

The logo for FALC, consisting of the letters 'FALC' in a bold, white, sans-serif font inside a black rectangular box.The logo for HOWARD, featuring a stylized four-pointed star icon to the left of the word 'HOWARD' in a bold, black, sans-serif font, with a registered trademark symbol (®) to the right.

## *Rotavation in a Biological/Organic Farming System*

### Let's Talk

Rotavation has long been preferred by biological/organic farmers because of the ROTAVATOR'S unique working characteristics that complement the tillage objectives that are so necessary to enhance biological life in the soil. What a ROTAVATOR does better than any other tillage tool, is controlled shallow tillage. The adjustable features in the HOWARD ROTAVATOR allow the operator to control how much tillage is done to the soil in one pass as well as the precise depth of that tillage.

The HOWARD ROTAVATOR is the most versatile tillage tool made because it is the most adjustable. Adjustability is a double edge sword in that if the operator has not examined the conditions and clearly defined the objectives and adjusted the ROTAVATOR appropriately to meet the tillage objectives, there is a great likelihood that the operator will be doing more tillage than what is really necessary. The objective when setting a ROTAVATOR should be to work the soil as little as possible in one pass, but still meet the desired objective.

Before discussing those adjustable features in a ROTAVATOR that allow the operator to precisely control tillage, it is important to understand the origin of rotary tillage. Most people think that rotary tillage mysteriously appeared in a garden one day, and was then applied on a larger scale to general or specialty farming. In fact the opposite is true.

In 1912, A.C. Howard, an Australian farmer, built the first conservation tillage tool ever made. His radical approach to tillage was to design a machine to utilize power more efficiently than a moldboard plow, to apply engine power directly to the soil thru his 'Hoe Blade'. A plow is a draft tillage tool that requires a significant pulling effort and traction. A.C. Howard's ROTAVATOR was the first tillage tool in the world to 'push' the tractor, and to operate at a shallow depth. It was the first tillage tool to break virgin ground, to bring it into production without turning the soil over. A.C. Howard's "Rotary Hoe" was designed to undercut all unwanted grass, weeds, brush and root structure free from the topsoil and leave the residue and root mass on the surface so the sun and wind could kill the vegetation. The ROTAVATOR was more effective with this objective than any other tillage tool in 1912 and retains that advantage today. The initial worldwide acceptance of the HOWARD ROTAVATOR was because of its unique ability to kill unwanted vegetation, not because of its ability to make a superior seedbed.

The 1922 HOWARD ROTARY HOE had a 60 HP Buda diesel engine and a 15-foot cutting width. The hoe type blades had no metal shielding above or behind the rotating blades to interfere with soil flow. The early design was intended to leave vegetation on the surface so the sun and wind could kill that vegetation. As objectives changed, and the ROTAVATOR evolved to meet tillage demands throughout the world, shielding was added. In the late 1930's fixed shielding was added above the rotating blades, as well as an adjustable top hinged soil tilth shield to contain the flow of material out the rear. Shielding around the rotating blades is a safety requirement today but the rear soil shield is still hinged high on a ROTAVATOR so that it can be in a fully raised position or even removed to allow free flow of soil and residue out the back of the machine to meet killing and conservation objectives.

The adjustable features which make the ROTAVATOR the most versatile tillage tool made are blade selection, rear soil shield adjustment, positive depth control adjustment, and tilth adjustment which is determined by blade cuts per linear foot.

Blades are essentially either a "C" shape which has a gradual bend to the blade, or an "L" type which has a distinct 90 degree bend. The "L" blade was the first blade Mr. Howard developed where precise shallow tillage was the objective. The "L" blade allows the operator to set the blade to run as shallow as one inch, maintain a constant one-inch tillage depth and undercut all vegetation at that depth. The "C" blade was developed for use in very tough residues (i.e.: cornstalks in the fall) and/or in moist, sticky or spongy soil conditions. The "C" bladed rotor is a more open rotor allowing moist, sticky soils to flow in and out of the rotor faster. An "L" bladed rotor is more closed, not allowing the soil to escape so quickly thereby inviting the soil and residue to go around the rotating blades on another ride and work the soil more. Very heavy residues and tough green cornstalks can sometimes fold over the cutting edge a blade in moist or spongy soil conditions because the blade can't cut the residue. The same problem occurs with tillage tools which have coulter blades

or disks where the cutting effect is greatly diminished when the ground is not firm to act as a chopping block to give a cutting edge something to cut against. In high residue and soft or spongy soil conditions, residue is more likely to slide off of the "C" blade than the "L" blade. For this reason, we call the "C" blade the speed blade because it is the best general purpose agricultural blade that takes the least amount of power in a broad spectrum of tillage conditions.

The "L" blades are used almost exclusively for very shallow tillage where the object is to move all the soil at a very shallow depth or to undercut roots at a uniform depth. The "C" blade running shallow leaves a pyramid shaped area of soil underneath the rotor flange that is not moved. When the ROTAVATOR is used to kill vegetation, the "C" blade must be set to run deeper than the "L" blade in order to undercut the vegetation. For use in stony or rocky conditions, both blades may be fitted with an optional double flange kit, which is designed to increase the holding capacity of the blade bolt and give additional strength to the shank of the blade. Both blades are guaranteed against breakage until they are half worn out providing the rotor is bladed properly and the blade bolts are kept to torque specifications.

The rear soil shield on a ROTAVATOR should be fixed in the fully raised position at the start of any tillage operation and only lowered by degrees if it is found necessary to better serve the tillage objective in the condition present. The shield in the fully raised position allows the free flow of soil residue, and roots out the back of the machine. The material is thrown up into the air where the soil tends to land first with the lighter residue and root mass on the surface. The shield in the raised position allows for a courser tilth and the least amount of power expended. Any time the shield is lowered, it starts to interfere with the free flow of the soil out the back of the ROTAVATOR. The shield down contains the soil and residue, mixing all materials throughout the depth of tillage. Anytime the shield is down, you are tilling the soil more than if the shield were in the fully raised position and because you are working the soil more, it will take more power. If the soil is moist and/or if there is an exceptional amount of tough residue, it may be necessary and desirable to make the first trip through the field with the soil shield in the fully raised position to get plenty of air into the soil so it will dry out and warm up. Adjusting the ROTAVATOR to till deeply with the rear shield down (especially in moist soil) is a certain cause for a malaise appropriately named "Rotavator Constipation" and this frustrating condition is to be avoided at all times.

Depth control on a ROTAVATOR is either with depth control skids, depth control wheels or an optional depth control roller. Wheels should be used whenever moist soils are worked so that in combination with a raised rear soil shield the soil is thrown up in the air to land lightly to invite maximum air infiltration to dry the soil out and warm it up. An optional depth control roller should only be used in a dry soil condition to level and firm the seedbed to reduce air infiltration and minimize moisture loss. The depth control roller is sometimes counterproductive to killing roots. The roller will tend to push the roots back down into the freshly tilled soil where they stand a greater chance of re-growing. If the objective is to kill as much vegetation in one pass, wheels should be used with the rear shield in the fully raised position to allow better separation of soil and roots by throwing the material up in the air which allows the soil to land first with the lighter material on the surface where the sun and wind stands the best chance of working in your favor. When the objective of the ROTAVATOR is to kill vegetation, the idea is to go as shallow as possible and not disturb the soil underneath the root mass so as to reduce the likelihood that the roots will be diluted in a greater volume of soil when they land lightly behind the ROTAVATOR. Fields should always be left as level as possible so that the blades can go as shallow as is possible to cut under the root mass. Uneven fields such as those that have been moldboard plowed, chisel plowed, or offset disked, require deeper cultivation with other tools and possible multiple trips in order to undercut the vegetation and/or move enough soil to level the ground. Tilth is controlled by the patented Select-A-Tilth gearbox and the forward travel speed of the tractor. The Select-A-Tilth gearbox allows the operator to select a blade speed that is the most correct for the existing conditions and his tillage objectives. This quick change gearbox allows a multitude of different blade speeds that in combination with different forward travel speeds will produce various blade cuts per linear foot. Blades cuts per foot in combination with the rear soil shield adjustment will produce either a fine or course tilth. The objective should always be to do as little to that soil as is necessary but consistent with the objectives for that single pass. If conditions and objectives allow faster forward travel speeds the Select-A-Tilth gearbox allows the blades to turn faster to keep up with the increased speed of the tractor so as to produce the same result obtained at the slower travel speed. Most ROTAVATORS can be equipped with either four or six blades per flange with six blades being standard for use in heavier soils to produce a seedbed tilth. When setting a ROTAVATOR, the objective should always be to do as little to the soil as is necessary in addition to completing the work as fast as possible.

Farmers often ask what other tillage tool they might need in combination with a HOWARD ROTAVATOR. A ROTAVATOR can take the place of a shedder (shedders are used because many tillage tools cannot work in heavy residue conditions) a moldboard plow, a chisel plow, and offset disk and a finishing disk. The ROTAVATOR will do a better job of handling heavy crop residue than any of these other tillage tools without the need to shred. The ROTAVATOR will handle a broader range of soil types and moisture conditions than any of these tillage tools and do a better job. The ROTAVATOR leaves the ground level, and as such there is no need to level ground after a



ROTAVATOR. Two different field cultivators might be considered in combination with a ROTAVATOR. A tillage tool as simple and light as a spike tooth drag harrow can be used to just tickle the surface of the soil to open it, to get it to dry out and warm up. Alternatively, if conditions are more demanding, a field cultivator with sweeps might be set shallow to kill a small amount of vegetation. If neither tool will produce the desired result in one pass, the Rotavator can be used for the second pass and fulfill the killing or seedbed objectives.

A ROTAVATOR when used properly is the least destructive of all tillage tools to your earthworm population. The objective with any tillage system should be to do tillage necessary to meet your objectives as shallow as possible, thereby leaving as much soil and as many earthworms undisturbed as possible. The ROTAVATOR does a good job of leaving the residue near the surface or mixing it into the surface for optimum decay into humus. Farmers, who have used ROTAVATORS correctly, along with other efforts to improve the biological activity of their soil, report dramatically increased worm populations compared to previous tillage systems.

Many tillage tools invite soil compaction; a ROTAVATOR does not. A moldboard plow turns the soil over, buries residue, and guarantees additional tillage trips to level the field and work down clot size. The multiple tillage trips after plowing invite compaction problems especially if the soil is moist. Spring plowing tends to bury the drier soil and bring up moist soil, which requires even more spring tillage than if that ground had been plowed in the fall and allowed to mellow during the off season. A chisel plow and a disk both depend upon weight in the tillage tool to obtain penetration. Any time a tillage tool depends upon weight for penetration, problems begin in the soil at the depth where the tillage tool stops cutting. Chisel plows and offset disks are known for making the ground uneven, which requires additional trips just to level the ground. Neither the chisel plow nor the disk is very effective at killing vegetation and both must be set to operate deeper than what a Rotavator would in order for those tools to work. There is very little adjustment to a chisel plow or a disk in order to control the amount of tillage done in one pass. Usually the only adjustment is a depth adjustment and if the tillage tool does not produce the desired result in one pass, very little can be done to modify that tool to make it work better. If necessary, a ROTAVATOR will work in moist sticky conditions better than any other tillage tool. A ROTAVATOR will do a better job than other tillage tools in heavy residues. Fewer tillage trips means less compaction, a more efficient use of power, a better environment for earthworms, and a better environment for your intended crop.

You never ever pull a ROTAVATOR. The power from the engine is going directly into the rotating blades, which help push the tractor forward. Because of this push there is never any need for fluid, wheel weights, front wheel assist, or duals. The push from a ROTAVATOR allows for unique performance in difficult conditions. A ROTAVATOR will work better on hillsides, contour strips, low ground, peat and muck soils better than any other tillage tool. The push from the blades is what enables the ROTAVATOR to work in exceptionally heavy residue. If the blade cannot cut the residue at least that residue and root mass is physically ejected out the back of the ROTAVATOR when the shield is raised. The push from the ROTAVATOR makes for unique abilities to incorporate surface applied wet manure. The ROTAVATOR will work in wet slurry and incorporate that slurry moving forward as fast as if the slurry was not there. Once the blades penetrate the firm ground beneath the slurry the blades are pushing the tractor as well as doing the necessary tillage. Drive tires do not slip and the tractor tends to stay clean. Many farmers report that the ROTAVATOR is the fastest, easiest, and best way to incorporate any manure in the top few inches of the soil. In certain circumstances it has been proven that sometimes the ROTAVATOR is the only tillage tool that will incorporate a wet material in the soil because of the pushing effect.

Growing a green manure of Rye, Clover, Oats, or Vetches, is very important to improve soil structure and Biological activity. Unfortunately, many farmers expend too many tillage trips, effort and time trying to "Manage" the green manure for optimum benefit. A ROTAVATOR, with the rear shield up will handle any height or density cover crop grown and will put the ground in a plantable condition faster, and better than other tillage tools. No big clods are made and the ground is kept level. Fewer trips save precious moisture for better germination of the following crop. The ROTAVATOR is fast, simple, and the best way to manage any green manure.

If deep soil compaction is a pre-existing condition before getting your soil to an acceptable biological level of activity, it may be necessary to do some subsoil tillage. The HOWARD PARAPLOW and HOWARD PARATILL were developed to remedy any severe compaction problem that might interfere with drainage, aeration, and root development, and ultimately crop potential. The PARAPLOW was designed to loosen soil to a depth of eight to sixteen inches by gently bending and stretching the soil to put many small cracks in the soil along natural lines of weakness. The ground is left level with the entire residue remaining on the surface so as to minimize any subsequent tillage trips. If the compaction is severe it must be done with a rigid shank deep tillage tool so as to guarantee that tool will stay at the proper depth to get underneath the compacted layer. The results are best when done in a dry fall. A chisel plow is not designed to penetrate hard compacted ground and will not.

The ROTAVATOR fulfills all the basic shallow tillage objectives that a biological or organic farmer has. The ROTAVATOR works the soil up with the least amount of effort and least amount of trips to guarantee less compaction beneath the depth of tillage and provides for better soil aeration than other tillage tools or systems. Residue is left on the surface or mixed into the surface with the minimum number of trips so as to promote health biological activity. Residue on or near the surface will prevent soil particles from sliding together and forming a crust. Residue provides an additional conduit for air and water movement into the soil. Nothing mixes soil and residue together more thoroughly as a ROTAVATOR with the rear shield down. A ROTAVATOR will mix fertilizer more effectively throughout the root zone than any other tillage tool. A ROTAVATOR when set up properly for the conditions and tillage objectives will produce a better quality seed bed in one pass in a broader range of tillage conditions than any other tillage tool or combination of tillage tools.

A ROTAVATOR when properly understood, properly set, and properly used will do more to fulfill your tillage objectives in a biological farming system than any other single tillage tool or combination of tillage tools. It is important for the biological farmer more so than any other type of farmer to not let over tillage or ineffective tillage is a limiting factor in the objectives he has for a healthy, biologically active soil.

*A HOWARD ROTAVATOR IS THE MOST VERSATILE SURFACE TILLAGE TOOL ON THE FARM, BECAUSE IT IS THE MOST ADJUSTABLE. THE ADJUSTABILITY OF THE ROTAVATOR ALLOWS FOR CONTROLLED TILLAGE. THE BEST TILLAGE IS THE LEAST TILLAGE; JUST ENOUGH TO MEET THE NEEDS OF THE CROP THAT WILL FOLLOW. DEFINE THE TILLAGE OBJECTIVE, THEN ADJUST THE ROTAVATOR FOR OPTIMUM ONE-PASS PERFORMANCE.*

FOR ADDITIONAL INFORMATION OF HOW TO GET THE BEST PERFORMANCE FROM YOUR ROTAVATOR OR HOW ROTARY TILLAGE CAN BEST FIT YOUR NEEDS, CONTACT GUY MACHINERY.

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