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FERTILIZING FARMLAND WITH YARD TRIMMINGS FROM LANDSCAPE MAINTENANCE

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Fertilizing Farmland with Yard Trimmings from Landscape Maintenance

Introduction

Yard trimmings are a mixture of grass clippings, leaves, woody trimmings, weeds, and the soil that accompanies these materials. Yard trimmings differ from yard debris compost, because they receive only minimal or no composting.

They are often composted for only a week or two, or they may just self-heat in piles after grinding, with little or no management of pile temperature and moisture. In general, yard trimmings are like hot, young compost.

Application of yard trimmings to agricultural land is an alternative to composting yard trimmings during the spring and early summer months (Fig. 1). Most yard trimmings are a beneficial soil amendment because they are a good source of plant nutrients and organic matter. They have been used with a variety of crops in western Washington, including sweet corn, silage corn, rhubarb, flower bulbs, cabbage, and squash.

This bulletin describes the use of yard trimmings in agriculture, including:

- Nutrient content and properties of yard trimmings
- Estimating nitrogen availability from yard trimmings
- Calculating application rates
- Managing yard trimmings applications
- Permits for yard trimmings applications
- Repeated applications

What nutrients are in yard trimmings?

Yard trimmings are ground and sometimes screened before shipment for agricultural application. Screening and grinding removes sticks and non-degradable material (such as plastic). Some facilities allow the yard trimmings to heat in aerated windrows for several days to reduce the viability of weed seeds.

Nutrient content varies depending on the composition of the yard trimmings. Materials with higher grass content contain more nitrogen (N), phosphorus (P), and potassium (K) than woodier materials, and they have a lower carbon to nitrogen (C:N) ratio (Tables 1 and 2).

Fig. 1. Applying yard trimmings with a manure spreader before planting sweet corn.

Most yard trimmings in western Washington fall within the range for mixed materials shown in Tables 1 and 2. Yard trimmings with a lower N content and higher C:N ratio than shown in Table 1 are likely to immobilize N during the year of application, and are better suited as a mulch than a soil amendment.

Yard trimmings contain other plant nutrients, such as calcium (Ca), magnesium (Mg), boron (B), and sulfur (S) (Table 3), and small amounts of trace elements (Table 4). Trace element levels are low in yard trimmings, generally less than 10% of the “exceptional-quality” limits used for biosolids applications (Table 4).

Yard trimmings tend to be slightly acid (pH 5.2 to 6.5), but their application has little effect on soil pH. Salt levels are generally low (1 to 3 dS/m) and will not affect crop growth. The moisture content of yard trimmings generally ranges from 50 to 70% by weight, with fresher, grassier materials containing more moisture (Table 2). Bulk density increases with moisture content (Table 5).

Nitrogen Availability

Nitrogen (N) availability is the key to estimating annual application rates for yard trimmings. Application rates are typically based on N, because N is usually the nutrient needed in the largest amount for crop growth.

Table 1. Typical composition of yard trimmings[1]. Nutrients and organic matter are shown on a dry weight basis.

Component	Chemical Symbol	Grass[2]	Mixed[3]
Total nitrogen, %	N	2 to 4	1.2 to 2.3
Ammonium nitrogen %	NH4-N	0.2 to 0.4	0.1 to 0.3
Nitrate nitrogen %	NO3-N	< 0.01	< 0.01
C:N ratio		10 to 15	15 to 25
Total phosphorus, %	P	0.3 to 0.6	0.2 to 0.3
Total potassium, %	K	1.3 to 2.3	0.5 to 1.0
Organic matter, %		65 to 85	50 to 60
Salts (dS/m or mmhos/cm)		< 1 to 3	< 1 to 3
pH		5.5 to 6.5	5 to 6
Moisture, % as is		60 to 75	45 to 65

[1] Based on samples collected at four facilities in western Washington over seven dates (Bary et al., 2005).
[2] Contains more than two-thirds grass
[3] Contains about one-third to two-thirds grass

Fresh yard trimmings compared with compost

Fresh yard trimmings are similar to compost in that both are organic materials that can improve soil productivity.

Fresh yard trimmings differ from composted materials in that they are less processed, less stable, and more biologically active.

The comparisons below show key differences between fresh and composted yard debris. Consider these comparisons when deciding to use fresh or composted yard trimmings on the farm.

Fresh yard trimmings	Yard trimmings compost
• Fast and slow release forms of nitrogen	• Slow release form of nitrogen
• About 40% of organic matter degrades rapidly; the remainder is similar to compost organic matter	• Organic matter in slowly-degradable forms
• May contain viable weed seeds or other weed propagules (e.g., stolons, rhizomes)	• Less likely to contain viable weed seeds
• Low cost	• More expensive
• Cannot be stored; must be applied shortly after delivery to the field	• Can be stored
• Particle size less uniform; sometimes not screened	• Large debris removed by screening
• Permits may be required for land application	• Land application permits not required

Table 2. Primary nutrients and organic matter in yard trimmings, lb./ton, as is[2].

	Grass lb./ton @ 30% solids[1]	Mixed lb/ton @ 50% solids
Total N	15 to 21	12 to 24
NH_4-N	1.2 to 3	1 to 3
NO_3-N	< 0.1	< 0.1
P	1.2 to 2.4	2 to 4
K	6 to 12	5 to 10
Organic matter	390 to 410	500 to 600

[1] Solids content = 100 % - moisture %
[2] As-is means fresh weight, as opposed to dry weight. Analyses are sometimes reported on a dry weight basis, but farmers apply the material "as-is."

Table 3. Typical content of other nutrients in yard trimmings[1].

Element	Chemical Symbol	Units	Range (dry weight basis)[2]
Calcium	Ca	%	0.6 to 1.0
Iron	Fe	%	0.3 to 1.0
Magnesium	Mg	%	0.2 to 0.3
Sulfur	S	%	0.1 to 0.3
Manganese	Mn	mg/kg[3]	225 to 315
Boron	B	mg/kg	15 to 30

[1] Based on samples collected from four facilities in western Washington (Bary et al. 2005).
[2] Total elemental content. Available element content is a fraction of total content.
[3] mg/kg = parts per million (ppm)

Table 4. Content of selected trace elements in yard trimmings compared with EPA exceptional quality standards for biosolids.[1]

Element	Chemical Symbol	Yard trimmings[2]	EPA biosolids standards
		mg/kg[3] (dry weight)	mg/kg
Arsenic	As	4 to 6	41
Copper	Cu	20 to 60	1,500
Nickel	Ni	15 to 50	420
Lead	Pb	10 to 50	300
Zinc	Zn	60 to 140	2,800

[1] Data from Bary et al. (2005)
[2] Total element content
[3] mg/kg = parts per million (ppm)

Table 5. Estimating the bulk density of fresh yard trimmings from moisture content.

Moisture Content	Typical Bulk Density
% by wt.	lb./yd3
50	1000 to 1100
60	1100 to 1200
70	1300 to 1500

Yard trimmings contain N in organic and ammonium forms. Organic forms of N are not immediately available to plants, but are released slowly as the yard trimmings decompose in the soil. Ammonium N is immediately available to the plant.

Nitrogen availability from yard trimmings increases as N content increases and C:N ratio decreases. Materials with a higher N content generally contain more ammonium N and more organic N in forms that are easily decomposed in the soil.

Woody yard trimmings with low N content (less than 1.2%) and high C:N ratio (greater than 22:1) tend to immobilize rather than release N during the first season after application. These woody materials are best used for mulching on the soil surface.

Tables 6 and 7 show alternative ways of estimating N availability. Table 6 gives estimates of first-year available N as a percentage and as lb/cubic yard, based on N analysis, C:N ratio, or estimated grass content.

Table 7 estimates available N from a 40 ton per acre (wet weight) yard trimmings application based on N analysis.

Table 6. Estimating available N from the grass content of yard trimmings.

Grass	Typical Total N	Typical C:N	Estimated Available N	Estimated Available N
% of pile volume	%		%	lb. N/cu yd.
0	Below 1.2	Above 22	-10 to 10	0
30	1.2 to 1.8	18 to 22	10 to 20	1
50	1.8 to 2.3	15 to 18	15 to 30	2.2
70	2.3 to 2.8	13 to 15	20 to 35	2.7
100	Above 2.8	11 to 13	20 to 45	4.8

Source: Sullivan et al. (2004).

Table 7. Estimated available N in a 40-ton/acre as-is application of yard trimmings.

Total N Analysis	Estimated volume applied	Estimated Available N
%	cubic yard/acre	lb./acre
Below 1.2	80	-40 to 40
1.2 to 1.8	73	50 to 100
1.8 to 2.3	67	100 to 200
2.3 to 2.8	62	120 to 210
Above 2.8	53	160 to 350

Calculating application rates

Because of variability in N availability from yard trimmings, a conservative application approach may be appropriate where nitrate leaching is a concern. A conservative target for yard trimmings is an application estimated to meet 50 to 75% of the crop N requirements.

About 30 days after the yard trimmings application, conduct a pre-sidedress nitrate test. Take a pre-sidedress nitrate sample as you would any other soil sample, collecting soil cores at multiple spots in the field and combining the cores into a composite sample. Collect the cores over a depth of 0 to 12 inches to determine the soil nitrate concentration.

The test was developed for corn, but is useful for estimating N availability for other annual crops as well. For more information on the pre-sidedress nitrate test, refer to Heckman (2002) and Hart et al. (2010) in the Additional Resources section at the end of this publication.

If soil nitrate-N is less than about 25 mg/kg at this time, the crop is likely to benefit from additional N fertilizer. If soil nitrate-N is greater than 25 mg/kg, additional N is unlikely to improve the yield of most crops.

This approach to yard trimmings management will reduce the potential for over-application of plant-available N, and give growers confidence that available N supply will meet crop needs.

Typical application rates of yard trimmings supply large amounts of total potassium (K) and moderate amounts of total phosphorus (P). If initial soil K levels are low, and a light rate of yard trimmings is applied, supplemental K may be needed. P in yard trimmings may not be available enough in cold soils to substitute for starter P fertilizer. Yard trimmings will usually supply adequate P later in the season.

The yard trimmings application rate calculation is based on: 1) N content of the yard trimmings, 2) estimated availability of the yard trimmings N, and 3) crop N requirements. You can obtain the N content of the yard trimmings from a lab analysis (see sidebar). Lab analyses for N, P, and K are usually reported in percentage on a dry weight basis.

To convert to lb/ton on an as-is (wet weight) basis, multiply the dry weight percentage by 20 and multiply the result by the solids content (Table 8). Estimate N availability using Tables 6 or 7. Use fertilizer guides or recommendations from agronomists to determine crop N requirement. Table 9 gives an example of an application rate calculation. Refer to the "Additional Resources" section at the end of this publication for sources of crop-specific fertilizer recommendations.

If a current lab analysis is not available, you can estimate N content and availability based on the estimated grass content of the yard trimmings (Table 6). This estimate should be done by someone familiar with the appearance of yard trimmings at different grass contents.

Laboratory analysis of yard trimmings

Yard trimmings suppliers are usually responsible for obtaining laboratory analyses for their product. A typical analysis includes total-N, ammonium N, total P, total K, pH, electrical conductivity (EC), moisture content, and C:N ratio.

Proper sample collection, handling, and shipping are critical to obtaining usable results. The sample must be fresh and it must be representative of the material.

Do not dry samples before shipping to the laboratory. Drying causes ammonia loss. Refrigerate samples if they will be delivered to the lab by hand; otherwise freeze them before shipping.

Refer to *Fertilizing with Manure and Organic Amendments*, for details on sample collection, shipment, and analytical laboratories.

Table 8. Converting yard trimmings nutrient content from dry weight to as-is basis. *(Note: Unshaded cells in table are information from lab analysis. Shaded cells are calculations you make.)*

	Example		Your value	
	Lab analysis	**As-is basis**	**Lab analysis**	**As-is basis**
Nutrient	%, dry weight	lb./ton wet weight[1]	%, dry weight	lb./ton wet weight
N	1.8	14		
P	0.3	2.4		
K	1.0	8		
	Fraction, wet weight		Fraction, wet weight	
Moisture	.60			
Solids[2]	.40			

[1] lb./ton = dry weight % x 20 x solids fraction
[2] Solids fraction = 1.0 – moisture fraction

Table 9. Example calculation for yard trimmings application rates, based on laboratory analysis. *(Note: Unshaded cells in table are information about yard trimmings and crop. Shaded cells are calculations you make.)*

Step	Units	Example	Your value
A. Crop		sweet corn	
B. Desired N application rate	lb. N/acre	100	
C. Yard trimmings N content, from laboratory analysis and Table 8	lb. N/ton as-is	14	
D. Phosphorus content, from laboratory analysis and Table 8	lb. P/ton as-is	2.4	
E. Potassium content, from laboratory analysis and Table 8	lb. K/ton as-is	8	
F. Bulk density, from Table 5	lb./cubic yard	1150	
G. Plant availability of N in yard trimmings, from Table 6.	percent	15	
H. Calculate available nitrogen **Line C x (line G / 100)**	lb. N/ton as-is	2.1	
I. Calculate application rate (tons/acre) **Line B / line H**	tons/acre as-is	48	
J. Calculate application rate (yards3/acre) **Line I x 2000 / Line F**	cubic yards/acre as-is	83	
K. Calculate amount of phosphorus applied **Line I x line D x 2.3**	lb. P2O5/acre	265	
L. Calculate amount of potassium applied **Line I x line E x 1.2**	lb. K2O/acre	460	

Managing yard trimmings applications

Site selection

The best sites are on productive farmland that can benefit from the nutrients and organic matter in the yard trimmings. The site must be accessible to delivery equipment (typically a semi-trailer) and have space for holding the delivered material. Avoid areas with poor drainage. Yard trimmings are not suitable for established pastures because the relatively high application rates may smother the pasture crops. They are suitable for annual and some perennial row crops.

Apple maggot quarantine restrictions apply to yard debris in Washington State. Nearly all of western Washington and parts of eastern Washington are under quarantine to prevent the spread of the apple maggot pest. Yard debris can be moved within, but not beyond the quarantine areas. For more information on the apple maggot quarantine, refer to the Washington State Department of Agriculture Apple Maggot Facts.

Odor control

Apply yard trimmings promptly after delivery, to prevent build-up of odors in the pile. If the pile sits too long, foul odors may affect neighbors during application. The local permitting authority may specify a time limit between delivery of the material and completion of application. The time limit is typically a week or less.

Application and incorporation

Farmers usually apply yard trimmings using rear- or side-delivery manure spreaders. Some farmers have adapted spreaders to deliver yard trimmings between the rows of perennial crops such as rhubarb (Figures 2 and 3). After application, incorporate the yard trimmings promptly as part of normal field preparation.

Proper calibration of spreaders is critical for applying the desired amount of yard trimmings uniformly across the field. For step-by-step instructions on calibrating spreaders refer to *Fertilizing with Manure and Other Organic Amendments*.

Fig. 2. Applying yard trimmings to rhubarb using a spreader adapted for delivery between rows.


Fig. 3. Yard trimmings applied between rows of rhubarb.

Timing of application and planting

Fresh yard trimmings contain easily degradable organic matter. About 40% of the organic matter in yard trimmings is decomposed by soil organisms during the first two to four weeks after incorporation in the field (Sullivan et al. 2004). The soil organisms consume large amounts of oxygen as they degrade the yard trimmings. A lack of oxygen in soil can damage crops.

To avoid crop damage, wait two to four weeks after incorporating high rates of yard trimmings before seeding or transplanting crops. Yard trimmings have been incorporated between the rows of standing perennial crops, such as rhubarb, without any evidence of harm to the crop.

Soil Testing

Taking soil test samples and observing your crops can help determine if application rates are adequate or if they need adjusting. The pre-sidedress nitrate test is an in-season test that indicates if the yard trimmings will supply enough available N for the crop, or if additional N fertilizer is needed.

The post-harvest nitrate test helps determine if you are applying too much yard trimmings. This test measures nitrate-N remaining in the soil in the fall. If you apply too much yard trimmings, nitrate-N will accumulate in the soil, and is unused by the crop. When the fall and winter rains come, the nitrate will leach from the soil and become a potential contaminant in ground water or surface water. Excess N can also harm some crops by delaying fruiting and increasing the risk of disease damage, freeze damage, and wind damage.

For a pre-sidedress nitrate test, sample the soil one month after applying yard trimmings. To do a post-harvest nitrate test, sample the soil (over a depth of 0 to 12 inches) between August 15 and October 1. Timing is critical. You want to take the sample after most crop uptake of N has occurred, but before the fall rains leach nitrate from the soil.

Take a post-harvest sample as you would any other soil sample, collecting soil cores at multiple spots in the field, and combining the cores together into a composite sample. A pre-sidedress test is done the same.

For details on soil sampling procedures, refer to *Soil Testing: A Guide for Farms with Diverse Vegetable Crops.*

If post-harvest nitrate-N results are greater than 15-20 mg/kg, this suggests that you are supplying more N than your crop needs, and you can reduce application rates. Post-harvest nitrate-N levels greater than 30 mg/kg are excessive.

When interpreting post-harvest nitrate test results, consider the performance of your crop as well. If crop growth was poor because of drought, pests, or poor growing conditions, crop N uptake may have been less than expected, resulting in excess N remaining in the soil profile even if yard trimmings applications were on target for a normal crop.

You can use basic soil tests to evaluate the soil for sufficiency or excess of other nutrients. A basic soil test includes P, K, calcium (Ca), magnesium (Mg), boron (B), pH, and a lime recommendation. If you have excessive levels of P and K, you may need to decrease or cease yard trimmings applications.

Herbicides and yard trimmings

Most herbicides that are available to the public for broadleaf weed control in turfgrass (such as 2,4-D) are rapidly degraded to non-toxic compounds by microbial activity in soil.

One turf herbicide (clopyralid) does not degrade readily in yard trimmings and compost, resulting in reports of damage when contaminated compost was used with susceptible plants. In response to this problem, residential turf applications were removed from the label for products containing clopyralid.

Washington State placed additional restrictions on clopyralid turf use, allowing applications only on golf courses where all clippings are kept on site. These restrictions have succeeded in removing the risk of clopyralid damage from yard trimmings.

Pathogens and yard trimmings

Yard trimmings can contain disease-causing pathogens. The source of the pathogens is most likely from feces left on lawns and landscapes by wildlife and pets. Although these pathogens are not taken up by plants, they can enter food through soil that adheres to crops (such as carrots, lettuce, and spinach).

Pathogens die off in the environment, and a waiting period between yard trimmings application and crop harvest reduces pathogen risk. For crops eaten raw that contact the soil (root and leafy green crops), wait at least 120 days between yard trimmings application and crop harvest.

For crops where the edible part does not contact the soil (such as broccoli), wait at least 90 days. For crops that are always cooked (such as winter squash), no waiting period is needed, because cooking kills the pathogens.

Permits

Because yard trimmings are usually handled under solid waste regulations, the permitting authority (the local health department in Washington State or the Department of Environmental Quality in Oregon) may require a permit for land application. The supplier of the yard trimmings is usually responsible for completing the permit application.

The purpose of the permit is to ensure that yard trimmings are applied to a suitable site at an appropriate application rate, and that the site is managed to protect ground water and surface water. Specific information and management requirements may differ, depending on the locality.

The permit will usually specify an application rate and timing based on soil, crop, and yard trimmings information, and estimated yard trimmings N availability. The permit may require subsequent testing, such as post-harvest soil nitrate tests, to determine if yard trimmings applications need to be adjusted in future years. Other information may also be required, depending on site conditions.

Repeated applications of yard trimmings

Repeated applications of yard trimmings increase soil organic matter content and increase the soil nutrient pool. As the pool of slow release nutrients increases, the amount of yard trimmings needed to meet crop requirements will decline.

When yard trimmings applications are based on N need, the application usually supplies K in excess of crop needs. Yard trimmings may also supply excess P. As a result, P and K can accumulate in soils over time, and may eventually reach excessive levels. Excess levels of soil P can increase the amount of P in runoff, increasing the risk of surface water degradation. Many crops can handle high levels of K, but livestock can be harmed by nutrient imbalances if they consume a diet of forage with high K levels.

When applying yard trimmings repeatedly to the same fields, it is important to have a regular soil testing program to track nutrient levels. If P and K reach excessive levels, you will need to move yard trimmings applications to other fields with lower P and K levels.

Summary

Yard trimmings are a beneficial soil amendment that supply plant nutrients and organic matter. They have been successfully used in the production of a variety of annual and perennial crops. Keys to the successful use of yard trimmings include compatibility with the cropping system, appropriate application rates and timing, and attention to soil tests and equipment calibration.

Additional Resources

Research publications that support recommendations

Bary, A.I., C.G. Cogger, and E.A. Myhre. 2004. Yard Trimmings as a Source of Nitrogen for Crop Production. *Compost Science and Utilization* 12:11-17.

Bary, A.I., C.G. Cogger, D.M. Sullivan, and E.A. Myhre. 2005. Characterization of Fresh Yard Trimmings for Agricultural Use. *Bioresource Technology* 96:1499-1504.

Gale, E.S., D.M. Sullivan, D. Hemphill, C.G. Cogger, A.I. Bary and E.A. Myhre. 2006. Estimating Plant-Available Nitrogen Release from Manures, Composts, and Specialty Products. *Journal of Environmental Quality* 35:2321-2332.

Sullivan, D.M. T.J. Nartea, A.I. Bary, C.G. Cogger and E.A. Myhre. 2004. Nitrogen Availability and Decomposition of Urban Yard Trimmings in Soil. *Soil Science* 169:697-707.

Spreader calibration, sample handling, and analysis

Bary, A.I., C.G. Cogger, and D.M. Sullivan. 2016. Fertilizing with Manure and Other Organic Amendments. *Washington State University Extension Publication* PNW 533.

Soil Testing and Fertilizer Recommendations

Collins, D. 2012. Soil Testing: A Guide for Farms with Diverse Vegetable Crops. *Washington State University Extension Publication* EM050E.

Collins, D. C. Miles, C. Cogger, and R. Koenig. 2013. Soil Fertility in Organic Systems – A Guide for Gardeners and Small Acreage Farmers. *Washington State University Extension Publication* PNW 646.

Fery. M. and E. Murphy. 2013. A Guide to Collecting Soil Samples for Farms and Gardens. *Oregon State University Extension Publication* EC 628.

Hart, J.M., D.M. Sullivan, J.R. Myers, and R.E. Peachey. 2010. Sweet Corn Nutrient Management Guide (Western Oregon). *Oregon State University Extension Publication* EM 9010-E.

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Sullivan, D.M. and C.G. Cogger. 2003. Post-harvest soil nitrate testing for manured cropping systems in western Washington and Oregon. *Oregon State University Extension Publication.* EM 8832-E.

Apple Maggot Quarantine

Washington State Department of Agriculture. 2016. Apple maggot – Unwanted in Washington.

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