

IPNI Estimates of Nutrient Uptake and Removal

This page lists estimates of nutrient uptake and removal for different crops grown in different countries of the world in both Imperial/U.S. and Metric units, and represent what IPNI scientists believe to be the best estimates of typical values to date. All tables are used within included in our [4R Plant Nutrition Manual](#). and are used within our Crop Nutrient Removal Calculator i-OS app ([PlantCalc](#)) and its [web-based version](#).

These tables are updated as new data become available. You can download these tables in pdf format (see 'Additional Resources' on left).

Imperial/U.S. Unit Tables

Table 4.1 Total nutrient uptake* by selected crops (Last modified: May 2014).

Crop***	Region	Harvested Unit	— lb uptake/harvested unit** —			
			N	P ₂ O ₅	K ₂ O	S
Alfalfa (DM)	Argentina	ton	54	11	50	7.0
Barley	Argentina	bu	1.3	0.44	1.1	0.2
Bermudagrass	USA	ton	46	12	50	
Canola	China	bu	2.2	1.4	4.4	
Chickpea	India	cwt	4.6	0.84	4.9	
Corn	USA	bu	1.0	0.54	1.4	
Grape	China	ton	11	10	17	
Mustard	India	cwt	3.3	1.5	1.1	1.4
Oranges	China	ton	5.3	1.6	7.2	
Peach	China	ton	9.0	3.0	10	
Peanut	India	ton	126	23	74	7.8
Pear	China	ton	10	4.0	10	
Peas, green	India	ton	84	29	62	8.6
Potato	Australia	cwt	0.49	0.21	1.2	
Rice	USA	bu	0.71	0.38	1.1	
Safflower	India	cwt	3.9	0.84	2.2	1.3
Sorghum	India	cwt	2.2	1.3	3.4	
Soybean	USA	bu	4.9	1.1	2.3	
Sugar beet	China	ton	9.6	2.8	19	
Sugarcane	China	ton	3.6	0.72	4.2	
Sunflower	Argentina	cwt	4.0	2.5	3.5	0.50
Tobacco	China	cwt	3.9	1.2	7.1	
Tomato	India	ton	5.6	2.6	7.6	
Wheat, spring	USA	bu	2.2	0.76	1.5	
Wheat, winter	USA	bu	1.9	0.68	2.0	

* Total nutrient uptake refers to the quantity of nutrient accumulated in the above ground portion, and harvested portions, of the plant by the time of sampling, usually physiological maturity or when uptake is at its maximum.

**Reported nutrient uptake coefficients may vary regionally depending on growing conditions. Use locally available data whenever possible.

***DM = dry matter basis; otherwise moisture content is standard marketing convention or at the stated moisture content.

Last modified May, 2014.

Table 4.5 Nutrient removal* by selected crops (Last modified: May 2014).

Crop***	Unit	Removal, lb/unit**			
		N	P ₂ O ₅	K ₂ O	S
Alfalfa (DM)	ton	51	12	49	5.4
Alsike Clover (DM)	ton	41	11	54	3.0
Bahiagrass	ton	43	12	35	
Barley grain	bu	0.99	0.40	0.32	0.09
Barley straw	bu	0.40	0.16	1.2	0.10
Barley straw	ton	13	5.1	39	3.0
Beans (dry)	bu	3.0	0.79	0.92	0.52
Bermuda grass	ton	46	12	50	
Birdsfoot trefoil (DM)	ton	45	11	42	
Bluegrass (DM)	ton	30	12	46	5.0
Bromegrass (DM)	ton	32	10	46	5.0
Buckwheat	bu	0.83	0.25	0.22	
Canola grain	bu	1.6	0.80	0.40	0.25
Corn grain	bu	0.67	0.35	0.25	0.08
Corn silage (67% water)	bu	1.6	0.51	1.2	0.18
Corn silage (67% water)	ton	9.7	3.1	7.3	1.1
Corn stover	bu	0.45	0.16	1.1	0.07
Corn stover	ton	16	5.8	40	2.6
Cotton (lint)	bale	32	14	19	
Cotton stover	ton	19	6.7	22	
Fescue (DM)	ton	37	12	54	5.7
Flax grain	bu	2.5	0.70	0.60	0.19
Flax straw	bu	0.7	0.16	2.2	0.15
Millet grain	bu	1.4	0.40	0.40	0.08
Millet straw	ton	15	4.3	39	
Mint oil	lb	1.9	1.1	4.5	
Oat grain	bu	0.77	0.28	0.19	0.07
Oat straw	bu	0.31	0.16	0.94	0.11
Oat straw	ton	12	6.3	37	4.5
Orchardgrass (DM)	ton	36	13	54	5.8
Peanut nuts	ton	70	11	17	
Peanut stover	ton	33	6.8	24	
Potato tuber	cwt	0.30	0.15	0.65	0.03
Potato above-ground stems & leaves	cwt	0.19	0.06	0.53	0.02
Red clover (DM)	ton	45	12	42	3.0
Reed canarygrass (DM)	ton	31	13	25	
Rice grain	bu	0.57	0.30	0.16	
Rice straw	ton	17	5.5	41	
Rye grain	bu	1.4	0.46	0.31	0.10
Rye straw	bu	0.80	0.21	1.5	0.14
Rye straw	ton	12	3.0	22	2.0
Ryegrass (DM)	ton	43	12	43	
Sorghum grain	bu	0.66	0.39	0.27	0.06

Removal, lb/unit**					
Crop***	Unit	N	P ₂ O ₅	K ₂ O	S
Sorghum stover	bu	0.56	0.16	0.83	0.12
Sorghum stover	ton	28	8.3	42	5.9
Sorghum-sudan (DM)	ton	30	9.5	34	5.8
Soybean grain	bu	3.3	0.73	1.2	0.18
Soybean hay (DM)	ton	45	11	25	5.0
Soybean stover	bu	1.1	0.24	1.0	0.17
Soybean stover	ton	40	8.8	37	6.2
Sugarbeet root	ton	3.7	2.2	7.3	0.45
Sugarbeet top	ton	7.4	4.0	20	0.40
Sugarcane	ton	2.0	1.2	3.5	
Sunflower grain	cwt	2.7	0.97	0.9	0.25
Sunflower stover	cwt	2.8	0.24	4.1	0.6
Sunflower stover	ton	23	2.0	34	5.0
Switchgrass (DM)	ton	22	12	58	
Timothy (DM)	ton	25	11	42	2.0
Tomatoes	ton	2.5	0.92	5.7	
Tobacco leaves	cwt	3.6	0.90	5.7	0.6
Vetch (DM)	ton	57	15	49	
Wheat straw	bu	0.7	0.16	1.2	0.14
Wheat straw	ton	15	3.7	29	5.4
Wheat (spring) grain	bu	1.5	0.57	0.33	0.10
Wheat (winter) grain	bu	1.2	0.48	0.29	0.10

* Nutrient removal refers to the quantity of nutrient removed from the field at crop harvest.
**Reported nutrient removal coefficients may vary regionally depending on growing conditions. Use locally available data whenever possible.
***DM = dry matter basis; otherwise moisture content is standard marketing convention or at the stated moisture content.
Last modified May, 2014.

Example: Using **Table 4.5**, an example of nutrient balancing would be a 200 bu/A corn crop removes 70 lb P₂O₅ from the soil (200 x 0.35=70). So, the maintenance P₂O₅ application will be 70 lb/A.

Metric Tables

Table 4.1 Total nutrient uptake* by selected crops (Last modified: May 2014).

Crop***	Region	— kg uptake/t** —			
		N	P ₂ O ₅	K ₂ O	S
Alfalfa (DM)	Argentina	27	5.7	25	3.5
Barley	Argentina	26	9.2	24	4.2
Bermudagrass	USA	23	6.0	25	
Canola	China	43	27	87	
Chickpea	India	46	8.4	50	
Corn	USA	18	9.6	25	
Grape	China	5.6	5.2	8.5	
Mustard	India	33	15	11	14
Oranges	China	2.6	0.80	3.6	
Peach	China	4.5	1.5	5.0	
Peanut	India	63	12	37	3.9
Pear	China	5.0	2.0	5.0	
Peas, green	India	42	15	31	4.3
Potato	Australia	4.9	2.1	12	
Rice	USA	16	8.4	24	
Safflower	India	39	8.4	22	13
Sorghum	India	22	13	34	
Soybean	USA	82	18	38	
Sugar beet	China	4.8	1.4	9.3	
Sugarcane	China	1.8	0.36	2.1	
Sunflower	Argentina	40	25	35	5.0
Tobacco	China	39	12	71	
Tomato	India	2.8	1.3	3.8	
Wheat, spring	USA	37	13	26	
Wheat, winter	USA	32	11	33	

* Total nutrient uptake refers to the quantity of nutrient accumulated in the above ground portion, and harvested portions, of the plant by the time of sampling, usually physiological maturity or when uptake is at its maximum.

**Reported nutrient uptake coefficients may vary regionally depending on growing conditions. Use locally available data whenever possible.

***DM = dry matter basis; otherwise moisture content is standard marketing convention or at the stated moisture content.

Last modified May, 2014.

Table 4.5 Nutrient removal* by selected crops (Last modified: May 2014).

Crop***	Removal, kg/t**			
	N	P ₂ O ₅	K ₂ O	S
Alfalfa (DM)	26	6.0	25	2.7
Alsike Clover (DM)	21	5.5	27	1.5
Bahiagrass	22	6.0	18	
Barley grain	21	8.3	6.7	1.9
Barley straw per t of grain	8.3	3.3	25	2.1
Barley straw	6.5	2.6	20	1.5
Beans (dry)	50	13	15	8.7
Bermuda grass	23	6.0	25	
Birdsfoot trefoil (DM)	23	5.5	21	
Bluegrass (DM)	15	6.0	23	2.5
Bromegrass (DM)	16	5.0	23	2.5
Buckwheat	17	5.0	4.4	
Canola grain	32	16	8.0	5.0
Corn grain	12	6.3	4.5	1.4
Corn silage (67% water) per t of grain	29	9.1	21	3.2
Corn silage (67% water)	4.9	1.6	3.7	0.55
Corn stover per t of grain	8.0	2.9	20	1.3
Corn stover	8.0	2.9	20	1.3
Cotton (lint)	64	28	38	
Cotton stover	9.4	3.3	11	
Fescue (DM)	19	6.0	27	2.9
Flax grain	45	13	11	3.4
Flax straw	13	2.9	39	2.7
Millet grain	28	8.0	8.0	1.6
Millet straw	7.7	2.2	20	
Mint oil	1,900	1,100	4,500	
Oat grain	24	8.8	5.9	2.2
Oat straw per t of grain	9.7	5.0	29	3.4
Oat straw	6.0	3.2	19	2.3
Orchardgrass (DM)	18	6.5	27	2.9
Peanut nuts	35	5.5	8.5	
Peanut stover	16	3.4	12	
Potato tuber	3.0	1.5	6.5	0.30
Potato above-ground stems & leaves	1.9	0.60	5.3	0.20
Red clover (DM)	23	6.0	21	1.5
Reed canarygrass (DM)	15	6.6	13	
Rice grain	13	6.7	3.6	
Rice straw	8.3	2.7	21	
Rye grain	25	8.2	5.5	1.8
Rye straw per t of grain	14	3.8	27	2.5
Rye straw	6.0	1.5	11	1.0
Ryegrass (DM)	22	6.0	22	
Sorghum grain	13	7.8	5.4	1.2

Crop***	Removal, kg/t**			
	N	P ₂ O ₅	K ₂ O	S
Sorghum stover per t of grain	11	3.2	17	2.4
Sorghum stover	14	4.2	21	3.0
Sorghum-sudan (DM)	15	4.8	17	2.9
Soybean grain	55	12	20	3.0
Soybean hay (DM)	23	5.5	13	2.5
Soybean stover per t of grain	18	4.0	17	2.8
Soybean stover	20	4.4	19	3.1
Sugarbeet root	1.9	1.1	3.7	0.23
Sugarbeet top	3.7	2.0	10	0.20
Sugarcane	1.0	0.65	1.8	
Sunflower grain	27	9.7	9.0	2.5
Sunflower stover per t of grain	28	2.4	41	6.0
Sunflower stover	12	1.0	17	2.5
Switchgrass (DM)	11	6.0	29	
Timothy (DM)	13	5.5	21	1.0
Tomatoes	1.3	0.46	2.9	
Tobacco leaves	36	9.0	57	6.0
Vetch (DM)	29	7.5	25	
Wheat straw per t of grain	12	2.7	20	2.3
Wheat straw	7.6	1.9	15	2.7
Wheat (spring) grain	25	9.5	5.5	1.7
Wheat (winter) grain	19	8.0	4.8	1.7

* Nutrient removal refers to the quantity of nutrient removed from the field at crop harvest.

**Reported nutrient removal coefficients may vary regionally depending on growing conditions. Use locally available data whenever possible.

***DM = dry matter basis; otherwise moisture content is standard marketing convention or at the stated moisture content.

Last modified May, 2014.

Example: Using Table 4.5, an example of nutrient balancing would be a 10 t/ha corn crop removes 63 kg P₂O₅ from the soil (10 X 6.3=63). So, the maintenance P₂O₅ application will be 63 kg/ha.
