



Nutrient Removal Values - Phosphorus

	Projected phosphorus removal (as P ₂ O ₅), "wet" or "as is" basis		% Moisture, Dry matter			Number of samples in survey *	
			Median*		Survey range*		
	lb P ₂ O ₅ per yield unit	*	Survey range*	- moisture -	----- dry matter -----		
Grains, oilseeds, fiber, sugar crops							
Barley, grain	0.35	/ bu (48 lb)	¹ 0.32 - 0.40	11.1	88.9	87.2 - 90.0	197
Beans (dry)	0.62	/ cwt (100 lb)	² ---	10.0	90.0	---	---
Beans (navy)	1.24	/ cwt (100 lb)	³ ---	10.0	90.0	---	---
Buckwheat, grain	0.38	/ bu (52 lb)	² ---	12.0	88.0	---	---
Canola, grain	0.86	/ bu (60 lb)	⁴ ---	8.0	92.0	---	---
Corn, grain (dry shelled)	0.31	/ bu (56 lb)	¹ 0.28 - 0.33	14.2	85.9	84.9 - 86.7	4,032
	0.55	/ cwt (100 lb)	¹ 0.51 - 0.59	14.2	85.9	84.9 - 86.7	4,032
Corn, grain (high moisture)	0.26	/ bu (56 lb)	² 0.24 --- 0.28	29.7	70.3	67.4 - 72.9	4,820
	0.46	/ cwt (100 lb)	² 0.43 --- 0.50	29.7	70.3	67.4 - 72.9	4,820
Cotton (seed, lint, trash) (≈1300 lb seed cotton yields 480 lb lint)	11.2	/ 1300 lb (bale)	³ ---	---	---	---	---
Cotton seeds	1.33	/ cwt (100 lb)	² ---	8.0	92.0	---	---
Field pea, seeds	0.56	/ bu (60 lb)	² ---	11.5	88.5	---	---
Flax, grain	0.84	/ bu (56 lb)	⁵ ---	8.7	91.3	---	---
Millet grain	0.36	/ bu (50 lb)	² ---	13.0	87.0	---	---
Oats, grain	0.23	/ bu (32 lb)	¹ 0.22 - 0.27	11.0	89.0	87.8 - 90.6	91
Peanuts, whole	0.55	/ cwt	⁶ ---	10.0	90.0	---	---
Popcorn	0.38	/ bu (56 lb)	³ ---	10.1	89.9	---	---
Potato tuber, fresh	0.13	/ cwt (100 lb)	³ ---	77.0	23.0	---	---
Rice, grain	0.29	/ bu (45 lb)	² ---	11.0	89.0	---	---
Rye, grain	0.62	/ bu (56 lb)	² ---	11.0	89.0	---	---
Safflower seeds	0.55	/ bu (38 lb)	⁴ ---	8.0	92.0	---	---
Sorghum, grain (milo)	0.32	/ bu (56 lb)	¹ 0.30 - 0.36	13.0	87.0	85.8 - 88.2	820
	0.58	/ cwt (100 lb)	¹ 0.54 - 0.63	13.0	87.0	85.8 - 88.2	820
Sorghum, grain (high moisture)	0.28	/ bu (56 lb)	¹ 0.24 - 0.29	30.5	69.5	65.2 - 74.5	97
	0.49	/ cwt (100 lb)	¹ 0.43 - 0.52	30.5	69.5	65.2 - 74.5	97
Soybeans, whole	0.78	/ bu (60 lb)	⁴ ---	12.0	88.0	---	---
Spelt, grain	0.32	/ bu (40 lb)	² ---	12.0	88.0	---	---
Sugarbeet (root)	2.19	/ ton	³ ---	80.0	20.0	---	---
Sugarcane	1.20	/ ton	⁷ ---	74.0	26.0	---	---
Sunflower seeds	1.37	/ cwt (100 lb)	⁴ ---	9.8	90.3	---	---
Triticale, grain	0.47	/ bu (60 lb)	² ---	11.0	89.0	---	---
Wheat, grain	0.46	/ bu (60 lb)	¹ 0.42 - 0.51	11.3	88.7	87.5 - 89.9	355
Hay, legumes							
Alfalfa hay	10.0	/ ton	¹ 8.4 - 11.1	12.7	87.3	85.0 - 89.1	8,360
Clover, hay alsike clover	9.7	/ ton	² ---	12.6	87.4	---	---
Clover hay, ladino clover	13.1	/ ton	² ---	10.0	90.0	---	---

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			Median*		Survey range*			
	lb P ₂ O ₅ per yield unit	*	Survey range*	- moisture -	----- dry matter -----			
Hay, legumes (continued)								
Clover hay, red clover	10.0	/ ton	2	---	12.0	88.0	---	---
Clover hay, sweetclover	10.4	/ ton	2	---	9.0	91.0	---	---
Cowpea hay	12.5	/ ton	2	---	9.6	90.4	---	---
Lespedeza hay	9.2	/ ton	6	---	8.0	92.0	---	---
Peanut hay	3.7	/ ton	1	3.3 - 4.9	10.8	89.2	86.4 - 90.8	56
Sanfoin hay	n/a			---	---	---	---	---
Soybean hay	6.7	/ ton	1	4.4 - 8.0	13.0	87.1	83.2 - 90.4	76
Trefoil hay, birdsfoot trefoil	9.7	/ ton	2	---	11.0	89.0	---	---
Vetch hay	13.8	/ ton	2	---	11.0	89.0	---	---
Hay, grasses								
Bahiagrass	8.2	/ ton	2	---	10.0	90.0	---	---
Bermudagrass hay	8.6	/ ton	1	7.0 - 10.3	10.0	90.0	87.4 - 91.8	350
Bluegrass hay	10.7	/ ton	7	---	11.0	89.1	---	---
Bluestem hay	5.1	/ ton	3	---	9.9	90.1	---	---
Bromegrass hay	7.2	/ ton	1	5.6 - 8.4	11.8	88.2	86.3 - 89.9	241
CRP hay	4.4	/ ton	1	-	11.4	88.6	85.7 - 90.6	---
Fescue hay	10.4	/ ton	2	---	12.2	87.8	---	---
Meadow hay	7.3	/ ton	1	6.1 - 8.6	10.6	89.4	87.0 - 90.9	215
Mixed grass hay	7.1	/ ton	1	4.9 - 8.6	10.7	89.3	86.5 - 91.8	2,951
Native grass hay	4.4	/ ton	1	3.2 - 6.4	12.9	87.1	67.5 - 90.5	227
Orchardgrass hay	12.0	/ ton	2	---	12.0	88.0	---	---
Prairie hay	4.8	/ ton	2	3.6 --- 6.1	11.4	88.6	86.6 - 90.2	295
Reed canarygrass hay	10.4	/ ton	2	---	9.0	91.0	---	---
Ryegrass hay	12.3	/ ton	2	---	8.5	91.5	---	---
Switchgrass hay	5.9	/ ton	3	---	4.6	95.4	---	---
Teff hay	n/a			---	---	---	---	---
Timothy hay	8.0	/ ton	2	---	12.0	88.0	---	---
Wheatgrass hay	8.4	/ ton	2	---	11.7	88.4	---	---
Hay, small grains								
Barley hay	9.5	/ ton	1	7.9 - 11.1	13.2	86.8	84.1 - 88.7	757
Millet hay	7.5	/ ton	1	5.9 - 9.5	13.1	86.9	83.3 - 89.4	399
Oat hay	9.6	/ ton	1	8.4 - 11.2	12.1	87.9	84.9 - 90.1	919
Rye hay	10.8	/ ton	1	8.2 - 12.8	12.4	87.6	84.6 - 90.2	71
Triticale hay	9.8	/ ton	1	8.2 - 11.8	10.4	89.6	86.0 - 92.0	204
Wheat hay	8.9	/ ton	1	6.9 - 10.9	11.5	88.5	84.9 - 90.7	684
Hay, annual sorghums								
Canex hay	n/a			---	---	---	---	---
Forage sorghum hay	6.1	/ ton	1	5.0 - 8.0	16.1	83.9	76.6 - 90.0	101
Haygrazer hay	6.4	/ ton	1	5.1 - 8.7	17.2	82.8	54.6 - 88.9	139
Milo (grain sorghum) hay	5.8	/ ton	1	4.0 - 7.2	21.0	79.0	61.3 - 85.9	128
Sorghum hay	6.4	/ ton	1	5.3 - 8.3	17.1	82.9	74.7 - 87.5	294
Sorghum-sudan hay	6.9	/ ton	1	5.7 - 8.8	16.3	83.7	74.7 - 88.0	156
Sudan hay	6.5	/ ton	1	5.4 - 8.8	16.2	83.8	77.3 - 87.8	370
Sumac hay	n/a			---	---	---	---	---

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			Median*		Survey range*					
	lb P ₂ O ₅ per yield unit	*	Survey range*	- moisture -	----- dry matter -----					
Hay, miscellaneous										
Cane hay	6.4	/ ton	1	4.9	- 7.9	17.0	83.0	77.4	- 86.8	610
Corn hay	6.6	/ ton	1	3.5	- 8.3	14.3	85.7	77.9	- 89.7	108
Kochia hay	8.2	/ ton	2	---		12.6	87.4	---		---
Weed hay	8.6	/ ton	1	6.5	- 10.7	12.2	87.9	84.4	- 90.3	58
Silage, annual crops										
Barley silage	4.5	/ ton	1	3.8	- 5.1	66.3	33.7	30.8	- 38.3	387
Cane silage	2.3	/ ton	1	2.1	- 2.6	71.4	28.6	24.9	- 33.3	231
Corn silage	3.4	/ ton	1	2.9	- 3.8	66.3	33.7	30.2	- 37.8	9,910
Corn silage (sweet corn)	n/a			---		---	---	---		---
Forage sorghum silage	2.4	/ ton	3	---		70.2	29.8	---		---
Milo silage (grain sorghum)	3.8	/ ton	1	3.1	- 4.2	64.9	35.1	28.9	- 41.4	103
Oat silage	4.2	/ ton	1	3.7	- 5.1	64.8	35.3	29.1	- 42.8	115
Oatlage	4.1	/ ton	1	3.5	- 4.9	66.3	33.7	28.9	- 43.0	145
Rye silage	4.5	/ ton	1	3.8	- 5.7	68.9	31.1	26.0	- 38.6	214
Small grain silage	4.3	/ ton	1	3.8	- 4.8	65.1	34.9	30.7	- 38.7	597
Sorghum silage	2.6	/ ton	1	2.2	- 3.1	70.5	29.5	26.2	- 33.1	1,750
Sorghum-sudan silage	2.2	/ ton	1	---		68.5	31.5	---		---
Sudangrass silage	3.2	/ ton	3	2.3	- 3.8	71.0	29.1	24.5	- 36.3	71
Triticale silage	4.3	/ ton	1	3.7	- 5.1	67.3	32.7	28.1	- 38.8	346
Wheatlage	4.1	/ ton	1	3.6	- 4.8	63.9	36.1	31.5	- 41.7	881
Wheat silage	4.2	/ ton	1	3.6	- 4.9	65.5	34.5	30.3	- 39.9	410
Silage, perennial crops										
Alfalfa haylage	5.4	/ ton	1	4.7	- 6.2	59.1	40.9	34.1	- 48.1	752
Alfalfa silage	4.4	/ ton	1	3.9	- 5.3	64.0	36.0	31.3	- 43.2	168
Bermudagrass silage	2.4	/ ton	2	---		74.0	26.0	---		---
Bromegrass silage	4.8	/ ton	2	---		65.0	35.0	---		---
Mixed grass silage	3.3	/ ton	2	---		70.0	30.0	---		---
Ryegrass silage	5.5	/ ton	2	---		68.0	32.0	---		---
Timothy silage	4.2	/ ton	2	---		66.0	34.0	---		---
Crop residues										
Barley straw (72 lb straw/bu)	3.3	/ ton	3	---		10.0	90.0	---		---
	0.12	/ bu harvested	3	---		---	---	---		---
Buckwheat straw	4.1	/ ton	3	---		11.3	88.7	---		---
Canola straw (236 lb straw/cwt)	n/a			---		---	---	---		---
Corn cobs	1.6	/ ton	2	---		6.4	93.6	---		---
Corn stalks	3.5	/ ton	1	2.7	- 4.7	15.0	85.0	79.9	- 88.1	132
Corn stover (70 lb stover/bu)	4.9	/ ton	1	3.2	- 6.9	11.3	88.7	83.3	- 92.1	100
	0.14	/ bu harvested	3	---		---	---	---		---
Cotton stover (1300 lb seed cotton yields 480 lb lint)	6.7	/ bale	2	---		7.7	92.3	---		---
Flax straw (80 lb straw/bu)	0.14	/ bu harvested	3	---		7.7	93.0	---		---
Grain sorghum (milo) stalks	n/a			---		---	---	---		---
Millet straw (84 lb straw/bu)	4.3	/ ton	2	---		10.0	90.0	---		---
	0.18	/ bu harvested	3	---		---	---	---		---

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			Median*		Survey range*			
	lb P ₂ O ₅ per yield unit	*	Survey range*	- moisture -	----- dry matter -----			
Crop residues								
Oat straw (44 lb straw/bu)	2.9	/ ton	2	---	9.0	90.3	---	---
	0.06	/ bu harvested	3	---	---	---	---	---
Peanut stover	6.8	/ ton	2	---	---	---	---	---
Popcorn stover (56 lb stover/bu)	30.8	/ ton	3	---	12.7	87.3	---	---
	0.86	/ bu harvested	3	---	---	---	---	---
Potato vines	2.0	/ ton	2	---	85.0	15.0	---	---
Rice straw (100 lb straw/cwt)	3.3	/ ton	3	---	9.2	90.8	---	---
	0.17	/ cwt harvested	3	---	---	---	---	---
Rye straw (87 lb straw/bu)	3.0	/ ton	7	---	9.1	90.9	---	---
	0.17	/ bu harvested	3	---	---	---	---	---
Sorghum stover (56 lb stover/bu)	4.8	/ ton	2	---	8.1	91.9	---	---
	0.16	/ bu harvested	3	---	---	---	---	---
Soybean stover (96 lb stover/bu)	1.1	/ ton	2	---	13.9	86.2	83.1	88.2
	0.11	/ bu harvested	3	---	---	---	---	---
Sugarbeet top	1.9	/ ton	2	---	81.0	19.0	---	---
Sunflower stover (150 lb stover/cwt)	2.0	/ ton	7	---	13.3	86.7	---	---
	0.24	/ cwt harvested	3	---	---	---	---	---
Wheat straw (92 lb straw/bu)	2.9	/ ton	1	2.5 - 4.9	9.8	90.3	86.5	94.0
	0.13	/ bu harvested	3	---	---	---	---	---

Fresh forage, vegetative stage - annuals

Cane plants, fresh	2.3 / ton	3	---	73.7	26.4	---	---
Corn plants, fresh	2.6 / ton	1	2.3 - 3.2	74.0	26.1	21.3 - 33.8	121
Forage sorghum plants, fresh	2.3 / ton	1	---	71.5	28.5	---	---
Millet plants, fresh	3.4 / ton	3	2.6 - 4.1	70.0	30.1	22.2 - 40.2	56
Milo plants, fresh (grain sorghum)	2.5 / ton	3	---	66.6	33.4	---	---
Oat plants, fresh	4.0 / ton	3	---	70.4	29.6	---	---
Rye plants, fresh	3.5 / ton	3	---	68.9	31.2	---	---
Sorghum plants, fresh	2.6 / ton	1	1.9 - 3.6	71.9	28.1	23.3 - 34.1	112
Sorghum-sudan plants, fresh	2.3 / ton	3	---	72.4	27.6	---	---
Sudangrass plants, fresh	3.0 / ton	2	---	75.1	24.9	---	---
Triticale plants, fresh	4.4 / ton	3	---	68.0	32.0	---	---
Weeds, fresh	n/a		---	---	---	---	---
Wheat plants, fresh	4.4 / ton	1	3.5 - 5.4	63.2	36.9	27.5 - 47.3	92

Fresh forage, vegetative stage - perennial grasses

Bermudagrass, fresh	2.6 / ton	3	---	71.0	29.0	---	---
Bluestem, fresh	3.3 / ton	2	---	39.0	61.0	---	---
Bromegrass, fresh	4.7 / ton	2	---	70.0	30.0	---	---
Fescue, fresh	4.9 / ton	2	---	71.0	29.0	---	---
Mixed grass, fresh	3.9 / ton	1	1.9 - 5.1	30.5	69.6	46.2 - 86.9	2,870
Native grass, fresh	3.4 / ton	1	2.3 - 4.5	58.5	41.6	33.5 - 52.1	149
Orchardgrass, fresh	4.3 / ton	2	---	76.0	24.0	---	---
Timothy, fresh	3.3 / ton	2	---	74.0	26.0	---	---
Wheatgrass (crested), fresh	5.4 / ton	2	---	63.0	37.0	---	---

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Fresh forage, vegetative stage - legumes

Alfalfa, fresh	4.3	/ ton	¹	3.8 - 4.9	72.4	27.6	20.8 - 39.5	63
Clover (ladino), fresh	3.3	/ ton	²	---	81.0	19.0	---	---
Clover (red), fresh	3.3	/ ton	²	---	76.0	24.0	---	---
Lespedeza, fresh	2.7	/ ton	²	---	75.0	25.0	---	---
Trefoil (birdsfoot) fresh	2.5	/ ton	²	---	78.0	22.0	---	---

Removal by animal type^{8,9}

Beef cattle	0.0051 lb P ₂ O ₅ per pound of weight gain (based on average 20% protein in meat, bones, offal, etc.)
Poultry	0.0257 lb P ₂ O ₅ per 5 lb market-weight broiler
Dairy cows	0.00217 lb P ₂ O ₅ per cwt (100 lb) of milk

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(Crop residue weights per unit of yield harvested were derived from NRCS PLANTS database.)

* References and Resources

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