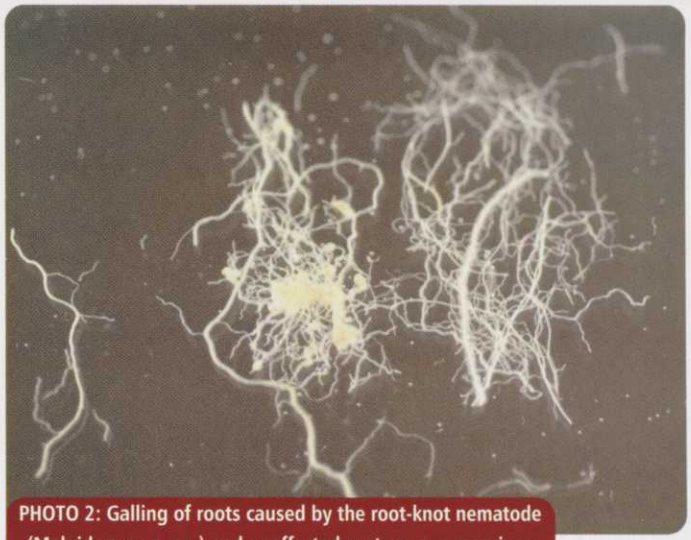

PHOTO 2: Galling of roots caused by the root-knot nematode (Meloidogyne n. sp.) and unaffected roots as a comparison

species (Meloidogyne n. sp.) which is currently being described by an expert in root-knot nematodes.

Now that we know a little more about the root-knot nematodes in general, we can take a look at the independent research that was completed under the direction of Dr Roger Cook at IGER, Wales. The aim of the research was to confirm whether or not the root-knot nematode (Meloidogyne n. sp) identified on the affected greens was the cause of the symptoms seen on the surface of the swards and to see if reducing the population levels of the nematodes present would allow improvement of the overall turf quality.

Three golf courses across the UK and Ireland, that had been affected by these yellow patches for up to four years, agreed to help with this experiment. All of the courses had been seeded with American bred creeping bentgrass cultivars and all had USGA-type rootzone constructions. From each course, 16 hole-cutter core samples were removed to a depth of 10 cm, eight from yellow affected areas and eight from green unaffected areas. All of the sixteen cores were wrapped separately to avoid movement of material between individual cores and to keep the rootzone profile intact. The cores were delivered either on the day of removal from the course or by next day delivery, to the laboratory at IGER. Once received, the cores were removed from their packing and prepared for the experiment. Details of this preparation are available should anyone be interested in reading it but for the purpose of this article, the set-up can be seen in Photo. 4.

A 'cake-slice' sample weighing on average 200g was removed from each of the cores to allow for an assessment of initial nematode population and degree of root galling to be made. Initial readings of turf colour were also recorded. Of the eight affected and eight unaffected cores from each course, half (i.e. four of each) were then treated with a nematicide. The purpose of this was to see if the nematodes that were present could be killed, resulting in subsequent improvement of turf quality and also, if further infections of new root growth could be prevented thereby determining the correlation between the nematode presence and the root galling /sward yellowing symptoms.

Initial assessments of the cores (which had been removed from each golf course by the Course Manger and not by anyone involved in completing this experiment) showed that on all courses, the samples removed from the yellow affected turf areas had populations of Meloidogyne n. sp. nematodes and numbers of root knots far in excess of those found on the green unaffected cores. In fact on two of the three courses there were no nematodes or galls present in the unaffected samples. On the third course, the apparently unaffected cores did have a few nematodes and galls present but their numbers were much less than those present on the yellow infected areas. It was concluded that these initial observations were strong evidence for constant association of nematode and symptom and indicate that this new root-knot

PHOTO 3: The female root-knot nematode inside the root (stained red and with the galled root tissue removed to show her size)

nematode species is the cause of the yellow patch problem.

Root damage was deemed to be so severe at the start of this experiment that any responses to the nematicide treatments in the short term, may have been difficult to determine. At the end of the experiment, there were many undeveloped juveniles in many new galls as well as newly matured females in older galls and newly hatched J2 in the rootzone. The results of the nematicide applications showed that the treatments controlled nematode populations in samples from all courses and reduced the severity of new gall development on new root growth. The experiment showed that controlling the root-knot nematode reduces symptom expression, confirming the conclusion based upon constant association, mentioned above, that these nematodes are the cause of the symptoms as seen.

It is accepted that, since the Meloidogyne n. sp. female is endoparasitic, any possible options for control would be best achieved if they could be applied before the female becomes embedded inside the roots. Once in the root, she is well protected from the treatments applied and therefore, able to continue feeding on the root and reproducing. However, the eggs and juveniles that she produces during her life will, during their early stages, be free-living in the rootzone. At this time, applications of the nematicide would have prevented their further development and subsequent symptom expression on the turf. The use of the nematicide in this experiment was to prove a point – that this new species of the root-knot nematode is the cause of the symptoms as seen. This has been achieved. The use of any nematicide to control this or any other nematode problem on amenity turf in the UK and Ireland is not permitted as no products have approval for use. The product used in this work is extremely toxic and was used under controlled experimental conditions in the laboratory.

So now that we have identified and confirmed the cause of this yellow patch problem on creeping bentgrass greens, how can we best control it? At the moment, the symptoms can be masked by foliar application of nutrients. The nematodes affect nutrient uptake due to their distortion of the roots and so if nutrients can get in to the plant without having to go through the root, the yellowing of the turf will be reduced. Work is ongoing and further research is being planned by Headland Amenity to help Course Managers find practical and lasting control options for this newly identified pest problem on cool season turf. I would like to thank Headland Amenity for allowing me to use some of the information gained from their independent research and for their photographs used in this article.

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All photographs courtesy of Headland Amenity

PHOTO 4: The set-up of the sample cores used for the experiment (before randomisation)

OVERSEEDING Golf Greens

By Henry Bechelet B.Sc (Hons) MBPR, STRI Turfgrass Agronomist, Eastern Region

THAT OLD CHESTNUT

We all want the best possible playing surfaces. For golf, the quality of the putting surfaces takes top priority. The golfer requires firm, fast, true and smooth greens that are receptive to well hit approach shots, that grip then release a chip and also allow a putt to roll out true. For the greenkeeper, we add ease of management to the playing quality. For the sake of argument, I say that better greens come with an increased proportion of the finer grasses. Bents and fescues create firm, fine and fast greens, while annual meadow grass gives good summer surfaces that very often suffer through autumn and winter, being soft and disease prone. I know that it is not entirely true to say that the quality of the surface is dependant on the sward composition, but an increased proportion of the finer grasses does usually bring; improvements in playing quality, a reduction in the propensity to build thatch, improved disease tolerance etc (better surfaces that are easier to manage). The finer grasses are good and must be the object of our intention.

GET REAL

Sometimes I feel that I'm wishing into the wind! Let's just say that we are aiming for predominantly bent and annual meadow grass greens for inland courses and predominantly bent and fescue surfaces for coastal situations. All I aim to do is reduce the level of annual meadow grass that I see and make things better for everyone. It's my job, remember.

WHAT DO YOU KNOW?

In my previous article "Changing the Nature of your Greens" (Greenkeeper International, April 2002 - unedited copies available via email); I tried to explain that the grass composition of golf greens reflects the environmental pressures being placed upon them. These pressures may come from the local climate, the geography of the site, the level of play and of course the greenkeeping management program. With the knowledge that the different fine turf grass species are adapted to survive in different conditions, we can endeavour to create an environment favourable to the finer grasses rather than (as at present) annual meadow-grass. To change the nature of the greens you have to influence the environment to favour the desired grasses. Annual meadow-grass comes with a highly productive and disturbed environment while the finer bents and fescues are left longing for a less productive and more settled situation. The current vogue for maintaining high levels of active growth (as dictated by dubious soil test based fertiliser programs) and regular inconsiderate verticutting using super-effective tungsten tipped verticut reels plays into the hands of meadow-grass dominance. Obviously, there are other factors; if the environment is overriding (poor drainage), or the course is heavily played through the year, then there is little else that you can do but work with the meadow grass and make the best greens possible. This however, is not nearly always the case and a great deal of my work with greenkeepers is involved with resetting the environment to bring the finer grasses – with much success I may add. The great challenge for the greenkeeper is (if possible) to create greens dominated by the finer grasses. Also, let's not forget that one of the reasons why Annual meadow-grass is so invasive is because it is such a cunning seeder (so to speak) – something to take encouragement from.

SO, WHAT ABOUT OVERSEEDING?

Simply changing the environment will encourage the existing finer grasses to flourish and take greater dominance. This process of change may be enhanced and accelerated with overseeding. This article is about successful overseeding. My perception of general opinion regarding overseeding is that it is a total waste of time, effort and money. Many greenkeepers hardly notice a difference achieved by overseeding, let alone the golfers. This lack of success may be due to incorrect overseeding procedure or maintaining the wrong "established environment" i.e. unsuccessful germination or failure to establish. Overseeding (if carried out correctly) can really help improve the quality of our greens.

Common sense!

Successful overseeding is simple, just follow the rules...

- **Choose the correct species for your situation**
- **Choose the best cultivars**
- **Undertake your overseeding at the right time of year during favourable conditions**
- **Create a receptive seedbed**
- **Place the seed correctly *into* the surface**
- **Encourage germination**

- **Nurture the seedlings through establishment to maturity**
- **Manage the correct "established environment"**

SUCCESSFUL OVERSEEDING REQUIRES A SPECIFIC MAINTENANCE PLAN

Introducing new grasses into your greens cannot be achieved by crow barring overseeding into the existing program. Seedlings are small and many are unable to survive in the conditions experienced by the established plant – they need help. You need to approach overseeding with a specific plan. To start with, successful overseeding needs to be founded upon a considerate and patient attitude – young plants need nurture. I'll make sure the golfers appreciate that their consideration is also necessary if the greens are to improve - It's my job, remember.

CHOOSING THE CORRECT FINE TURF GRASS SPECIES

Choose grass species that, when established, actually have a chance of surviving in the environment you are tending. The existing composition of your greens will give you an indication – take a closer look. If drainage is a problem sort it out, then select your preferred grass species. From my previous article, we know that Browntop bent is adapted to survive in fairly unproductive, undisturbed environments possessing satisfactory drainage and preferably an acid soil. Creeping bent requires fairly continuous "active growth" through the year with infrequent levels of disturbance and low levels of stress i.e. a quiet, high quality course set in an environment where play occurs during the growing season and tails off during dormant periods – nice work if you can get it. Velvet bent competes with moderate levels of stress and low levels of disturbance. Red fescue prefers an unproductive, dry, acid environment with low levels of disturbance. Annual meadow-grass likes a highly productive and disturbed environment with low levels of stress. The choice is yours. Basically, in the UK we are looking to favour Browntop bent for inland soil based greens and bent/fescue on for coastal situations (ignoring complicating factors).

CHOOSING THE CORRECT VARIETY OF SEED

Use the science; the STRI cultivar-testing program for amenity grasses has been developed for over 35 years now. Tests are carried out in a number of areas including close mown fine turf. The results of the tests were listed each year in the STRI Turfgrass

OVERSEEDING Golf Greens

Seed booklet now the "2003 Buyers Guide to Quality Amenity Turfgrasses" (produced in conjunction with The British Society of Plant Breeders). The lists within this booklet enable managers of turf to evaluate the different cultivars in terms of colour, shoot density, disease tolerance. This is an excellent trial, which clearly shows how well each cultivar performs under management and wear. You are welcome to view these trials by appointment. Choose top rated varieties, they do perform better. Use a balanced mix of 2-3 cultivars and make consideration to seed coatings and dressings, which may enhance germination and establishment.

TIMING OF OVERSEEDING

The general rule of thumb for overseeding is that it is best carried out in late summer-early autumn when the soil temperature is still high and rainfall adequate for the germination and establishment of new seedlings without experiencing too much environmental stress. Autumn is also a time when the maintenance program begins to tone down, to give the new seedlings a greater chance of surviving. It depends; a spring overseeding will likely germinate the same and establish if allowed, it depends on the intensity of the post-seeding management. Ideally, we should be thinking of introducing the seed when the sward is at its least competitive to give a better chance of establishment. In an annual meadow-grass dominated sward, this may well be during early spring or during the height of summer, which might not be a practical time considering the intensity of play or management. Decide what is best for your situation.

PREPARATION OF THE SURFACE

Before overseeding, the surface must be opened up and turned into a welcoming and protective environment (without unduly disturbing the surface). The surface should be able to accept the seed to the desired depth, be able to permit germination, it should allow the seedling to grow unencumbered and it must also provide protection all-the-way through from establishment to maturity.

The seedbed must be a good growing medium (get rid of thatch it produces stress extremes of wet and dry) - nutrient may be required on sandy materials. The soil must also be open structured to allow rooting to develop (roots grow in airspace), so aerate if necessary.

Bury the seed to prompt germination, aid root penetration and to provide protection for the developing seedling. Work the seed into the turf base/upper soil profile and follow with top dressing. Open the surface by either aerating (hollow tining, micro-hollow tining, solid tining or sarrel rolling) or by opening a channel (slit-seeder or deep scarifying). Overseed at a rate of 35g/m2 for fescue and bent/fescue mixes and at the lower rate of 5-6g/m2 for a pure bent-grass mix. Apply seed in conjunction with top dressing then work into the surface and down tine holes by brushing (brushing by hand is by far the most effective method of working top dressing into the surface). Leaving hollow tine holes partially full (i.e. 1-2mm below the turf surface) gives the seedlings a chance to establish, mature and thicken without being unduly disturbed (cut too close) from regular mowing. This tactic should be used for spring overseeding when the post seeding maintenance is (necessarily) quite intensive.

GERMINATION

Climate dictates germination, so time overseeding appropriately taking heed of the prevailing weather and future forecasts. Germination sheets are available to hasten germination. These require the surface to be covered and are therefore quite disruptive – it depends on your level of commitment. Seed germination takes time so be patient, the weather is in charge.

ESTABLISHMENT

Once the seed has germinated we move into the most important "establishment phase". Be considerate through this period, I am fed up with hearing that the seed germinated well not to see any evidence of it 2 months later. Be easy on the seedlings they are small, vulnerable and need time to strengthen enough to survive the fine turf environment. This will mean toning down the intensity of mowing (raise mowing heights to 6-8mm) and verticutting (don't for a while). To prevent or control thatch build up, it is best that the greens are intensively worked (scarified, hollow tined and top dressed) prior to seeding. Timing may be best in autumn when the maintenance program begins to naturally tone down. Just be considerate and patient, it will come.

GET BACK

Successful overseeding requires a considered plan. You must be able to move your greens from a nurturing environment gradually through to mature intensively maintained fine turf. Don't bother if you are not creating an environment suitable for the finer grasses at the end of it.

Henry Bechelet is an STRI Turfgrass Agronomist covering Eastern England. Henry and the rest of the team may be contacted on: 01274 565131, email: info@stri.co.uk or visit our website: http://www.stri.co.uk

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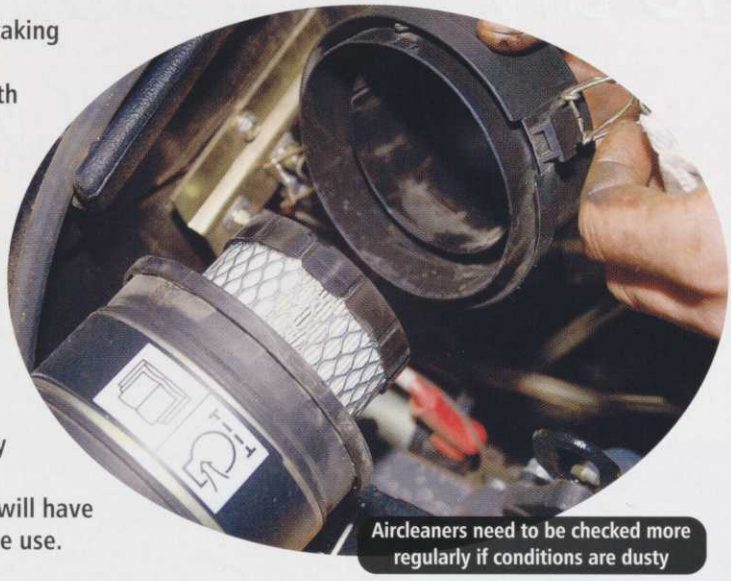
MACHINERY SERVICING

Roland Taylor gives some handy tips which should help you make the most of your machinery this season

My New Year brought with it a heavy head cold. It was while taking various potions to get rid of it, that I got to think how many similarities a piece of machinery, especially the engine, has with the human body.

With that first flush of new growth only a few weeks away, if the equipment has not already been serviced, now is the ideal time to carry out this important work. Modern machinery requires less servicing than in the past, but it is still vital that it is done, as laid down by the manufacturer, if optimum performance is to be maintained.

Bearing in mind my original thoughts, lets first take a look at the heart of all powered equipment - the engine. This component requires the most attention and there are generally four areas of importance, fuel, lubrication, air and coolants - similarly our bodies require all these. A deficiency in any one will have detrimental effects on both our performance and machinery we use.



Aircleaners need to be checked more regularly if conditions are dusty

FUEL

There are two factors that can effect fuel's efficiency, contamination and sell-by-date. Where modern petrol has been left in the engine's fuel system it becomes stale, and may have done considerable damage to the carburettor's components. This is a common reason why an engine fails to start and means the whole system needs to be thoroughly cleaned down and fresh fuel used. In storage it will also go off. A solution to both these problem is to use a fuel additive. This is reasonably cheap and will keep petrol fresh for up to 24 months. It is available from leading engine manufacturers and is worth the investment.

We do not like drinking dirty liquid, nor does an engine. Contamination of fuel can occur in a number of forms. The most obvious one is dirt and this can get into an engine's system via the fuel container and/or the method of filling the tank. Some form of clean filter funnel is required. Water is another agent that could find its way inside a power unit. A by-product of the considerable heat, combustion generates, is condensation. Water can also gain entry via the the fuel supply system.

LUBRICATION

Going back to the comparison between machinery and the human body, our joints need some form of lubrication otherwise we would seize up. But there is a greater problem. When our hands are cold we rub them together and this creates friction, which in turn produces heat. In the context of engineering, two metal surfaces rubbing against each other results in a considerable increase in surface temperature. If this is not dissipated they will eventually become welded together. The main function of oil is to provide a protective film between two surfaces. This keeps them apart so they move smoothly with minimal heat generated. Oil also acts a coolant, helping to disperse the heat. Any changes in this vital film, if left unchecked, could have a number of unpleasant possibilities including poor performance, a reduction in the equipment's life span or a complete seizure. It also causes downtime and, top of the list, costs money. The crazy thing about this situation is that the quantity of oil involved is relatively inexpensive, especially when compared to the bill for, say, a replacement engine. Combustion is a filthy process and generates carbon and moisture coupled to this the ingress of dirt from outside and it is easy to see how polluted and ineffective oil can become. This also applies to other lubricants such as grease.

Lack of a reduction in oil efficiency, due to contamination, decreases the film layer and brings the two surfaces closer together so heat builds up and in turn starts burning off what little oil is left. It is not long before metal is rubbing against metal. Oil needs changing at the recommended times and the levels checked every time a piece of equipment is used. When it comes to oil, saving pence at the expense of quality is definitely false economy.

COOLANTS

For small engines these are water, air or a combination of both. As already mentioned oil also helps to dissipate heat.

From a human point of view we all know how lethargic we become in hot weather if there is nothing to keep us cool. With engines the heat build up results in a decline in performance, more fuel is used and the chances of damage occurring is considerably increased.

AIR

To be efficient, air-cooling requires a large surface area. On engines and hydrostatic systems this is achieved by creating a series of fins. The air is sucked or blown over these by some form of fan. In the event of these airways becoming blocked up with dirt, debris or dried grass the flow becomes restricted and hot spots start occurring. If nothing is done to clear these, then there is every possibility of a fire breaking out.

WATER

This is pumped around a system and into a reservoir (radiator) where air again is used to cool it. The same applies, as far as blocked fins are concerned, the water is then not cooled sufficiently before being returned into the system. Hydraulic oil is dealt with in a similar way. The level of liquid is also critical. If it is too low, then the cooling process becomes highly inefficient.

With both these methods, cleanliness and regular checking of liquid levels (topping up) are key operations.

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AIR FILTERS

With head colds you generally have a stuffed up feeling, it is hard to breathe and one is left thoroughly debilitated. This is what happens with an engine.

In addition to producing correct power output, the air filtration system is a major factor in the level of emissions an engine puts out. An efficient combustion process requires an air and fuel mixture in the right ratios. Less air means more fuel is used and this is emitted into the atmosphere. Another symptom is poor starting. There is also an increased possibility that foreign bodies will enter the engine.

Air filtration systems are generally in the form of paper cartridges often with a pre-cleaning element. Although, in some cases these can be cleaned, for the amount of money they cost, it is better to replace them with new ones. In dry, dusty conditions the elements will need to be checked more regularly and cleaned or renewed. Oil baths are less commonly found. Where they are fitted the level and condition of the oil needs to be constantly monitored.

SPARK PLUGS

Electronic ignitions are virtually trouble free, thank goodness! Some readers will remember contact points and the fiddly process to ensure the gap was set correctly in relation to the pistons top-dead-centre. While these have long disappeared, there is one part of the ignition system that does require attention - the spark plug. Combustion is a dirt process with carbon and some oil being by products. This accumulates around the plug's electrode and as a result reduces the quality of spark and in extreme cases it eliminates it. The symptoms of spark plug problems include poor starting, increased fuel consumption and a considerably reduced performance. In the old days sand blasting was the method of cleaning spark plugs. However much they were cleaned afterwards some minute particles of sand were still retained. These rattling around in the engine, in alloy models quickly heralded its demise. A spark plug is not an expensive component, so badly corroded or worn ones should be dumped and new ones fitted.

OTHER THINGS TO LOOK OUT FOR

Where a recoil starter is fitted, the rope needs to be checked regularly for any signs of fraying or wear. An electric starting system includes a battery that may require inspection. Connectors and terminals will benefit from a smearing of grease.

Having looked at servicing, as far as the power source is concerned, it is time to consider the rest of the equipment. Each machine will have its own specific requirements, but there are areas that are common to all.

At this point it is worth considering overall cleanliness. Because of the types of condition these units are used in there is always plenty of dirt, dust and abrasive compounds around, plus build-ups of debris. It is easy to forget that the modern machine is often a sophisticated piece of technology, built to exacting tolerances and therefore can be easily damaged by the ingression of foreign bodies. For this reason alone, it is wise to keep equipment as clean as possible. This policy also has other spin-offs. It is much more pleasant to operate and work on and there is less chance of a problem being hidden from sight by a layer of grime. In some cases if it has been maintained and kept to a high standard of cleanliness its resale value can be higher than one that has not been looked after. The modern pressure washer is ideal for the job, but beware of forcing water into electronic components.

BLADES

There are a number of possibilities that need consideration when it comes to poorly maintained cutting systems.

- Regardless of the system, the common denominators of all are sharpness and balance.
- Blunt worn or damaged blades are unsafe. An unbalanced unit will set up destructive levels of vibration and is highly dangerous.
- More stress is placed on all the machine's components thus shortening their lives.
- A bigger risk of a major breakdown which will result in down time and inconvenience.
- Increased fuel and oil consumption.
- It takes longer to carry out the work.
- Increased costs.
- Damaged turf, especially the finer grass.
- Higher levels of emissions into the atmosphere and an increase in noise levels.

All blades that are sharpened must also be balanced. Most of us, who drive cars, have at sometime experienced an unbalanced wheel. Whatever the travelling speed, it is not a very pleasant experience and we take immediate steps to rectify it as soon as possible. A rotary blade is spinning at 120mph plus, so if it is damaged or worn and unbalanced it becomes lethal. The vibration generated will eventually shake the machine to bits.

In the case of cylinder mower systems the settings are critical, not only for a quality cut, but also so the grass is subjected to as little stress as possible. A badly adjusted unit, where the reel is too hard onto the bedknife, will give a poor finish, and act like a brake on the engine. Similarly, a cylinder not set close enough to the bedknife will tend to snatch at the grass rather than cut it. This damages the plants and makes them more susceptible to disease. The whole mower is subjected to more stress, the job takes longer and the quality of finish is not acceptable.

After the power source, the sharpness of the cutting system is critical to all round performance.

HYDRAULIC SYSTEMS AND OTHER DRIVES

The cooling of these is similar to that of an engine, so where fins are involved they need to be kept free of debris so the airflow can circulate freely. Check the oil levels regularly and top up if necessary. An inspection should be carried out to ensure all the hose connections are not leaking and there are no signs of them being of chaffed or worn. Spots of hydraulic fluid on the storage area floor or lower levels in the tanks require further investigation.

Where belts or chains are used, they should be adjusted to the correct tension, especially in the case of belts if these are loose they will quickly heat up and can cause a fire.

TYRES & GUARDS

Having the correct tyre pressure is important, if incorrect it could increase ground pressure resulting in compaction. Take a look at treads for signs of wear or 'foreign bodies'. Missing or damaged safety guards should be repaired or replaced.

Having a good service schedule pays dividends across the board.