**The Vegan-Organic Network**

The Vegan Organic Network is a registered charity (registered charity number 1080847), providing education and research in vegan-organic principles and has an international network of supporters. VON supporters enjoy a wide variety of contacts and can obtain advice on cultivation techniques. The magazine *Growing Green International* is sent to supporters twice a year. For more information and details of how to join, please contact:


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General enquiries and advice on growing:
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**Vegan-Organic information sheets**

This is one of several sheets produced on various topics by the Vegan-Organic Network. These are aimed mainly at those with allotments, kitchen gardens or other small growing areas, although many of the techniques will also apply to larger-scale situations. We welcome feedback on this information sheet and any other related topics. The information sheets currently available are: #1 Propagation and Fertilisers; #2 Growing Beans for Drying; #3 Growing on Clay Soils; #4 Vegan-Organic Growing - The Basics; #5 Fungi - FAQ: #6 Gardening for Wildlife; #7 Growers' Guide to Beetles; #8 Green Manures; #9 Chipped Branch-Wood; #10 Composting.

These are available on request. Please send £5.00 per set, or 60p each (£6 and 75p respectively if outside the UK). The sheets are also available free on our website.


Issued March 2005. This advice is given as guidance only, with no responsibility for any results, due to the nature of the processes involved!



**Vegan-Organic Information Sheet #9 (60p)**


# Chipped Branch Wood


***By Dave of Darlington***


**Growing with concern for people, animals and the environment**

Organic growing involves treating the soil, the growing environment and the world environment as a resource to be preserved for future generations, rather than exploited in the short term. Vegan-organics means doing this without any animal products at all, which is not difficult when you know how. *All soil fertility ultimately depends on plants and minerals - these do not have to be passed through an animal in order to work.* Fertility can be maintained by plant-based composts, green manures, mulches, chipped branch wood, crop rotations and any other method that is sustainable, ecologically benign and not dependent upon animal exploitation.

The guidelines below do not attempt to be fully comprehensive. *The extent to which you adhere to any system really depends on you, your conscience and circumstances.* We can only do our best with our available time and money. The Vegan-Organic Network has now published comprehensive Stockfree Organic Standards, which are available to commercial growers and can also be used as a reference for home growers. Of course, no one person or organisation knows everything about the subject, so constant co-operation and updating of ideas and information is needed.

Whilst conventional cultivation relies on synthetic chemicals and animal products, traditional organic production also generally relies on animal wastes and by-products. Both involve the exploitation of living creatures, and the inefficient use of land, water and energy resources. Vegan-organic methods minimise these drawbacks. Many people who are not themselves vegan or vegetarian are coming to appreciate that animal-free growing is the most sustainable system: it is the future of organics.

**Chipped branch wood: introduction**

Chipped branch wood is wood consisting of twigs and of branches up to about 7 cm in thickness, which has been ‘chipped' or otherwise cut into thin fragments about 2-3 cm across. This product can then be spread on the soil in the form of a mulch or incorporated into the top layer of the soil. Nothing very revolutionary about that, you might think. But it turns out that what might have been simply an alternative method of mulching or fertilising the soil has, in fact, very far reaching significance for our understanding of what the soil is and what it does.

Before describing this in more detail, I feel that some explanation of the terminology is required. The material in question is known in the literature under several different names. I have chosen to use the name that sounds to me like good simple English: chipped branch wood[1]. It is also known as chipped twig wood[2] or, more pretentiously, as chipped ramal wood[3]. But what is really confusing is that in the United States it has come to be known by the misnomer 'ramial chipped wood'. The un-English word order and the mis-spelling of the word 'ramal' have arisen as a consequence of the history of this subject. Most of the early research on chipped branch wood was done by French-Canadian forestry scientists at Laval University and at the Ministry of Forestry in Quebec. They coined the name 'le bois raméal fragmenté' for this material.

The principle researcher into chipped branch wood at Laval University was Gilles Lemieux (now retired). He summarised his work and his ideas in a paper that was published on the internet in 1997[4]. Despite the impenetrable jargon of its title this is a wonderful paper that everyone should read. It is packed with great ideas about forestry, agriculture and the soil. The only drawback is that the English translation given on the internet is appallingly bad. It is so full of errors that some sentences are completely unintelligible. I have decided to start learning French again after a gap of nearly sixty years, so that I will be able to read Lemieux's papers in the original and hopefully understand better what this brilliant man has written.

Just to give readers a foretaste of what it is like, here are a few slightly edited quotations from this paper. '... our concept and knowledge of agricultural soils are based solely on references to chemistry and pathology ... in reality, pedology [i.e. soil science] is much more than just chemistry and physics.' '.... in the biological field, particularly the forestry and agricultural sectors .... the quest for data has replaced the quest for ideas...' '... societies that depend on and live in tune with nature and its constraints do not hold the same view as those, such as industrial societies, that live off the fruits of nature while controlling its constraints.' '... wood can be seen as the result of overproduction and not of production itself, since ... 80% of a tree's energy production is transported directly to the hypogeous [i.e. underground] ecosystem.' 'Both agriculture and forestry foster increasing instability rather than the maintenance and enhancement of metastability, the goal of all ecosystems. [We can] envisage the eventual use of chipped branch wood as an agent to improve the soil not just by adding chemical nutrients but, more importantly, by increasing the stability of tellurian [i.e. earth] ecosystems.'

**How to use chipped branch wood**

The following recommendations for the use of chipped branch wood as a soil amendment are taken mainly from the writings of Gilles Lemieux, the Canadian forestry scientist who has done most of the research on the subject.

1. Sources of the material.

The wood to be used as a soil amendment must be branch wood, which is



## Books

Readily available handbooks, which are not wholly vegan but provide good vegan alternatives are: *The Organic Bible* by Bob Flowerdew (ISBN 1856265951) and *The New Organic Grower* by Elliot Coleman (ISBN 093003175X).

*Weeds* by John Walker is an earth-friendly guide to tackling weeds and making good use of them. Published by Cassel (ISBN 1 84403 061 X).

The following books are available from The Vegan Society, Donald Watson House, 7 Battle Rd. St Leonards-on-Sea, East Sussex TN37 7AA. Tel: 01424 427393. www.vegansociety.com/shop:

*Abundant Living in the Coming Age of the Tree* by Kathleen Jannaway (ISBN 0951732803) – towards a vegan, self-sustaining tree-based culture.

*Forest Gardening* by Robert A de J Hart (ISBN 1900322021) – turn your garden or allotment into a vegan-organic, permaculture-based mini-forest.

*Permaculture: A Beginner's Guide* by Graham Burnett – apply the principles of sustainability and working with nature to your land, your community and your life.

*Plants for a Future* by Ken Fern (ISBN 1856230112) – pioneering book that takes gardening, conservation and ecology into a new dimension. Information about growing edible and other useful plants.

*The Animal Free Shopper* (ISBN 0907337252) – The Vegan Society's guide to all things vegan includes a section on garden products.

## Seeds and Supplies

**The Organic Gardening Catalogue**, Riverdene Business Park, Molsey Rd, Hersham, Surrey KT12 4RG, UK. Tel: 01932 25366. www.organiccatalog.com. Seeds and products such as fertilisers and compost listed as organic and animal-free.

**Suffolk Herbs**, Monks Farm, Coggeshall Rd, Kelvedon, Essex CO5 9PG. Tel: 01376 572456. www.suffolkherbs.com

**Chiltern Seeds**, Bortree Stile, Ulverston, Cumbria LA12 7PB. Tel: 01229 581137. www.edirectory.co.uk/chilternseeds. Wide range of seeds including uncommon and unusual vegetable varieties.

**Tamar Organics**, Unit 5A, Westbridge Trading Estate, Tavistock, Devon PL19 8DE. Tel: 01822 834887. www.tamarorganics.co.uk. Excellent organic seed supplier.

rapidly consumed by the soil micro-organisms. Most of the green manure will be decomposed within a few weeks, depending on weather and soil conditions. This is very good from one point of view - it releases a lot of nutrients into the soil, which could feed the next crop. But from another point of view it is bad news. It means that green manures supply the soil with very little of the recalcitrant material needed to boost the soil's long-term organic matter reserves and to improve or maintain the soil structure. Ironically from a vegan-organic point of view, farmyard manure is much better than fresh green manures at supplying this important recalcitrant factor.

So what can vegan-organic growers do to remedy this deficiency? Well, this is where chipped branch wood could fill a gap. Although, percentage-wise, it is poorer in nutrients than most green manures, it is rich in recalcitrant organic materials that could replenish the soil's long-term reserves of organic matter. The next article in this series will explain in more detail how this might happen.

Finally, it must be stressed that the above is a very over-simplified description of how soil organic matter works. It is a very complicated subject, which, in spite of decades of intensive study by soil scientists, is still poorly understood.

[1] As, for example, in Swift, M.J. *The role of fungi and animals in the immobilisation and release of nutrient elements from decomposing branch wood*. In: Lohm, U, and Persson, T. (eds.). *Soil Organisms as components of Ecosystems.* Ecol. Bull. of the Swedish N.S.R.C

[2] See, for example, Aman, S., Depatie, S., Furlan, V. and Lemieux, G. 1997. *Effects of chopped twig wood (CTW) on maize growth and yields in the forest-savanna transition zone of Cote d'Ivoire.* Tropical Agriculture.

[3] . The word ramal comes from the Latin word 'ramus' meaning 'branch', which is also the basis of the English word 'ramification'.

[4] . Lemieux, G. 1997. *Fundamentals of forest ecosystem pedogenetics: an approach to metastability through tellurian biology.* On website www.forestgeomat.for.ulaval.ca

[5] The tissues of fungi have a C/N ratio of about 10, so, if all their food were used for growth and converted into tissues, the ideal food for them would also have a C/N ratio of 10. But, besides growth, they also need food for maintenance, which means mainly respiration - the release of usable energy from food by oxidising carbon to carbon dioxide. This is true of all living organisms, including ourselves. In fact, we use almost all our food for maintenance and only a very little for growth. We are said to have a low-growth efficiency. Fungi, on the other hand, have a high-growth efficiency - on average they use 40% of their food for growth and the rest for respiration. So, for each unit of nitrogen, they need 10 units of carbon for growth and a further 10 x 60/40 = 15 units of carbon for respiration. In other words, they need altogether 25 units of carbon for each unit of nitrogen. So their ideal food would have a C/N ratio of 25 (roughly that of a not-very-mature plant-based compost).



defined as wood from twigs and from branches up to 7 cm in diameter. Stem wood - the wood from larger branches and trunks of trees - is unsuitable for this purpose. Ideally the wood should be from broad-leaved trees, although a proportion of wood from conifers may be added, as long as it does not exceed 20% of the total. Oak wood has been found to work best, but many other deciduous species have been used successfully.

To give a rough idea of the quantity available we are told that the annual yield from a hectare of forest would be about 10-20 cubic metres, from a hectare of orchard about 2-15 cubic metres, from 100 m of hedge about 2-3 cubic metres and from a single hedgerow tree about 0.1 cubic metres of chipped wood. (See below for the quantity required per unit area of soil.)

2. Chipping the wood

The wood has to be reduced to small pieces - no larger than a few millimetres thick and a centimetre or two in width - before it can be used. On a very small scale this could be done by hand with an axe, but it is more usual to do it mechanically. Many garden shredders have a chipping attachment, although a heavy-duty machine like one of those from Globe Gardening Services would do the job more quickly. For farm or market garden work there are larger machines that are usually driven from the power take-off of a tractor. Where the machine might only be used a few times a year, it would be more economic to hire in a contractor to do the chipping. Many arboriculturalists and landscape gardening contractors have suitable machines. According to Lemieux, the job can also be done with a disused maize forage harvester, if you happen to have one lying about!

3. Application of the chipped wood

Once the wood has been chipped, it is best to use it straight away. If it is stored outdoors in heaps or windrows for any length of time, it will start to compost, in which case much of the useful energy in it will be lost. If it does have to be kept for a while before use, then it is best to keep it dry, in which case it will last indefinitely.

4. When to apply it

The chipped wood is best spread on the soil in the late autumn or early winter but, since the spreading involves a fair amount of running about on the soil, it needs to be done before the soil gets too


**Small electric shredder (Organic Growers of Durham)**

wet. If the chance is missed to do it at the beginning of winter, then it will have to wait till the soil dries out in the spring, but this is a much less favourable time.

5. Frequency of application
Since the application will need to be repeated at regular intervals, it should be done at an appropriate stage in the rotation. Especially in the case of the first application, the chipped wood may lead to some short-term loss of fertility, so it is better to apply it before a crop that does not demand very high fertility. Best of all is to apply it just before a leguminous green manure, if there is one in your rotation. In that case the soil will have fully recovered its fertility before the following crop. The application is then repeated at the same point in every rotation - say, every four or five years, depending on what kind of rotation you are using.

6. How much to apply
The normal rate of application is between 20 and 50 cubic metres to the hectare annually. This means, if it is applied on a four-year rotation, up to a maximum of 200 cubic metres per hectare, which gives a layer averaging about 2 cm thick. At 50% humidity a cubic metre of chipped wood weighs about 400 kg, so on a garden scale we are talking about 1-2 kg per square metre per year or 4-8 kg per square metre every four years.

7. How to apply it
On a garden scale it can be done by hand with a wheelbarrow and shovel, but on a field scale it should be applied with a muck-spreader.

8. Post-application treatments
It is most important that the chipped wood be correctly treated after being spread on the soil. It is not a mulch! It needs to be in very close contact with the soil in order to be decomposed quickly by the soil microorganisms. On the other hand, it must not be buried deeply, because the appropriate organisms are aerobic (they need air) and are most active near the soil surface. So the chipped wood should neither be left on the surface nor should it be ploughed or dug in. (For the same reason it should not be applied to waterlogged or other non-aerated soils.)

What is really required is just to mix it with the top four or five centimetres of soil. In a garden this can be done with a rake, but on a field scale a tractor-mounted machine is required. Lemieux recommends a spring-tine harrow. Alternatively a disc harrow could be used, but, especially with thicker applications of chipped wood, it is less effective because it tends to 'float' on top of the chips. A week or two after the chipped wood application the green manure (or other crop) can be sown, followed by a Cambridge roll if soil conditions permit.

On soils that have been intensively cultivated in the past the populations of the microorganisms that decompose wood may be very low, so, at the time of the first application of chipped branch wood, it is recommended to inoculate the soil with these organisms. Leaf mould can be used for this purpose and should be applied to the soil at a rate of



define. It is known as recalcitrant organic matter and, unlike the labile organic matter, it can stay in the soil a very long time - up to hundreds or even thousand of years. It can only do this because it is very much less likely than the labile organic matter to get eaten by microorganisms. Some of it could be described as unpalatable to the fungi and bacteria. As a result of its chemical properties it is simply resistant to microbiological attack. Besides this, there is also recalcitrant organic matter that is quite palatable but which gets protected in some way that makes it difficult or impossible for the micro-organisms to eat it. This protection can take various physical or chemical forms. Some of the organic matter is just very tight-ly surrounded by small soil particles. Some is physically adsorb-ed onto the surface of small soil particles. Some is chemically bonded with certain minerals to form so-called complexes. Which form of protection predominates at any one place depends on the particular composition and texture of the soil there.

These various forms of close attachment between the mineral soil particles and the organic matter are mutually beneficial to both sides. On the one hand they protect the organic matter and stop it being consumed by the bacteria and fungi. On the other hand they facilitate the clumping together of mineral particles into the crumbs that give soil a good structure, make it workable, make it permeable to air and water and make it resistant to erosion. So, like the labile part of the organic matter, the recalcitrant part also has a very important function in organic farming and growing. Whereas the labile part supplies the crops with nutrients, the recalcitrant part provides a good soil structure. Or, to look at it in another way, the labile part constitutes a temporary larder of organic matter, while the recalcitrant part is a more permanent store.

That said, it is important to stress that, although the recalcitrant part of the organic matter can stay in the soil a long time, it is still eventually decomposed - just very slowly. Chemical resistance, for example, will not protect organic matter against all microorganisms. There are a few species of fungi that will decompose even the most resistant forms of organic matter in the soil, such as coal and charcoal. And the physical forms of protection may be broken down by any severe disturbance of the soil, such as ploughing. So, although not to the same degree as the labile organic matter, the recalcitrant organic matter also needs replenishing. This is especially so in the case of soils in which, due to a long period of cultivation, the recalcitrant organic matter content has fallen very low, as in the case of most of arable soils.

So how do we replenish the organic matter? Well, in vegan-organic growing we do it by growing green manures. These are then either ploughed/dug into the soil or, preferably, mulched on top of the soil. It is standard practice to apply green manures to the soil when they are still quite young, with usually not more than a few months of growth in them. At this stage the green manure plants consist mainly of very labile or fairly labile organic matter and so are

mops up excess nitrate that would otherwise be lost through leaching.
3. Immobilisation of nitrogen will benefit a leguminous green manure crop by stimulating it to fix more nitrogen from the air.
4. By the following season, when the next crop is grown, the immobilised nitrogen will be being released into the soil again.

Finally, even if there is some fall in crop yields in the first season or two after application of chipped branch wood, it is worth it for the long-term benefit to the soil. Improving soil and preserving it from erosion is more important in the long run than maximising yields. How chipped branch wood can contribute to conserving the soil will be the subject of a future article in this series.

**Why chipped branch wood could be very important in vegan-organic growing**

Next to sunlight the soil is probably the most important resource we have. Without it food production, as we now know it, would be impossible. But despite the vital role that soil plays in our lives, we actually know very little about it - mainly because it is an extraordinarily complex material that is changing all the time and therefore very difficult to pin down. While we know, for example, that the organic matter content of soil is extremely important, both for the supply of nutrients to the plants and for the structure of the soil, we only have quite vague ideas of how the organic matter in the soil really works.

One thing we do know is that soil organic matter is under continual attack by the microorganisms (fungi and bacteria) that feed on it. Whenever they get the chance, they will eat it up, using some of it for their own growth and turning the rest into carbon dioxide in the process of respiration. When feeding, they naturally tend to go for the food that is most readily available and to leave the rest for later. On this basis we can define two broad categories of organic matter in the soil.

Firstly there is the so-called labile organic matter. This is organic matter that is very easily reached and digested by the microorganisms and is therefore consumed by them very quickly - in a matter of weeks or months. It is quite rich in nutrients - particularly nitrogen and phosphorus - and some of these are surplus to the requirement of the microorganisms and are released into the soil, from where the roots of the plants can absorb them. So this labile organic matter plays a major role in feeding the crops in an organic farming system. But its capacity to be rapidly decomposed by microorganisms also has some drawbacks:
1. it means that the labile organic matter quickly disappears from the soil and needs to be frequently replenished;
2. on average about half of the labile organic matter is decomp-osed by microbial respiration into carbon dioxide, which goes back into the air and contributes to the greenhouse effect; and
3. the labile organic matter does not stay long enough in the soil to make a contribution to the soil structure.

That brings us to the second category of soil organic matter that I wanted to



10 - 20 grams per square metre. The best is leaf mould that has been freshly collected from the floor of a deciduous forest at a depth of about 5 cm. If chipped branch wood is regularly applied thereafter, the appropriate microorganisms will be permanently present in the soil.

**Why nitrogen robbery is not a problem when using chipped branch wood**

For many gardeners the idea of putting wood in the soil raises the spectre of 'nitrogen robbery', known technically as nitrogen immobilisation. But, if chipped branch wood is correctly used, then nitrogen robbery will not be a problem. To understand why this is the case, we need to look in some detail at what happens to nitrogen in the soil.

Almost all the nitrogen in the soil is in the form of nitrogen-containing organic compounds like amino acids. Plants do not normally use that nitrogen because it requires more energy for their roots to absorb it in that form. They prefer to absorb nitrogen in simple water-soluble inorganic forms - principally as nitrate ($NO_3^-$). Fortunately for the plants, however, soil organisms are continually feeding on the soil's organic matter and breaking some of it down, resulting eventually in the release of small amounts of nitrate into the soil. This process of turning an organic soil constituent into an inorganic one is known as mineralisation.

In natural soils this mineralised nitrogen is immediately absorbed by soil microorganisms - mainly fungi, which are very abundant and widespread in natural ecosystems. The fungi use this nitrogen to build the amino acids and proteins that they use for their own growth. This turning of inorganic nitrogen into organic nitrogen by soil microorganisms is variously known as the immobilisation or locking-up of nitrogen or as nitrogen robbery. Once the nitrogen is part of organic compounds again, it is no longer immediately available to plants, because, as previously stated, plants usually only absorb inorganic nitrogen compounds. It should be noted, by the way, that the immobilised nitrogen is not lost; it is merely put into temporary storage, only to be made available again at a later date. The fungi that consume the nitrogen normally only live for a few months and, when they die, their decomposition releases the nitrogen again into the soil.

In cultivated soils the populations of fungi are very much smaller than in natural ones, so not all the mineralised nitrogen gets swallowed up by them and immobilised. A small amount of nitrate remains dissolved in the soil water, where one of three things can happen to it: if it happens to be near the roots of a crop plant, it can be absorbed by that plant; otherwise it either gets leached (washed) out of the soil by the rain, causing pollution of the ground-water or nearby watercourses; or it gets decomposed by bacteria into gases like nitrogen ($N_2$) and nitrous oxide ($N_2O$), which find their way into the atmosphere and, in the case of nitrous oxide, contribute to the greenhouse effect.

So how can we avoid this harmful loss of nitrate from the soil? The obvious way is to get fungi to mop it up for us. So we need to increase the amount of fungi in the soil. Generally fungi respond rapidly to changes in their food supply, so we can boost the fungal populations by feeding them more organic matter. The more organic matter we add to the soil, the more the fungi will grow. But it is not only the quantity of organic matter that is important - the quality matters too. The fungi would naturally prefer food that has the right composition for them. In particular, they need food with the right proportion of carbon to nitrogen (known as the C/N ratio). The perfect C/N ratio for fungi would be about 25[5], which means that for every gram of nitrogen in the food, there would be 25 grams of carbon.

In practice, of course, the organic matter entering the soil would be unlikely to have precisely this C/N ratio. In the case of a lush young green manure, for example, the C/N ratio might be as low as 15. In other words, it is too rich in nitrogen for the requirements of the fungi. They still feast on it and grow very rapidly, but there is always some nitrogen there that they cannot use and they just release that into the soil as nitrate, which may feed the crops but also increases the risk of leaching.

Suppose, on the other hand, that the C/N ratio of the added organic matter is much higher than 25. For example, cereal straw can have a C/N ratio as high as 70. It contains lots of succulent carbohydrates that the fungi can feed on but, as the fungi grow, they soon run out of nitrogen because of the low proportion of nitrogen in the straw. They then mop up and immobilise any stray nitrate dissolved in the soil water until that has all gone too. So the result of adding a lot of excess carbon to the soil may be that there is no nitrogen available for the crops, which means that their development will be checked. This is the nitrogen robbery that some gardeners fear.

When all the available nitrogen is used up, the fungi cannot grow any more either, because, like plants and animals, they need nitrogen to build their tissues. So the fungal population of the soil is limited by the lack of available nitrogen and reaches a steady state. But even then the fungi don't waste their time! They start to burn off the excess carbon in the soil organic matter, using it for their own respiration to give themselves energy and releasing it as carbon dioxide. In this way they gradually reduce the C/N ratio of the soil organic matter. (Left alone, they would eventually bring it down to the C/N ratio of their own tissues, which is about 10.)

But, besides respiration, the fungi also do something that is a lot more useful to us: instead of burning up all the excess carbon, they also build a lot of it into polysaccharides (complex carbohydrates), which are stored in the soil and make a vital contribution to soil's humus content and to the soil structure.

On the one hand, some of these polysaccharides get incorporated into the very stable pool of organic matter that remains in the soil for hundreds or even thousands of years. On the other hand, their viscous character in contact with soil water enables them to literally glue fine soil particles together and form the



small aggregates (crumbs) that provide the stable and friable structure necessary to a good soil. So the production of polysaccharides by the soil fungi is of long-term importance to the conservation of arable soils and it requires plenty of carbon for them to eat.

The ratio of carbon to nitrogen is not the only aspect of organic matter quality that is important to the fungi when choosing their food. The form in which the carbon and nitrogen occur in the organic matter is also significant. The two elements need to be readily available to the fungi. If either of them is physically or chemically bound up in such a way that the fungi cannot get access to them, then the fungi cannot feed and grow. Wood is a good example of this. It contains large quantities of luscious cellulose, which fungi would love to eat, but, unfortunately for them, the cellulose is closely associated with another substance: lignin. The next article in this series will describe lignin in more detail. For now it is enough to say that lignin is extraordinarily resistant to microbial attack; there are only a few species of fungi that can decompose it at all and then only slowly. The lignin actually protects the cellulose and prevents the microorganisms from getting to it. So, although wood has a very high C/N ratio, it does not promote rapid fungal growth and hence nitrogen immobilisation is not nearly as much as might be expected.

In any case, it should be noted that the chipped branch wood that is used as a soil amendment is not like wood in general. Coming as it does from twigs and young branches, it contains a much higher proportion of living tissue, and hence of proteins and other nitrogen-containing compounds, than do thicker branches and tree trunks. The C/N ratio of branch wood may be as low as 30 and is usually in the range of 50-100, which means that there is quite a bit of nitrogen available for the fungi to use before they start to immobilise nitrogen in the soil.

It is worth stressing the importance of following the correct method for using chipped branch wood. It needs to be applied in autumn or early winter, when there is no great demand for nitrogen from crops. On the contrary, at that time of year there is often a surplus of mineralised nitrogen in the soil and consequently a serious danger of leaching. The immobilisation of nitrogen at such a time can do nothing but good. Also, a leguminous green manure should be grown in the following season, in which case any shortage of available nitrogen in the soil will also do good by stimulating the symbiotic bacteria on the roots of the legume to fix even more atmospheric nitrogen.

In summary, the main arguments for using chipped branch wood, despite the possibility of nitrogen immobilisation, are:

1. The rate of immobilisation is less than might be expected because:

a. the carbon supply in the wood is protected by lignin;

b. the C/N ratio of branch wood is relatively low.

2. Nitrogen immobilisation in the autumn and winter is beneficial, because it