Revegetation Techniques: the Ways and Means to Protect, Arrestand Repair Erosion

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1 Introduction

Erosion just doesn't happen unless encouraged by mans destruction, or careless maintenance of his environment.

It is well known that in his quest to farm and graze the land, man has effectively destroyed millions of hectares of land because of over grazing and over farming. Much of the damage caused by this activity was further exacerbated by wind and water and may never be repaired.

Erosion is not confined to rural areas. Urban development of roads, mines, quarries, bridges, railways and factories etc, has produced a need to revegetate the areas disturbed by mans progress and in so doing, prevent erosion. In many cases the method of establishing vegetation may be quite simple, since little of the natural topsoil may not have been removed or the area was quite flat and able to be revegetated in the conventional way. Unfortunately in many cases the areas requiring revegetation do not meet this standard and are often steep and lacking in suitable site material and access.

There are techniques available to overcome these problems and this paper will deal with the approaches that can be used. These techniques are not confined to the use of equipment alone but also to the selection of suitable materials to carry out the work. In dealing with materials, selection is also based on the needs of the site. In some cases the area may be part of a National Park and therefore require revegetation using indigenous seed species rather than grass. The techniques to be discussed in this paper are more applicable to urban development but may be used in rural areas.

2 Erosion control techniques

2.1 Hydromulching

The first of the most common techniques is known as Hydromulching and was introduced into the US in 1956. The first commercial operation using this technique did not occur in Australia until November 1969. In this approach a self contained and specially constructed tank is used which agitates a mixture of seed, wood fibre, fertiliser and an adhesive binder. When ready for application this mixture is sprayed out by way of a specially constructed pump onto the area to be vegetated. In this way difficult areas which may be inaccessible even by foot, can be treated.

The advantage of this approach is that the wood fibre retains moisture which in turn assists in the germination of the seed. This is even more important where maintenance watering cannot be carried out due either to inaccessibility of the site or because it is uneconomical due to the size of the area and the need to water by water cart or other mechanical means. Irrigation can sometimes be installed but this too can prove extremely expensive and impracticable.

Though we recommend that any maintenance watering that is carried out should commence at the onset of rain, it sometimes becomes necessary to irrigate if a result is to be achieved.

2.2 Strawmulching

Another revegetation technique that has been in common use throughout the world since the 1950's is Straw Mulching. In this technique, straw or hay is fed into a specially designed machine that chops it up and blows it onto the surface that is to be vegetated. So as to prevent it blowing away, a stream of Bitumen Emulsion is sprayed out at the same time as the straw is blown onto the surface, the straw then adheres to the surface material. It is also possible to apply the straw in one operation followed by an overspray of bitumen or polymer binder. This latter approach is more susceptible to wind damage as it does not tack the straw to the ground surface as well as the one part operation. Prior to this straw application, the area must be seeded and fertilised either by a hydroseeder or by conventional methods.

Each of the two previous approaches can be used in almost all situations requiring revegetation. However some considerations are necessary before making a choice.

These are as follows:

2.3 Hydromulching

(1) This is a one part operation and therefore less expensive than straw mulching. The use of wood fibre acts as a moisture retention agent and is effective in areas where there is regular and reliable rainfall. However it does not provide as much protection against heavy rainfall as does straw mulching.

(2) It is general practice to spray the hydromulch mix from the top of the tank but it is also possible to extend the distance from the machine up to four hundred metres (400m) by using hoses. This is common practice in areas where it is impossible or impracticable to take the machine.

(3) maintenance of the seeded area is limited by the size, the terrain and availability of water. Though it is desirable to water the area, in almost all cases this is impracticable and uneconomical.

The object of this technique is to give the seed the best protection from the elements and provide an environment for the seed to germinate since it cannot be sown by conventional methods. Hydromulch can partly achieve this by the "spray, roll and bury" action of the spray operation. The success of this depends on the soil surface onto which the hydromulch is applied. It is imperative to have some topsoil spread or site cultivation before the hydromulch application.

2.4 Strawmulching

(1) This technique is most suitable for the more arid areas as the straw thatch affords considerable moisture retention and creates suitable growing conditions for the germinating seeds.

(2) During storm periods the straw thatch affords greater protection against heavy rainfall since the thatch helps disperse the raindrops. However it is not infallible in the heavier rainfall areas.

(3) Since the straw is usually tacked down with a bitumen binder it is important to use this process where there is no possibility of overspraying onto houses, cars or public utilities. During the operation the bituminous emulsion is sprayed as a fine mist which drifts considerable distances from the place of operation.

(4) This process can only be carried out during calm weather as high winds will disperse the straw thatch before it reaches the soil surface.

(5) This process is the more expensive of the two as it is a two part operation requiring the seed and fertiliser to be applied as a separate operation to the application of straw and binder.

(6) One drawback to this method is that the maximum distance the straw can be applied away from the machine would be approximately 40 metres.

3 Bio engineering

Where the erosion problems are extreme, techniques other than the use of machinery are employed. Commonly referred to as Bio Engineering, these approaches to stabilisation and revegetation have greatly enhanced the successful revegetation of areas damaged by man's progress.

As was indicated earlier in this paper, we are seeking to establish vegetation in generally steep and inaccessible areas and the techniques used to do this depends not only on the nature of the site, but also, and more importantly, on the choice of seed and fertiliser. Since we can use both pasture and lawn seeds, as well as seeds of native trees, shrubs and groundcovers, care must be taken to select seed that will germinate and survive in the climate and area in which they are sown.

In some difficult areas requiring revegetation, the use of a hydromulch or straw mulch application is not sufficient to protect the area from erosion before the establishment of vegetation is achieved. In these situations we can use erosion control "mats" or "blankets". There are quite a few of these products on the market and I do not propose to either compare or discuss the economics of using one against the other. However, it would be fair to say that whichever type of 'blankets' used, the cost is considerably higher than the straight application of hydromulch or straw mulch. The use of jute mesh, coconut fibre matting, enviromat and other jute, wool and coconut fibre blends, though popular, are expensive. They require labour as they need to be pegged to the ground and/or dug in at the edges. Even though every care is taken in laying these materials , there is still a danger water running underneath them. Since the seeding of the blankets is usually undertaken after the blankets have been laid, and sometimes before, there is still a danger of losing site material underneath the blanket as well as the seed before it has time to establish and bind the soil together. Not all the blankets suffer this fate, however they are vulnerable under extreme weather conditions.

4 Bonded fibre matrix (BFM)

Since all of the revegetation techniques discussed to date are vulnerable to the extremes of wind and rain, a product has been developed that can not only prevent erosion prior to vegetation being established, but can also continue to assist the seed to germinate and at the same time protect the soil surface even after germination has been effected and vegetation is beginning to establish. This product is commonly referred to as Bonded Fibre Matrix. It not only has moisture retention properties far in excess of hydromulch, but also acts as a mat or blanket.

Basically, the material consists of a blend of wood fibre and other ingredients, which not only allow it to be applied as a heavier application through the hydromulcher, but also forms a thick mat on the surface of the soil. Unlike a normal hydromulch application, this application is 5mm to 8mm in thickness, but is still porous. Hence, in heavy storm conditions, the water will run over it but at the same time absorb some of the moisture, thus allowing the seed that is contained within the BFM mix to germinate. Since wood fibre is a well known moisture retentive material, BFM ensures the better short and long term success of the job.It is not intended that the BFM's take the place of a normal hydromulch operation. BFM's can take the place of a blanket, but at the same time are far less expensive-at least 50% to 70% cheaper. Alternatively, it is much more expensive than a hydromulch application, but as explained earlier, a normal hydromulch application would not succeed in a situation where a mat/blanket is required.

The most important feature of using a BFM is that that it can be applied in areas that may be impracticable or dangerous to place a blanket or where no other approach to establishing vegetation is possible.

5 Terraseal

Terraseal, similar to BFM, is intended for use where the site is so steep or inaccessible that little or no topsoil can be placed on it, or any form of cultivation carried out on it. There are many sites like this that continue to erode, causing extensive damage and incurring high costs in cleaning out drainage channels, and repairing collapsed embankments. Though it would appear that little can be done in this situation to establish vegetation and prevent the problem, this is where Terraseal can be used. As with BFM, it is applied as a heavier slurry, but with a difference. Apart from consisting in the main of wood fibre, other organic materials are added to the mix (eg. peat moss) as well as a soil improver. The additional ingredients give the seed a seed bed in which to grow and thrive whilst the soil improver, through the action of alginites, reproduces topsoil over a period of time.

6 Some factors to consider when carrying out a revegetation program seed and fertilizer selection

Since the main object of the revegetation technique is to establish vegetation, the choice of seed and fertiliser is an important consideration.

The use of seed indigenous to the area is of prime importance if it is intended to re establish bush or forest land. However in most cases the germination and ongoing growth of these species is slow and unreliable, therefore it is important to include an annual clover crop in the seed mix.

The same approach would still apply when stabilising steep cut and fill areas with pasture seed. The quick growing annuals will stabilise the site whilst the secondary pasture seeds establish.

When choosing a fertiliser it is important to establish by way of a soil test what the soil lacks in N.P.K. and trace elements as well as organic material. These results will dictate what fertiliser or soil ameliorant is required to achieve a satisfactory vegetation establishment.

7 Conclusion

In conclusion, this paper has concentrated on the approaches available to establish vegetation and thus prevent erosion in both rural and urban environments.

Education is the prime requisite to achieve the knowledge required to carry out revegetation programs and unless people are aware of the techniques and processes available, then our restoration and protection of the environment is in jeopardy.

However, because of man's present concern about our environments and the need for vegetation, we move into the 21st century with far more confidence about the future of our environment than was the case in the earlier period of the 20th century.