Wood Ash

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Last winter we installed a Morso wood-burning stove in our lounge at home, which was most welcome over the coldest part of the winter. It has a rated output of 5 kW of heat, with a wood consumption rate of 2kg per hour. The Morso was plumbed into the existing chimney, in front of a classic Edwardian fireplace. The original fireplace was close to useless. It was small, and clearly designed to burn coal, but it didn't do that very well either. I estimate that it had about the same effect as a 2 kW heater. Some figures published for open fireplaces quote efficiency figures as low as 10%, which means that 90% of the heat goes up the chimney. Our Morso is rated at 70%, and this can be improved if the flue is run up inside the room. The larger Morso stoves have higher efficiencies and outputs. (See www.morso.co.za) The stove is smokeless, although it does smoke at startup, for about 10 minutes. The exact model we picked is designated the 1442 ribbed, which we picked because it has a double skin on the sides, so the safe distance on the sides is relatively small – flammable items can be close by.

It does need feeding fairly often – about once an hour. I have a lot of off-cuts from turning blanks –with cracked ends and corners to be removed, about half the weight of a blank can be removed on the bandsaw before going to the lathe. Also, we took down a large Australian Blackwood last year, which had been dead some time. I estimate that about 2 m^3 of dry wood is lying in the wood pile, which, with our relatively mild winters, should last us quite some time.

In the instruction book for the stove, they state that wood ash should **not** be put onto the garden and should be disposed of with normal domestic waste, making sure that it has cooled down. Of course. I questioned this – clearly some research was required.

We have a large compost heap in the corner of the garden and all our garden refuse goes onto the heap. Once it has composted, it is then recycled onto the garden to complete the cycle. On the compost heap, the worms and bugs and bacteria all feed on the vegetable matter reducing it to compost over a few months to years.
Compared with composting, wood ash is a special case – all the water and hydrocarbons in the wood are burned off in the fire, and what remains is essentially the mineral content of the wood that was burned. Given that this wood all arose from the same soil to which is being returned, I wondered: Why do they recommend that wood ash not be used on the garden? What is different between composting and burning?

When wood burns completely, the organic compounds that are essentially hydrocarbons are converted into carbon dioxide and water vapour. The more volatile constituents also go into the atmosphere, and the minerals remain. The exact processes depend on the conditions prevailing in the fire such as the temperature, moisture content of the wood, oxygen available, and the wood composition.

The weight of ash remaining is typically between 0.5% and 2% of dry weight of the wood that burned. The largest constituent of the ash is calcium carbonate ($CaCO_3$) comprising 15% to 45%. Next is potash (potassium compounds in various forms) at about 10% and about 1% is phosphate. Then there are all sorts of trace elements – magnesium, iron, manganese, zinc, copper and various heavy metals that were taken up and used by the tree. There may be significant amounts of silica as well, depending on the species of tree. Some woods such as eucalyptus species contain enough silica to noticeably wear tool edges – ask the turners about this.

As you may know, commercial fertilisers are labelled with the N-P-K composition, indicating the proportion of Nitrogen, Phosphorus and Potassium respectively. A common, general purpose garden fertiliser is 2-3-2 which contains:

- 2 units of nitrogen, probably in the form of ammonium nitrate (NH_4NO_3)

- 3 units of phosphorus, probably in the form of phosphate (P_2O_5)
- 2 units of potassium, probably in the form of potassium chloride (KCl)

Wood ash varies depending on the tree species, but typically it is 0-1-3. If you combine wood ash with ammonium nitrate, you can create a balanced fertiliser to suit your application.
(These days, it is difficult to buy ammonium nitrate, as it is an ingredient in explosives – to render it safe, it is usually sold as LAN – Lime Ammonium Nitrate.)

Calcium carbonate is the main ingredient in agricultural lime, which is used by gardeners to reduce acidity in soil, and improve the uptake of other nutrients from acidic soils. Wood ash is effective as a liming agent because the very small particle size makes it more reactive than other sources of lime. Weight for weight, about twice as much ash is required as agricultural lime.

You can't dump unlimited quantities of wood ash on your garden, like you can with compost. You need to be careful not to make your soil too alkaline (increased pH). In Gauteng, due to the long-term deposition of lime from the municipal water supply, gardens can tend to become too alkaline (basic) with time. The calcium carbonate in the ash can make this worse. If you are a keen gardener, you will probably have tested the pH of the soil and you will know where you stand. Apparently, wood ash should never be used on acid loving plants such as potatoes, blueberries, azaleas, conifers, etc.
Another problem with wood ash is that it is very fine, so to prevent it blowing away, it should be watered into the soil after application.

Probably a better use for wood ash is mixing it into your compost heap – a study done in Finland and backed by another in Austria showed significantly faster decomposition with controlled amounts of wood ash mixed into the heap. Up to 20% by weight was found to be beneficial.

If you are into self-sufficiency, then wood ash has many uses – soap making, as a cleaning agent, for scouring pots, etc.

What about coal ash? The problem with coal ash is that the origins are unknown, so you don't know what the mineral and heavy metal content is. Generally, coal ash is dumped in landfill sites if the composition is unknown. There are numerous industrial uses for coal ash, such as cement, brick-making, roads. However, due to risks of groundwater contamination from heavy metals, it should not be used in your garden.

Health and Safety. Wood ash contains very fine particles, so a dust mask should be worn and then the ash should be watered into the soil. Varying amounts of silica may be present, so precautions against silica dust apply. Also, wood ash is alkaline, so skin contact should be avoided.
Make sure that the ash is cool when removing it from the fireplace – ash is an excellent insulator, and it is surprising how long hot coals can persist in a bed of ash.

Sources:
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