the bags, the fertilizer should not be stacked too high, and there should

be a good floor under it. Planks placed on two-by-fours or rails to raise them off the floor, allowing air circulation underneath make an excellent floor under the fertilizer. Nitrates are best stored in air-tight containers such as dust barrels or an air-proof room to prevent absorption of moisture.

5. RECONDITIONING OLD FERTILIZER

Fertilizer which has been left over from last year, if it has been stored in a dry place is just as good as newly mixed goods, except that it will probably be hard and lumpy. Screen through a gravel screen made with hardware cloth of about 3/8-inch mesh. Crush the lumps on a concrete or tight wooden floor with a tamp. It may be necessary to slit the bag lengthwise to get the fertilizer out of the bag.

6. FERTILIZER ANALYSES

Since fertilizers are designed to supply one or more of the plant food elements, nitrogen, phosphoric acid, and potash, the Michigan fertilizer law requires that the percentage of each of these nutrients be printed on the container or on a tag attached to the container. It has become customary on the large containers to print the percentages with dashes separating the figures, as 2-16-8; 0-14-7; 3-12-12. This series of figures is popularly known as the analysis or grade of the fertilizer.

The first figure in the analysis gives the percentage of total nitrogen. The second figure in the analysis represents the percentage of available phosphoric acid (P_2O_5). The percentage of water soluble potash (K_2O) is represented by the last figure in the analysis. Farmers are urged to study the results of experiments to determine the grade of fertilizer needed for different crops on the different soil types on the farm and to order fertilizer by analysis or grade.

7. MINOR ELEMENTS

Under specific soil conditions one or more of some five plant food elements not commonly added to fertilizers may be of benefit to certain crops. These five elements, manganese, boron, copper, zinc, and sodium, are often referred to as "minor" elements because they are used in very small quantities by plants. Experiments to date show that only two of these nutrients, namely manganese and boron, are needed by a few crops on mineral or upland soils which are neutral or alkaline. On the other hand, all five of them may be needed under specific con-

ditions by certain crops on muck soil. *Definite recommendations for use of these elements for different crops are given in tables 1, 2 and 3.*

These minor elements are ordinarily applied in relatively cheap and available forms, already mixed in the fertilizer. The following percentages only can be so included: manganese sulfate, 5, 10 and 15%; borax, 2½, 5 and 10%; copper sulfate, 2½, 5 and 10%; and zinc sulfate, 1¼ and 2½%. Sodium ordinarily is applied separately in the form of common salt although the salt can be mixed with the fertilizer if the mixture is to be used in a short time. The 0-6-18 fertilizer also contains 700 pounds or more of salt per ton as an impurity in the mine-run potash.

TABLE 1—HEAVY LOAMS, SILT LOAMS, AND CLAY LOAMS

Crop	Dark-colored soils high in humus Grades recommended	Rates and methods of application and other suggestions	Yellowish brown to grayish brown soils medium to low in humus Grades recommended
Alfalfa, alfalfa-brome, sweet clover	Superphosphate 18-20% 0-20-10 0-14-7	Drill 300 pounds or more when seeding and repeat after every second year.	0-20-10 0-14-7
Barley, oats	Superphosphate 18-20% 0-14-7 2-16-8 4-16-4(1)	Drill 200-300 pounds per acre, if legume is seeded apply 300-400 pounds.	2-16-8 2-12-6 If manured superphosphate 18-20% 4-16-4(1)
Beans, soy beans	0-20-10 0-14-7 2-16-8	Drill 200-300 pounds in bands 1 inch to the side and 1½ inches below the seed. Do not apply in contact with seed. Borax is injurious to beans.	2-16-8 2-12-6
Corn	2-16-8 0-20-10	Fertilizer applied directly to corn hastens early growth but usually does not increase yield of grain. Apply fertilizer liberally to small grain, legume, and other cultivated crop preceding corn in the rotation.	2-16-8 4-12-8

HEAVY LOAMS, SILT LOAMS AND CLAY LOAMS—Continued

Crop	Dark-colored soils high in humus Grades recommended	Rates and methods of application and other suggestions	Yellowish brown to grayish brown soils medium to low in humus Grades recommended
Sugar beets, chicory, red beets	3-18-9 2-16-8 2-12-6	Drill 300-500 pounds in bands 1 inch to side and 1½ inches below seed. Not more than 200 pounds with the seed is safe. Broadcast application of 500 pounds may be used if beet drill is not available. Use 5-10 pounds borax with sugar beets and chicory, 20 pounds with red beets in fertilizer beside seed or 40 pounds broadcast.	3-18-9 2-16-8 2-12-6
Potatoes(2)	4-12-8 4-16-4 3-18-9 2-16-8	Drill 500 pounds in bands 2 inches to side of seed pieces. In cases where it is advantageous to use more plow under 500 pounds additional.	4-12-8 3-18-9 2-16-8
Wheat, rye	Superphosphate 18-20% 0-20-10 0-14-7 2-16-8	Drill 200-300 pounds per acre, if legume is seeded use 300-400 pounds.	2-16-8 2-12-6
Peas	0-20-10 0-14-7 2-16-8	Drill fertilizer in bands ½ inch to side and 1½ inches below seed, or drill deep before planting. Do not place in contact.	2-16-8 2-12-6
Sweet corn	2-16-8 2-12-6 4-16-4(1)	Drill 100-200 pounds per acre. Plow under 200-400 pounds.	2-16-8 2-12-6 4-16-4(1)
Tomatoes	Superphosphate 18-20% 4-16-4	Drill 300 pounds per acre in bands 2 inches to side of root clusters. Plow under 500 pounds.	If manured use Superphosphate 18-20% 4-16-4 2-16-8
Home gardens	4-16-4 4-12-8 2-16-8 4-12-4	Broadcast 1 pound per 100 square feet before plowing or spading. Sprinkle another pound in a 6 inch band along the row and hoe in before sowing seed or setting plants.	4-16-4 4-12-8 2-16-8 4-12-4
Market gardens	4-16-4 4-12-8 2-16-8 2-12-6	Plow under 500-800 pounds per acre. Drill 200-300 pounds in bands ½ inch to side and 1½ inches below seed.	4-16-4 4-12-8

[1]For use in the Upper Peninsula.

[2]White-skinned varieties that are subject to severe scab injury are usually grown on strongly acid soils (pH 4.5-5.5) where they are freer of infection. Scab-resistant strains are grown successfully on high lime soils (pH 6.5-7.5).

HEAVY LOAMS, SILT LOAMS AND CLAY LOAMS—Concluded

Crop	Dark-colored soils high in humus Grades recommended	Rates and methods of application and other suggestions	Yellowish brown to grayish brown soils medium to low in humus Grades recommended
Spinach, cabbage, lettuce, leafy vegetables	4-16-4 2-16-8	Drill 300-500 pounds per acre in bands 1 to 2 inches to side and 2 inches below seed. Do not place fertilizer in contact with seed.	4-16-4 4-12-8
Pepper, eggplant Carrots, etc.	2-12-6	Sidedress cabbage, lettuce, spinach and similar crops and pickles with 100 pounds ammonium nitrate or nitrate of soda in cool wet seasons.	2-16-8
Pickles, melons, squash, etc.	Superphosphate 18-20% 4-16-4		4-12-8 4-16-4 If manured use Superphosphate 18-20%
Snap beans	2-16-8 2-12-6 0-14-7	If soil is alkaline apply 10 pounds borax per acre to cabbage, spinach, lettuce and similar crops. Borax is injurious to beans.	2-16-8 2-12-6
Radish seed	2-16-8 2-12-6		2-16-8 2-12-6
Apples, peaches, pears, cherries	Ammonium nitrate, nitrate of soda	2-3½ pounds ammonium nitrate or 4-7 pounds nitrate of soda per tree. Use less on small or very vigorous trees. Use none first year trees are planted.	Ammonium nitrate, nitrate of soda
Small fruits	Ammonium nitrate, nitrate of soda	Broadcast 200-500 pounds per acre.	Ammonium nitrate, nitrate of soda
Strawberries	4-16-4	Old Beds: Broadcast 200-500 pounds per acre after harvest. New Beds: Broadcast 200-500 pounds before planting. Topdress with 100 pounds ammonium nitrate or nitrate of soda in early September.	4-16-4

TABLE 2—LOAMS, SANDY LOAMS AND SANDY SOILS

Crop	Loams and heavy sandy loams Grades recommended	Rates and methods of application and other suggestions	Sandy loams and sandy soils Grades recommended
Alfalfa, alfalfa-brome, sweet clover	0-12-12 0-20-20	250-350 pounds. Apply fertilizer when seeding and after second year.	0-10-20 0-12-12
Barley, oats	3-12-12 2-16-8 4-16-4(1)	200-300 pounds. If legume is seeded use 0-12-12 at 300 pounds rate.	Barley not recommended 3-12-12 4-16-4(1)
Beans, soybeans	0-12-12 0-14-7	200 pounds. Apply 1 inch to the side and 1½ inches below seed. None with seed.	Crop not recommended
Corn	2-12-6 3-12-12	100-200 pounds. Fertilizer hastens early growth, but usually does not greatly increase yield of grain.	3-12-12
Sugar beets, chicory, red beets	Sugar beets and chicory recommended on better soils only 3-12-12	300-500 pounds. Place 1 inch to side and 1½ inches below seed. Not over 200 pounds with the seed is safe. Use 5-10 pounds borax per acre.	Sugar beets and chicory not recommended 3-12-12
Potatoes: Early Late	4-12-8 3-12-12 3-18-9 3-12-12	500-600 pounds. Apply in bands at side of seed piece. In special cases, especially under irrigation, up to 1000 pounds may be used.	3-9-18 3-12-12
Wheat, rye	3-12-12 2-16-8 2-12-6	300 pounds drilled at seeding. Topdress in winter with manure.	3-12-12
Peas	0-12-12 3-12-12	200-300 pounds per acre.	Crop not recommended
Sweet corn	2-16-8 2-12-6 3-12-12	100-200 pounds in row with planter and 200 pounds plowed under.	3-12-12
Tomatoes	3-12-12 2-16-8 2-12-6	500-1000 pounds. Apply 300 pounds 2 inches to side of root cluster and plow under remainder.	3-12-12 3-9-18
Home garden	3-12-12 4-12-8 2-16-8 4-12-4	Broadcast 1 pound per 100 square feet before plowing or spading. Sprinkle another pound in a 6-inch band along the row and hoe in before sowing seed or setting plants.	3-12-12 4-12-4

[1]For use in the Upper Peninsula.

LOAMS, SANDY LOAMS AND SANDY SOILS—Continued

Crop	Loams and heavy sandy loams Grades recommended	Rates and methods of application and other suggestions	Sandy loams and sandy soils Grades recommended
Market gardens	3-12-12 4-12-8 2-16-8	500-1200 pounds. Apply 200-300 pounds 1 to 2 inches to the side of and below seed. Plow under remainder.	3-12-12
Cabbage, spinach, lettuce, leafy vegetables	4-12-8 4-16-4	400-800 pounds. Side-dressing with nitrogen fertilizer during growth is desirable. If soil is alkaline apply 10 pounds of borax per acre.	3-12-12
Peppers, eggplant	2-16-8 3-12-12	300-600 pounds. Apply largely in row.	
Carrots and other roots		500 pounds. Apply beside seed or broadcast before planting.	
Pickles, melons, squash, etc.	4-16-4 3-18-9 3-12-12 If manured, use superphosphate 18-20%	400-600 pounds. For early market, mix 200-300 pounds with soil in hills and broadcast remainder before planting.	3-12-12
Snap beans, radish seed	3-12-12 2-16-8 2-12-6	300-500 pounds. Apply 1 inch to the side and 1½ inches below seed. None with seed.	3-12-12
Apples, peaches, cherries, pears	Ammonium nitrate, nitrate of soda	2-3½ pounds per tree. If nitrate of soda is used, apply 4-7 pounds per tree. Use less for small or very vigorous trees and none the year trees are planted.	Ammonium nitrate, nitrate of soda
Small fruits	Ammonium nitrate, nitrate of soda	Broadcast 200-500 pounds per acre.	Ammonium nitrate, nitrate of soda
Strawberries	4-16-4	200-500 pounds. Apply after harvest on old beds. For new beds, apply before planting and topdress in early September with 100 pounds nitrogen fertilizer.	4-16-4
Asparagus	0-10-20 Ammonium nitrate, nitrate of soda	Broadcast 700-1000 pounds per acre of 0-10-20 before cutting begins. Apply 150 pounds ammonium nitrate or nitrate of soda before cutting begins and 150 pounds at the end of the season. Use half portions on young beds.	0-10-20 Ammonium nitrate, nitrate of soda

TABLE 3—MUCK SOIL

Fertilizer analysis and rate of application for crops on muck soil, together with initial percentage of minor element plant foods which should be included in the fertilizer mixture.*

Salt (pounds per acre)	Acid Muck Soils (pH 6.5 or less)				Crop and Rate of Fertilization		Alkaline and Faintly Acid Muck (pH 6.6 or more)				Salt (pounds per acre)
	Fertilizer analysis for mucks of good and poor drainage. Percentage minor plant foods in fertilizer mixture						Fertilizer analysis for mucks of good and poor drainage. Percentage minor plant foods in fertilizer mixture				
	Per cent in fertilizer***		Fertilizer analysis				Fertilizer analysis		Per cent in fertilizer***		
	Borax	Copper sulphate	Poor drainage	Good drainage	Crop**	Pounds per acre	Good drainage	Poor drainage	Manganese sulphate	Borax	
0	0	0	0	0–9–27	Asparagus	400–800	0–9–27	.....	15	0	0
0	0	0	0–12–12	0–10–20	Beans	250–500	0–10–20	3–12–12	15	0	0
0	0–5	2.5–5	3–9–18	0–9–27	Broccoli	400–800	0–10–20	3–12–12	15	5	0
100	0–5	5	3–9–18	0–9–27	Cabbage	500–1000	0–10–20	3–9–18	5–10	5	100
0	0	5	0–9–27	0–9–27	Carrots	400–800	0–9–27	3–9–18	15	0	0
0	2.5	2.5	3–9–18	0–9–27	Cauliflower	800–1600	0–9–27	3–9–18	5	2.5	0
500–1000	2.5	0	3–12–12 3–9–18	0–10–20 0–9–27	Celery { Early Late	1200–2000 1200–2000	0–10–20 0–9–27	3–12–12 3–9–18	5–10	5–10	500
0	0	2.5	3–9–18	0–9–27	Cucumbers	400–800	0–9–27	3–9–18	10	0	0
100–200	0	2.5	3–9–18	0–9–27	Kohl rabi and kale	500–600	0–9–27	3–9–18	0	0	100–200

MUCK SOIL—Continued

Salt (pounds per acre)	Acid Muck Soils (pH 6.5 or less)				Crop and Rate of Fertilization		Alkaline and Faintly Acid Muck (pH 6.6 or more)				Salt (pounds per acre)
	Fertilizer analysis for mucks of good and poor drainage. Percentage minor plant foods in fertilizer mixture						Fertilizer analysis for mucks of good and poor drainage. Percentage minor plant foods in fertilizer mixture				
	Per cent in fertilizer***		Fertilizer analysis				Fertilizer analysis		Per cent in fertilizer***		
	Borax	Copper sulphate	Poor drainage	Good drainage	Crop**	Pounds per acre	Good drainage	Poor drainage	Manganese sulphate	Borax	
0	5	10	3–9–18	0–9–27	Lettuce	500–1000	0–10–20	3–12–12	15	5	0
0	0	5	3–12–12 3–18–9	0–10–20 0–12–12	Mint	300–600	0–10–20 0–12–12	3–12–12 3–18–9	0	0	0
0	0	5	3–12–12 3–18–9	0–10–20 3–9–18 0–12–12	Onions†	800–1800	0–12–12 3–9–18 0–20–20	3–12–12 3–18–9	5–15	0	0
0	5	2.5	3–9–18	0–9–27	Parsnips	600–1200	0–9–27	3–9–18	5–10	5	0
0	0	2.5	3–9–18	0–9–27	Potatoes	600–1200	0–9–27	3–9–18	10–15	0	0
0	0	2.5	0–12–12	0–9–27	Pumpkins, squash	300–600	0–9–27	3–9–18	15	0	0
100–200	2.5	2.5	3–9–18	0–9–27	Radishes	400–800	0–9–27	3–9–18	15	5	100–200
0	5	10	3–9–18	0–9–27	Spinach	600–1200	0–10–20	3–9–18	10–15	5	0
0	5	0	3–12–12	0–10–20	Sweet corn	500–800	0–10–20	3–12–12	10	5	0
500–1000	2.5–5	5	3–9–18	0–9–27	Table beets, Swiss chard	600–1000	0–9–27 0–10–20	3–9–18	5–15	10	500

0	0	5	3–12–12	0–9–27	Tomatoes	600–1000	0–10–20	3–12–12	5–10	0	0
500	2.5–5	5	0–10–20	0–9–27	Turnips, rutabagas	300–500	0–9–27	0–10–20	10–15	5	500
0	5	0	3–9–18	0–9–27	Corn, field	250–500	0–9–27	3–9–18	15	5	0
0	0	5	.....	0–9–27	Grain	250–400	0–9–27	.....	15	0	0
500–1000	2.5	5	3–9–18	0–9–27	Sugar beets, mangels	300–700	0–9–27	3–9–18	0	5	500–1000
0	0	5	0–9–27	0–9–27	Permanent pasture	100–150	0–9–27	0–9–27	0	0	0
0	0	2.5	3–9–18	0–9–27	Timothy and alsike, brome grass	200–350	0–9–27	3–9–18	15	0	0
0	0	2.5	3–9–18	0–9–27	Reed canary grass	300–400	0–9–27	3–9–18	15	0	0
0	0	5	0–10–20	0–9–27	Soybeans, sweet clover	200–350	0–9–27	0–10–20	15	0	0
0	0	5	3–9–18	0–9–27	Sudan grass, Hungarian millet	200–300	0–9–27	3–9–18	15	0	0
0	0	2.5	3–9–18	0–9–27	Blueberries	500–800	.....	.....	.....	.....	.....
0	0	2.5	3–9–18	0–9–27	Raspberries	500–800	0–9–27	3–9–18	15	0	0
0	0	5	0–12–12	0–12–12	Strawberries	200–400	0–12–12	0–12–12	0	0	0

*Where two crops are produced on the same field in one growing season, the maximum fertilization for the year should be not more than the maximum recommended for the first crop plus two-thirds of the maximum recommended for the second crop.

**Sidedressings of an available nitrogen carrier may be required during growth on the following crops: Broccoli, cabbage, cauliflower, 100 to 150 pounds per acre. Celery, 150 to 400 pounds. Topdressings of available nitrogen following exceptionally wet weather may be required on the following crops: Lettuce, mint, onions, radishes, spinach, table beets, Swiss chard, 100 to 200 pounds per acre.

***Where a range in percentage of minor plant food elements is given, the percentage which should be used depends on the rate of application of fertilizer and on the degree of acidity or alkalinity of the soil.

†For onions 2½% zinc sulfate is recommended in the fertilizer mixture on new muck for the first two years of cropping. See further footnotes on page 10.

NOTES REGARDING MUCK LAND FERTILIZATION AND CROPPING

Crop	Remarks
Broccoli Cabbage Cauliflower Lettuce Spinach Swiss chard	Apply fertilizer in 7″ drills before seeding or transplanting. For cabbage and cauliflower transplanted to wet muck, 400 to 500 pounds per acre can be applied in row 4″ deep. These six crops responsive to manure, supplemented with 0–9–27 fertilizer.
Celery Radishes Table beets	Nitrogen advisable in fertilizer mixture for early crops. Celery responsive to manure, supplemented with commercial fertilizer. In absence of manure, side-dress celery with available nitrogen fertilizer.
Onions	Row application 400 to 500 pounds 2 inches below seed advisable on moist muck. Try 3–12–12 or 3–18–9 if crop is generally slow in maturing.
Mint	Fertilizer needed to maintain stand, as well as to increase oil content. Try 0–12–12 on well drained, and 3–18–9 on poorly drained muck if mint is late in blossoming.
Carrots Parsnips	Fertilize in 7″ drills 3 to 4 inches deep. Sow parsnips early for good yields on muck.
Potatoes	Fertilize in 7″ drills or, on moist muck, put 400 pounds in row, preferably 4″ below seed. Plant close to avoid hollow heart and frost injury and fairly early for good yields.
Field corn Sweet corn	Fertilize in 7″ drills 4″ deep. Applied in row, not more than 200 pounds for field corn and 400 pounds for sweet corn should be used.
Grain	Apply fertilizer in 7″ drills 4″ deep. Grow varieties adapted to muck, as Peatland barley, Gopher oats and Rosen rye.
Pasture	Apply fertilizer broadcast in spring. Growth increase, and palatability and nutritive value much improved by proper fertilization.
Meadows	Seeding without nurse crop often advisable. Early seeding necessary to beat weed growth.
Soybeans	Sow around May 20 in vicinity of Lansing if weather is favorable. Use early variety if grain is desired.
Sugar beets	Apply fertilizer and salt in 7″ drills, 4″ deep, or apply not more than 200 pounds fertilizer in row, preferably 2″ below seed. Apply remainder in 7″ drills.
Beans Cucumbers Squash Tomatoes	These crops easily killed by frost, therefore, generally not safe on muck soil. Keep soil compact and well supplied with moisture to help prevent frost injury.
Blueberries	Blueberries require very strongly acid soil (pH 5.0 or lower).
Strawberries	For berry production on strawberries, fertilize lightly —100 to 300 pounds 0–12–12. For plant production apply 500 to 600 pounds 0–9–27.