



Grass Combustion – Europa Pellet Stove

Purpose: The purpose of this publication is to describe grass pellet combustion in the Paromax Inc. Europa 75 pellet stove.

Appliance Description

The Europa pellet stove has a two-step combustion process with an EPA-certified 86% efficiency with wood pellets. It allows feeding of 1-4 lbs of fuel/hour, and has an output of 8,500 BTUs to 34, 000 BTUs/hour. It has an upright cylindrical burn pot with multiple augers at its base for periodic removal of ash from the burn pot. It has a relatively large ash storage compartment. The stove can be purchased with a 12 v DC battery backup.



Fig. 1. Paromax Europa 75 pellet stove.

Control Panel

The control panel has settings for wood, corn or wheat. For grass combustion, the wheat setting is used. The stove comes with a wood burn pot and a corn burn pot. The corn burn pot is used for grass combustion, it has about twice as many holes in the sides for air entrance, compared to the wood burn pot. The

control panel has settings for combustion fan adjustment, ash extraction, and heat level settings. As heat level setting is adjusted (from 1 to 5), ash extraction rate changes. In order to burn grass pellets, the ash extraction rate must be matched to the pellet feed rate, such that a consistent mat of fuel is maintained in the burn pot.

High ash grass pellets averaged 5.5% ash and 7891 BTU/lb. Low ash grass pellets averaged 3.0% ash and 7749 BTU/lb. Premium wood pellets averaged 1.1% ash and 8202 BTU/lb. The BTU values are on an “as is” basis.

Pellet Feed Rates

Pellet feed rates were determined by difference, weighing in and out from the fuel bin over several hours of feeding. The Europa does not allow pellet feeding without combustion, which would have allowed easy collection of fed pellets for direct rate determinations.

The pellet feed rate setting of two was 40.6% of the maximum feed rate for wood, 39.9% for low ash grass, and 41.5% for high ash pellets. High ash grass pellets had feed rates about 25% faster than wood pellets at high (5.43 lb/h) and low (2.25 lbs/h) settings. Ash removal settings at the wheat fuel defaults had to be adjusted to maintain a mat of consistent depth in the burn pot.

Combustion Measurements

A Testo 350XL emissions measurement system determined CO, CO₂, O₂, H₂, NO, NO₂, and SO₂ concentrations in the flue exhaust. Runs were restricted to 15-30 minutes in duration, to eliminate the possibility of overloading the CO sensor. After each run the probe filter was backwashed, and the Testo was allowed to rinse detection cells for at least 10 minutes, depending on the CO concentrations of the past run. The SO₂ cell was inconsistent and readings are not reported. All emissions measurements varied with feed rate for all 3 fuels. All emissions tests were run in triplicate.

Smoke Spot Tests

Smoke spot tests were collected every 30 seconds for 24 readings, and repeated 3 times, for a total of 72 smoke spot readings for each feed rate. For the low and nominal feed rate settings, Wood pellets averaged readings of 1.3 and 1.8, high ash grass averaged 1.1 and 0.9, and low ash grass averaged 0.7 and 0.1. Grass readings were significantly lower than wood, but may not be meaningful due to variable ash color among grasses.

Emissions Results

Emissions, recorded every second, varied over individual runs (Fig. 1&2), and varied among triplicate runs. CO emissions were lower at the nominal feed rate, as was O₂ which varied from 12% at nominal to 14% at the lower rate. CO values would be considerably higher if adjusted to a lower O₂ rate.

Table 1. Average emissions readings for wood, low ash and high grass pellets at nominal feed rate (5) and 40% of nominal (2).

Fuel	Setting	CO	NOx	CO ₂
		ppm	ppm	%
Wood	2	135	38	1.17
	5	50	66	1.54
Grass, low	2	85	120	1.39
	5	56	198	1.87
Grass, high	2	104	174	1.30
	5	90	237	1.49

NOx emissions were considerably lower with wood pellets, as would be expected. Both NOx and CO₂ increased with pellet feeding rate.

Concerns with Grass Pellets

As with any stove that relies on periodic removal of ash from the bottom of the burn pot, it is crucial to match the ash removal rate with the pellet feed rate, to maintain a consistent depth for the fuel mat. While this was not a problem for wood, ash removal rate required adjustment for grass pellets.

Warranty Issues

As with almost all residential-scale combustion appliances, the Europa is not certified to burn grass pellets, and doing so will most likely void the warranty.

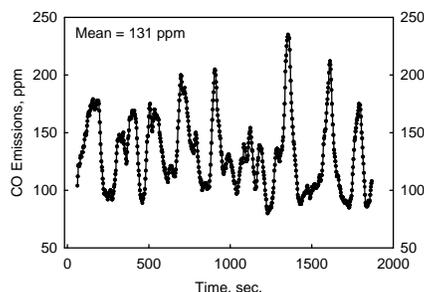


Fig. 1. Wood pellets at 40% nominal feed rate.

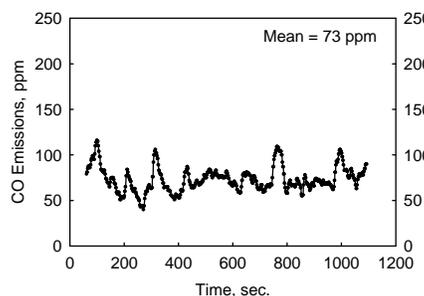


Fig. 2. Low ash grass at 40% nominal feed rate.

Summary

The Europa 75 pellet stove is capable of efficiently burning grass pellets without clinking issues. For grass combustion it requires that a sensitive balance be maintained between pellet feeding and ash removal to maintain a consistent fuel mat in the burn pot.

Additional Resources

Cherney, J.H. and K.M. Paddock. 2013. Basic emissions testing for residential appliances. Bioenergy Information Sheet #18. www.grassbioenergy.org.

Acknowledgments

Testing was supported by the New York Energy Research and Development Authority (NYSERDA), and the Cornell University Agricultural Experiment Station.

For more information



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