

IMPROVE YOUR BOTTOM LINE WITH CHANDLER SOIL



**ARE YOU FARMING
FIVE FEET DEEP?**

**MARKETED BY
MIDWEST BIO-TECH, INC.**

WHAT IS CHANDLER SOIL?

Chandler Soil is a liquid biological soil conditioner designed to improve soil fertility and tilth. Chandler Soil stimulates growth and metabolism of beneficial soil bacteria and other microorganisms that fix nitrogen, solubilize phosphate ions, and decompose organic materials. Chandler Soil also contains micro-nutrients and naturally-occurring organic compounds (enzymes, hydrolyzed proteins, and amino acids) that promote bacterial activity.

WHAT DOES CHANDLER SOIL DO?

Nitrogen is abundant in our atmosphere as a gas but most plants cannot use it in this form and depend on nitrogen fixing soil bacteria to convert it to a usable form. In fact, all nutrients applied to the soil for crop production (fertilizer, manure, lime, etc.) have to be converted to a form usable by the plant. As the level of soil bacterial activity increases, more of these applied nutrients are converted and made available for the next crop. The conversion process helps to create a natural balance of nutrients in the soil.

Biologically active soil will also be more flocculent or porous so there will be more air spaces among the soil aggregates. The risk of compaction is reduced in biologically active soils. Also, a flocculent soil will allow more rainfall to penetrate where it falls, which reduces standing water problems and erosion from runoff. Plant roots will be able to penetrate deeper into the soil so they can pull moisture and nutrients from greater depths. Thus, the increased bacterial activity allows you to farm more of your soil.

HOW DO YOU APPLY CHANDLER SOIL?

Chandler Soil may be applied with conventional on-farm or commercial spray equipment and is non-toxic when used as directed. For best results, we recommend that you incorporate the product in the soil soon after application. However, you may also use Chandler Soil without incorporation on hay fields, pastures, and no-till cropland. In general, you should apply Chandler Soil with enough water to provide good coverage of the soil (10-20 gallons per acre), and the product may be applied with newer spray equipment that uses lower water flow rates.

Chandler Soil may be applied in a tank mix, and the product is compatible with most commonly used liquid fertilizers and pesticides. We recommend that you test all new tank mix combinations, and you should dilute one part Chandler Soil with 3 to 5 parts water prior to mixing. Chandler Soil may also be impregnated on dry fertilizer with the proper handling equipment at the time of blending.

HOW MUCH PRODUCT IS REQUIRED?

In general, we recommend that you apply 8 ounces of Chandler Soil per acre on most soils. One gallon of Chandler Soil covers 16 acres at the 8 ounce rate. However, you may want to use higher application rates on heavier soils with high organic matter content, compaction, or other problems that limit soil nutrient conversion and restrict air and water penetration. Chandler Soil may also be applied in a band over the row (with a field sprayer or a planter-mounted applicator), but these limited applications may not provide the full benefit of the product. At the full retail price per gallon, the per-acre cost of Chandler Soil is:

Per-Acre Application Rates and Investment

Broadcast	8 oz per acre	\$5.60 per acre
	10 oz per acre	\$7.00 per acre
	12 oz per acre	\$8.40 per acre
Banded	8 oz per acre	\$5.60 per acre
	8 oz per acre	\$5.60 per acre

The per-acre cost will be lower if you buy in larger unit sizes, and Chandler Soil is also available in 2.5 gallon jugs or in 30 gallon drums. The per-acre cost will also be lower if you buy product during our Fall Discount Program (September and October) or our Pre-season Discount Program (December to March).

LONG-TERM BENEFITS OF AN ACTIVE SOIL

Although many of our users achieve higher yields and see other direct gains from using Chandler Soil in the first year, the most important benefits of building an active soil are realized over the long run. For example, the photo on the front panel of the brochure shows a corn root system in a rocky soil with less than 12 inches of topsoil. The user first applied Chandler Soil to this field in 1983 and continued using the product until he retired in 2000. He never applied more than 80 units of nitrogen per acre, and his average yield over this period was 160 bushels per acre of #2 corn. The crop in the photo produced 175 bushels of #2 corn from 66 units of nitrogen, and the root system was traced down over five feet in the soil.

By using Chandler Soil each year, you can build a biologically active soil that produces higher crop yields and provides several other long-term benefits. These benefits include improved water and nutrient uptake and higher plant sugar content, reduced soil erosion, better air and water penetration due to less compaction, lower nitrogen and chemical application rates, less chemical carryover, and fuel savings from improved soil tilth.

HIGHER PLANT SUGAR CONTENT

The following photos show corn plants raised by Rick Bauer of La Moille, Illinois, in 2001. Rick planted Pfister 2550 on April 28 at a population rate of 28,000 to 29,000 plants per acre. He applied 100# of nitrogen and 120# of both phosphate and potash to the field, but he did not apply insecticide to the corn. On half of the field, Rick applied Chandler Seed Treat and Soil at the recommended rates.

The yield plot treated with Chandler Seed Treat and Soil produced 185.6 bushels per acre of #2 corn with a 60 pound test weight. However, a more dramatic difference was observed when plants from the treated and control plots were split open for inspection. The treated corn plant (left) is covered with house flies, which are attracted to the higher sugar content in this plant. Notice that there are only a few flies attracted to the control plant (right). The differences between the treated and control plots were also measured:



	Treated	Control
Plant population	26,000	23,875
Kernels around the ear	16	12
Kernels along the ear	40	40
Stalk sugar at the ear	13.0%	8.75%
Stalk sugar at the base	10.0%	5.0%
Corn borers in the stalk	0	3

Destructive insects such as corn borer cannot digest high levels of sugar in the treated plant (below right) and prefer to feed on stressed plants with lower sugar content (control is on the left). For this reason, many Chandler Soil users do not apply any corn insecticide.



REDUCED SOIL EROSION

Two of the most important causes of eroded soil are rill and sheet erosion. As excess water moves across the soil surface in stream-like or sheet-like flows, the soil structure is disturbed and precious top soil may be shifted to another site within the field or outside the field boundaries. In addition to depleting the productive capacity of the land, soil erosion can clog drainage tiles, waterways, ditches, and streams and rivers.

One way to reduce the impact of these types of soil erosion is to improve soil tilth and structure so that water from rainfall and other sources can be more easily absorbed. Biologically active soils are more flocculent or porous and have more air spaces among the soil colloids or aggregates. For illustrative purposes, the components of a flocculent soil are like a bowl of popped popcorn but the components of an inactive soil are like a bowl of unpopped popcorn. A biologically active soil has more air spaces where excess rainfall and water run-off can be absorbed, and the problems of rill and sheet erosion are reduced. Further, there is a direct relationship between soil air, nutrient uptake, root growth, and biological activity in the soil. With a more flocculent soil, the plant roots can extend deeper into the soil, which improves plant stability, increases water and nutrient uptake, and enhances additional bacterial activity.

The beneficial bacteria in biologically active soils also secrete mucus-like compounds that bond the individual soil particles together. For example, you may have observed these sticky secreted compounds that result from the bacterial activity in a compost pile. Soils with improved structure resulting from these strong bonds formed by bacterial activity are less susceptible to wind erosion.

THE ROLE OF SOIL COMPACTION

The problems associated with water and wind erosion are hampered by the presence of soil compaction. Although compaction is often blamed on too much weight and horsepower, these are only contributing factors to the problem. One of the major reasons for soil compaction is a lack of biological life in our soils. Over the past 40 years, excessive amounts of inorganic chemicals and fertilizers have been applied to our soils in order to increase production. These toxic chemicals can kill or depress all forms of biological life in the soil, including beneficial bacteria, earthworms, and night-crawlers. As the biological life declines, the soil structure degrades and becomes more compacted.

REDUCED SOIL COMPACTION

Chandler Soil reduces soil compaction by promoting beneficial bacterial activity in the soil. The photograph at the right shows the root development of a corn plant grown on a heavy black gumbo (clay) soil. Chandler Soil had been applied to the soil for the three previous years. Note that several of the main (tap) roots are very long, and some of these long roots had to be broken off to remove the plant from the soil. There are also several hair-like feeder roots that provide nutrients to the plant. Although gumbo is a very heavy, easily compacted soil, Chandler Soil helped to improve the soil structure so the plant roots could penetrate deep into the soil. The corn plant is more stable and can draw more water and nutrients to support plant growth and grain production.



REDUCED NITROGEN APPLICATIONS

Over the past several years, numerous major soil testing organizations have stated that only about 50% of nitrogen applied as fertilizer is actually used by the crop. The other half of applied nitrogen leaches into the soil and may enter the water supply (e.g., lakes, rivers, wells). Our previous experience with on-farm nitrogen field trials shows similar results. Users of Chandler Soil report that they have reduced their nitrogen application by 50% or more without affecting crop yields.

Despite these research findings that support lower nitrogen use, most fertilizer recommendations for corn production are still based on 1.2 to 1.5 units of nitrogen for each bushel of corn to be produced. If you follow these recommendations, you would apply 190 to 240 units of nitrogen to produce 160 bushels of corn per acre. Given the current high cost of nitrogen fertilizer, the recommended fertilizer rates add a lot of unnecessary dollars to the cost of corn production and subtract from your bottom line.

By increasing bacterial activity in the soil, Chandler Soil helps make more of your applied nitrogen available for crop production. On average, users of Chandler Soil apply 0.5 to 0.75 units of

nitrogen for each bushel of corn produced. The average nitrogen application is 90 units per acre, and the range is 60 to 120 units, but many of these users are still producing 180 to 200 bushels of corn per acre. Based on these findings, why should you apply more nitrogen than is necessary to produce the same corn crop?

REDUCED CHEMICAL APPLICATIONS

Most recommended herbicide application rates are based on calcium availability or soil pH. As more calcium becomes available in the soil, the herbicide application rate required for effective weed control declines. Chandler Soil helps to stimulate the soil bacteria that make more calcium available in the soil. Consequently, users of Chandler Soil find that they can reduce their chemical application rates and yet maintain the desired level of weed control.

LESS CHEMICAL CARRYOVER

Chemical carryover in the soil is perhaps the second most limiting factor in crop production (after soil compaction). High levels of chemical carryover in the soil restrict root growth and plant development. In the presence of excess pesticides carried over in the soil, the crop root system will be abnormally small, and the stunted roots cannot properly feed the plant. As a result, the plant may shut down prematurely and reduce crop yield and quality.

According to universities and other research and testing sources, the only way to remove excess chemical from the soil is to use other compounds to break down the excess chemicals. One feasible and effective way to achieve chemical breakdown is to increase bacterial activity in the soil.

Crop producers across the Midwest have reduced or eliminated chemical carryover problems by using broadcast applications of Chandler Soil in the fall or early spring (well ahead of planting). The increased bacterial activity in the soil will reduce the amount of residual chemical that may otherwise harm the next crop.

FUEL SAVINGS

The increased bacterial activity stimulated by Chandler Soil also improves soil tilth, especially after the second continuous year of product use. Many Chandler Soil users state that they cannot believe how much easier their soil works after the second year. They find that they can farm the same acreage faster and easier, and the resulting fuel savings pay for the cost of the product.

USERS REPORT THESE BENEFITS

- Reduces or eliminates soil compaction – users report at least 5 inches less compaction each year Chandler Soil is used
- Increased water penetration and utilization
- Increased soil flocculation with less compaction
- Less chemical carryover -- microbial activity degrades or breaks down pesticides and other chemical compounds remaining after harvest
- Better utilization of applied nutrients such as fertilizer and manure – converts them to an organic form readily available to plants
- Improves the natural balance of the soil
- Soil has improved tilth and is easier to farm
- Deeper root penetration, providing better nutrient and water uptake
- Better chemical performance at reduced application rates – due to increased calcium availability
- Earthworms and night-crawlers return to the soil
- All of the above benefits lead to reduced input costs while promoting higher yields and grain quality

Limited Warranty

Sellers' and Manufacturers Warranty is limited to replacement of defective product.

Neither seller, nor manufacturer shall be liable for any injury, loss or damage directly or consequentially arising out of the misuse or inability to use the product.

All other warranties unless from the manufacturer, whether expressed or implied, are hereby disclaimed.

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