HYDROGRASSING and POWER MULCHING

A GUIDE TO METHODS and COST ANALYSIS

Hydrograssing and Power Mulching are common methods for the application of seed, fertilizer, mulch and other ingredients, to temporarily stabilize and permanently revegetate areas disturbed by construction practices.

Today, the methods established by large highway and commercial contractors, have been adopted and are used world wide by a growing number of contractors and governmental agencies for new and maintenance projects for residential housing developments, commercial and industrial construction, golf courses, schools, parks departments, dam and water-way projects, secondary road improvement, interstate highways, strip mines, forestry and landfill reclamation and much more. Whether your application calls for commercial erosion control measures, or creating a lawn, the methods outlined here can provide a basic understanding of the machinery and applications available to the contractor.

Realistically, every application has some criteria, which may apply particular requirements. The versatility of the Reinco Equipment line helps to make equipment selection easier.

Optional equipment makes the machinery available for a variety of alternative applications.

The information provided in this booklet is designed help gain an understanding of the methods most commonly used and the costs associated with each of these applications. The table formulas presented may be adjusted to suit a particular project.

While costs are generally a foremost consideration with any project, the requirements of a given site must be evaluated carefully to select the proper application method(s) and assure the intended results.

Reinco manufactures eight models of Hydrograssers and five models of Power Mulchers, Mulch Discs and tackifier products, allowing the professional contractor to choose the right equipment and materials for the application.

At Reinco we encourage your questions and comments.

Call us at 800-526-7687 to discuss your individual requirements.

UNDERSTANDING HYDROSEEDING METHODS

The following methods are listed as commonly practiced procedures for landscape reclamation and erosion control seeding. Each of the methods described has advantages and limitations. Understanding the options available will help decide which application method is best suited for the requirements of a particular site.

THE ONE STEP METHOD (1SM)

When the word Hydrograssing (hydroseeding or hydromulching) are mentioned, most think of what is referred to as the One-Step Method (1SM). This process, likely the most common hydraulic seeding technique, is so named because all the materials needed to plant seed are mixed and applied in a single spray application. Ideally, a minimum crew and one machine can effectively apply all of the required materials in a single pass.

Pros

The process is clean, quick and ideally suited for relatively small areas. This is often considered a 'Sterile application' where the potential introduction of weed seed is minimized

Cons

The operation is extremely water intensive.
Mulch requires substantial water to become a pumpable slurry and, therefore, limits the coverage capability of any hydraulic seeder. The "rule of thumb" is that for every 40 pounds of fiber mulch loaded, 100 gallons of water is required. The high mineral content of water (hard water) restricts the ability of mulch to slurry quickly, extending mixing times. Mulch materials vary; paper products are fast mixing but may be prone to emulsification, and wood mulches may require longer mixing times. Debris and foreign materials may contribute to mixing problems. Shelf life and storage of materials will affect productivity.
Productivity is the poorest of all the hydraulic seeding methods.
Without ideal conditions Irrigation is often required to initiate and maintain the new growth.
Probably the most significant limitation of the 1SM is the coverage capabilities per tankload. A 1000-gallon working volume machine can broadcast approximately 1/3 of an acre of material at a 1200-1500 lbs. per acre fiber mulch rate. Some specifications will require mulch rates of 3000-4000 lbs. High mulch rates will require sufficient water availability to maximize productivity. It is important to realize that high mulch rates are best applied in consecutive passes, overlaying the previous layers, until the desired mulch application is achieved. As outlined below, this Modified One Step Method requires a single pass with *all materials*, using this initial load to gauge the seed and fertilizer application, and therefore providing close soil contact for the seed and fertilizer, then *consecutive loads of mulch* (and tackifier) to provide the cover. Multiple charges of mulch should be drifted into place to minimize the impact of the slurry water on the seedbed.

Consider a contractor trying to seed a one acre site @ 1200 lbs. fiber rate with a machine that mixes a 250 gallon slurry. If he encounters no problems, he can expect to mix at least 12 batches to complete the one acre site. This scenario does not represent productive equipment utilization, nor is it economical. On the other hand, if the average prepared site footage is between 5,000 and 20,000 square feet, the 1SM will perform for his purpose.

Now consider an operator working reclamation areas with a 3000 gallon working capacity machine, using the same application rate, would be expected to cover up to 8 acres per day. Economies of size are understandable, but as developed later in this analysis, the same crew could seed and mulch up to eight times as much area using the alternate two step method.

Short fiber mulches are minimally effected by wind erosion and ideally should be applied with a quality tackifier; but only at high application rates, do they offer significant protection from the impact of substantial rain. Mulch coverage requirements must be factored with soil types and topography, plant seed selection and contour specifications. Short fiber mulches (hydraulically applied) have seasonal limitations. High

temperatures require high mulch applications. Retention of topsoil moisture depends upon mulch application rates.

THE 'MODIFIED' ONE STEP METHOD (1SMM)

This method originates from DOT regulations requiring assurance of seed contact with the soil. All of the amendments for the slurry are mixed and sprayed with a trace amount of fiber mulch for gauging, or none at all. Subsequently, batches of fiber mulch and tackifier only, are applied over the hydraulically seeded areas. This process is ideal when the site prep work has been completed and the landscaper wants to seed the entire area quickly. Given the granular capacities of most machines, up to one acre or more can be seeded for each 500 gallons of water capacity (working volume). The "mulching" of the areas can be done in the days following the initial seeding. Overall, productivity and costs are slightly more than the 1SM.

This method is also adapted for applications of BFM materials, due to the high material rates, multiple passes are required to place material without disturbing the seedbed, or causing a 'shedding' effect (slope runoff or sliding of materials from water heavy material).

Pros

Better seed contact than the 1SM. The site can be prepared and "seeded" the same day with fiber mulch being broadcast in consecutive loads. The consecutive mulch applications can be broadcast with minimal effect on the seedbed, minimizing the potential of failure during the application.

Cons

Increased water requirements, same as 1SM.

THE TWO STEP METHOD (2SM)

The most significant difference with the 2SM is that fiber mulch is not added to the slurry, reducing the large quantities of water required. An experienced operator can effectively broadcast an acre or more of seed and fertilizer with as little as 500 gallons of water. The increase in productivity becomes obvious. A 1000 gallon working volume machine may now be rated for two acres and a 3000 gallon unit up to six acres.

The second step involves applying hay or straw mulch to the preseeded areas. A second piece of equipment commonly known as a power mulcher is used for this operation. Flakes of bales are thrashed and, by a high velocity air stream carries the mulch to distances up to 100 feet. Applications vary between 3000 and 4000 pounds to the acre. Depending upon selection, (Reinco power mulchers are rated from 2 to 20 tons per hour capacity) this coverage can be very quickly applied to virtually any site.

Pros

The need for refinishing the final site prep may be avoided. The capital equipment investment required to be able to handle jobs of varying sizes may be significantly reduced. In most instances, this is a case where buying two pieces of specialized equipment makes more sense. Additionally, the associated expenses such as truck and body costs are minimized.

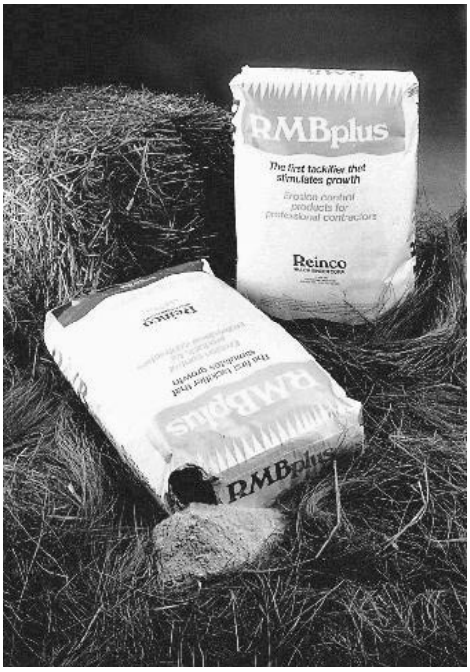
Cons

Hay and straw prices are subject to seasonal price fluctuations, and supply of suitable rectangular bales may be a problem in certain geographic locations. The inherent seed content of some mulches may be undesirable on certain revegetation sites.

Newly applied hay or straw mulches are subject to displacement by the forces of wind and rain, unless properly anchored. Tacking or Crimping are considered for minimizing this displacement potential.

THREE STEP METHOD (3SM)

To minimize the effects of wind and rain, and to keep the long fiber (hay or straw) mulch in place it must be anchored in some manner. Stapled plastic or fiber netting, blankets, and other methods are used, however tacking or crimping are considered the most cost effective. While this adds another step to the process, this step is considered a reasonable 'job insurance'. To repair a washed out site can be significantly more expensive. Mulch is applied to protect the new seedbed from the potential damage caused by the effects of wind and rain impact. Assuring that the mulch is kept in place will minimize any damage resulting from natural causes.



TACKIFIERS

A tackifier is normally an aqueous mixture applied as an over-spray onto hay or straw mulch serving as a bonding medium. The individual strands are stuck or 'tacked' together to form a continuous mat. Tackifier application rates vary with the product but sufficient quantities should be sufficient to prevent the mat from lifting from the prepared soil surface.

Examples of various products and application methods follow.

TAR - EMULSIFIED ASPHALT

With the exception of rain, emulsified asphalt was probably the first tackifier. It is extremely effective in gluing or tacking straw to itself so it forms a temporary protective blanket. Unfortunately, asphalt does a poor job of tacking this blanket to the soil it is intended to cover and instead of blowing away loosely, it tends to roll up like a carpet when a strong gust of wind comes along. High application rates do little to improve this situation. Tar tackifier is applied using specialized equipment. Typical applications require that the Power Mulcher be fitted with a pumping system to deliver the spray directly onto the broadcast mulch. Often overspray applications are required to assure adequate material has been placed.
Some other disadvantages of emulsified asphalt are; Emulsified Asphalt is messy. Atomized particles drift onto nearby vehicles, buildings and machinery. Clean-up is time consuming and expensive. Routine cleanup of the application equipment adds labor costs to the job. Access to the site after application, is prohibited as the tar remains sticky and will adhere to tires, equipment and shoes. Asphalt emulsions are phytotoxic - emulsified asphalt is a petroleum derivative which has been emulsified in water. If improperly applied and the seed is coated completely, the seed can be deprived of the oxygen and moisture it needs to germinate and survive. With tar emulsion's there is a potential fire hazard and it is aesthetically displeasing. High volume applications require heating to keep the emulsion flowable. Because it is a liquid, transportation costs can become prohibitive. Field handling of drums is dangerous and difficult so bulk carriers are often used. Sediments inherent in the emulsion wear on pumping equipment and settle in transport tanks.
Asphalt emulsions are petroleum based products. Concerns of biodegradability have restricted its use in some jurisdictions and outlawed completely in others.
Emulsified asphalt cannot be used as a fiber mulch binder (1SM) as many other tackifiers can.
Cost - Applied cost ranges from about $120 - $600 per acre. Material price ranges from about 80 cents to $1.50 per gallon while application rates vary from 150 - 400 gallons per acre. Handling costs vary with availability.

HYDRAULIC MULCH-FIBER MULCH

Slurried fiber mulch applied at 700-800 lbs per acre, serves as a 'clean' alternative to emulsified asphalt. Approximately 1500-1800 gallons of water will be required to slurry the fiber as described under the 1SM. The wetted fiber cover weighs the hay or straw down, holding the long fiber mulch strands together. A hydrograsser is employed to mix and apply the slurry and cleanup is minimal.

A drawback for fiber mulch as a tackifier is that when the 12,000 to 15,000lbs of water evaporates, the remaining fiber weight has limited holding capability. Paper fiber mulches have the potential of creating a mache effect which provides for better bonding. Care should be taken to avoid matting. When using wood fiber mulches for holding hay and straw, an additional tackifier should be used to promote adhesion of the fibers to the long stalks. Without a tackifier used, the expense of wood or paper cellulose mulches may be prohibitive for use separately as tacking agents.

Fiber mulch manufacturers offer products, which include a tackifier suitable for one step seeding or hay/straw tacking. Originally intended for hydraulic seeding applications (1SM), these fiber mulch applications for hay or straw tacking would still require the 700 to 800 pounds *(or more)* per acre coverage.

LIQUID TACKIFIERS-LATEX-ACRYLIC RESINS

The liquid tackifiers have become popular due to the easy dispersion in water, and ease of cleanup. Little if any agitation is needed, allowing application with equipment designed for asphaltic emulsions, however, care must be given to flush and protect the equipment from rust and residues. Depending upon dilution ratios, these tackifiers may offer superior holding power. Color is usually milky white, and requires inclusion of dyes (or fiber mulch with dye) for placement visibility.

When cured, a water insoluble film is produced. Addition of fiber mulch increases permeability allowing for air and moisture to circulate, as well as serving as a spotting aid. Like asphalt, they are expensive to transport. Latex and acrylic tackifiers may chemically deteriorate if allowed to freeze and therefore, must be shipped in temperature controlled trailers and stored inside.

This liquid group is probably the most expensive. Applied costs can range from $250-$600 per acre. With today's increasing technology, these prices will likely go down significantly as new products are made available.

POWDERED TACKIFIERS

There is a myriad of dry powdered tackifiers available and selection of the best product can be difficult. To begin with, determine the basic ingredient. Each will have inherent performance characteristics. Investigate if the product, when cured, becomes water insoluble.

Plant based mucilage such as psyllium, guar and starches are common materials, and are available in a variety of grades and grinds. Better grades have higher viscosity's and are more expensive. Therefore, viscosity becomes an important measure of comparison. Low-grade guar for example may cost $.50 per pound, and premium grades at six times that.

Vegetable or plant based products may encourage mold and bacteria growth if not kept absolutely dry. Mold inhibits germination and can retard seedling growth. Mucilage's will tend to ball when wetted and become difficult to maintain a homogenous mixture unless carefully incorporated.

Calcined clay products are another prime source of base materials. Again the viscosity index is a good measure of comparison. Clay, by proper particle sizing and blending, can minimize the balling effect of the mucilage's.

A powdered tackifier, to work, must have a polymer incorporated to assure proper curing. The polymer cross-links with the base material resulting in insolubility.

APPLYING TACKIFIERS

Tackifier slurries have become the preferred method of holding long fiber mulches in most applications. A Hydrograsser or tack applicator, can conveniently be employed to mix an over-spray tackifier slurry. The application technique requires only 150-500 gallons of water per acre. Trace amounts of processed fiber mulch is added to provide color for spotting and serves to assure linkage of the tack droplets as they land on the long fiber strands. The tackifier slurry is broadcast upwards over the previously placed hay or straw mulch at low pressures to assure a large droplet sizing. As the droplet lands on the mulch cover, the 'splat' cross-links the strands and secures the blanket to the soil surface. Properly applied, the cured slurry creates a structurally connected mulch blanket.

TACKING BY CRIMPING

With this method the hay/straw mulches are held in place by mechanical means. The mulch is literally punched into the soil. A tractor drawn crimper tool presses the mulch into rows nominally spaced. Typical machines create mini-windrows to break the wind and water flows, however little protection is offered to the areas between. Sharp bladed tools will often cut through the mulch limiting the effectiveness of the desired application.

The Reinco Mulch Disc utilizes flat scalloped coulters to press the strands into the topsoil, then followed by heavy cast iron packer wheels with matched incremental spacing, locks in the crimped mulch strands. The packing feature assures protection for the area between the crimps, while providing a finished appearance to the site. Additional impressions formed by the packer wheels provide pockets to trap water, silt and seed, providing maximum erosion protection. This method is limited to open areas that are level or have gradual slopes. The soil must be loose, friable and free of large rocks or boulders and debris. Crimping speed and ground penetration is controlled by weight. Increasing weight(s) on the machine must be considered to improve crimping speed. Tractor lift capabilities must be suited to the additional weight if utilized.

Crimping is very cost effective under proper conditions, and where alternative methods are not practical.

APPLYING BFM (BONDED FIBER MATRIX MATERIALS)

BONDED FIBER MATRIX PRODUCTS are relatively new to the hydroseeding process and have become an effective alternative to blanketing and other methods where erosion control methods are critical, and applications are difficult or not easily accessible. The material application forms a three dimensional mat protecting the soil surface. BFM's are specified where soil or silt erosion cannot be tolerated. For example, steep slopes with existing vegetation, and where other methods are impractical or ineffective. Similarly, as with the 1SMM (Modified One Step Method), the ‘matrix’ is created by applying the material in a stacking manner, where a high density interlocking mat is formed, thus controlling the moisture at the seed germination zone, and without disturbing the soil texture. Usual applications require the seed and granulars are applied as with the 1SMM (Modified One Step Method) to assure seed to soil contact.

Bonded Fiber Matrix is comprised of a hydroseeding type of mulch, either paper, wood, or combinations, with high volumes of 'bonding agents' (Tackifiers). As with standard hydrograssing mulches, water requirements are high, and effective density of the matrix mixtures are dependent upon operator capability. Curing times with tackifier bonded materials vary with climatic conditions. As with most hydroseeding tackifiers, they are water soluble, therefore 'curing' or 'setting' becomes dependent upon moisture variables. As the tackifier rate is increased, drying (curing) times will relatively increase. Additional moisture, either while mixing, or ambient moisture (ground water or rainfall, even dew) while curing, will dramatically effect the application 'set' times. Mechanically bonded materials include synthetic materials, with tackifier added for water holding capability. Mechanically bonded materials will require minimal or no curing time, dramatically improving application cycle times.

BFM material application rates are usually very high, by comparison to standard hydroseeding applications. Applications of 2000 to 4000 lbs. to the acre are usual for critical areas and will vary with erodable water velocity predictions.

COSTS

Now that we have described the various techniques available to the contractor, and briefly discussed the productivity associated with each method, we can return to the question of costs. For the purpose of this analysis, some assumptions are made for the purpose of calculations. While some figures are assumed, they are relative to the methods applied here. For accuracy, it is recommended that 'Local' costs are prepared and applied to the formulas given.

Assumptions

Site preparation is not considered for these calculations since the factors involved are varied and do not include the use of this equipment.

Selected Hydrograssing and power mulching machinery are estimated at list prices with common options and a factor for freight included. Depending upon your particular model selection, these tables can be adjusted for capacity and coverage capabilities.
Notice that the costs in these tables are based on averages for brand new trucks, tractors and the like. We have learned over the years that it is better to consider new rather than used, in evaluations such as this. If existing equipment is on hand, feel free to adjust the number as your particular circumstance dictates.

While equipment cost values can be varied due to the particular payment program, in effort to simplify these analysis tables, all equipment shown will be considered paid off *(based upon hourly rates)* for the first 750 hours of seasonal usage (estimated 250 hrs. annual usage) including trucks, trailers, seeding and mulching equipment. Depreciation methods are not considered here for simplification purposes.
Depending on equipment selection and site inventories, this payoff can be realized in as little as one season.

The figures here can be adjusted and applied to these tables to meet any desired term. Reinco equipment is designed to last, with most units in service for 15-20 years or more.

No maintenance, fuel, insurance or other such operating costs are considered in this analysis.

For our purpose here, Labor costs are set at $25.00 per man hour.

Water is assumed to be a free commodity. Where certain regulating agencies may charge a nominal fee for accessibility, these figures should be adjusted to include these costs.

At the end of this booklet, just for fun, we'll adjust the figures for a service life of 10 years, assuming some maintenance costs, and see what figures we produce.

EQUIPMENT COSTS

First, look at the equipment pricing. To simplify the analysis, we calculate a purchase price, including common options, a factor for freight and a work inventory of 750 hours including the necessary man hours. Truck pricing is averaged for new equipment. All figures are without financing costs or taxes.

TABLE 1 - HYDROGRASSER COSTS				
EQUIP SIZE	500 GAL	1000 GAL	1500 GAL	3000 GAL
SEEDER	$19,375.0000	$31,650.0000	$46050.0000	$53,200.0000
TRUCK	$27,000.0000	$36,000.0000	$65,000.0000	$75,000.0000
TOTAL	$46,375.0000	$67,650.0000	$111,050.0000	$128,200.0000
Hourly Rate	$61.8333	$95.3967	$158.1927	$185.4840
LABOR	$50.0000	$75.0000	$75.0000	$75.0000
Combined Cost	**$111.8333**	**$165.2000**	**$233.0667**	**$245.9333**

TABLE 2 - POWER MULCHER COSTS				
EQUIP SIZE	**2 TPH**	**5 TPH**	**10 TPH**	**20 TPH**
MULCHER	$ 7,245.0000	$ 15,067.0000	$ 23,100.0000	$ 36,225.0000
TRUCK	$ 27,000.0000	$ 36,000.0000	$ 65,000.0000	$ 75,000.0000
TOTAL	$ 34,245.0000	$ 44,067.0000	$ 88,100.0000	$ 111,225.0000
Hourly Rate	$ 45.6600	$ 58.7560	$ 117.4667	$ 148.3000
LABOR	$ 50.0000	$ 75.0000	$ 75.0000	$ 75.0000
Combined Cost	**$ 95.6000**	**$ 133.7560**	**$ 192.4667**	**$ 223.3000**

TABLE 3 - MISCELLANEOUS EQUIPMENT* COSTS	
EQUIPMENT	**MULCH DISC**
MACHINERY	$ 5,906.0000
TRACTOR	$ 27,000.0000
TOTAL	$ 31,725.0000
Hourly Rate	$ 42.3000
LABOR	$ 25.0000
Combined Cost / Hour	**$ 67.3000**

EQUIPMENT COSTS - SPECIALIZED EQUIPMENT

Specialty equipment is often recommended to mix and apply some products, while most can be applied with conventional hydrograssing machinery. Material to water ratios increase due to the density of the material, decreasing load coverage, and increasing water requirements. One must consider the breadth of work to be performed when selecting a long term equipment investment.

Specialized equipment costs shown are based upon comparative equipment fitted with available optional pump systems. As with the standard Hydrograsser tables, we calculate a purchase price, work inventory, and necessary man hours.

All pricing is averaged using the same formulas as determined in the standard equipment tables.

SPECIALIZED HYDROGRASSER COSTS				
EQUIP SIZE	**500 GAL**	**1000 GAL**	**1500 GAL**	**3000 GAL**
SEEDER	$19,375.0000	$35,547.5000	$53,644.5000	$64,113.0000
TRUCK	$27,000.0000	$36,000.0000	$65,000.0000	$75,000.0000
TOTAL	$46,375.0000	$71,547.5000	$118,644.5000	$139,113.0000
Hourly Rate	$61.8333	$95.3967	$158.1927	$185.4840
LABOR	$50.0000	$75.0000	$75.0000	$75.0000
Combined Cost	**$111.8333**	**$170.3967**	**$233.1927**	**$260.4840**

Should you be satisfied with a lower return on investment, or alternately wish to consider an extended term, these calculations can be modified to suit your individual requirements.

MATERIAL COSTS

Next, a summary of material cost associated with the different methods are tabulated on a per acre basis. Pricing for products vary dramatically, based upon availability, site requirements and product applications. The product pricing used here is based on average minimum per acre material costs.
Freight and handling costs are not included.

ONE STEP SEEDING - 1SM

MATERIAL COSTS PER ACRE - 1SM			
MATERIAL	**QTY (LBS)**	**UNIT COST**	**EXTENDED COST**
SEED	200	$2.0000	$400.0000
FERTILIZER	500	$0.1400	$70.0000
FIBER MULCH	1,200	$ .1200	$80.0000
TACKIFIER	100	$ .0800	$ 80.0000
Combined Cost/Acre			**$ 694. 0000**

TWO STEP SEEDING - 2SM

MATERIAL COSTS PER ACRE - 2SM			
MATERIAL	**QTY (LBS)**	**UNIT COST**	**EXTENDED COST**
SEED	200	$2.0000	$400.0000
FERTILIZER	500	$0.1400	$70.0000
STRAW MULCH	3,000	$ .0450	$ 135.0000
Combined Cost/Acre			**$ 605. 0000**

THREE STEP SEEDING - 3SM

MATERIAL COSTS PER ACRE - 3SM			
MATERIAL	**QTY (LBS)**	**UNIT COST**	**EXTENDED COST**
SEED	200	$2.0000	$400.0000
FERTILIZER	500	$0.1400	$70.0000
STRAW MULCH	3,000	$ .0450	$ 135.0000
TACKIFIER	100	$ .0800	$ 80.0000
Combined Cost/Acre			**$ 700. 0000**

BONDED FIBER MATRIX - BFM

MATERIAL COSTS – BFM			
MATERIAL	**QTY (LBS)**	**UNIT COST**	**EXTENDED COST**
SEED	200	$2.0000	$400.0000
FERTILIZER	500	$0.1400	$70.0000
BFM	3,000	$0.5500	$1,650.0000
Combined Cost/Acre			**$2,120.0000**

It is recommended that local material sources be consulted for actual job requirements.
The costs listed are averaged and will vary significantly depending upon availability and types of products used.

FULLY BURDENED COSTS

ONE STEP SEEDING - 1SM

To establish a cost per square foot, we combine the hourly equipment rates (Tables One to Three) with the material acre costs. For calculation purposes, the cycle times listed for Hydrograssing (tankload charging and discharging) is assumed to be one (1) hour, regardless of equipment capacity.

COST CALCULATIONS - ONE STEP SEEDING - 1SM				
EQUIP SIZE	**500 GAL**	**1000 GAL**	**1500 GAL**	**3000 GAL**
CHARGES / ACRE	6	3	2	1
EQUIP RATE/ HR	$ 111.8333	$ 165.2000	$ 233.0667	$ 245.9333
EQUIP RATE/ ACRE	$ 670.9998	$ 495.6000	$ 446.1334	$ 245.9333
MATERIAL COST/ACRE	$ 694.0000	$ 694.0000	$ 694.0000	$ 694.0000
TOTAL COST/ ACRE	**$ 1,364.9998**	**$ 1,189.0000**	**$ 1,140.1334**	**$ 939.9333**
The per acre costs are further broken to square footage costs (Total cost divided by 43,560 sq. Ft.)				
Cost per Square Foot	**$ 0.0313**	**$ 0.0273**	**$ 0.0262**	**$ 0.0216**

MODIFIED ONE STEP SEEDING - 1SMM

COST CALCULATIONS – MODIFIED ONE STEP SEEDING - 1SMM				
EQUIP SIZE	**500 GAL**	**1000 GAL**	**1500 GAL**	**3000 GAL**
CHARGES / ACRE	7	3.5	2.2	1.13
EQUIP RATE/ HR	$ 111.8333	$ 165.2000	$ 233.0667	$ 245.9333
EQUIP RATE/ ACRE	$ 782.8331	$ 578.2000	$ 490.7467	$ 277.9046
MATERIAL COST/ACRE	$ 694.0000	$ 694.0000	$ 694.0000	$ 694.0000
TOTAL COST/ ACRE	**$ 1,476.8331**	**$ 1,272.2000**	**$ 1,184.7467**	**$ 971.9046**
The per acre costs are further broken to square footage costs (Total cost divided by 43,560 sq. Ft.)				
Cost per Square Foot	**$ 0.0339**	**$ 0.0292**	**$ 0.0272**	**$ 0.0223**

Note that the modified one step seeding application requires approximately 500 gallons of additional water to first apply the seed and fertilizer. The recurring applications increase water requirements relative to the mulch application.

TWO STEP SEEDING - 2SM

To determine the fully burdened costs using the 2SM, the results derived from the following tables must be combined based upon the Hydrograsser and Power Mulchers selected. Pairing of equipment is arbitrary, and should be adjusted to meet your situation. For our purposes here the selections are based upon capacities.

In this application Hydrograsser costs are calculated to apply the seed and fertilizer requirements only.

COST CALCULATIONS - TWO STEP SEEDING - 2SM				
TABLE 1 - HYDROGRASSER COSTS				
EQUIP SIZE	**500 GAL**	**1000 GAL**	**1500 GAL**	**3000 GAL**
CHARGES / ACRE	1	.5	.33	.16
EQUIP RATE/ HR	$ 111.8333	$ 165.2000	$ 233.0667	$ 245.9333
EQUIP RATE/ ACRE	$ 111.8333	$ 82.6000	$ 73.6120	$ 39.3493
MATERIAL COST/ACRE	$ 694.0000	$ 694.0000	$ 694.0000	$ 694.0000
TOTAL COST/ ACRE	**$ 805.8330**	**$ 776.6000**	**$ 767.6120**	**$ 733.3493**
Cost per Square Foot	**$ 0.0185**	**$ 0.0178**	**$ 0.0176**	**$ 0.0168**

Power Mulcher costs are then calculated to apply the mulch requirements.

TABLE 2 - POWER MULCHER COSTS				
EQUIP SIZE	**2 TPH**	**5 TPH**	**10 TPH**	**20 TPH**
HOURS / ACRE	.75	.33	.167	.008
EQUIP RATE/ HR	$ 45.60	$ 58.7560	$ 117.4667	$ 148.3000
EQUIP RATE/ ACRE	$ 34.2450	$ 19.3895	$ 19.6169	$ 1.1864
MATERIAL COST/ACRE	$135.0000	$135.0000	$135.0000	$135.0000
TOTAL COST/ ACRE	**$ 169.2450**	**$ 154.3895**	**$ 154.6169**	**$ 136.1864**
Cost per Square Foot	**$ 0.0039**	**$ 0.0035**	**$ 0.0035**	**$ 0.0031**

Costs are then combined for totals.

COMBINED COSTS - TWO STEP METHOD				
HYDROGRASSER	**500 GAL**	**1000 GAL**	**1500 GAL**	**3000 GAL**
POWER MULCHER	**2 TPH**	**5 TPH**	**10 TPH**	**20 TPH**
SEEDING COST/ FT^2	$ .0185	$ .0178	$ .0176	$ 0168
MULCHING COST/ FT^2	$ .0039	$ .0035	$ .0035	$ .0031
COMBINED COST/ FT^2	$.0224	$ .0213	$.2110	$ .0199
TOTAL COST/ ACRE	**$ 975.7440**	**$ 927.8280**	**$ 919.1160**	**$ 866.8440**

THREE STEP SEEDING - 3SM - TACKING

Total costs associated with the 3SM are harder to present than the other methods due to the variety of tacking options available.
Today, tacking is routinely applied with a Hydrograsser tackifier slurry, and our presentation will be adjusted to follow this thought process.

By taking the average cost of the 2SM from the preceding table;

COMBINED COSTS - TWO STEP METHOD				
COMBINED COST/ FT^2	$.0224	$ .0213	$.2110	$ .0199
TOTAL COST/ ACRE	**$ 975.7440**	**$ 927.8280**	**$ 919.1160**	**$ 866.8440**

and adding the calculations associated with the third step, we can calculate total 3SM costs.

This table considers the costs for using fiber mulch as a tackifier.

TACKING COSTS - 700 lbs. FIBER MULCH				
EQUIP SIZE	**500 GAL**	**1000 GAL**	**1500 GAL**	**3000 GAL**
CHARGES / ACRE	3	1.5	1	.5
EQUIP RATE/ HR	$ 111.8333	$ 165.2000	$ 233.0667	$ 245.9333
EQUIP RATE/ ACRE	$ 335.4900	$ 247.8000	$ 233.0667	$ 122.9666
MATERIAL COST/ACRE	$ 84.0000	$ 84.0000	$ 84.0000	$ 84.0000
TACKING COST/ ACRE	**$ 419.4900**	**$ 331.8000**	**$ 307.0667**	**$ 206.9666**
TACKING COST/ FT^2	**$ .0096**	**$ .0076**	**$ .0070**	**$ 0.0047**
COMB. 2SM COST/ FT^2	$.0224	$ .0213	$.0211	$ .0199
COMB 3SM COST/ FT^2	**$ .0320**	**$ .0289**	**$ .0281**	**$ .0246**
COMB 3SM COST/ ACRE	**$ 1,393.9200**	**$ 1,258.8840**	**$ 1,224.0360**	**$ 1,071.5760**

Now consider a slurry application using RMB-plus tackifier.

TACKING COSTS - RMB-plus Tackifier Slurry				
EQUIP SIZE	**500 GAL**	**1000 GAL**	**1500 GAL**	**3000 GAL**
CHARGES / ACRE	.5	.25	.13	.06
EQUIP RATE/ HR	$ 111.8333	$ 165.2000	$ 233.0667	$ 245.9333
EQUIP RATE/ ACRE	$ 55.9150	$ 41.3000	$ 28.9987	$ 14.7500
MATERIAL COST/ACRE	$ 86.0000	$ 86.0000	$ 86.0000	$ 86.0000
TACKING COST/ ACRE	**$141.9150**	**$ 127.3000**	**$ 114.9987**	**$ 94.7500**
TACKING COST/ FT^2	**$ .0033**	**$ .0029**	**$ .0026**	**$ 0.0022**
COMB. 2SM COST/ FT^2	$.0224	$ .0213	$.0211	$ .0199
COMB 3SM COST/ FT^2	**$ .0257**	**$ .0242**	**$ .0237**	**$ .0221**
COMB 3SM COST/ ACRE	**$ 1,119.4920**	**$ 1,054.1520**	**$ 1,032.3720**	**$ 962.6760**

THREE STEP SEEDING - 3SM - CRIMPING

With mechanical anchoring, the formula here adjusts the final step with relation to equipment and labor costs. No material costs are required to be added for this process. Ground speed is dependent upon the soil type and conditions. A well tilled seedbed will crimp faster than hard compacted areas. Rocks and debris will prohibit proper operation and potentially damage the crimping tool. Routinely an acre of ground can be crimped in one hour.

COMBINED COSTS - 3SM - Crimping				
EQUIP RATE/ ACRE	$ 67.3000	$ 67.3000	$ 67.3000	$ 67.3000
TACKING COST/ FT^2	**$ .0015**	**$ .0015**	**$ .0015**	**$ 0.0015**
COMB. 2SM COST/ FT^2	$.0224	$ .0213	$.0211	$ .0199
COMB 3SM COST/ FT^2	**$ .0239**	**$ .0228**	**$ .0226**	**$ .0214**
COMB 3SM COST/ ACRE	**$ 1,041.084**	**$ 993.1680**	**$ 984.4560**	**$ 932.1840**

BFM APPLICATION

Again using the formulas given for the hydroseeding tables, we can figure our combined or fully burdened costs. As noted in the equipment cost tables, applications using BFM products would normally follow the 'Modified One Step' method costing formulas, with the required charges per acre, adjusted to correspond with material requirements. We consider two scenarios, one with conventional equipment, the other using specialized machinery. Both applications suggest a material application rate of 3000 lbs.

COST CALCULATIONS - BFM Application - Conventional Equipment				
EQUIP SIZE	**500 GAL**	**1000 GAL**	**1500 GAL**	**3000 GAL**
CHARGES / ACRE	15	7.5	5	2.5
EQUIP RATE/ HR	$ 111.8333	$ 165.2000	$ 233.0667	$ 245.9333
EQUIP RATE/ ACRE	$ 1,677.4995	$ 1,239.0000	$ 1,165.3335	$ 614.83325
MATERIAL COST/ACRE	$ 2,120.0000	$ 2,120.0000	$ 2,120.0000	$ 2,120.0000
TOTAL COST/ ACRE	**$ 3,797.4995**	**$ 3,359.0000**	**$ 3,285.3335**	**$ 2,734.8333**
Cost per Square Foot	**$ 0.0872**	**$ 0.0771**	**$ 0.0754**	**$ 0.06278**

Where specialized equipment may reduce material to water ratios for some products, we will consider equal proportions for our cost purposes.

COST CALCULATIONS - BFM Application - Specialized Equipment				
EQUIP SIZE	**500 GAL**	**1000 GAL**	**1500 GAL**	**3000 GAL**
CHARGES / ACRE	15	7.5	5	2.5
EQUIP RATE/ HR	**$111.8333**	**$170.3967**	**$233.1927**	**$260.4840**
EQUIP RATE/ ACRE	$ 1,677.4995	$ 1,277.9753	$ 1,165.9635	$ 651.21
MATERIAL COST/ACRE	$ 2,120.0000	$ 2,120.0000	$ 2,120.0000	$ 2,120.0000
TOTAL COST/ ACRE	**$ 3,797.4995**	**$ 3,397.9753**	**$ 3,285.9635**	**$ 2,771.2100**
Cost per Square Foot	**$ 0.0872**	**$ 0.0780**	**$ 0.0754**	**$ 0.0636**

Where earlier it had been discussed that One Step Hydroseeding (1SM) and Modified One Step (1SMM) are considered the most expensive applications, costs for applying BFM products are averaged at 2-1/2 to 2-3/4 times higher.

Where economics are a factor, usage may be prohibitive, therefore limiting applications to highly sensitive site work.

Each method has its place, and the successful contractor must know when to use it effectively.

COST SUMMARY

Finally, what does it all mean?

It is obvious that the least expensive seeding method is the **2SM**. But we are not talking about fractions of cents.

The savings offered with the 2SM of between $73.00 to $389.00 on a per acre basis, as compared to the 1SM is significant, to say the least!

When these figures are considered at 250 Acres a year average seasonal usage ($73.00 x 250 = $18,250.00 or $389.00 x 250 = $97,250.00).

We can also see substantial savings using the three step processes. A point that should be made during this analysis is that using any anchoring method is an additional expense and there are conditions for which the effectiveness of the application are dependent. Anchoring applications should be considered as an 'insurance policy'. The costs associated with reseeding a washed out job far exceeds the expense of a quality anchoring application.

The point we hope to promote here is that in many instances, it makes more economical sense to revegetate sites using the multi-step methods and often utilizing a combination of methods. The savings is not only in cost per square foot but also in productivity!

It is worthwhile to repeat, that each method has its place, and the successful contractor must know when to use it effectively.

MACHINE SELECTION AND PRODUCTIVITY

The contractor considering the purchase of Hydrograssing and Power Mulching equipment must ask the following questions;

⇒ What kind of seeding jobs do I have?
⇒ What is my average job size?
⇒ How much of the site will be ready for seeding and mulching on any given day?
⇒ Do I need to combine methods to achieve the best potential results?
⇒ What machine sizes fit best for the work I want to do?

CHOOSE YOUR SEEDING METHOD
We have shown that the lowest cost seeding method is the 2SM. Certainly, many areas can be seeded this way. Some sites with higher erosion potential from wind and water demand the use of the 3SM. Projects requiring low weed seed introduction dictate using the 1SM. Highly critical areas may justify the expense of BFM application. Revegetation equipment selection is based on seeding method used and projected inventories of site work. Each site and the application methods selected should be scrutinized to provide the intended results.

Large Area Reclamation -
Reforestation, landfills, strip mines, hydroelectric plants and pipeline projects fall into this category. This kind of work often lends itself to the 3SM. Due to high wind erosion potential, most of this work is over sprayed with tackifier. Crimping of large flat areas are considered where soil conditions permit. Highly critical slope areas would recommend BFM applications.

Small Area Reclamation -
Commercial construction sites such as manufacturing plants, communication towers, or haz-mat cleanup projects support the use of the 3SM. Wind erosion is normally not a concern, however steep slopes and swales are over sprayed with tackifier, as insurance against the effects of rain and wind.

Temporary Soil Stabilization -
To comply with the requirement of the Clean Air and Water Act, contractors must prevent erosion or sedimentation of excavated areas. Many have found the most cost effective route to follow is seeding the disturbed areas with a quickly germinating seed such as annual rye and then mulching with hay or straw. The 2SM is one of the quickest and least expensive ways to comply with regulatory agency requirements

Highway Construction -
Secondary road improvement, right-of-way utility work and new highway construction all lend themselves to the 3SM. Again, displacement of the mulch blanket by wind is a concern, much of this work is subject to DOT specifications which dictates the actual seeding process used. Highly critical slope areas would recommend BFM applications.

Residential Construction Projects -
Condominium, apartment and housing development
final seeding can be effectively done with the 2SM. Normally the areas under consideration are large enough that the low output rate associated with the 1SM proves undesirable. Many contractors limit their daily production to only those areas that can be prepared, seeded and power mulched all in the same day.

Residential Landscaping -
Jobs, which are small enough to allow a contractor to do finishing site work and 1SM seeding all in the same workday, allow better utilization of labor resources. Typically, only a two-man crew is required. Additionally, the “blanket of green” aesthetically pleases the homeowner. It should be noted also that the 1SM limits the potential for weed seed introduction. An obvious long-term advantage is in minimized weed control treatments.

It should be realized that the 2SM or 3SM might be utilized under circumstances where economy and productivity are factors.

JOB SIZE

Once determining the seeding method you will normally use the proper equipment to accomplish the average job must be selected. Keep in mind future growth potential of the revegetation work. Lets look at two different scenarios.

SITE DEDICATED EQUIPMENT

Many times jobs are large or long enough in duration to justify the purchase of dedicated equipment to be used only during the life of the project. Long-term projects may only have 20,000 square feet to be seeded each day. To buy equipment capable of 10 acres per day is wasteful.

Analyze the actual area expected to be revegetated and convert the data to acreage per day requirement. Keep in mind that in most areas of the world, seeding cannot occur on a daily basis. Pick the size of crew you want to dedicate to the equipment and make your machine selections based on required daily output.

CONTRACTOR EQUIPMENT

A contractor must pull out his "crystal ball" and anticipate what kind of work he expects to get. He must still consider the actual square footage requirements needed on a daily basis. Additionally, he must be able to handle the peaks and valleys associated with the seasonal requirements of his business.
Having decided which seeding method will be used makes this decision easier.

Adequate thought should be given to the size of the crew required to prepare the site(s) for seeding while minimizing machine idle time. Choosing a machine that is too big is just as distasteful as one, which is too small. Reinco offers a full range of models to suit nearly any application. Combining equipment may make the most sense regarding cost and productivity.

Finally, keep in mind any unique requirements associated with the type of work you do.

* Is water and/or materials availability a problem?
* What kind of spray range do you need?
* Are you doing work in flat or steep terrain?
* Do you need to get in and out of a job in a single day?
* Do you need to seed multiple sites in the same day?

MACHINE PRODUCTIVITY

The following tables show expected capacity per 8 hour working day. The crew sizes and cycle times are the same as in the preceding chapter. The annualized ratings assume 250 hours a year operation.

HYDROGRASSER PRODUCTIVITY						
WORKING VOLUME	ACRES / DAY			ACRES / YEAR		
	1SM	2SM	3SM	1SM	2SM	3SM
500	1.3	8	4	41	250	125
1000	2.7	16	8	84	500	250
1500	4	24	12	125	750	375
3000	8	48	24	250	1500	750

POWER MULCHER PRODUCTIVITY				
MACHINE RATING	ACRES / DAY		ACRES / YEAR	
	1.5 TPA	2 TPA	1.5 TPA	2 TPA
2 TONS PER HOUR	11	8	333	250
5 TONS PER HOUR	27	20	833	625
10 TONS PER HOUR	53	40	1666	1250
20 TONS PER HOUR	107	80	3333	2500

PICK THE RIGHT COMBINATION

Make your Hydrograsser selection using the preceding tables based on the minimum number of acres you want to seed in any given day. Balance this choice with any other special considerations that may apply.

Review truck capacity requirements and determine if moving up to the next machine size makes sense. Many times the cost of the next large unit is minimal relative to the total outlay of capital.
Special requirements such as water availability or required spray range may force the purchase of an alternate unit.

If you will be using the 2SM or 3SM, match a power mulcher to the rated capacity associated with the Hydrograsser of your choice. Again, range requirements may force the selection of an alternate unit.