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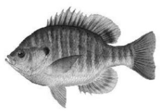

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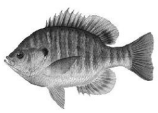

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ADAPTING CORN PRODUCTION TO CLIMATE IN ALABAMA

Corn is one of Alabama's most important row crops. Alabama farmers usually harvest more than half a million acres of corn each year. Corn is grown as a part of crop rotation systems that include cotton and peanuts. Although corn is planted throughout Alabama, the majority of production is located in the northern region (Lawrence, Madison, Limestone, Jackson, Lauderdale, and Colbert Counties) providing more than 50 percent of total corn acreage. Central and southern counties such as Talladega, Baldwin, Coffee, Escambia, and Houston provide 12 percent of corn acreage.

The climate variability in Alabama is mainly linked to ENSO, which is an oscillation that occurs every 3 to 7 years between warm and cold phases of sea surface temperature in the Equatorial Pacific. The El Niño phase of ENSO results in lower winter temperatures and higher winter-spring rainfall. The La Niña phase of ENSO causes warmer and drier conditions from fall to spring. Summers are drier and hotter than normal in El Niño years in northern and southern parts, but wetter and cooler in La Niña years in northern and central parts of the state.

Crop yield is affected by the variability in rainfall and temperature in Alabama through the influence in plant growth and development rates and pest and disease dynamics. Climate forecasting can be a valuable tool in increasing yields and securing a more profitable crop.

Seasonal Climate Variability Affecting Corn Production in Alabama

- The ocean-atmospheric phenomenon associated with unusually warm water forming occasionally across the eastern and central Pacific is referred to as the El Niño
- The La Niña phase is characterized by cooler than average sea surface temperatures across the same
- The phenomenon associated with close-to-average sea surface temperature in this region is referred to as the Neutral
- El Niño, La Niña, and Neutral are the three phases of ENSO, the El Niño-Southern In Alabama, the ENSO phenomena affect rainfall and temperature during winter, spring and summer months.
- In an El Niño phase year, the southern part of Alabama is wetter and cooler than average condition during winter, whereas the northern part is drier and In a La Niña phase year, the conditions are just opposite.
- Summers are drier and hotter than normal in El Niño years in northern and southern parts, but wetter and cooler in La Niña years in northern and central
- The effect of ENSO on corn yield is more pronounced closer to the Gulf Coast (south) than in the northern parts of the
- El Niño produces larger yields than does La Niña in the southern part of the state, whereas La Niña results in larger yields than El Niño in the central and northern parts.
- Throughout Alabama, the Neutral phase has the largest yields of all ENSO
- Corn is most susceptible to water stress at tasseling which occurs during the Low precipitation especially in July, the warmest month of the year, reduces corn yield substantially. La Niña phase years have larger yields than El Niño phase years. Thisis mainly due to summer rainfall which tends to be higher in La Niña phase years. For the same reason, El Niño phase years have lower yields.
- High maximum temperatures during tasseling and grain filling periods also reduce corn yield Higher temperatures shorten grain filling period. La Niña phase years have larger yields than neutral or El Niño phase years because La Niña phase years tend to be cooler during summer.

Resources

AgroClimate Tools: www.agroclimate.org/tools.php

Climate Risk Tool: www.agroclimate.org/tools/climate-risk/

Climate Impacts: www.cpc.ncep.noaa.gov/products/precip/CWlink/ENSO/composites/

ENSO overview: www.cpc.ncep.noaa.gov/products/ precip/CWlink/MJO/enso.shtml

CHOOSING EFFECTIVE LIMING MATERIALS

Acidic soils require lime to maintain the proper pH for growing crops and forage. Learn how to test and maintain your soil for optimal production.

Most Alabama soils are naturally low in pH and must be limed to create soil conditions that increase plant nutrient availability and decrease aluminum toxicity. The ideal pH for most Alabama crops is in the range of 6.0 to 6.5. When the pH of a soil falls below a value of 6.0, the availability of most macronutrients (such as nitrogen, phosphorous, and potassium) needed for crop and forage production begins to decrease. When pH increases above 6.5, the availability of most plant micronutrients (such as zinc, manganese, copper, and iron) tends to decrease.

Maintaining pH according to soil testing laboratory recommendations will ensure that the availability of all plant nutrients is maximized and that any fertilizers applied to the soil will not go to waste.

How Lime Recommendations Are Determined

The amount of liming material needed to reach a target soil pH depends on the soil's current pH and the soil's buffer pH. Soil pH is a measurement of the acidity or alkalinity of a soil, while buffer pH is used to measure the soil's resistance to change in pH.

Soils that are high in organic matter and clay content have a higher buffering capacity. More lime is therefore required to raise the pH in these soils than in soils that are sandy and low in organic matter. For example, a sandy soil at pH 5.0 may require only 1 ton of ground limestone to raise the pH to 6.5, while a clay soil at the same pH may require 4 tons of ground limestone. A one- unit increase in soil pH is equivalent to a tenfold increase in soil acidity; therefore, small changes in soil pH can result in different lime requirements.

Soil testing labs measure both soil pH and buffer pH to make accurate lime recommendations to producers. This is the best way to accurately test how much lime needs to be applied to the soil. For instructions on submitting soil samples for analysis to the Auburn University Soil Testing Laboratory, go to www.aces.edu/soiltest.

Qualities That Determine the Effectiveness of a Liming Material

Not all liming materials are of equal quality. A liming material's effectiveness is based on the calcium carbonate equivalent (a measurement of the material's ability to change pH) and the particle size of the material. The fineness of the liming materials affects how quickly the materials react with the soil. The most common liming materials used in Alabama are ground calcitic limestone and dolomitic limestone.

Not all products containing calcium and magnesium are liming materials. There are many alternative liming products on the market today that have no ability to increase soil pH. Examples include calcium chloride, calcium sulfate (gypsum), and magnesium sulfate (Epsom salt). These products can have value as calcium or magnesium fertilizers, but beware those advertised as being able to "improve fertility with much smaller amounts of calcium."

Other products containing small amounts of calcium carbonate dissolved in water claim to adjust pH with 1 to 5 gallons of product per acre. Beware of these products as well. The cost to purchase the actual amount of product required to adjust pH on a per-acre basis would be exorbitant. An actual liquid lime material consists of approximately 50 percent lime and 50 percent water by weight. Therefore, for every ton of lime required based on soil test recommendations, approximately two tons of liquid lime are required to increase the soil pH by the same amount.

The effectiveness of a liming material is typically expressed as relative neutralizing value (RNV) or effective calcium carbonate equivalent (ECCE). Contact your local Extension agent for help in determining whether a product is a liming material or a fertilizer.

How Liming Materials Increase pH

The liming materials indicated in table 1 are alkaline. They contain carbonates (CO_3^{2-}), hydroxides (OH^-), or silicates ($(SiO_4)^{4-}$) of calcium and magnesium. As liming materials dissolve in water, acidic soil cations of aluminum (Al^{3+}) and hydrogen (H^+) react with carbonates (CO_3^{2-}), hydroxides (OH^-), or silicates ($(SiO_4)^{4-}$) to form water and insoluble aluminum minerals, thereby reducing the acidity of the soil.

Neutral salts, such as calcium chloride, calcium sulfate (gypsum), and magnesium sulfate (Epsom salt), do not raise soil pH, because they do not react with Al^{3+} to form insoluble minerals.

Tests to Determine a Material's Effectiveness

Alabama has a state lime law specifying that a product cannot be marketed as an agricultural limestone unless it meets the following criteria:

- The material has at least a 90 percent calcium carbonate equivalent.
- At least 90 percent of the material passes through a 10-mesh sieve.
- At least 50 percent of the material passes through a 60-mesh sieve.

Products that meet these requirements have a relative neutralizing value (RNV) or effective calcium carbonate equivalent (ECCE) of at least 63 percent. Therefore, producers can be guaranteed that a product is at least 63 percent effective if they buy an agricultural lime product in Alabama.

For other liming products, such as wood ash, it is important to have a lime analysis performed to test the effectiveness of the product. For instructions on submitting soil samples

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for lime analysis to the Auburn University Soil Testing Laboratory, go to www.aces.edu/soiltest.

Adjusting Lime Application Based on Relative Neutralizing Value

Soil testing laboratories make varying assumptions regarding RNV when reporting lime recommendations. The Auburn University Soil Testing Laboratory assumes a liming material is 63 percent effective when making lime recommendations, since agricultural lime products in Alabama are required by law to be at least 63 percent effective. Other laboratories may assume that the liming material is 80 or 100 percent effective.

Depending on the assumed RNV, recommendations by soil testing laboratories may result in overapplication if a high-quality limestone is used or underapplication if a poor-quality ground limestone or by-product is used. To adjust lime recommendations based on the actual RNV, use the following formula:

Adjusted lime recommendation (lbs/acre) = Lime recommendation (lbs/acre) × (Assumed RNV (%))/ (Actual RNV (%))

ALABAMA PROSPECTIVE PLANTING NUMBERS RELEASED

A year of tumultuous weather and natural disasters, 2018 brought challenges where expectations were high for good yields and market pricing. In Alabama alone, producers experienced hurricanes, tornadoes and flooding on top of the usual changes in weather farmers expect.

Alabama Cooperative Extension System economist, Max Runge, said while uncertainty is normal in the agricultural sector, there is more uncertainty for 2019 than usual and that may impact farmers' planting decisions.

"Prices, trade and farm policy coupled with natural disasters have not only producers, but agribusinesses across the country uneasy as we start this growing season," Runge said. "We always encourage crop rotations, but this may be a year where farmers alter their cropping decisions because of their financial situation or factors that prevent them from maintaining their rotation."

Alabama's Prospective Plantings Report

In its March report, the USDA's National Agricultural Statistics Service (NASS) estimates corn planting at 280,000 acres—an increase of eight percent over 2018. Estimates for Alabama cotton intended acres are equal to acres planted in 2018 at 510,000. Peanuts are up three percent from the previous year, estimated at 170,000 acres. Winter wheat planted is estimated at 170,000 acres, up six percent from last year. Intended soybean acreage is down to 280,000—a large 19 percent decrease from 2018.

Runge said the biggest surprise in the report was the number of soybean acres projected in Alabama.

"Alabama's soybean acres are projected to be down 19 percent from last year," he said. "I expected these acres to be lower, but not this much lower since the total U.S. acres are only forecasted to be down five percent from 2018."

U.S. Prospective Plantings Report

Across the country, planted acreage looks to be lower for soybeans, wheat and cotton. Corn is the exception with an estimate of 92.8 million acres, up 4 percent from 2018. Soybean planted area estimates are 84.6 million acres—a drop of five percent from the previous year. Cotton acreage is projected at 13.8 million acres, two percent below 2018. The wheat planted area is down four percent from last year at 45.8 million acres.

NASS reports the wheat planted area is the lowest on record since records began in 1919.

"If estimates are correct, this will be the fewest U.S. wheat acreage in 100 years," Runge said. "Low wheat price and cost of production are factors in the lower wheat acreage."

Runge believes projected cotton acres across the U.S. may be on the low side, but acres for other row crops seem reasonable.

"It should be noted that the survey was conducted before the flooding in the Midwest," he said. "Crop choices in Nebraska, Iowa and Missouri could be affected."

More Information

The prospective planting report was seen as bearish for corn and bullish for soybeans.

Runge said trade issues are hanging over the markets.

"Until the trade agreements are settled, I do not expect many upside possibilities," he said. "Continued flooding in the Midwest and along the Mississippi River could alter which crops farmers are able to plant. I do see a chance of increased soybean acres due to wet planting conditions in the Midwest."

BIOSECURITY FOR BACKYARD POULTRY FLOCKS

The effects of disease outbreaks in poultry should increase every poultry owner's awareness of developing and maintaining a good biosecurity program. Having a good biosecurity program will help protect your flock from contracting a disease that can infect poultry. It also provides a measure of protection to you and your neighbors with poultry because you are not spreading disease.

Four key steps of a biosecurity program are isolation, traffic control, sanitation, and recognition of warning signs. Realistically, it is difficult to perform all of these steps, but the more you do, the more protected your birds will be.

Isolation

• Keep the area around housed poultry clean. Keep the grass cut and remove possible shelter

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and food sources to discourage animals and insects from coming near your poultry.

• Prevent wild birds and waterfowl from coming in contact with your poultry. Do this by preventing accumulation of freestanding water near poultry pens or by limiting poultry access to freestanding water, such as ponds.

• Minimize contact with other poultry, such as at swap meets. If contact with poultry is unavoidable, proper sanitation (see proper sanitation recommendations below) is crucial to minimize the chance of accidental transmission.

• Avoid dead wild birds. Treat any that you find as if they were highly infectious and dispose quickly. After disposal, wash your hands and sanitize the area where the bird was found.

Traffic Control

• Minimize traffic. This includes visits to other poultry pens/livestock sales/farms/swap meets. Avoid transporting equipment from location to location. If this is unavoidable, thoroughly sanitize the equipment before use.

• Keep curious people away from the chickens. Latch and lock gates. Hang No Trespassing or Keep Out signs.

• Ask visitors if they have had recent contact with poultry. If they have, do not let them near your poultry.

• If possible, use clean protective foot and head coverings and overalls and ask others to do so as well. Clothing and shoes are excellent methods for transporting disease to your premises.

• Sanitize your shoes or change shoes before entering your chicken pen. If possible, have a pair of shoes just for the farm.

• If dealing with poultry of various ages, always try to handle younger birds before you handle older birds.

• Mortality disposal should be done in a timely manner. Make sure that animals can't gain access to the carcasses. Minimize traffic to and from the dead bird disposal area.

Sanitation

• For general cleaning and disinfection, remember that most micro-organisms are susceptible to sanitizers and can be killed by heating or drying. Many types of sanitizers are available ranging from quaternary ammonia to bleach and everything between. An important consideration when using a sanitizer is that you switch between types a couple of times a year. Sanitation should be done on all equipment and surfaces between flocks or once a year. Remove all organic material from surfaces before sanitation. This will ensure that the sanitizer has proper contact time with the surface, which should maximize its effectiveness.

• Manure is a reservoir of most diseases and should be handled with care. Heating of a facility to 100 degrees F for 100 hours is an effective method of sanitation. If heating of the facility is impractical, spray it with a sanitizer and remove the manure. After the manure has been removed, apply a second application of the sanitizer and allow it to dry in the sun. The facility should then be left vacant for two weeks.

Warning Signs

• Know your chickens! Try to spend time with them so you can learn their personalities. You can then easily identify sick ones.

• Recognize unusual behavior to help you treat and prevent the spread of disease within the flock. Unusual behavior includes a lack of energy, poor appetite, watery/green diarrhea, sneezing, gasping for air, coughing, nasal discharge, discoloration of the wattle/comb/hocks, swelling of the neck/head/eyes, drooping wings, tremors, and twisting of the neck or head. If you suspect that the chickens are sick, contact your veterinarian, the state diagnostic lab, or a qualified expert. Get a diagnosis, if possible, before going to the store to buy a treatment that may or may not be effective.

It doesn't matter if you are raising five or fifty-thousand-plus chickens, preparing and following a good biosecurity program is important for maintaining the health and well being of a poultry flock. Then, if there is a disease outbreak, your flock has a good chance of not being affected.

EFFECTS OF DIET PARTICLE SIZE ON POULTRY PERFORMANCE

Feed costs represent between 60 and 70 percent of production costs in poultry and livestock diets. Therefore, improving feed utilization has a tremendous impact on production costs. Poultry producers face the challenge of finding cost-effective nutritional and processing strategies in order to remain profitable.

Particle size reduction during grinding increases the surface area of feed ingredients, which increases the interaction of the ingredients with digestive enzymes, improves mixing characteristics, and reduces nutrient segregation during handling, particularly in mash diets. However, excessively fine grinding can increase grinding costs, lead to dust pollution and moisture losses, and cause flowability problems during feed manufacturing. In broiler diets, the addition of finely ground ingredients has been associated with increased gastrointestinal passage rate, poor gut health, and low nutrient digestibility.

The effect of ingredient particle size in poultry diets is complex and is influenced by a number of factors, such as age, grain type, grinding method, and particle size distribution. Whole grains or coarsely ground ingredients have been reported to influence gastro intestinal tract (GIT) function and gizzard development as well as reverse peristalsis. A well-developed gizzard improves gut motility, increases retention time of the feed in the GIT, promotes better digestion and absorption of nutrients in the upper gut, and reduces the risks of coccidiosis and other enteric diseases in the lower gut. In addition, feeding whole grains or coarsely ground ingredients reduces proventricular swelling.

Tests on two levels of coarse corn (0 and 50 percent) during the grower and finisher period have indicated that the inclusion level of coarse corn was obtained by replacing 0 or 50 percent of the total dietary corn with coarse corn (1,359 µm) in a basal diet that contained fine corn (294 µm).

As 50 percent coarse corn replaced fine corn, the average particle size of the mash diet prior to pelleting increased from 432 μm to 640 μm in the grower diets and from 389 to 651 μm in the finisher diets and produced a bimodal particle size distribution (figure 1). In this study, pellets were screened to remove the variability caused by pellet fines on growth performance.

The addition of 50 percent coarse corn significantly improved feed efficiency during the grower and finisher periods (table 1). The improvement in feed efficiency when 50 percent coarse corn replaced fine corn appeared to be associated with better nitrogen and energy digestibility. The improvement in nutrient digestibility when coarse particles are fed has been reported in several studies. Furthermore, the addition of 50 percent coarse corn increased relative and absolute gizzard weight, reduced relative proventriculus weight, and produced an improved compartmentalization between gizzard and proventriculus.

Increased gizzard development is a consequence of increased grinding activity through the addition of coarse corn or other structural material. The improved compartmentalization suggests a better balance between the enzymatic activity and acid secretion in the proventriculus and grinding activity in the gizzard, which results in better nutrient digestion.

Studies show that the addition of coarse corn had an effect on litter condition (nitrogen, moisture, and pH). A decrease in litter nitrogen of 8.47 percent was reported when 50 percent coarse corn replaced the fine corn. The reduction of nitrogen in the litter is important to reduce the incidence of footpad dermatitis, particularly in conditions of high litter moisture.

The particle size of SBM has also been shown to influence broiler performance. A 2004 study reported an improvement in mineral digestibility when the particle size of SBM increased from 891 μm to 1,239 μm. A 2013 study evaluated the effect of SBM source (solvent extracted and expeller extracted) and particle size (coarse–1,330 μm and fine–520 μm) on broiler performance from 1 to 49 days old. Authors of the study reported a higher body weight and improved feed efficiency at 35 and 49 days old when birds were feed coarse SBM. There was an interaction between SBMsource and particle size on body weight at 49 days old. No differences in body weight were observed when birds were fed solvent-extracted and expeller-extracted SBM in a coarse ground form. However, grinding the expeller-extracted SBM depressed body weight at 49 days.

Subsequently, a 2014 experiment was conducted to evaluate the effect of particle size (530 and 1300 μm) and trypsin inhibitor levels of expeller-extracted SBM on growth performance of chicks from 1 to 14 days. Increasing the particle size of expeller-extracted SBM improved growth performance, especially when the trypsin inhibitor level was greater than 9 TIU/mg (figure 3). It is theorized that coarse grinding of expeller-extracted SBM increased gastric reverse peristalsis (gizzard and proventriculus) and caused acid denaturation of trypsin inhibitors, increased bile movement into the gizzard, released trypsin inhibitors more slowly or consistently, and, consequently, provided the chick with the opportunity to adapt.

Although there are multiple benefits of feeding coarse particles, the age and the size of the birds are important when deciding on particle size. Newly hatched chicks can have problems consuming whole grains or coarse particles, an issue directly influenced by beak size. A 2004 study reported a significant decrease in body weight gain at 7 and 15 days when the particle size of corn in diets fed to poults increased from 606 to 1,094 μm. Moreover, other studies show that chicks fed whole wheat had lower body weight because of poorer feed consumption as compared to those receiving ground wheat. Young chicks might have difficulties swallowing the unground grain.

A 2010 study reported a linear decrease in body weight gain (0 to 21 days) and poorer feed efficiency (0 to 7 days) when the particle size of corn increased from 557 to 1,387 μm. In a 2013 study, four dietary treatments evaluated SBM particle size (coarse–1,290 and fine–470 μm) and corn particle size (coarse–1,330 and fine–520 μm) in a factorial arrangement (table 2). The chicks were fed a starter diet in mash form from 1 to 19 days. Chicks fed fine SBM had a greater body weight at 19 days than chicks fed coarse SBM, primarily driven by higher feed consumption. Furthermore, chicks fed fine corn had greater body weight at 7 and 19 days, influenced by both greater feed consumption and better feed efficiency. In this study, grinding corn from 1,290 to 470 µm improved feed efficiency by 15 percent at 7 days and by 4 percent at 19 days. The inclusion of whole grain or coarse corn with an average particle size greater than 1,000 µm can reduce body weight and feed efficiency, particularly during the starter period, likely because the gizzard of newly hatched chicks is not fully developed and is unable to grind large particles as in the older bird. Further, the grinding process in the gizzard requires energy that is diverted from growth. For these reasons, it is advisable to consider incorporating large quantities of coarse materials only in later production phases.

Particle size reduction is the second largest energy cost after pelleting during feed manufacturing. For this reason and those described above, sampling should be conducted and particle size analysis performed at least weekly after performing any preventive or corrective maintenance, such as changing screens, hammers, or changing rotation, as well as when the characteristics of corn may change (e.g., new crop corn). Particle size manipulation has a tremendous effect on feed costs, nutrient digestibility, animal welfare, and overall profitability of poultry operations.

As described, the target particle size in poultry diets should depend on the phase of production. Starter diets should contain a small percentage of coarse particles of corn, which should then gradually increase with body weight and age. During the grower and finisher periods, the particle size of corn-SBM diets fed to broilers should be around 650 to 700 µm with approximately 20 percent of the particles being larger than 1,180 µm (bimodal distribution) to stimulate gizzard function, increase the gut retention time, improve nutrient digestibility, and promote intestinal health. Following these strategies has been shown to improve bird performance, reduce feed costs, and positively affect overall profitability.

A 2010 study reported a linear decrease in body weight gain (0 to 21 days) and poorer feed efficiency (0 to 7 days) when the particle size of corn increased from 557 to 1,387 µm. In a 2013 study, four dietary treatments evaluated SBM particle size (coarse–1,290 and fine–470 µm) and corn particle size (coarse–1,330 and fine–520 µm) in a factorial arrangement (table 2). The chicks were fed a starter diet in mash form from 1 to 19 days. Chicks fed fine SBM had a greater body weight at 19 days than chicks fed coarse SBM, primarily driven by higher feed consumption. Furthermore, chicks fed fine corn had greater body weight at 7 and 19 days, influenced by both greater feed consumption and better feed efficiency. In this study, grinding corn from 1,290 to 470 µm improved feed efficiency by 15 percent at 7 days and by 4 percent at 19 days. The inclusion of whole grain or coarse corn with an average particle size greater than 1,000 µm can reduce body weight and feed efficiency, particularly during the starter period, likely because the gizzard of newly hatched chicks is not fully developed and is unable to grind large particles as in the older bird. Further, the grinding process in the gizzard requires energy that is diverted from growth. For these reasons, it is advisable to consider incorporating large quantities of coarse materials only in later production phases.

Particle size reduction is the second largest energy cost after pelleting during feed manufacturing. For this reason and those described above, sampling should be conducted and particle size analysis performed at least weekly after performing any preventive or corrective maintenance, such as changing screens, hammers, or changing rotation, as well as when the characteristics of corn may change (e.g., new crop corn). Particle size manipulation has a tremendous effect on feed costs, nutrient digestibility, animal welfare, and overall profitability of poultry operations.

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