Liquid-cooled 22 or 27 PTO hp diesels that are big enough to do all the jobs you need to do. Yet small enough so you can afford them.

If the jobs you have are too big for a lawn and garden tractor and too small for a farm or industrial tractor, John Deere has the tractor you need. In fact, two of them. The new John Deere 850 and 950 Tractors. Rugged. Reliable. And built to handle the jobs you'll give them.

**Big-tractor features.** Under each tractor's lift-up hood is a liquid-cooled, fuel-efficient diesel engine: 22 PTO hp for the 850, 27 PTO hp for the 950. Both tractors have smooth-running transmissions with 8 forward speeds, 2 reverse. Speeds are well-spaced from less than 1 mph for tilling to almost 12 mph for transporting.

Other big-tractor features are standard. There's a differential lock that engages on-the-go for added traction in slippery conditions and a fully shielded rear PTO. Individual rear wheel brakes lock together for highway transport and lock down for parking. A heavy-duty drawbar adjusts to four positions. Hand and foot throttles are both standard. Integral equipment easily attaches to a 3-point hitch (Category 1). The adjustable, fully cushioned seat tilts forward for weather protection.

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Choose from a family of tractor-matched implements for all the jobs you need to do:

<table>
<thead>
<tr>
<th>Center-Mounted Rotary Mower</th>
<th>31 Posthole Digger</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 Utility Box Scraper</td>
<td>100 Integral Disk</td>
</tr>
<tr>
<td>31 Integral Disk</td>
<td>205 Rotary Chopper</td>
</tr>
<tr>
<td>Johnson-Arps Model 30 Loader</td>
<td>2-Row Cultivator</td>
</tr>
<tr>
<td>350 Mower</td>
<td>30 Integral Plow</td>
</tr>
<tr>
<td>71 Flexi-Planter</td>
<td>40 Rotary Tiller</td>
</tr>
<tr>
<td>11 Light-Duty Field Cultivator</td>
<td>45 Rear Blade</td>
</tr>
<tr>
<td>45 Integral Plow</td>
<td>25A Flail Mower</td>
</tr>
</tbody>
</table>

*Nothing Runs Like A Deere®*
It would appear that after 40 years of research, we, in the forest service should know what trees to plant on surface mines and how to plant them. If all we want is trees just to say we have trees, the above statement can be assumed to be true. However, if we are thinking in terms of high-value tree species that will yield a high monetary amount in return, then we’re still back in the dark ages.

Many sites have been replanted successfully with Virginia and Loblolly pine and several species of hardwood, namely Black Locust. The Loblolly pine grows well in Kentucky but is apparently subject to ice damage and winter burn from the extreme cold that we’ve had for the last 2 years. Virginia pine is an excellent pulpwood species, but will there be a market for it when it is matured?

And lastly, what are we going to do with the thousands of acres of Black Locust? Most of the disturbed areas in western Kentucky were hardwood sites, as were most of the disturbed areas in the surrounding states. It is natural then to reclaim these areas to their original status. This has been attempted on many areas over the years. Some of these attempts have been notable successes, others failures, and some just mediocre.

Overall, we have had about a 35% survival rate on hardwood plantations since we started planting hardwood trees several years ago. This rate even extends to our newer studies, recently installed. The notable successes in the past continue to encourage us and to give us hope that we can consistently get good results from present and future plants.

What are some of the problems that face us on getting good survival and growth of trees? Well, first and foremost is the fact that mining spoil is not agricultural or silvicultural soil as we know it. I would say that many of our problems arise from this fact.

I’m going to add another category, biological factors. And under this I have the lack of micro and macro organisms. Not only are these items problems in themselves, but their interaction problems are many. In many cases we don’t know the answers because we don’t even know the questions. Willis Vogle, our range scientist in Berea [Ky.] has found it necessary to fertilize a site in order to get satisfactory grass and legume growth, but we in the forestry picture have found that, most of the time, the application of nitrogen and phosphorus is detrimental to tree survival, if we apply them at the time of planting. There are studies going on; planting with fertilization before the fact, during the fact and after the fact.

Another subject that affects us is the problem of allelopathy, the toxicity or inhibiting factors of one plant on another. This problem is not new in literature, but it is new to us. At the present time there’s only one book on the subject in the English language. Not only are these items problems in themselves, their interrelationships compound our problems.

For instance, we know that some seeds are allelopathic in the absence of micro organisms. We also know that the presence of fescue grass inhibits the germination of some pine seeds. We know that crownvetch inhibits new root growth of year old Red Oak seedlings. The allelopathic role is still not completely understood, but some substances have been identified that apparently are inhibiting agents. One of these is in the realm of pheno nolic compounds. Interestingly, our research geologist in Berea highly suspects the presence of some phenolic compounds in some spoils that he has analyzed. It is noteworthy to add that the difference between allelopathy and competition is difficult to separate scientifically. These factors that we’ve just talked about form the basis of our tree planting research in western Kentucky.

The first of our recent plantations was established in 1976 with the cooperation of the Pittsburgh and Midway Mining Company. This study and a subsequent study established in 1977 are much the same. Now we have more variables than we had seasons to plant, so we made up. We used Black Walnut, White Ash, Green Ash, Sycamore, Sweet Gum, Cottonwood, White Oak and Yellow Poplar. We wanted to test some of the seedlings that we’ve had good luck with in the past and some that we’ve had back luck with in the past. We also wanted to test tree-grass competition at the same time so we used control plots, fertilizer only plots, fertilizer and legumes, and fertilizer with grass. And we also used nurse trees as a nitrogen fixer. We used Black Locust, European Black Olive, and we also used both. We substituted for both in 1977. We used Autumn Olive which is also an excellent nitrogen fixer. And of course we had a control of none. We used hardwood bark mulch, with control trees with no mulch and, of course, trees with mulch.

The 1977 study was installed to check the differences in planting years and the possible consequences of different weather conditions. Following the 1976 planting we had an extremely long dry spell, about 6 weeks. We expected the worst. The spring of 1977 was more nearly normal than that of 1976 and we expected better. But you never get what you expect especially in silviculture.

In our study established in 1976 on the P & M land we used White Ash, 1-0 stock and 2-0 stock. We used 2-0 Black Walnut stock. I’ve never seen such huge 2-0 stock in all my life. No wonder they wanted to get rid of it; they knew they couldn’t
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Trees

plant it, so they gave it to us. But the Black Walnut had tap roots about 3 feet long. You’re not about to plant something like that in a spoil, so we had to trim down to about 6 inches. All we had left was just a big thick carrot. But look at the survival — 65%. Now we don’t know whether that holds true today or not. We’re going to check it this fall and we’re going to find out. But the 2-0 stock out-survived the 1-0 stock. This was during a year that we had 6 weeks of drought. I think we had exceptional survival.

The 1977 survival came down to about the same

Combining survival for 1976 and 77 begins to show a trend:

<table>
<thead>
<tr>
<th>Species</th>
<th>Percent Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Ash</td>
<td>53</td>
</tr>
<tr>
<td>White Ash</td>
<td>42</td>
</tr>
<tr>
<td>River Birch**</td>
<td>39</td>
</tr>
<tr>
<td>Sycamore</td>
<td>20</td>
</tr>
<tr>
<td>Sweetgum*</td>
<td>20</td>
</tr>
<tr>
<td>Yellow-poplar</td>
<td>17</td>
</tr>
<tr>
<td>Black Walnut</td>
<td>16</td>
</tr>
<tr>
<td>Cottonwood</td>
<td>16</td>
</tr>
<tr>
<td>White Oak</td>
<td>12</td>
</tr>
</tbody>
</table>

**1976 study only  
*1977 study only

again for Green Ash and White Ash. When we combine the species we get a table of trend. This is the trend that has been established over the years. As we look at more and more data this trend falls right along the same lines as what we read. As we get more green ash and White Oak, we get more White Ash and Cottonwood. Yellow Poplar is always, not last, but it’s up from the bottom. Black Walnut seems to be a real excellent species to work with. We get extreme variance in our Black Walnut. Sometimes we’ll get 2½% survival and sometimes we’ll get 65% survival. Why is this? Again, we can’t give an answer because we don’t even know the questions yet. As we will note from observing the previous survival count, the trend has been established.

Recent studies by Willis Vogle and others show that Sycamore dies back after about five years. Some people’s studies will show that Sycamore did real good. Most of the time we found that Sycamore died back and would just come back in the same root stock year after year. Either the leader dies or the entire stem dies.

The only meaningful data on treatment effects that we can glean from our studies at the present time are on mulching and fertilizing. In both years the grass and legumes failed to germinate the first year. So we couldn’t use this as an effect. But mulching and fertilizing give a pronounced effect
Effects of mulching on survival:

<table>
<thead>
<tr>
<th>Species</th>
<th>Mulched</th>
<th>Unmulched</th>
<th>Mulched</th>
<th>Unmulched</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Ash</td>
<td>48</td>
<td>44</td>
<td>68</td>
<td>44</td>
</tr>
<tr>
<td>White Ash</td>
<td>35</td>
<td>23</td>
<td>62</td>
<td>49</td>
</tr>
<tr>
<td>White Ash (2-0)</td>
<td>50</td>
<td>32</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>River Birch</td>
<td>42</td>
<td>35</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Sycamore</td>
<td>13</td>
<td>14</td>
<td>30</td>
<td>24</td>
</tr>
<tr>
<td>Sweetgum</td>
<td>—</td>
<td>—</td>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td>Black Walnut</td>
<td>52</td>
<td>43</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Black Walnut (2-0)</td>
<td>70</td>
<td>60</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>White Oak</td>
<td>34</td>
<td>29</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>Cottonwood</td>
<td>33</td>
<td>27</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Yellow-poplar</td>
<td>9</td>
<td>7</td>
<td>.4</td>
<td>.2</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>38</td>
<td>30</td>
<td>28</td>
<td>18</td>
</tr>
</tbody>
</table>

Fertilization effects on species survival:

<table>
<thead>
<tr>
<th>Species</th>
<th>Fertilized</th>
<th>Unfertilized</th>
<th>Fertilized</th>
<th>Unfertilized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Ash</td>
<td>38</td>
<td>61</td>
<td>61</td>
<td>64</td>
</tr>
<tr>
<td>White Ash</td>
<td>26</td>
<td>46</td>
<td>62</td>
<td>63</td>
</tr>
<tr>
<td>Sycamore</td>
<td>14</td>
<td>16</td>
<td>29</td>
<td>35</td>
</tr>
<tr>
<td>Sweetgum</td>
<td>—</td>
<td>—</td>
<td>24</td>
<td>30</td>
</tr>
<tr>
<td>Black Walnut</td>
<td>43</td>
<td>54</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>White Oak</td>
<td>31</td>
<td>44</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Cottonwood</td>
<td>25</td>
<td>38</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Yellow-poplar</td>
<td>6</td>
<td>13</td>
<td>.5</td>
<td>.5</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>26</td>
<td>39</td>
<td>50</td>
<td>56</td>
</tr>
</tbody>
</table>

On survival. In both 1976 and 1977 mulching the trees increased survival. In the 1976 and 1977 studies we mulched alternate trees in every row. Evidently mulching helped retain moisture and reduce micro-site temperatures because survival was increased for most species.

We used about a bushel of mulch for every tree. This is about 4 inches thick and reaches out to about 15 inches from the center of the pile or the seedling itself. In the earlier study of 1976 we had used about half this much mulch and, within a year, it had flattened out and almost deteriorated. We can use the ones where we used 4 inches of mulch and it does look substantial, even today.

Fertilization

We have found in the past that addition of nitrogen and phosphorous fertilizer has decreased survival. In some studies we have found this decrease to be significant. The decrease in survival, due to...
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fertilizer, effects hardwood as well as pine seed. This effect has also been found on whole fields and forest sites as well as surface-mined lands.

Fertilizer rate was 400 pounds of 18-46-0 and 100 pounds of 0-0-60. In an early study on bush lespedeza, the decrease in survival was thought to be from the common phosphate. We found that dicalcium and triple-super phosphates significantly reduced survival. After studying data and survival results from the past several decades, we come to the conclusion that we haven't really increased survival over this period.

We have several thoughts along this line. One thought is that perhaps our planting crews are becoming less efficient. If the crewman is paid by the ceiling, his thoughts are on quantity rather than quality. If he gets paid by the hour and a minimum wage, he thinks he's just doing a job that's not very important. Since our desired end result is good reforestation, tree planting is a very important part of the total picture.

Another thought is of the conditions under which we plant with our present technology, expertise and species adaptation. These are becoming less conducive to survival than they were several decades ago. For instance, studies of 30 years ago showed evidence that survival was greater on ungraded spoil than on spoil compacted by grading machinery. Also, at that time, over-
Can Exhalt® 800 cut your fungicide cost in half?

Many turfmen say yes. Our lab tests confirm it. Don't you at least owe it to yourself to spend three minutes reading the story?

For years, fungus disease control has been a source of trouble, frustration and expense. The problem is not the fungicide itself, but the application: how to keep it in place despite torrential rains and irrigation. The problem is wash-off.

That's why the development of Exhalt® 800 is a milestone of progress in the turf world. Here's the story:

Unlike many sticker-extenders that give little help, Exhalt® 800 encapsulates every fungicide particle with an armor of protection—a sticky, flexible "fabric" that clings to turf and foliage, essentially on contact. Yet it flexes and "breathes" to allow normal plant growth.

Because Exhalt® 800 keeps much of the fungicide in place, even in extreme weather, it can double or triple the control period. Even if it rains an hour after application, you'll still have effective control (see test chart), with less wash-off and less build-up of residue in soil.

A closer look at Exhalt® 800 — the reason it works

1) Microscopic particles of fungicide are suspended in water in spray tank.

2) One minute fungicide particle, greatly magnified. Countless millions of such particles in water become the spray solution.

3) Exhalt® 800 liquid enters spray tank. Hydrophobic (repelled by water), it breaks into a myriad of tiny droplets and attaches to fungicide.

4) Tiny Exhalt® 800 droplets form a porous, flexible "fabric" that encapsulates each fungicide particle (enlarged to show detail).

5) Turf, when sprayed, becomes coated with millions of fungicide particles, each particle encapsulated within the porous "fabric" of Exhalt® 800 droplets.

6) Encapsulated fungicide particles on blade of grass (magnified portion). The Exhalt "fabric" around each particle is porous and flexible; it lets plant "breathe", flex and grow, releases fungicide slowly.

Using Exhalt® 800, you may save 50% or more because you will need fewer sprays, you will use less fungicide with each, and reduce labor costs proportionately. Meanwhile, you can be confident the disease won't flare out of control. The evidence is clear.

In university field tests using leading fungicides, Exhalt® 800 added to spray tank at minimum-label recommendations gave control equal to higher recommendations without Exhalt® 800. With higher Exhalt® 800 dosages, you can double or triple the control period. Results can vary with the kind of fungicide used.

Exhalt® 800 costs little because it goes far (mix one pint with each 100 gallons in spray tank). Won't damage turf, trees and ornamentals when used as directed. Easy to use: add to spray tank and agitate. Easy clean-up: rinse equipment with water. If frozen in storage, Exhalt® 800 won't separate; may be thawed and used.

Too good to be true? The question doesn't surprise us. Compared with its competition, Exhalt® 800 is hard to believe. To know the truth, you should test it. On a golf green. A fairway. On any fungus-infested lawn or foliage.

As an efficient manager, can you ignore the overwhelming evidence? See your Gordon distributor for information, prices and technical assistance.

Percentage of fungicide retained after rain

<table>
<thead>
<tr>
<th>INCHES OF RAIN</th>
<th>Fungicide alone</th>
<th>Fungicide &amp; Exhalt® 800</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>0.5</td>
<td>75%</td>
<td>90%</td>
</tr>
<tr>
<td>1</td>
<td>50%</td>
<td>85%</td>
</tr>
<tr>
<td>2</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>3</td>
<td>0%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Chart shows how Exhalt® 800 resisted wash-off in a laboratory test. Spray coatings were applied to glass panels and dried 10 minutes at approximately 70°F. Retention after erosion by rain was measured by solvent stripping the panels and determining the residual fungicide by quantitative ultraviolet spectroscopy.

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Trees

burden removed was not as deep as it is now. Maybe our increase in expertise is just keeping pace with the increase in adverse spoil conditions, hence no net increase in seedling survival.

This spring, with the cooperation of AMAX Coal Company’s Ayrgem and Pittsburgh and Midway’s Colonial mines, we installed a study that’s combined the old with the new. We plowed the planting areas with a disc harrow or chiselplow.

We mulched every other row of trees with hardwood bark mulch and we did not fertilize. We used Black Walnut as a starting species because of its potentially high value and the trouble we’ve had with survival in the past. We also interplanted Autumn Olive as a nitrogen fixture.

Our microbiologist at Berea has been attempting to isolate endomycorrhiza from high value hardwoods grown in a natural forest in the nursery and on surface mine plantations. At present he is growing these associates in quantity for inoculation. In the spring of 1979 we hope to install a study in the western coal fields with hardwoods inoculated with different endomycorrhizal fungi. Our last study concerns planting methods. We have a hundred extra Black Walnut trees that we can sacrifice each year and study their roots for mycorrhiza and their tops for nutrient growth and the presence of essential nutrients and toxic elements.
Dr. A. J. Turgeon and co-workers J. E. Haley and J. R. Street conducted intensive Kentucky bluegrass cultivar management studies. Twenty-one cultivars were planted in September 74. Varying management regimes were imposed to measure their competitiveness against the infestation of Poa annua.

They concluded: "The most impressive differences among cultivars were observed under close mowing (0.75") and high fertilization (8 lb./N per 1000 sq.ft.). Several of the cultivars were virtually overrun by Annual bluegrass while others remained nearly weed free. Those cultivars which are apparently best adapted to this cultural intensity include A34, Brunswick and Touchdown".

Touchdown fights Poa annua two ways: First — its superior disease resistance means it won't thin out from Crown rot (Leaf spot) Leaf rust, Stripe smut or today's Fusarium so Poa can't get a foothold . . . and secondly it's so aggressive and dense in growth habit it just keeps on fighting Poa.

Touchdown is ideal for overseeding . . . it germinates fast and quickly develops a healthy, mature turf.

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- rapid establishment
- drought and heat tolerant
- dwarf growth habit
- superior disease resistance
- bright green color

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JUNE 1978/WEEDS TREES & TURF 49
ABILITY TO CHANGE, RESEARCH ARE VITAL ACCORDING TO BOARD

Alva P. Burkhalter, Ph.D.

Dr. Burkhalter is chief of the Bureau of Aquatic Plant Research and Control in Tallahassee, a division of the Florida Department of Natural Resources.

Burkhalter received his Ph.D. in plant physiology from Auburn University in 1970. His B.S. in forestry and M.S. in genetics were earned at the University of Georgia.

Burkhalter's latest research explores the use of the white amur for aquatic weed control in landlocked lakes used for irrigation. The exotic fish is banned in many states for fear of its effect on the ecological balance of the aquatic environment. Burkhalter thinks research on the fish will dispel such fears and legalize use of the fish in more states.

Burkhalter is a member of the Weed Science Society of America, the Aquatic Plant Management Society (APMS), and is a past president of the Florida Chapter of APMS. Hobbies include hunting, fishing, guitar, banjo, golf, and basketball.

Aquatic Plant Management — the science, profession and the problems — is still in the early stages of development. Compared to childhood, it would now be in its rapidly expanding and growing adolescent years.

The science of Aquatic Plant Control has developed as a branch or support function of many other major areas. Its earliest function was to assist commercial efforts by controlling plants that caused problems to navigation. From here it has expanded to other areas of concern — Fish and Wildlife, Public Health (Mosquito Control), agricultural irrigation and potable waters.

With the growing population of our nation and the increased emphasis on multiple usage of water, the aquatic plant managers of today must understand the various facets of aquatic plant control and how they differ, while at the same time relate to each other. This is becoming increasingly important because water used today for one purpose may be used tomorrow for another.

Aquatic plant problems are generally directly attributable to man's activities as he progresses. Man's increased mobility and world traveling have led to the introduction of exotic noxious aquatic plants that now plague many of our waterways. His pollution either from industrial, agricultural or domestic waste often provides excessive food stuff for their growth and mans designated usages of waters and conservation practices (navigation, irrigation, etc.) often mean that even the native plants that were heretofore no problem have subsequently become a problem in these types of waters.

Current trends in control necessitate that the aquatic plant manager of today be a "jack of all trades." Early aquatic plant control centers mainly on the use of machines of which similar methods are still used today. The most commonly used method of control at present is chemical, but rapid development is taking place in the area of biological control. Therefore, the managers of today must be part engineer, chemist, and biologist, and adapt rapidly as changes take place.

The nature of the problems are also rapidly changing. Early plant problems centered around floating and emergent species such as water hyacinth and alligatorweed, but submerged plants, such as Eurasian watermilfoil and hydrilla, are posing greater threats.

In summary, aquatic plant problems and control technology are rapidly changing, the future of aquatic plant management belongs to individuals who will do likewise.

Harry D. Niemczyk, Ph.D.

Dr. Niemczyk is Professor of Entomology for the Ohio Agricultural Research and Development Center in Wooster, a research facility of Ohio State University. He is also a consultant for Chem-Lawn Corp.

Niemczyk's research centers on insects of turf. Two examples of his research are the life cycle of the ataenius beetle and the characteristics of the winter grain mite. Both pests are not found on any registered pesticide label even though they can cause significant damage to turf. Niemczyk is working to collect information to make registration of pesticides for these minor pests more likely.

Niemczyk received his Ph.D. from Michigan State University. In 1974, he was presented with the Ohio Turfgrass Foundation Professional Excellence Award. He is a member of the Entomological Society of America, the American Society of Agronomy, the International Turfgrass Society, and the Ohio Turfgrass Foundation.

An ardent fisherman, Niemczyk often returns to Michigan with his wife and four children to fish for steelhead.

The single most significant event in turfgrass entomology was the labeling of DDT and later the chlorinated cyclodiene insecticides (aldrin, dieldrin, heptachlor, chlordane) for control of turf insects and, in the case of chlordane, crabgrass.