

## Nutrient Management

NM-3  
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### PHOSPHORUS REMOVAL BY CROPS IN THE MID-ATLANTIC STATES

Reliable data about phosphorus (P) removal rates of crops are essential for nutrient management planners developing P-removal based recommendations. P-removal is available from many sources, although no source is comprehensive.

P-removal data from 7 regional or national published sources were used to compile the P-removal tables in this information sheet:

- <sup>1</sup> *Chesapeake Bay Region Nutrient Management Manual*
- <sup>2</sup> *Plant Food Uptake* booklet
- <sup>3</sup> *Knott's Handbook for Vegetable Growers*
- <sup>4</sup> *Nutrients Available from Livestock Manure Relative to Crop Growth Requirements*
- <sup>5</sup> *The PLANTS Database*
- <sup>6</sup> *The Fertilizer Handbook*
- <sup>7</sup> *National Nutrient Database for Standard Reference*

P-removal was expressed as phosphate (P<sub>2</sub>O<sub>5</sub>) per unit yield.

- When P-removal information was available from more than one source, the source with the highest reported P-removal rate was used.
- When no data were available from regional or national published sources, data were obtained from an Extension Specialist with expertise on that particular crop. Typically, in these instances P-removal data were estimated from closely-related species with similar removal potential.
- Superscripts after each crop indicate the source of information.

<b>CROP</b>	<b>YIELD UNIT</b>	<b>LB P<sub>2</sub>O<sub>5</sub> PER YIELD UNIT</b>
<b>GRAINS</b>		
barley <sup>4</sup>	bushels	0.41
barley straw (per bushel grain) <sup>5</sup>	bushels	0.11
buckwheat <sup>4</sup>	bushels	0.37
corn <sup>1</sup>	bushels	0.40
corn stover (per bushel grain) <sup>5</sup>	bushels	0.14
oat <sup>1</sup>	bushels	0.30
oat straw (per bushel grain) <sup>5</sup>	bushels	0.09
proso millet <sup>5</sup>	bushels	0.39
rye <sup>1</sup>	bushels	0.50
rye straw (per bushel grain) <sup>5</sup>	bushels	0.17
sorghum <sup>1</sup>	bushels	0.42
triticale <sup>4</sup>	bushels	0.39
wheat <sup>1</sup>	bushels	0.56
wheat straw (per bushel grain) <sup>5</sup>	bushels	0.11

<b>CROP</b>	<b>YIELD UNIT</b>	<b>LB P<sub>2</sub>O<sub>5</sub> PER YIELD UNIT</b>
<b>OILSEEDS</b>		
canola <sup>5</sup>	cwt	1.3
soybean <sup>1</sup>	bushels	1.0
sunflower <sup>5</sup>	tons	27

<b>CROP</b>	<b>YIELD UNIT</b>	<b>LB P<sub>2</sub>O<sub>5</sub> PER YIELD UNIT</b>
<b>SILAGE</b>		
corn silage <sup>2</sup>	tons	3.6
grass silage <sup>4</sup>	tons	3.7
sorghum silage <sup>4</sup>	tons	5.6

<b>CROP</b>	<b>YIELD UNIT</b>	<b>LB P<sub>2</sub>O<sub>5</sub> PER YIELD UNIT</b>
<b>FORAGES</b>		
alfalfa hay <sup>2</sup>	tons	15
bermudagrass <sup>2</sup>	tons	12
birdsfoot trefoil <sup>2</sup>	tons	21
bluegrass <sup>1</sup>	tons	18
bluegrass/white clover <sup>#</sup>	tons	13
bluestem species <sup>#</sup>	tons	10
bromegrass <sup>1</sup>	tons	13
buffalograss <sup>#</sup>	tons	10

<b>CROP</b>	<b>YIELD UNIT</b>	<b>LB P<sub>2</sub>O<sub>5</sub> PER YIELD UNIT</b>
<b>FORAGES (Continued)</b>		
clover and grass <sup>2</sup>	tons	15
crown vetch #	tons	13
gamagrass <sup>5</sup>	tons	11
hairy vetch <sup>5</sup>	tons	14
indiangrass #	tons	10
lespedeza <sup>5</sup>	tons	10
millet #	tons	8.4
orchardgrass <sup>1</sup>	tons	17
red clover <sup>1</sup>	tons	10
reed canarygrass <sup>5</sup>	tons	12
ryegrass (annual # & perennial <sup>2</sup> )	tons	17
small grain, hay or pasture <sup>5</sup>	tons	10
sorghum <sup>2</sup>	tons	8.4
sorghum x sudangrass <sup>1</sup>	tons	15
soybean and sorghum <sup>1,2</sup>	tons	9.2
soybean hay <sup>1</sup>	tons	10
soybean and millet <sup>1,#</sup>	tons	9.2
soybean and sudangrass <sup>1,5</sup>	tons	11
switchgrass #	tons	10
sudangrass <sup>5</sup>	tons	12
tall fescue <sup>1</sup>	tons	19
timothy <sup>1</sup>	tons	14
weeping lovegrass #	tons	10

# No P-removal information was available in published sources for these forages. P-removal was estimated by Dr. Lester Vough, Extension Specialist, Forage Systems Management, from closely-related crops with similar uptake potential.

<b>CROP</b>	<b>YIELD UNIT</b>	<b>LB P<sub>2</sub>O<sub>5</sub> PER YIELD UNIT</b>
<b>SEED CROPS</b>		
crimson clover seed <sup>4</sup>	pounds	0.018
lespedeza seed <sup>4</sup>	pounds	0.016
red clover seed <sup>4</sup>	pounds	0.016
white clover <sup>4</sup>	pounds	0.030

<b>CROP</b>	<b>YIELD UNIT</b>	<b>LB P<sub>2</sub>O<sub>5</sub> PER YIELD UNIT</b>
<b>VEGETABLES &amp; HERBS</b>		
artichoke (globe) <sup>5</sup>	cwt	0.20
artichoke (Jerusalem) <sup>5</sup>	cwt	0.14

<b>CROP</b>	<b>YIELD UNIT</b>	<b>LB P<sub>2</sub>O<sub>5</sub> PER YIELD UNIT</b>
<b>VEGETABLES &amp; HERBS (Continued)</b>		
asparagus <sup>5</sup>	cwt	0.13
basil <sup>7</sup>	cwt	0.16
beans (dried, all types) <sup>4</sup>	cwt	1.1
beet (root) <sup>5</sup>	cwt	0.092
beet (top) <sup>5</sup>	cwt	0.12
broccoli <sup>5</sup>	cwt	0.18
brussels sprout <sup>3</sup>	cwt	0.29
cabbage <sup>1</sup>	tons	1.8
carrot <sup>3</sup>	cwt	0.092
cauliflower <sup>5</sup>	cwt	0.14
celery <sup>5</sup>	cwt	0.083
chervil <sup>^</sup>	cwt	0.092
chickpeas <sup>^</sup>	cwt	1.1
chive <sup>5</sup>	cwt	0.12
cilantro <sup>^</sup>	cwt	0.092
collard <sup>^</sup>	cwt	0.13
cucumber <sup>5</sup>	tons	1.1
dill <sup>^</sup>	cwt	0.092
eggplant <sup>5</sup>	cwt	0.050
endive <sup>5</sup>	cwt	0.051
escarole <sup>5</sup>	cwt	0.032
fennel <sup>^</sup>	cwt	0.092
garlic <sup>5</sup>	cwt	0.39
horseradish <sup>7</sup>	cwt	0.071
kale <sup>5</sup>	cwt	0.13
leafy greens (various) <sup>5</sup>	cwt	0.10
leek <sup>5</sup>	cwt	0.080
lettuce (head) <sup>3</sup>	cwt	0.079
lettuce (leaf) <sup>5</sup>	cwt	0.10
lima bean <sup>5</sup>	cwt	0.34
mint <sup>7</sup>	cwt	0.17
mustard green <sup>5</sup>	cwt	0.10
okra <sup>5</sup>	cwt	0.15
onion (dry) <sup>5</sup>	cwt	0.60
onion (green) <sup>5</sup>	cwt	0.084
oregano <sup>^</sup>	cwt	0.17
parsley <sup>5</sup>	cwt	0.092
parsnip <sup>5</sup>	cwt	0.16

<sup>^</sup> No P-removal data were available in published sources. P-removal was estimated by Extension Vegetable Specialists from closely-related crops with similar removal potential.

<b>CROP</b>	<b>YIELD UNIT</b>	<b>LB P<sub>2</sub>O<sub>5</sub> PER YIELD UNIT</b>
<b>VEGETABLES &amp; HERBS (Continued)</b>		
pea <sup>3</sup>	cwt	0.57
pepper <sup>5</sup>	cwt	0.066
potato <sup>4</sup>	cwt	0.14
pumpkin <sup>5</sup>	tons	1.7
radish <sup>5</sup>	cwt	0.064
rutabaga <sup>5</sup>	cwt	0.092
snap bean <sup>3</sup>	cwt	0.23
soybeans (green, Edamame) <sup>7</sup>	cwt	0.44
spinach <sup>6</sup>	cwt	0.15
squash (summer) <sup>5</sup>	cwt	0.064
squash (winter) <sup>5</sup>	cwt	0.079
sweet corn <sup>3</sup>	cwt	0.14
sweet potato <sup>3</sup>	cwt	0.12
Swiss chard <sup>5</sup>	cwt	0.11
tomatillos ^	cwt	0.10
tomato <sup>1</sup>	tons	2.0
turnip (green) <sup>5</sup>	cwt	0.14
turnip (root) <sup>5</sup>	cwt	0.065

<b>CROP</b>	<b>YIELD UNIT</b>	<b>LB P<sub>2</sub>O<sub>5</sub> PER YIELD UNIT</b>
<b>FRUITS</b>		
apple <sup>1</sup>	bushels	0.020
grape <sup>1</sup>	tons	2.0
honeydew melon <sup>3</sup>	tons	1.3
muskmelon (cantaloupe) <sup>3</sup>	tons	3.5
peach <sup>1</sup>	bushels	0.033
Persian melon ^	tons	3.5
rhubarb (stalk) ^	cwt	0.046
watermelon <sup>5</sup>	tons	0.47
strawberry <sup>5</sup>	cwt	0.043

<b>CROP</b>	<b>YIELD UNIT</b>	<b>LB P<sub>2</sub>O<sub>5</sub> PER YIELD UNIT</b>
<b>MISCELLANEOUS</b>		
cotton (seed & lint) <sup>1</sup>	tons	27
cotton (stalk, leaf & bur) <sup>1</sup>	tons	10
tobacco (leaf & stalk - based on harvest leaf weight) <sup>1</sup>	tons	30

**Sources:**

- <sup>1</sup> Nagle, S., G. Evanylo, W.L. Daniels, D. Beegle, V. Groover, and F. Coale. 1997. Chesapeake Bay region nutrient management training manual. Misc. Publ.
- <sup>2</sup> Anonymous. Undated. Plant food uptake. Potash and Phosphate Institute Misc. Publ.
- <sup>3</sup> Maynard, D.N., and G.J. Hochmuth. 1997. Knott's handbook for vegetable growers. 4<sup>th</sup> ed. John Wiley, New York, NY.
- <sup>4</sup> Lander, C.H., D. Moffitt, and K. Alt. 1998. Nutrients available from livestock manure relative to crop growth requirements. *In* USDA resource assessment and strategic planning working paper 98-1.
- <sup>5</sup> USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA
- <sup>6</sup> The Fertilizer Institute. 1982. The fertilizer handbook. The Fertilizer Institute, Washington, DC.
- <sup>7</sup> USDA, ARS. Nutrient Data Laboratory. (<http://www.nal.usda.gov/fnic/foodcomp/>). National Nutrient Database for Standard Reference, Release 16-1.

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