A Guide to Corn Production in Georgia 2013

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A GUIDE TO CORN PRODUCTION IN GEORGIA

2013

2013 CORN PRODUCTION IN GEORGIA

Dewey Lee

Corn production in Georgia has remained relatively steady in the past decade due to limited opportunities for profit and increased risks from higher production costs. Corn acreage in the 1970s averaged 1.64 million acres in Georgia, however, it declined almost 50 per cent in the 1980s to 0.86 million acres due to poor prices and extended periods of drought and further still during the 1990's. Since then, acreage has stabilized averaging 350,000 acres in recent years. It is predicted that acreage will drop slightly in 2012 from 2011 due to rising peanut prices and cost of inputs.

Dryland vs. Irrigated Corn

Estimates by the Georgia Agricultural Statistics Service and the Cooperative Extension Service indicate that approximately 65+ per cent of Georgia's corn is irrigated (Table 1.).

Table 1. Planted Corn Acreage in Georgia for Selected years

Year	Planted Acres	Irrigated Acres	% Irr. Acres
2000	240,000	140,000	58
2001	220,000	120,000	55
2002	290,000	160,000	55
2003	290,000	155,000	53
2004	280,000	155,000	55
2005	230,000	125,000	54
2006	280,000	155,000	55
2007	530,000	290,000	55
2008	370,000	225,000	61
2009	420,000	285,000	68
2010	370,000	244,000	66
2011	345,000	250,000	72

Irrigation and other production technology, and good management have made 250 bushels/acre achievable throughout the state. In fact, corn yield under irrigation reached record levels during 2011. The highest yield ever recorded in Georgia measured 364 bushels per acre in Brooks Co. in 2011. These higher yields may not always be a practical goal for all producers. Your decision to irrigate changes the way a corn crop is managed to maximize a return on investment. Cultural practices such as hybrid selection, plant population, fertility level, and crop protection all change under irrigation.

Why irrigate? Surveys by the Georgia Agricultural Statistics Service show that yields of dryland producing from 1999 to 2008 on average were only 48% of irrigated yields (Table 2). In recent years, the differences have been greater due to the La Nina effects on our weather patterns.

Table 2. Irrigated and Non-irrigated Corn Production in Georgia, 12 Yr Avg

Year	Acres Harvested for Grain -----1000 Acres-----		Yield per acre -----bushels-----		Dryland Yield as a % of Irr. Yield
	Non-Irr.	Irr.	Non-Irr.	Irr.	
1997	300	150	85	145	59
1998	90	175	27	115	23
1999	160	140	66	145	46
2000	100	140	48	149	32
2001	100	120	92	169	54
2002	130	160	65	156	41
2003	135	150	102	153	67
2004	125	155	93	160	58
2005	105	125	104	150	69
2006	95	130	62	149	50
2007	160	290	65	166	39
2008	85	225	64	169	38
Average	**132**	**176**	**73**	**152**	**48**

Of the many climatic and environmental factors that affect corn production, water is the most significant. Research at The University of Georgia Coastal Plain Experiment Station (Hook, 1991) show that severe, droughty condition that were most damaging to corn yields since 1938 were clustered into two periods, the early 1950s and most of the 1980s. During the survey period, dryland production was predicted to be 38-64% of non-stress yields. Unfortunately, in corn production, yield reducing droughts should be considered the norm rather than the exception.

Irrigation can eliminate much of the moisture stress during these critical periods if correctly applied. Irrigation makes it possible for the crop to fully utilize fertilizer and other inputs to improve profitability. However, irrigation as with any other management tool must be used effectively and efficiently to achieve its maximum potential. See the irrigation management and scheduling section for details on efficient irrigation techniques.

AGRONOMIC PRACTICES FOR CORN

Dewey Lee

Soil Preparation

A good soil management program: (1) protects the soil from water and wind erosion, (2) provides a good, weed-free seedbed for planting, and (3) destroys hardpans or compacted layers that may limit root development. To conserve moisture and reduce compaction, work the land no more than necessary to achieve these objectives.

Water erosion is a significant problem on many Georgia soils during the high rainfall, winter months. Wind erosion can be a problem on sandy Coastal Plain soils in early spring when blowing sand can severely injure young corn plants. Crop residue left on the soil surface or a seeded cover crop effectively reduces water erosion problems. Using minimum-till planting practices such as strip-till or slit-till helps reduce soil losses and "sand blasting" from wind erosion.

Tillage

Compaction layers or traffic pans (dense areas) are present in many, if not most, of the sandy, Coastal Plain soils in Georgia. These traffic pans restrict root growth and thus affect water and nutrient uptake by the plant. Traffic pans or dense soils should be disrupted by deep turning, V-ripping, paraplowing, chisel plowing or by in-row subsoiling during planting. In-row subsoiling has increased corn yields over 50 per cent on soils where traffic pans were present (Table 3). It enables corn plants to develop deeper root systems which make better use of sub-soil moisture and improves chances of recovering nutrients as they move through the soil.

Table 3. Influence of Tillage and Water Management or Corn Yield (Bu/A)

Tillage	Irrigation	Year 1	Year 2	Year 3	Avg
Conventional	No	71	30	30	42
Conventional	Yes	114	137	138	130
Subsoil	No	159	130	78	122
Subsoil	Yes	155	162	149	155
[1]Cassel and Edward, North Carolina.					

Data in Tables 4 and 5 demonstrates that a full zone fracturing of sandy soils such as that which is achieved with a paraplow is equal in yield to in-row subsoiling of corn. Under current fuel and equipment cost, it is more cost effective to perform some type of tillage that disrupts plow pans than to plant strictly no-till without in-row subsoiling.

Table 4. Corn Yield as Affected by Tillage, Tifton (bu/ac)

Tillage	1999	2000	2002	3 yr av.
Paraplow	162	188	177	179
In-row subsoil	167	195	168	177
No-till	145	153	147	148
Lsd p□ 0.10	7	16	8	

The results of several years of tillage studies conducted in Tifton, demonstrate that corn yields produced under conservation tillage methods are equal to or better than those with conventional tillage such as rip & bed (Table 5).

Table 5. Tillage X Crop Rotation Study, 2003-06, Lang Farm, Tifton GA

Tillage	2003	2004	2005	2006	Avg.
Strip	165	198	195	202	190
Slit	148	195	200	199	186
Rip & Bed	163	178	189	203	184
No-till	153	157	156	149	154
Lsd $p \leq 0.10$	NS	30	29	17	

Hybrid Selection

Many different hybrids are marketed in Georgia each year. Differences exist among hybrids in yield potential, maturity, lodging resistance, disease resistance, grain quality and adaptability to different geographic areas of the state. Keep the characteristics that best fit your farm in mind when you select hybrids for planting on your farm.

The right choice of hybrids for any production system is crucial since large genetic differences exist for the many traits of yield. Hybrids for irrigation should have the genetic potential to perform at high plant densities and respond to water and other inputs such as increased fertility. Hybrids with strong stalks and roots are needed under higher densities and yield levels to allow the corn crop to dry down with minimal harvest loss due to lodging. Higher populations suggest the need for a hybrid that can take the crowding and still maintain stalk quality and ear development. Dryland hybrids on the other hand require good stress tolerance with good grain quality. Each company that sells hybrids generally makes distinctions between hybrids that perform better under one production system or another.

Leaf disease resistance is a necessary component of hybrid selection particularly in irrigated corn and corn behind corn situations. Higher humidity, fluctuating water availability and higher plant populations under irrigation will favor many diseases. Selection of hybrids with a higher degree of resistance to a variety of stresses is important. Hybrids should have very good resistance to the many organisms that cause diseases such as northern and southern corn leaf blight, anthracnose, grey leaf spots, common rust, southern rust, maize chlorotic dwarf virus, etc.

Hybrids with high-grain quality at harvest are necessary to provide a better market for the crop. Grain quality depends on resistance to ear rots and other pests. Good husk cover to retard moisture and insect penetration minimizes damage from subsequent development of ear or kernel diseases. In addition, hybrids with higher grain quality typically weather better during dry down.

Hybrid maturity determines how well a hybrid will fit into a production program and maturity is another selection consideration. Hybrids are generally classified as early (short-seasoned), medium (mid-season) or late (full-season) maturity. Early and medium maturing hybrids are usually better adapted to irrigated corn production than dryland production because they, (1) mature 2 to 3 weeks earlier, (2) generally grow shorter and are less subject to lodging, (3) may need fewer irrigations because of their shorter season and (4) are more suitable for use where large acreages may require a harvest spread to improve harvest efficiency. If the farm work load normally prevents harvesting early to medium maturing hybrids within 30 days after physiological maturity (black layer) consider planting a later maturing hybrid.

Today, hybrid seed companies identify proprietary hybrids that are genetically similar but differ in one or more traits (Bt, Roundup resistance, Liberty Link, etc) which they distinguish from the conventional parent line. Care should be taken when examining these hybrids for possible use that other equally important characteristics have not unfortunately been altered, i.e. disease resistance, root strength, etc.

The results of annual hybrid evaluation tests at several locations throughout the state are available from your county Extension office. Information on most of the traits can be found in the Corn Performance Trial Bulletin **(http://www.swvt.uga.edu)**. Consistent performance is most important and growers should evaluate hybrid performance data over at least three years at several locations. It is important however, to compare hybrids within maturity groups. Growers should test new hybrids on their farms but should not plant them initially to large acreages. Through continued evaluation of new hybrids, you should be able to select hybrids which will contribute and enhance production under irrigation on your farms.

Planting Dates

Plant corn as soon as temperature and moisture become favorable for seed germination and seedling growth. Soil temperature in the seed zone should be 55^0F or greater before planting. Corn seed will sprout slowly at 55^0F while germination is prompt at 60^0F. Delay planting if cold weather drops soil temperatures below 55^0F at the two-inch level. However, if soil temperatures are 55^0F and higher, and projections are for a warming trend, corn planting can proceed. Extremely early planting introduces a risk to frost or freeze damage and subsequent loss of stands. Usually, as long as the growing point is below ground level, corn can withstand a severe frost or freezing damage without yield reduction. It is best therefore to monitor soil conditions and weather if your desire is to plant as early as possible. Generally it takes corn seed 7 to 12 days to emerge when planted in soils there are 55^0F.

Early planted corn out-yields late planted corn. Depending on your location, planting dates may range from early March in south Georgia to mid-May in north Georgia. Early planting helps avoid periods of low rainfall and excessive heat during pollination, both of which lead to internal water stress during critical periods of corn development. Early planting is essential when double cropping soybeans, grain sorghum, millet or vegetables following irrigated corn.

As planting is delayed into the summer, corn yields decline. In general, yields decline at ¾ a bushel per day rising to about 2.5 bushels per day. Studies in Tifton, under irrigation, demonstrate that yields of stress tolerant and disease resistant hybrids are about 50% of normal when planted in late May or early June. Therefore, late planting is very risky with a high degree of failure.

Plant Populations and Row Spacing

The optimum population for a given situation varies with soil type, hybrid, the ability to supply irrigation water and other management practices. Irrigated corn requires higher plant population than dryland corn to fully explore the potential of irrigation. Generally 26,000 to 36,000 plants/A are recommended for most intensively grown hybrids. Excessive populations increase seed costs and may reduce yield because of crowding and lodging. Plant 10% more seed/ac than is necessary to produce the desired plant population for any particular hybrid. This over-planting will leave the harvest plant population at the desired level after a normal stand loss due to uncontrollable factors.

Optimum plant populations for dryland production range in general from 18,000 to 20,000. Though greater plant populations would provide higher yields in good rainfall years, the stress of higher plant populations above 20,000 in drier years would significantly increase the risk to yield loss due to plant competition. Conversely, lower plant populations reduce yield potential in years with adequate rainfall.

Most farm equipment in Georgia is set to plant in 36" rows. Wider rows, 38” to 40" rows usually results in little space between plants within a row. This creates in-row competition for water and nutrients**. Studies conducted in corn reveal that yields increase as rows narrow at high plant populations (Table 6).** Many growers have tried to reduce this in-row competition with twin row corn on 36 inch row widths. If twin row spacing is used, it is best to fully disrupt the hard pans beneath both rows. Either adding shanks or using some type of full zone fracturing allows the plants to grow without root restriction. This allows plants to exploit more moisture, nutrients and light due to greater space between plants. It also helps weed control by shading the lower canopy. Row widths of 30 to 36 inches are adequate for top yields in Georgia.

Table 6. Yield of corn in various row widths, Tifton GA

Row width	2003	2004	2005	2006	AVG
20"	255 a	263 a	230 a	267 b	254
30"	191 c	252 b	225 a	311 a	245
36"	232 b	250 b	202 b	257 b	235
Twin(36")	227 b	254 b	202 b	266 b	237

Lsd $p \leq .10$

Table 8 illustrates plant populations at various row widths and plant spacings. This table can be used to estimate plant populations. To check the calibration measure off the indicated distance found in Table 7, avoiding the first 40 to 50 feet seeded to allow the planter seed drop to become uniform. Count the number of kernels in one row for the indicated distance and multiply this number by 1,000 to get the population/A. Check several rows to be certain each planter unit is working properly. It is always best to double check the planter to ensure seed drop is providing the desired populations. Vacuum-type planters have excellent control in attaining a desired seed drop and plant populations. Whether old or new, well-maintained planters are necessary for evenly distributed plant population.

Table 7. Length of Row Required for 1/1,000 Acre at Various Row Widths.

Row Widths inches	Length of row for 1/1,000 acre
20	26 ft. 2 in.
30	17 ft. 4 in.
32	16 ft. 3 in.
36	14 ft. 6 in.
38	13 ft. 9 in.
40	13 ft. 1 in.

Table 8. Approximate Plant Populations at Various Row Widths and Plant Spacing within a row.

	Row Width in Inches				
Within row Plant Spacing (inches)	20	30	36	38	40
4.5			38,700	36,700	34,800
4.7			37,100	35,100	33,400
5.0		41,800	34,800	33,000	31,400
5.3		39,400	32,900	31,100	29,600
5.5		38,000	31,700	30,000	28,500
5.7		36,700	30,600	29,000	27,500
6.0		34,800	29,000	27,500	26,100
6.2		33,700	28,100	26,600	25,300
6.5		32,200	26,800	25,400	24,100
6.8		30,700	25,600	24,300	23,100
7.0		29,900	24,900	23,600	22,400
7.3		28,600	23,900	22,600	21,500
7.5		27,900	23,200	22,000	20,900
7.8	40,200	26,800	22,300	21,200	20,100
8.0	39,200	26,200	21,800	20,600	19,600
8.3	37,800	25,200	21,000	19,900	18,900
8.5	36,900	24,600	20,500	19,400	18,400
8.8	35,600	23,800	19,800	18,800	
9.0	34,800	23,200	19,400	18,300	
9.3	33,700	22,500	18,700	18,700	
9.5	33,000	22,000	18,300		
10.0	31,400	20,900			
10.3	30,500	20,300			
10.5	29,900	19,900			
10.7	29,300	19,500			
11.0	28,500	19,000			
11.5	27,300	18,200			
12.0	26,100				
12.5	25,100				
13.0	23,200				
13.5	23,200				
14.0					
14.5					
15.0					

FERTILIZATION

Glen Harris

By nature, soils of Georgia are acid and infertile; therefore, substantial quantities of limestone and fertilizer are required for optimum fertility levels. Fertilizer recommendations are based on yield goals and crop utilization. Corn harvested for silage requires more fertilizer than corn grown for grain because silage removes from the field all the nutrients in the above-ground plant parts. The removal of potassium is especially great in comparison to grain harvest. A comparison is given in Table 9 of the nutrients contained in grain and the stover.

Table 9. Pounds of Nutrients Removed by the Grain and Stover of a 180-Bushel Corn Crop.

Nutrient	Grain	Stover	Total
	--------------lbs/acre---------		
Nitrogen	170	70	240
Phosphorus (as P_20_5)	70	30	100
Potassium (as K_20)	48	192	240
Calcium	15	42	57
Magnesium	16	34	60
Sulfur	14	16	30
Zinc	0.15	0.54	0.69

Liming

Many Georgia corn fields are naturally acid. This acidity is primarily because of (1) increased use of nitrogen in acid forming sources, (2) leaching of calcium and magnesium, and (3) nutrient removal by high-yielding crops. Liming such soils has certain advantages:

$ Corrects soil acidity - Corn grows well in soil with a pH between 6.0 - 6.5 but is inhibited by a soil pH less than 5.7.

$ Supplies plant nutrients - All plants need calcium and magnesium for growth. Dolomitic liming materials containing these elements will increase yield on soil low in either or both of these nutrients.

$ Makes other plant nutrients more available - Acid soils fix plan nutrients, especially phosphorus, in forms unavailable to plants. Liming acid soils will release fixed nutrients, making them more available to the growing crop.

$ Promotes bacterial activity - They break down soil organic matter to make soil nitrogen and other nutrients more available. Since most bacteria cannot live under very acid conditions, liming acid soils increases bacterial activity.

Magnesium is frequently a limiting nutrient in corn production, especially on the sandy soils of the Coastal Plain area. Dolomitic limestone will help eliminate this problem; however, to be effective as a source of magnesium, apply dolomitic lime several months prior to planting. If soil test results show that magnesium levels are low and dolomitic limestone cannot be applied several months before planting, apply a supplemental application of 25 to 50 pounds of elemental magnesium per acre before planting.

BASE FERTILIZATION

Fertilizer recommendations depend on the soil fertility level as determined by soil tests and the yield goal. Fertilization programs not based on soil tests may result in excessive and/or sub-optimum rates of nutrients being applied. Take soil samples each fall to monitor the current fertility level. Use the yield goal to determine the quantity of nitrogen, phosphate and potash to be used. At high yield levels, the balance of nutrients in relation to one another also is important.

Nitrogen: In sandy Coastal Plain soils, nitrogen is very mobile. If excessive rainfall occurs or excessive amounts of water are applied through the irrigation system, leaching losses of nitrogen can be quite drastic during the growing season. To increase the efficiency of nitrogen recovery during the season, split applications of nitrogen are recommended.

Apply 25 to 30 percent of the projected nitrogen needs before or at planting. The remaining nitrogen can be applied sidedress and/or injected through the center-pivot systems (fertigation). If all the nitrogen is applied with ground equipment, apply 50 to 75 pounds per acre at or before planting under irrigated conditions and 20 to 50 lbs per acre in dryland environments and the rest when the corn is 12 to 16 inches tall.

If nitrogen is to be injected through the irrigation system, apply 40 to 60 lbs at or before planting and begin ground or injected applications of 30 to 60 pounds of nitrogen per acre when the corn is 8 to 12 inches tall. Continue on a bi-weekly basis until the total required nitrogen is applied. Three to five applications of nitrogen will be needed during the growing season.

Applications of nitrogen after pollination **are not recommended unless a severe nitrogen deficiency is detected.**

Phosphate and potash: Apply all the phosphate and, on most soils, all the potash at or before planting. Some of the phosphate requirements may be obtained through the use of starter fertilizer. On deep sands, you should probably apply potash in split applications, half at planting and half at layby.

Secondary and micronutrients: Corn requires a relatively large amount of sulfur, generally 20 to 30 pounds per acre. On deep sands, apply sulfur in split applications. All sulfur should be applied in the sulfate (SO_4=) form. Applications with nitrogen may prove efficient.

Base magnesium fertilization on soil tests. If the level is low, apply 25 to 50 pounds per acre of water-soluble magnesium by lay-by.

Zinc deficiency can be prevented by using thee pounds per acre of actual zinc. Do not use zinc unless soil test levels are low. If needed, apply preplant or at planting.

Boron deficiencies can occur on sandy soil low in organic matter. Generally, use one to two pounds per acre of boron applied in split applications. It is best to apply boron with the nitrogen applications. The application of other essential nutrients should be based on plant analysis results.

FERTILIZER PLACEMENT

The main objectives in fertilizer placement are to avoid injury to the young seedling and to use fertilizer nutrients efficiently. Fertilizer applied too close to the germinating seed or emerging plant will cause severe salt injury to the plant. With low soil moisture, the fertilizer salts will draw water away from the plant roots causing the plants to wilt. It is important though to apply your nitrogen in a band near the row (4 to 6 inches next to the row) particularly in soils where N easily leaches and where traffic rows restrict root growth.

Broadcasting fertilizer will help reduce the risk of fertilizer injury. Research shows that broadcasting fertilizer is less expensive and just as efficient as banding on soils with medium fertility. If soil tests low in phosphorus and potassium, it is better to place one-half of the needed fertilizer in a band near the row and broadcast the rest.

STARTER FERTILIZER

Small amounts of nitrogen and phosphorus are often used as a starter or "pop-up" fertilizer. The main advantage of starter fertilizer is better early-season growth. Corn planted in February, March or early April is exposed to cool soil temperatures, which may reduce phosphate uptake. **Banding a starter fertilizer two inches to the side and two inches below the seed increases the chances of roots penetrating the fertilizer band and taking up needed nitrogen and phosphorus.**

Deduct the amount of nitrogen and phosphorus used in a starter fertilizer from the total nitrogen and phosphorus needed for the season. However, total phosphate requirements of the corn crop can often be supplied in the starter fertilizer. Since nutrients applied in starter fertilizers are a part of the total fertilizer program, using this recommended practice is not very costly.

Currently, the most popular starter fertilizer is ammonium polyphosphate (10-34-0). Monoammonium and diammonium phosphates are equally effective. There is generally no advantage in using a complete fertilizer (NPK) as a starter since applying phosphate is the primary objective. There is an advantage to using additional N such as 28-0-0-5 particularly in sandy soils to encourage growth as soils warm. Depending on your needs, a typical popup application is 6 to 7 gallons each of 10-34-0 and 28-0-05, as described above.

ANIMAL MANURE

Animal manures such as poultry litter and lagoon water can be an excellent source of nutrients for corn. It is important though to know the amounts of nutrients contained in the manure prior to making a decision to use it as your main source of phosphorus and potassium. The majority of the nutrients contained in the manure are readily available in the season. If you are using poultry litter, in general, you should be able to use about 65% of the nitrogen and 80% of the phosphorus and potassium contained in the litter the first year. For example, if your analysis is 50-50-50 per ton, and you apply two tons per acre, then credit your fertility program 65 lbs of nitrogen, phosphorus and potassium the first year. At least 25% of the nitrogen should be available within the first two to three weeks after application and the remainder throughout the season.

PLANT ANALYSIS

Soil tests serve as a sound basis for determining fertilizer requirements for corn; however, many factors such as nutrient availability, leaching and crop management practices may require modification in a basic soil fertility program to maximize fertilizer use efficiency.

Plant analysis, a laboratory procedure used to determine the concentration of elements present in a plant, can be used to (1) monitor the nutrient status of the plant and evaluate the appropriateness of the fertilization program used, (2) confirm a suspected nutrient deficiency, or (3) detect low nutrient levels before growth is affected.

Plant analysis usually consists of determining the concentration of the following essential plant nutrients: nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), manganese (Mn), boron (B), copper (Cu), iron (Fe), zinc (Zn) and sulfur (S). The concentration found is a measure of the plant's nutrient status. The analysis is interpreted by comparing the concentration found to known standards for that plant part and stage of growth when sampled. When the concentration of an element falls outside the normally expected range, an evaluation and recommendation based upon the results and information with the sample, is made. Information such as soil test level, soil type, and fertilizer and lime applied is essential to properly evaluate a plant analysis and make a valid recommendation.

Do not substitute plant analysis for a soil test, but use it to determine (1) whether essential elements are present in low, adequate or excessive amounts in the plant and (2) whether the proper ratio of certain elements exists. It is advisable to take plant samples throughout the growing season to monitor nutrient status and detect any deficiencies or imbalances. What actually gets into the plant is really what counts most. If a deficiency or imbalance is detected early enough, it can usually be corrected in time to improve yield.

SCHEDULING AND MANAGING CORN IRRIGATION

Kerry Harrison and Dewey Lee

Irrigation requires a relatively high investment in equipment, fuel, maintenance and labor, but offers a significant potential for increasing net farm income. Frequency and timing of water application have a major impact on yields and operating costs. To schedule irrigation for most efficient use of water and to optimize production, it is desirable to frequently determine the soil water conditions throughout the root zone of the crop being grown. A number of methods for doing this have been developed and used with varying degrees of success. In comparison to investment in irrigation equipment, these scheduling methods are relatively inexpensive. When properly used and coupled with grower experience, a scheduling method can improve the grower's chances of success.

Any plan typically is better than no plan or method at all, particularly with corn. A good plan pays dividends in terms of yield, water-use efficiency and net returns. In corn, irrigating too late causes yield loss while irrigating too much wastes energy, water, money and can leach nutrients beyond the root zone.

The most simple and practical way of scheduling corn irrigation is to use the moisture balance or check-book method. This helps a grower keep up with an estimated amount of available water in the field as the crop grows. The objective is to maintain a record of incoming and outgoing water so that an adequate balance amount is maintained for crop growth. Growers will need certain basic information to use a check-book method. The soil type of the field, expected daily water use of corn, water holding capacity of the soil and a rain gauge or access to nearby rainfall information are the basic starting point items. An example of a check-method book calculation is presented at the end of Table 10.

Check-book type methods can be enhanced with other different tools or methods such as the EASY pan method. The UGA EASY (Evaporation based Accumulator for Sprinkler enhanced Yield) Pan is designed to be easy to operate, economical, and representative of the water used by the crop in humid areas. A couple of the unique operating characteristics is the ability to read the unit from a distance and the fact that no record keeping is required. This makes the Easy Pan a simple tool for scheduling irrigation. The float based mechanism is designed to represent both the effective root depth of a crop and the soil water holding capacity. The covering screen on the pan unit is designed to limit evaporation to a level similar to the evapotranspiration rate (water use) of a crop.

Also expert systems such as Irrigator Pro (software by USDA), or other scheduling software are available to help you make decisions regarding when to irrigate. Soil moisture measuring devices such as Echo' and Watermark' can be used in conjunction with corn growth curves to enhance irrigation scheduling as well. These devices provide instant readings of either soil moisture content or tension in the root zone and can identify exactly when water is needed to replenish the root zone.

Soil water sensors (measuring devices) range in prices from $30 to $40 per probe to $100 + per probe. With these probes, data loggers (additional expense) will be needed to log the data as the software is design to accumulate the information. Each data logger collects information from several probes that might be used in the field. Some devices have the ability to collect and send information either through cellular or radio technology and will vary in price and abilities. This makes obtaining information simple and can be directly imported into your computer at home. A few notable companies are: Decagon

Devices (http://www.decagon.com); Irrometer (www.irrometer.com); and AquaSpy (www.aquaspy.com).

Tables 10 and 11 are provided to help you determine when to schedule irrigation by the check book method. The expected daily water use of corn is shown in Table 16. This table also provides growth stage, days after planting and estimated water use in inches per day for hybrids with a relative maturity of 115-119 days. Table 11 provides examples of available water holding capacities of soils in Georgia.

Table 10. Estimated Water Use of Corn in Georgia

Growth Stage	Days After Planting	Inches Per Day
Emergence and primary root developing.	0-7 8-12	.03 .05
Two leaves expanded and nodal roots forming.	13-17 18-22	.07 .09
Four to six leaves expanding. Growing point near surface. Other leaves and roots developing.	23-27 28-32 33-36	.12 .14 .17
Six to eight leaves. Tassel developing. Growing point above ground.	37-41 42-45	.19 .21
Ten to twelve leaves expanded. Bottom 2-3 leaves lost. Stalks growing rapidly. Ear shoots developing. Potential kernel row number determined.	46-50 51-54	.23 .25
Twelve to sixteen leaves. Kernels per row and size of ear determined. Tassel not visible but about full size. Top two ear shoots developing rapidly.	55-59 60-64	.27 .29
Tassel emerging, ear shoots elongating.	65-69	.31
Pollination and silks emerging.	70-74 75-79	.32 .33
Blister stage.	80-84	.33
Milk stage, rapid starch accumulation.	85-89	.34
Early dough stage, kernels rapidly increasing in weight.	90-94	.34
Dough stage.	95-99	.33
Early dent.	100-104	.30
Dent.	105-109	.27
Beginning black layer.	110-114	.24
Black layer (physiological maturity).	115-119	.21

The following example of the water balance or check-book method demonstrates how to determine how much and how frequent to irrigate.

Example:

Step 1. The soil type of the corn field is a Tifton soil series. In Table 11, look at the average available water capacity in in/ft increments. Assuming a rooting depth of 24 inches, the total available water is 2.2 inches (2 feet x 1.1 in/ft)

Step 2. The corn crop is 65 days old. From Table 10, the daily water use is about .31 inches/day

Step 3. Determine the irrigation by setting a lower limit of available water due to soil tension. For this example use 50%. In other words, only half of the water in the root zone will be allowed to be depleted. Therefore, 1.1 inches of water will be needed to replace the soil water used or lost.

Step 4. Determine the amount of irrigation to apply by dividing the amount replaced by an irrigation efficiency. Using 75% as the irrigation efficiency, the amount of irrigation to apply is 1.1/.75 = 1.47 or 1.5 inches.

Step 5. Determine the frequency of irrigation by dividing the amount of water replaced by water use per day. An example of frequency of water (either rainfall or irrigation) need:
1.1 in /.31 in per day = 3.5 days.

Step 6. It is necessary then to apply 1.5 inches every 3.5 days to maintain 50% available water for corn that is 65 days old.

Table 11. Examples of Available Water Holding Capacities of Soils in the Coastal Plain of Georgia

Soil Series	Description	Intake In/Hr for Bare Soil*	Available Water Holding Capacity In: In/Ft. Increments
Faceville		1.0	1.3
Greenville	Sandy Loam, 6-12"		1.4
Marlboro	Moderate intake, but rapid in first zone		1.2 - 1.5
Cahaba		1.2	1.0 - 1.5
Orangeburg	Loamy sand, 6-12"		1.0 - 1.3
Red Bay	Loamy subsoil, rapid in first zone, moderate in second		1.2 - 1.4
Americus		2.0	1.0
Lakeland	Loamy Sand , 40 to 60 inches		0.8
Troup	Rapid permeability		0.9 - 1.2
Norfolk	Loamy sand,	1.3	1.0 - 1.5
Ochlocknee	12-18" rapid permeability		1.4 - 1.8
Dothan	Loamy sand and	1.0	1.0 - 1.3
Tifton	sandy loam 6-12", moderate intake		0.8 - 1.0
Fuquay	Loamy sand,	1.5	0.6 - 8
Lucy	24 - 36"		1.0
Stilson	Rapid permeability in first zone, moderate in second		0.9
Wagram			0.6 - 0.8

* Increase soil infiltration rate in field where conservation tillage methods are used.

IRRIGATION SCHEDULING

Probably the most important management decision about irrigation scheduling is your yield expectation and water availability. For growers targeting yields of less than 150 bushels per acre or with less than 5 inches of water available, watch for visual signs of stress that occur just prior to tasseling. This will be "leaf curling" that occurs before noon. In this case a thorough application of water (up to 2.5 inches depending on soil type) should be made as tassels begin to emerge and another application made two weeks later. Do not change this timing unless very heavy rainfall occurs. If water is still available a third application of the same amount could be made two weeks after the second application

In short, if you are targeting a yield of less than 150 bushels per acre or if you have a limited amount of water to apply you should not irrigate until you see "leaf curl" at the tassel stage. At this point apply 2-2.5 inches of water every 14 days (1-1.25 inches back-to-back may be necessary) until you receive a heavy rainfall or run out of water.

Corn growers who are targeting yields of greater than 150 bushels per acre and have adequate amounts of water available may want to consider other methods to schedule irrigation that will help eliminate **ALL periods of drought stress**. To effectively schedule irrigation, determine soil moisture conditions in the rooting zone frequently and keep a record of your findings. Devices such as soil water potential sensors can be used to monitor water use and increase water-use efficiency by more accurately helping to schedule irrigations. Irrigate whenever soil moisture falls below the desired level. This system allows efficient water use and top yield potential. Make soil moisture determinations daily during peak moisture use periods. During other periods, make readings frequently enough to detect irrigation needs before stress occurs. Usually three times weekly will be often enough for the first 50 to 60 days after planting.

WEED MANAGEMENT IN FIELD CORN *(Prostko)*

One of the most important aspects of field corn production is weed management. Uncontrolled weeds not only reduce corn yields through their competition for light, nutrients, and moisture, but they can also severely reduce harvest efficiency. Before implementing a weed management plan for field corn, several factors need to be considered including weed species, rotational crops, and cost/A.

Georgia's Field Corn Weed Problems

The top 10 most troublesome weeds in Georgia field corn are as follows: 1) Texas panicum; 2) crabgrass; 3) morningglory species; 4) pigweed species; 5) sicklepod; 6) nutsedges; 7) johnsongrass; 8) annual ryegrass; 9) Pennsylvania smartweed; and 10) Benghal dayflower.

Weed Competition in Field Corn

If a weed management program in field corn is going to be successful and economical, a thorough understanding of the competitive effects of weeds is important. In regards to this area, three things must be considered: 1) How many weeds are there and when did the weeds emerge in relationship to the crop? 2) How much yield loss are they actually causing?; and 3) When do the weeds need to be controlled in order to prevent significant yield losses? Research has shown that weeds that emerge just prior to or at the same time as corn cause greater yield losses than later emerging weeds. Consequently, the use of effective weed control programs from 20 to 45 days after planting usually prevents yield losses due to weed competition. Weeds that emerge 45 days after planting will likely not cause competition-related yield losses but can have a negative influence on seed quality and harvest efficiency. Other research has shown that corn can tolerate a certain level of weed pressure and that control strategies should only be implemented when the potential yield losses caused by the weeds exceeds the cost of control (i.e. economic threshold concept). The following table illustrates the influence of various weed species on corn yield:

Table 12. Number of weeds/100 feet of row that cause yield reductions in field corn.

Weed	Corn Yield Loss (%)					
	1	**2**	**4**	**6**	**8**	**10**
Cocklebur or giant ragweed	4	8	16	28	34	40
Pigweed or lambsquarters	12	25	50	100	125	150
Morningglory or velvetleaf	6	12	25	50	75	100
Smartweed or jimsonweed	10	20	40	60	70	80
Yellow Nutsedge	400	800	800+	800+	800+	800+

Source: Pike, D. R. 1999. Economic Thresholds for Weeds. University of Illinois, Cooperative Extension. Available on-line at http://web.aces.uiuc.edu/vista/pdf_pubs/ECTHR.PDF.

Field Corn Weed Management Strategies

The most effective weed management programs in corn use a combination of cultural, mechanical, and chemical control strategies. Cultural practices include such factors as planting date, planting rate, and row spacing. Cultural practices improve weed control by enhancing the competitive ability of the field corn. Mechanical practices, such as cultivation, are a non-chemical method for controlling weeds between rows. A multitude of herbicides are labeled for use in field corn and can be applied preplant incorporated (PPI), preemergence (PRE), postemergence (POST), and post-directed (PDIR). A complete update on the herbicides recommended for use in Georgia can be found at the end of this section.

Atrazine

The foundation of weed management systems in all field corn production systems is atrazine. Atrazine provides broad-spectrum control of many weeds with excellent crop safety. Atrazine can be applied PPI, PRE, or POST (up to 12" tall). Numerous pre-mixtures are available that contain atrazine + a grass herbicide (Bicep, Bullet, Guardsman, Lexar, Lumax, etc). Generally, these pre-mixtures will provide broad spectrum weed control when applied PRE. However, they are usually not very effective for the control of Texas panicum. In order to protect both surface and groundwater, it is important to read and follow the label regarding the use of atrazine. When atrazine is applied PRE + POST, a total of 2.5 lb ai/A can be applied per year (2.5 qt/A of 4L or 44 oz/A of 90DF). When atrazine is applied only POST, a total of 2.0 lb ai/A can be applied per year (2 qt/A of 4L or 36 ozs/A of 90DF).

Atrazine-resistant (AR) Palmer amaranth was confirmed in Macon County in 2007. Specific control recommendations for growers who are concerned about atrazine resistance are included later in this chapter.

Herbicide-Resistant Crop Management Systems

In 2012, it was estimated that 73% of the field corn acreage in the United States was planted using herbicide-resistant corn hybrid technologies. Yield performance of herbicideresistant corn hybrids has improved to the point where yield drag is no longer a major concern. There are 3 types of herbicide-resistant technologies that can be used by Georgia corn growers including Roundup Ready (RR), Liberty-Link (LL), and Clearfield (CL).

Roundup Ready Systems (RR): Numerous hybrids are available that are resistant to overthe-top applications of glyphosate. Glyphosate provides broad-spectrum control of many grass and broadleaf weeds. Research in Georgia has shown that 2 applications of glyphosate, applied approximately 21 and 35 days after planting, are more effective than single applications. It is also recommended that atrazine be included in the RR corn system. Atrazine can be applied either preemergence or in combination with the first postemergence application of glyphosate in the RR corn system. Glyphosate-resistant Palmer amaranth (pigweed) has been discovered in Georgia. Consecutive plantings of RR crops should be avoided. Refer to the section on herbicide-resistant weeds later in this chapter for more information.

Liberty-Link Systems (LL): Liberty-link corn hybrids are tolerant of postemergence applications of Liberty (glufosinate). Liberty provides good control of many troublesome weeds including morningglory, Texas panicum, and sicklepod. Atrazine should always be included with Liberty to improve the spectrum of control and to provide residual weed control.

Clearfield Systems (CL): Clearfield corn hybrids are tolerant of postemergence applications of Pursuit (imazethapyr) or Lightning (imazethapyr + imazapyr). Lightning provides broad spectrum control of many troublesome corn weeds including crabgrass, annual morningglories, pigweed, and smartweed. However, Pursuit or Lightning would not be useful for the control of ALS-resistant Palmer amaranth (pigweed). Clearfield corn hybrids were developed using traditional breeding techniques and are not considered to be genetically modified organisms (GMO). Before using Pursuit or Lightning in the Clearfield system, pay close attention to rotational crop restrictions.

Herbicide/Insecticide Interactions

Growers who prefer or need to use organophosphate (OP) soil insecticides (Counter, Lorsban) should not apply certain postemergence herbicides if these insecticides are used or severe crop injury can occur. Herbicides that interact with OP soil insecticides include Accent, Beacon, Callisto, Capreno, Exceed, Halex GT, Option, Realm Q, Resolve Q, and Steadfast Q. This interaction does not occur with other types of soil insecticides (Force, Furadan) or seed treatments (Poncho, Cruiser).

Herbicide/Disease Interactions

Growers who need to control johnsongrass should make sure that the planted corn hybrid has acceptable tolerance to maize dwarf mosaic virus (MDMV) and/or maize chlorotic dwarf virus (MCDV). Insect vectors (aphids, leafhoppers) will move from herbicide treated johnsongrass to the corn crop resulting in the increased incidence of these diseases.

Herbicide-Resistant Weeds

Herbicide-resistant weed species can become a serious problem in fields when a single herbicide or herbicides with similar modes of action are used repeatedly. This phenomenon has been documented in Georgia with Palmer amaranth (pigweed) and other weed species (Table 2). Populations of Palmer amaranth have been found in the state that are resistant to atrazine, glyphosate and/or ALS-inhibiting herbicides. Check with your county extension agent for updated information about the distribution of herbicide resistant weeds in your area.

Table 13. Herbicide Resistant Weeds in Georgia

Weed	Year	Herbicide(s)	Site of Action
goosegrass	1992	Treflan	Tubulin protein
Prickly sida	1993	Scepter	ALS enzyme
Italian ryegrass	1995	Hoelon	ACCase enzyme
Palmer amaranth	2000	Cadre, Pursuit	ALS enzyme
Palmer amaranth	2005	glyphosate	EPSP synthase
crabgrass	2007	Poast	ACCase enzyme
Palmer amaranth	2007	atrazine	PS II
Italian ryegrass	2008	Osprey, PowerFlex	ALS enzyme
Italian ryegrass	2010	Poast, Hoelon	ACCase

Herbicide-resistant weeds can be managed by using a combination of strategies including crop rotation, narrow row patterns, mechanical cultivation, and utilizing herbicides with different modes of action. Specific herbicide recommendations for the control of glyphosate-resistant (GR) Palmer amaranth and ALS-resistance management in field corn are included later in this chapter

Atrazine-resistant (AR) Palmer amaranth was confirmed in Macon County in 2007. In 2008 and 2010, additional seed samples were collected to determine the distribution of this type of resistance. At this point, it appears as though AR-Palmer amaranth may be limited to dairy farms that have a long history of continuous atrazine use. If glyphosate-resistance is not an issue, AR-Palmer amaranth should be easily controlled with glyphosate. However, growers who are concerned about ALS, AR and GR-Palmer amaranth should consider the weed control programs provided later in this chapter.

Rotational Crop Concerns

Advances in herbicide chemistry have led to the development of some exceptional families including the sulfonlyureas (Accent, Beacon, and Sandea), imidazolinones (Lightning, Pursuit), sulfonanilides (Python), and others. Many herbicides in these families are used in field corn. However, some of these herbicides have the potential to injure rotational crops if the appropriate replanting interval is not observed. Atrazine also has the potential to cause carryover problems to sensitive crops particularly when used in late plantings. Because of the diversity of crops that are grown in Georgia, producers must consider the potential effects that herbicides could have on a rotational crop the next year. This information is readily available on nearly all herbicide labels.

Controlling Volunteer RR Soybeans in RR Corn

Volunteer RR soybeans can occasionally be a problem in RR corn production systems. Generally, volunteer crops are more difficult to control than planted crops. The following sequential program should be considered for the control of RR soybeans in RR corn:

Table 14. Suggested Control Program for RR Soybeans in RR Corn.

Preemergence	Postemergence
Atrazine	Glyphosate + Status or Sandea/Profine

FIELD CORN WEED CONTROL

Eric P. Prostko, Extension Agronomist - Weed Science

USE STAGE/ HERBICIDE	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: LBS ACTIVE INGREDIENT/A	REMARKS AND PRECAUTIONS
PRE-PLANT SOIL INCORPORATED			
butylate + safener (Sutan+) 6.7 E or EPTC + safener (Eradicane) 6.7E	 4.75 - 7.33 pts 4.75 - 7.33 pts	3.97 - 6.14 3.97 - 6.14	Incorporate these herbicides 2 to 3" deep into the soil immediately after application. Use higher rate (7.33 pts/A) for suppression of bermuda-grass and johnsongrass. Cultivation and/or postemergence herbicide treatments will be required to control escaped weeds. Can be tank-mixed with atrazine for additional broadleaf weed control. **NOTE: Repeated use of these herbicides can increase levels of herbicide degrading soil microorganisms. This can result in short-term or reduced weed control.** MOA = 8.
PREEMERGENCE			
acetochlor + safener (Harness) 7EC (Surpass) 6.4EC (Harness) 20G (TopNotch) 3.2ME (Degree) 3.8ME (Breakfree) EC	 1.5 - 3.0 pts 2.0 pts 6.0 - 10.0 lbs 2-3 qts 2.25-4.25 pts 1.5 - 2.5 pts	 1.3 - 2.6 1.6 1.2 - 2.0 1.6-2.4 1.06-2.02	Controls most annual grasses (except Texas panicum) and certain small- seeded broadleaf weeds. Acetochlor can be tank-mixed with other broadleaf materials (atrazine) for improved weed spectrum. Only rotate to small grains, soybeans, or corn - 12 month restriction for other crops for Harness, 18 month restriction for Surpass. **Acetochlor is restricted for use in the Piedmont regions only.** Available in several pre-mixes with atrazine (Harness Extra, FulTime, Degree Xtra, Keystone, BreakfFree ATZ). Can be applied up to 11" tall corn. MOA = 15.
alachlor + safener (Micro-Tech 4ME)	 2.0 -2.75 qts	2.0- 2.75	Controls most annual grasses (except Texas panicum) and certain broadleaf weeds. Under cool, wet weather conditions, stunting or crop injury expressed as malformed, knotted, twisted top growth may occur. Corn normally outgrows early season injury. Alachlor may be tank-mixed with atrazine or simazine. Alachlor can be applied up to 5" tall corn. Available in several pre-mixes with atrazine (Bullet, Lariat). MOA = 15.
metolachlor (Stalwart C, Parallel, Me-Too-Lachlor-II) S-metolachlor (Dual Magnum) 7.62E (Dual II Magnum) 7.64E (Cinch 7.64E)	 1.0 -1.33 pts 1.0 - 1.33 pts 1.0 - 1.33 pts 1.0 - 1.33 pts	1.0- 1.33 0.96 - 1.27	Controls most annual grasses (except Texas panicum) and certain broadleaf weeds. Fair to good control of yellow nutsedge. Under cool, wet weather conditions, stunting or crop injury expressed as malformed, knotted, twisted top growth may occur. Corn normally outgrows early season injury. Metolachlor may be tank-mixed with atrazine or simazine. Metolachlor can be applied up to 40" tall corn. Available in several premixes with atrazine (Bicep II Magnum, Cinch ATZ, Lexar, Lumax, Parallel Plus, Stalwart Xtra). The generic formulations of metolachlor (**Parallel, Stalwart, Me-Too- Lachlor**) have not provided the same length of residual control of certain weeds as similar rates of Dual Magnum formulations in some UGA field trials. MOA = 15.
dimethenamid-p (Outlook/Propel) 6L	 10 -16 ozs	0.47 - 0.75	Rate is dependent on soil texture, organic matter, and CEC. Controls most annual grasses (except Texas panicum) and certain broadleaf weeds. Under cool, wet conditions, stunting or crop injury expressed as malformed, knotted, twisted growth may occur. Dimethenamid may be tank-mixed with atrazine or simazine. Dimethenamid can be applied up to 12" tall corn. Available in several premixes with atrazine (Guardsman, Guardsman Max). MOA = 15.
atrazine (numerous trade names) 80W 90DG 4L	 2.5 - 3.0 lbs 2.25 - 2.66 lbs 2.0 - 2.5 qts	 2.0 - 2.4 2.0 - 2.4 2.0 - 2.5	Refer to herbicide table and label for specific product. Good to excellent control of most annual broadleaf weeds. Does not usually provide adequate control of Texas panicum or fall panicum. Atrazine will often fail to provide extended control of crabgrass and late season control of sicklepod and morningglories. Atrazine may be tank-mixed with metolachlor, alachlor, simazine. **Do not use more than 2.5 lbs ai/A/year of atrazine. MOA = 5.**

USE STAGE/ HERBICIDE	BROADCAST RATE/ACRE AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT/A	REMARKS AND PRECAUTIONS
PREEMERGENCE (cont.)			
simazine (numerous trade names) 80W 90DG 4L	 2.5 - 3.0 lbs 2.2 - 2.6 lbs. 2.0 - 2.5 qts.	 2.0 - 2.4 2.0 - 2.3 2.0 - 2.5	Refer to herbicide table and label for specific product. Similar to atrazine but requires more rainfall for activation and is generally less effective in control of certain broadleaf weeds. Good control of crabgrass and fall panicum. Simazine may be tank-mixed with atrazine, alachlor or metolachlor. MOA = 5.
flumetsulam (Python) 80 WDG	0.80 - 0.89 oz	0.04 - 0.045	Python may be used preplant, preemergence or at the spike stage of corn for broadleaf weed control. Can be mixed with atrazine and other materials labeled for use on field corn to increase weed control spectrum. May be followed with corn, soybeans or wheat. Rotational restrictions for the following year include peanuts and small grains - 4 months, canola - 26 months, cotton - 18 months, tobacco - 9 months. Refer to label for additional rotation restrictions. Due to possible crop injury, flumetsulam cannot be used when Counter (terbufos) or Thimet (phorate) insecticides are applied. All other soil insecticides should be applied in a T-band or band to avoid potential crop injury. This precaution applies to all prepackaged tank mixtures that contain flumetsulam (Hornet) **Use on soils with less than 1.5% OM may result in crop injury.** MOA = 2.
pyroxasulfone (Zidua) 85WG	1.5 - 2.75 oz	0.079 - 0.146	Can be applied PPI, PRE, or early postemergence (V4 stage). Provides residual control of certain annual grasses and broadleaf weeds including Palmer amaranth. Can be tank-mixed with atrazine, glyphosate, and Liberty. No more than 2.75 oz/A can be applied per year on coarse soils. MOA = 15.
s-metolachlor + mesotrione atrazine (Lexar EZ) 3.704 lb/gal	3 qts	1.305 + 0.168 + 1.305	Apply PRE up until 12" tall corn for the control of certain annual grasses and broadleaf weeds. Will not control annual grasses when applied POST. When applied POST alone, use a NIS (0.25% v/v) or COC (1% v/v). Can be tank-mixed with glyphosate (RR corn) or Liberty (LL corn). Do not use if an OP soil insecticide (Counter) was applied. MOA = 5 + 15 + 27.
CHEMIGATION			
alachlor (Micro-Tech 4ME) metolachlor (Stalwart C, Parallel, Me-Too-Lachlor-II) s-metolachlor (Dual Magnum, Dual II Magnum, Cinch) butylate + safener (Sutan+ 6.7E) pendimethalin (Prowl 3.3 EC) EPTC + safener (Eradicane 6.7E)			May be applied by injection through center pivot irrigation systems. Use at normal rates recommended for conventional methods of application. Apply after planting but before crop emergence. Requires proper system calibration and safety devices (check valves, cutoff switches, etc.) to provide effective weed control and prevent environmental contamination. The generic formulations of metolachlor (**Parallel, Stalwart, Me-Too-Lachlor**) have not provided the same length of residual control of certain weeds as similar rates of Dual Magnum formulations in some UGA field trials.
POSTEMERGENCE: OVER-THE-TOP			
atrazine (numerous trade names) 80W 90DG 4L	 1.88 - 2.5 lbs 1.67 - 2.22 lbs 1.5 - 2.0 qts	1.5 - 2.0	Refer to herbicide table and label for specific information. Use low rate for broadleaf weeds. Use high rate for mixed infestations of grasses and broadleaf weeds. Application with crop oil or crop oil concentrate (1 qt/A) will improve control. Can be applied up to 12" tall corn. Poor control may result on sicklepod more than 2 in. tall and on grasses beyond the 2-leaf stage. Do not apply with fluid fertilizer. If no atrazine was applied preemergence, apply no more than 2.0 lb/ai/A. If a preemergence treatment was used, do not exceed a total of 2.5 lbs/ai/A calendar year. MOA = 5.

USE STAGE/ HERBICIDE	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: LBS ACTIVE INGREDIENT/A	REMARKS AND PRECAUTIONS
POSTEMERGENCE: OVER-THE-TOP (cont.)			
pendimethalin (Prowl/Pendimax 3.3EC) (Prowl H_20 3.8 ACS) + atrazine (numerous trade names) 4L*	1.8 - 2.4 pts 2 pts + 1.5 - 2.0 qts	0.75- 1.0 0.95 + 1.5 - 2.0	Refer to herbicide table and label for specific product. Apply over-the-top after corn emergence but when weeds are less than 1 in. tall. For control of seedling grasses apply when no more than 1/2 in. tall. Consistency of control is contingent on timing of rainfall or irrigation after application. Do not use with fluid fertilizers after crop emergence. Pendimethalin or tank mixtures including pendimethalin may cause crop injury expressed as restricted root growth and crop stunting. Potential for injury is greatest on sand or loamy sand soils under cool, wet conditions. Plant corn at least 1.5 in. deep when using pendimethalin. Can be applied up to 12" tall corn. MOA = 3 + 5.
bentazon (Basagran) 4SC	1.5 - 2.0 pts	0.75 - 1.0	Controls yellow nutsedge, cocklebur, bristly starbur, and certain other broadleaf weeds. Adjust rate according to weed size as noted on the label. A second application within 7 to 10 days will often be required for yellow nutsedge control. Add a crop oil concentrate at 1 qt/A. Rain-free period is 4 hours. MOA = 6.
bromoxynil (Buctril) 2EC	1.0 - 1.5 pts	0.25- 0.38	Can be applied in corn from the 4th leaf stage until tassel emergence. Controls cocklebur, bristly starbur, morningglories, and certain other broadleaf weeds when less than 3 in. tall. Adjust rate according to weed size and species as noted on label. Temporary corn leaf scorch may occur. Spray additives can cause increased leaf burn. Available in premix with atrazine (Buctril + Atrazine). Rain-free period is 1 hour. MOA = 6.
carfentrazone (Aim 2EC)	0.50 - 1.0 ozs	0.008 - 0.016	For the control of pigweed, annual morningglory species (except smallflower), and tropical spiderwort. Can be applied over the top of corn until the V8 stage of growth. Aim will cause crop injury in the form of leaf speckling and necrosis but this injury will not affect yield. Use in combination with a crop oil concentrate @ 1% v/v (1 gal/100 gals). Aim can be tank-mixed with glyphosate (**GR corn hybrids only**), 2,4-D, atrazine, and Accent. Refer to label for a more complete list of approved tank-mixes. **Rain-free period is 6 to 8 hours.** MOA = 14.
2,4-D (numerous trade names) 3.8 lb/gal	0.5 - 1.0 pt	0.24 - 0.48	Refer to herbicide table and label for specific product . May be applied over-the-top of the crop and weeds until corn is 5 to 8 in. tall. Use only as a directed spray after corn is 8 in. tall. Do not apply after tassels appear. No spray additive is required. Corn is most subject to injury if it is rapidly growing and if soil moisture and temperature conditions are high or from over-the-top applications. If soil moisture levels and temperatures are high, use no more than 0.25 lb/ ai/A. To minimize drift hazards where 2,4-D sensitive crops are present, use amine formulations and observe drift control precautions noted on label. MOA = 4.
pendimethalin (Prowl/Pendimax 3.3EC) (Prowl H_20 3.8 ACS) trifluralin (numerous trade names) 4 lb/gal	1.2 - 1.8 pts 1.5 pts 1.0 - 1.5 pts	0.5 - 0.75 0.71 0.5 - 0.75	**CULTI-SPRAY TECHNIQUE (Postemergence Incorporated)** These treatments will provide residual control of annual grasses, including Texas panicum. They will not control existing grasses. They should be used t o augment other weed control tactics. When using either of the treatments, the following steps must be followed. 1. The herbicides must b e applied to weed-free soil. 2. Corn brace roots must be protected by soil thrown to the base of the stalk with a sweep or rolling cultivator prior to application. 3. The herbicides can be applied over-the-top or post-directed, depending on corn size. 4. A shallow, follow-up cultivation is required after application to minimize herbicide loss. Rainfall or irrigation amounts of 0.5-1.0" can be used instead of mechanical cultivation. 5. Apply pendimethalin when the corn is at least 4" tall until layby. Apply trifluralin when the corn is in the 2 true leaf stage until it reaches 30" in height. MOA = 3.

USE STAGE/ HERBICIDE	BROADCAST RATE/ACRE AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT/A	REMARKS AND PRECAUTIONS
POSTEMERGENCE: OVER-THE-TOP (cont.)			
dicamba (Banvel, Clarity, Sterling, Vision, etc.) 4 lb/gal	8 ozs	0.25	May be applied either over-the-top u p to 8 in. corn then as a directed spray. Directed sprays are less likely to result in crop injury or drift hazards and will improve weed coverage in larger corn. Refer to label. Do not use crop or petroleum oils. **DO NOT** apply after corn is 36 in. tall or within 15 days of tassel emergence, whichever occurs first. Where dicamba-sensitive crops such as cotton, soybeans, tobacco and vegetables are near treatment area, observe the following precautions to minimize drift hazards. 1. Use coarse sprays and spray pressure of less 20 psi. 2. Apply **only** as a directed spray. 3. DO NOT apply if maximum daily temperature is expected to exceed 85°F. 4. DO NOT apply if winds exceed 5 mph and are blowing in the direction of the sensitive crop. **Rain-free period is 4 hours.** MOA = 4.
dicamba + diflufenzopyr + isoxadifen (Status) 56WDG	5 - 10 ozs	0.125-0.25 + 0.05-0.10 0.175-0.350	Will control many annual broadleaf weeds. Include a NIS @ 0.25% v/v and AMS @ 5-17 lbs/100 gals. Can be applied from 4" tall corn (V2) to 36" tall corn (V10). Status can also be tan k-mixed with Round up or Liberty when used on RR or LL corn hybrids only. The normal use rate when tank-mixed with these herbicides is 5 oz/A. **Status should not be tank-mixed with Dual Magnum, Harness, Outlook, Surpass, Lorsban, 2,4-D, Stinger.** Rotational crops can be planted 120 days after application with the following exception: When Status is applied at 5 oz/A or less and field receives at least 1" of rainfall or irrigation, the following crops can be planted 30 days after application: alfalfa, cereal grain crops, cotton, grain sorghum, soybeans. Field corn can be re- planted 7 days after application. **Rain-free period is 4 hours.** MOA = 4 + 19.
clopyralid (Stinger/Spur) 3.0 lb/gal	4 - 8 oz	0.094 - 0.19	Controls many annual broadleaf weeds including ragweed, sicklepod, cocklebur, and pigweeds. Can be used from emergence through 24 inch tall corn. May cause severe injury to in-bred lines or breeding stock. Rotational restrictions include: soybeans, canola, grain sorghum, sweet corn - 10.5 months, cotton and all other crops - 18 months. MOA = 4.
halosulfuron (Profine, Sandea) 75 DF	0.67 - 1.00 oz	0.032 - 0.047	Controls many annual broadleaf weeds and nutsedge. Can b e applied over-the-t op from spike stage through layby stage of corn. Use higher rates for nutsedge control and larger weeds. Can be tank-mixed with Banvel, Accent, 2,4-D, Buctril, Beacon and atrazine. The use of a non- ionic surfactant or crop oil is recommended. May be applied in a split application but do not exceed 2.67 oz/acre/year. Rotational restrictions include the following: barley, oats, rye, wheat - 2 months; cotton - 4 months; peanuts - 6 months; soybeans - 9 months; onions - 18 months. Refer to product label for additional crop rotation information. **Rain-free period is 4 hours.** MOA = 2.
primisulfuron + prosulfuron (Exceed) 57 DF	1.0 oz	0.018 + 0.018 0.036	Provides postemergence and residual control of many annual broadleaf weeds and certain grasses. Apply after corn reaches 4 inches in height and before 48 inches. Refer to label for specific weed sizes but as a general rule apply before weeds reach greater than 4-6 inches high. The use of a non-ionic surfactant or crop oil is recommended. May be tank- mixed with Banvel, 2,4-D, Beacon. atrazine, Buctril, or Accent. **DO NOT** apply to corn treated with Counter insecticide due to severe crop injury or mortality. Do not apply Exceed within 7 days to corn treated with foliar applied organophosphate insecticides. Do not plant cereal grains within 3 months; soybeans, canola, cotton, or tobacco within 10 months after application. **DO NOT USE EXCEED ON PIONEER 3085, 30F33 and 30F34**. MOA = 2.
nicosulfuron (Accent) 75DF (Accent Q) 54.5 WDG (includes crop safener) (Nic-It) 2SC	 0.67 oz 0.9 oz 2.0 oz	 0.031	Controls many annual and perennial grasses, including johnsongrass. **DO NOT** apply to corn treated with Counter insecti¬cide due to severe crop injury or mortality. Can be applied over-the-top of corn up to 20 inches tall or before the V6 stage (*whichever is more restrictive*) and post-dire¬cted up to 36 inches tall. A nonionic surfactant (0.¬25% v/v) or crop oil concentrate (1% v/v) is required. Do not apply Accent within 7 days to corn treated with foliar applied organophosphate insecticides or with herbicides con¬taining bentazon or 2,4-D. **DO NOT** apply organophosphate insecticides within 3 days after applying Accent. Refer to manufacturer's label for sprayer cleanup. **DO NOT** apply within 30 days of harvest. **Accent Q** formulation contains a crop safener (isoxadifen). Rotational restrictions include the following: soybeans - 0.5 months; winter wheat, barley, rye - 4 months; oats - 8 months; cotton, sorghum, peanuts, tobacco - 10 months. **Rain-free period is 4 hours.** MOA = 2.

USE STAGE/ HERBICIDE	BROADCAST RATE/ACRE AMOUNT OF FORMULATION	BROADCAST RATE/ACRE LBS ACTIVE INGREDIENT/A	REMARKS AND PRECAUTIONS
POSTEMERGENCE OVER-THE-TOP (cont.)			
primisulfuron (Beacon) 75WG	0.76 oz	0.035	<u>**Single Application**</u> Controls many annual and perennial grasses, including johnsongrass. **DO NOT** apply to corn treated with Counter insecticide du e to severe crop injury or mortality. Apply over-the-top to 4 to 20 inch corn. A nonionic surfactant (0 .25% v/v) or crop oil concentrate (1 qt/A) is required. Do not use liquid fertilizer as the spray carrier. Do not apply Beacon within 10 days to corn treated with foliarly applied organophosphate insecticides or with herbicides containing bentazon or 2,4 -D. Some corn varieties may be sensitive to Beacon. Refer to manufacturer's label for a complete listing. Do not apply within 60 days of harvest for grain, 30 days for forage. <u>**Split Application**</u> For hard to control weeds, applications of 0.38 oz/A can be made one time prior to the corn reaching 20 in. in height and a second time prior to tassel emergence. Follow all precautions listed for single application. **DO NOT** exceed 0.76 oz/A/yr. **Rain-free period is 4 hours.** MOA = 2.
nicosulfuron + rimsulfuron + crop safener (Steadfast Q) 37.7WDG	1.5 oz	0.024 + 0.012	Can be applied over-the-top of corn up to 20" tall and exhibiting up to and including 6 leaf-collars. When tank-mixed with atrazine, can only be applied to corn that is 12" tall or less. Use in combination with a NIS @ 0.25% v/v or COC @ 1% v/v + ammonium-nitrogen fertilizer (2 qt/A UAN or 2 lb/A AMS). **Do not tank-mix with Basagran, 2,4-D, Lorsban, parathion, and malathion. Do not use on corn that was previously treated with Counter, Lorsban, and Thimet.** Rotational Restrictions: field corn = 0 months; soybeans = 15 days; small grains = 4 months; cotton = 10 months; sorghum/ peanut = 10 months (soil pH < 6.5). **Steadfast Q** contains a crop safener (isoxadifen). **Rain-free period = 4 hours**. MOA = 2 + 2.
rimsulfuron + thifensulfuron + crop safener (Resolve Q) 22.4DG	1.25 oz	0.014 + 0.0003	Apply postemergence to corn that is up to 20" tall for the control of many annual grasses and broadleaf weeds. Will also provide some residual control. Do not apply to corn taller than 20" or exhibiting 7 or more leaf collars. Use in combination with a NIS @ 0.25% v/v or COC @ 1% v/v + ammonium-nitrogen fertilizer (2 qt/A UAN or 2 lb/A AMS). Can be tank-mixed with atrazine, glyphosate (RR corn) or Ignite (LL corn). **Do not apply Resolve Q to corn that has been previously treated with an OP insecticide such as Counter, Lorsban, or Thimet**. Rotation restrictions: field corn = 0 months; STS soybeans = 1 month; soybeans = 10 months; cotton = 1 month; wheat = 3 months; sorghum = 10 months; peanuts = 18 months. **Resolve Q** contains a crop safener (isoxadifen). *In some UGA field trials, Resolve Q has not been as effective as Accent (nicosulfuron) in controlling Texas panicum.* **Rain-free period = 4 hours.** MOA = 2 + 2.
foramsulfuron + crop safener (Option) 35WDG	1.5-1 .75 oz	0.033-0.038	Can be applied broadcast in corn from 0 to 16" or when corn is in the emergence to V5 stage of growth. Use drop nozzles when the corn is 16- 36' tall. Option will provide good to excellent control of many annual grasses and johnsongrass. Must be applied with a methylated or ethylated seed oil (1.5 pts/A) and nitrogen fertilizer (28 or 32% UAN at 1.5-2 qts/A or AMS at 1.5-3.0 lbs/A). Sequential applications can be made but the total rate cannot exceed 3.5 ozs/A/season. Option can be tank-mixed with certain herbicides (atrazine, Permit, others) and insecticides (Ambush, Asana, Pounce, Warrior) but should not be applied in a nitrogen solution. Refer to label for specific tank-mix directions. **Option** contains a crop safener (isoxadifen). **DO NOT USE OPTION IF THE FOLLOWING SOIL INSECTICIDES WERE USED: COUNTER, DYFONATE, AND THIMET.** Crop rotation restrictions: corn - 7 days; soybeans - 14 days; all other crops - 60 days. Option is rainfast 2 hours after application. *In some UGA field trials, Option has not been as consistent as Accent for the control of Texas panicum. However, corn yields have been equivalent.* MOA = 2.

USE STAGE/ HERBICIDE	BROADCAST RATE/ACRE AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT/A	REMARKS AND PRECAUTIONS
POSTEMERGENCE OVER-THE-TOP (cont.)			
mesotrione (Callisto 4SC)	3 ozs	0.094	May be useful for the postemergence control of escaped Palmer amaranth (pigweed) in situations were 2,4-D use would be undesirable or glyphosate, ALS, or triazine-resistance is suspected. Callisto will also provide residual control. Apply before Palmer amaranth exceeds 5" in height. **Do not use if the corn has been treated with a soil application of Counter or Lorsban**. Corn may be treated up to 30" tall or the 8-leaf stage of growth. Use in combination with a COC (1% v/v) and UAN (2.5% v/v) or AMS (8.5 lbs/100 gals). Callisto can be tank mixed with Accent, atrazine, Liberty, Lightning, Basagran, Buctril, Dual Magnum, Bicep II Magnum, Steadfast , or Warrior. Crop injury is increased when tank-mixed with EC formulations of grass herbicides such as Dual Magnum. Do not tank-mix with carbamate or organophosphate insecticides. Rotational restrictions: field corn, grain sorghum = 0 months; small grains and sugarcane = 4 months; soybeans, cotton, peanuts, sunflowers, canola, tobacco = 10 months; other crops = 18 months. Temporary bleaching may occur under extreme weather conditions or when the crop is suffering from stress. Sold in various pre-mixes with atrazine + Dual Magnum (Lexar, Lumax). Rain-free period is 1 hour. Callisto does **not** provide effective control of Texas panicum or sicklepod. **Callisto Xtra** is a premix formulation of Callisto (0.5 lb/gal) + atrazine (3.2 lb/gal) MOA = 28.
tembotrione + crop safener (Laudis 3.5SC)	3 ozs	0.082	May be useful for the postemergence control of escaped Palmer amaranth (pigweed) in situations were 2,4-D use would be undesirable or glyphosate, ALS, or triazine-resistance is suspected. Apply postemergence to field corn from emergence to V8 stage of growth . Two applications can be made if needed (1 4 days apart). Can be tank-mixed with the following herbicides: atrazine, Liberty, Define, glyphosate, Accent, Option, Steadfast, Buctril. Use a methylated seed oil (MSO) at 1% v/v and nitrogen (1.5 qt/A UAN or 1.5 lb/A AMS). **Rain-free period is 1 hour.** Crop rotation restrictions: small grains = 4 months; soybeans = 8 months; cot ton and sorghum = 10 months; peanut = 12 months. *In some UGA field trials, Laudis has not been as effective as Accent (nicosulfuron) in controlling Texas panicum.* MOA = 28.
topramezone (Impact/Armezon) 2.8SC	0.75 oz	0.016	May be most useful in areas where atrazine-resistant Palmer amaranth is a problem. Can be applied postemergence up until 45 days before harvest. Tank- mix with atrazine, glyphosate (RR corn), or Liberty (LL corn). Use in combination with MSO or COC @ 1% v/v and 1.25% v/v UAN or AMS (8.5-17 lbs/100 gallons water). Rotation restrictions: wheat = 3 months; cotton, peanut, soybean, sorghum, sunflower = 9 months; tobacco = 18 months. **Rain-free period = 1 hour:** MOA = 27.
thiencarbazone + tembotrione + crop safener (Capreno) 3.45SC	3 oz/A	0.013 + 0.0675	Contains same active ingredient as Laudis. Apply postemergence for the control of Palmer amaranth and certain annual grasses such as crabgrass and Texas panicum. Capreno can be applied over-the-top from V1 until V6 stage of growth and post-directed from V6-V7 stage of growth. Can be tank-mixed with atrazine, glyphosate (RR corn), or Ignite (LL corn). Use in combination with a COC @ 1% v/v and 1.5 qt/A UAN or 1.5 lb/A AMS. **Do not use on field corn treated with OP soil insecticides.** Crop rotation restrictions: wheat = 4 months; cotton, soybean, sorghum = 10 months; peanut = 12 months; canola, tobacco = 18 months. **Rain-free period = 1 hour.** Capreno contains a crop safener (isoxadifen). MOA = 2 + 27.
rimsulfuron + mesotrione + crop safener (Realm Q) 38.75DG	4 oz/A	0.019 + 0.078	May be most useful in areas where atrazine-resistant Palmer amaranth is a problem. Realm Q can be applied postemergence to corn that is up to 20" or V7, whichever is more restrictive. Use in combination with a COC @ 1% v/v or NIS @ 0.25% v/v and 2 qt/A UAN or 2 lb/A AMS. Can be applied in combination with atrazine, glyphosate (RR corn), or Ignite (LL corn). **Do not use on field corn treated with OP soil insecticides.** Crop rotation restrictions: wheat = 4 months; cotton, canola, sorghum, soybeans, sunflower = 10 months; peanut and tobacco = 18 months. Rain-free period = 4 hours. **Realm Q** contains a crop safener (isoxadifen). MOA = 2 + 27.
acetochlor (Warrant) 3ME	1.25-1.5 qt	0.94- 1.13	Apply over-the-top from emergence up to 30" tall field corn for residual control of tropical spiderwort, crabgrass, and Palmer amaranth. Can be tank-mixed with glyphosate for use in RR corn systems. Warrant does not control emerged weeds. For the following soil types, do not apply Warrant within 50 feet of any well where the depth to groundwater is 30 feet or less : sands <3% OM; loamy sands < 2% OM; sandy loams <1% OM. These restrictions do not apply for areas more than 50 feet from a well or if groundwater is more than 30 feet below land surface. MOA = 15.

USE STAGE/ HERBICIDE	BROADCAST RATE/ACRE AMOUNT OF FORMULATION	BROADCAST RATE/ACRE LBS ACTIVE INGREDIENT/A	REMARKS AND PRECAUTIONS
POSTEMERGENCE OVER-THE-TOP (cont.)			
pyraflufen (ET) 0.208EC	0.50 - 0.75 oz	0.0008- 0.0012	Can be applied over-the-top of field corn up to V4 stage of growth. Can be tank-mixed with glyphosate for use in RR corn to improve the control of annual morningglories. Use a NIS @ 0.25% v/v. **Rain-free period = 1 hour. Do not use a COC adjuvant.** MOA = 14.
POSTEMERGENCE - HERBICIDE TOLERANT HYBRIDS: PLEASE NOTE = Herbicide selection should not be the dominant factor in determining varietal selection. Consult your local extension personnel or seed dealer when choosing a hybrid(s) that is best adapted for your area and farming operation.			
imazethapyr (Pursuit) 2AS 70DG	4 fl oz 1.44 oz	0.063	**USE ONLY ON CLEARFIELD CORN HYBRIDS (IR/IT). APPLICATIONS OF PURSUIT TO NON-TOLERANT HYBRIDS WILL RESULT IN SEVERE CROP INJURY AND/OR CROP DEATH!!** Can be applied pre-plant incorporated, preemergence or postemergence for the control of many annual broadleaf and grass weeds. Provides good control of wild poinsettia, morningglories, and pigweeds. **DO NOT** tank-mix with Accent or Beacon. Do not apply within 45 days of grain or silage harvest. DO NOT apply to "IT-Corn" varieties treated with Counter or Thimet insecticides due to severe crop injury or mortality. Rotation restrictions include: 4 months - wheat; 8.5 months - field corn (other than Clearfield corn); 9.5 month - tobacco; 18 months - cotton, sorghum, sunflower, sweet corn. Consult label for further rotation restrictions. Rain-free period is 1 hour. MOA = 2.
imazethapyr + imazapyr (Lightning) 70DG	1.28 oz	0.042 + 0.014 0.056	**USE ONLY ON CLEARFIELD CORN HYBRIDS (IR/IT). APPLICATIONS OF LIGH TNING TO NON-TOLERANT HYBRIDS WILL RESULT IN SEVERE CROP INJURY AND/OR CROP DEATH.** Can be applied early-postemergence from spike to 20". Provides broad-spectrum control of many annual broadleaf and grass weeds when applied at the appropriate stage of growth (*weeds less than 3-4" tall*). Must be used in combination with a non-ionic surfactant (1qt/100 gal) and a nitrogen-based fertilizer such as liquid 2 8% N (1-2 qts/A). Can only be applied once per growing season. Any soil insecticide can be used with IR hybrids but only Counter CR or Thimet in a banded application can be used on IT hybrids. Rotational restrictions include: 4 months - wheat , rye; 8.5 months - field corn (other than Clearfield corn); 9 months - soybeans; 9.5 months - peanuts, tobacco. **Cotton can be planted 9.5 months after application only if greater than 16" of rainfall and/or irrigation occurs after application through October . If the above criteria are not met, the cotton rotation interval is 18 months.** Consult label for further rotation restrictions. Rain-free period is 1 hour. MOA = 2.
glufosinate (Liberty 280) 2.34SL	22-29 oz	0.40-0.53	**USE ONLY ON "LIBERTY-LINK" CORN HYBRIDS. APPLICATIONS OF Liberty TO NON-TOLERANT HYBRIDS WILL RESULT IN SEVERE CROP INJURY AND/OR CROP DEATH!!** Can be applied postemergence from crop emergence until the corn is 24" tall or in the V7 stage of growth. For corn 24"-36" tall, only apply Liberty with drop nozzles and avoid spraying directly into the whorl or leaf axils. Broad-spectrum material with limited systemic activity. Possesses no soil residual activity. Effective on a number of grassy weeds including Texas panicum and several broadleaf species including sicklepod and morningglories. **Thorough coverage is essential - use with at least 15-20 gallons water/acre.** Should be tank-mixed with atrazine for broader spectrum and more consistent control. No major rotation restrictions exist with Liberty. Do not apply within 70 days of grain harvest or 60 days for silage. Requires the use of spray grade ammonium sulfate at 3 lbs/A or 17 lbs/100 gallons. Weak on arrowleaf sida. Do not apply more than 2 applications of Liberty (10-14 day interval). Do not apply more than 44 oz/A of Liberty on corn per growing season. **Applications of Liberty should be made between dawn and 2 hours before sunset for optimum weed control. Rain-free period is 4 hours.** MOA = 10.

USE STAGE/ HERBICIDE	BROADCAST RATE/ACRE AMOUNT OF FORMULATION	BROADCAST RATE/ACRE LBS ACTIVE INGREDIENT/A	REMARKS AND PRECAUTIONS
POSTEMERGENCE - HERBICIDE TOLERANT HYBRIDS: PLEASE NOTE = Herbicide selection should not be the dominant factor in determining varietal selection. Consult your local extension personnel or seed dealer when choosing a hybrid(s) that is best adapted for your area and farming operation. (cont.)			
glyphosate + *S*-metolachlor (Sequence) 5.25 lbs/gal	2-2.5 pts	0.56-0.70 + 0.75-0.94	**FOR USE ONLY ON ROUNDUP READY CORN HYBRIDS APPLICATIONS OF GLYP HOSATE TO NON-TOLE RANT HYBRIDS WILL RESULT IN SEVERE CROP INJURY AND/OR CROP DEATH!!** Can be applied from corn emergence until the corn plants reach 30 " in height. Do not exceed 2.5 pts/A in a single application or 5.0 pts total/A/year. Very effective for the control of tropical spiderwort if applied before the weed exceeds 1". Can be tank- mixed with atrazine for improved broadleaf weed control. MOA = 9 + 15.
glyphosate + *S*-metolachlor + atrazine (Expert) 4.88 lbs/gal	2.5 - 3.75 qts	0.63 - 0.94 + 1.09 -1.63 + 1.34 -2.00	**FOR USE ONLY ON ROUNDUP READY CORN HYBRIDS APPLICATIONS OF GLYP HOSATE TO NON-TOLE RANT HYBRIDS WILL RESULT IN SEVERE CROP INJURY AND/OR CROP DEATH!!** Expert can be applied over-the-top of RR corn up until a maximum corn height of 12". MOA = 9 + 15 + 5.
glyphosate + *S*-metolachlor + mesotrione (Halex GT) 4.389 lbs/gal	3.6 - 4.0 pts	0.941- 1.568 + 0.941 - 1.568 + 0.094 - 0.105	**FOR USE ONLY ON ROUNDUP READY CORN HYBRIDS.** Can be applied from corn emergence up until 30" or 8 leaf stage of growth. Atrazine can be tank-mixed with Halex if desired. Add a NIS @ 0.25% v/v + AMS @ 8.5-17 lbs/100 gallons of water. **Do not use Halex GT if OP insecticides have been used at planting.** Rotation restrictions: corn = 0 months; grain sorghum (Concep treated) = 0 months; barley, wheat, rye = 4 months; cotton, peanuts, soybeans, sunflowers, tobacco = 10 months; MOA = 9 + 15 + 28.
glyphosate (numerous trade names) 3.00 lb ae/gal 3.73 lb ae/gal 4.00 lb ae/gal 4.17 lb ae/gal 4.50 lb ae/gal 5.00 lb ae/gal	 32 oz 26 oz 24 oz 23 oz 22 oz 19 oz	0.75 ae	**FOR USE ONLY ON ROUNDUP READY CORN HYBRIDS APPLICATIONS OF GLYPHOSATE TO NON-TOLERANT HYBRIDS WILL RESULT IN SEVERE CROP INJURY AND/OR CROP DEATH!!** Can be tank-mixed with atrazine, Dual, Harness, Harness Xtra, Micro-Tech, Bullet, Partner, or Permit herbicides. Various formulations of glyphosate are available. Not all formulations of glyphosate are labeled for use on RR corn hybrids. Please refer to specific product label. Sequence is a pre-mix of glyphosate + S- metolachlor. Expert is a pre-mix of glyphosate + S-metolachlor + atrazine. **Halex GT** is a pre-mixture of glyphosate + S-metolachlor + mesotrione. MOA = 9. USE RATE TABLE (lb ae/A): RR-Corn 2 / RR-Corn Normal Application Rate: 0.75 / 0.75 Maximum Application Rate: 1.12 / 0.75 Maximum Total In-Crop Rate: 2.25* / 1.50* Application Timing: Up to V8 or 30" 30-48" (drops) / Up to V8 or 30" *1.50 lb ae/A = 64 oz/A of 4 lb ai/gal or 43 oz/A of 5.5 lb ai/gal *2.25 lb ae/A = 96 oz/A of 4 lb ai/gal or 64 oz/A of 5.5 lb ai/gal
POSTEMERGENCE-DIRECTED			
ametryn (Evik) 80W	1.25 - 2.0 lbs	1.0 - 1.6	Apply only as a directed spray to corn. Minimum corn height: ametryn-12 in., linuron- 15 in., paraquat-10 in. Spray to cover weeds no more than 3 to 4 in. tall. Where rate range is given, use lower rate when weeds are no taller than 2 in. and higher rate for weeds up to 4 in. tall. Use a nonionic surfactant to improve spray coverage of weeds (ametryn and linuron - 0.5% v/v; paraquat - 0.25% v/v). **DO NOT** apply ametryn within 3 weeks of tasseling. With paraquat arrange nozzles to spray no higher than lower 3 in. of stalks. Ametryn MOA = 6 Linuron MOA = 7 Paraquat MOA =22 Carfentrazone MOA = 14
linuron (numerous trade names) 50DF 4L	 1.25 - 1.5 lbs 1.25 - 1.50 pts	0.63 - 0.75	
paraquat (Gramoxone Inteon /Gramoxone SL) 2.0 lb/gal (Firestorm/Parazone) 3.0 lb/gal	 16 - 32 oz 11 - 21 oz	0.25 - 0.50	
carfentrazone (Aim 2EC)	0.5 - 1.9 oz	0.08 - 0.031	Use Aim for the control of annual morningglory, pigweed, and tropical spiderwort. Add a COC at 1% v/v (1 gal/100 gals). Avoid directing the spray in the whorl of the plant. Aim provides no residual control.
pyraflufen (ET) 0.208EC	0.5 - 1.0 oz	0.008 - 0.0016	Can be applied post-directed or with drop nozzles up until the V8 stage of growth. Avoid spraying into the whorl. Corn leaf speckling will occur. Use a NIS @ 0.25% v/v.

USE STAGE/ HERBICIDE	BROADCAST RATE/ACRE AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT/A	REMARKS AND PRECAUTIONS
MINIMUM TILLAGE			
paraquat (Gramoxone Inteon /Gramoxone SL) 2.0 lb/gal (Firestorm/Parazone) 3.0 lb/gal	 1.88 - 3.76 pts 1.25 -2.5 pts	0.47 - 0.94	Use with a nonionic surfactant (0.25% v/v for contact kill of emerged annual weeds. **Paraquat will not adequately control horseweed, swinecress, purslane speedwell, or curly dock**. Apply prior to, during, or after planting, but prior to crop emergence. Use 20 to 60 gallons of spray solution to assure good spray coverage. Use high spray gallonage for heavier weed infestations and where crop residue or stubble is dense. Paraquat does not provide residual control. Paraquat is registered for application as a tank-mixture with the following residual herbicides and herbicide combinations: AAtrex, Atrazine, Dual + Aatrex, AAtrex + Lasso, Harness Xtra, Aatrex + Princep, Surpass. Can be tank-mixed with atrazine, 2,4-D or Aim to improve burndown weed control. However, if 2,4-D is used, corn planting must be delayed for 7-14 days. MO A = 22.
glyphosate (numerous trade names) 3.00 lb ae/gal 3.73 lb ae/gal 4.00 lb ae/gal 4.17 lb ae/gal 4.50 lb ae/gal 5.00 lb ae/gal	 16 - 128 ozs 13 - 103 ozs 12 - 96 ozs 11.7 - 92 ozs 11 - 85 ozs 10 - 77 ozs	0.38 - 3.0 ae	Use 0.38-1.13 lbs ae/A for control of most emerged annual grasses and broadleaf weeds. Use 1.5 -3.0 lbs ae/A for control of perennial grasses and broad leaf weeds. Apply with 10 to 40 gallons of water/A immediately before, during, or after planting, but before crop emergence. As stubble, crop residue or weed density increases, spray gallonage and glyphosate rate should be increased (refer to label). <u>Glyphosate tank mixtures are not recommended for bermudagrass or johnsongrass control in minimum tillage systems.</u> Weed kill from glyphosate treatments applied as a tank mixture with residual herbicides has not been as consistent as when glyphosate and preemergence herbicides are applied separately. Glyphosate is registered for use as a tank-mixture with the following herbicide combinations: Lasso, Dual + atrazine, Lasso + atrazine, Harness Plus, Surpass, Lasso + simazine, Dual + simazine atrazine + simazine, Dual + atrazine + simazine. Can be tank-mixed with atrazine, 2,4-D or Aim to improve burndown weed control. However, if 2,4-D is used, corn planting must be delayed for 7-14 days. MOA = 9.
glufosinate (Liberty 280 SL) 2.34 lb/gal	 22-29 ozs	0.40 - 0.53	Apply during or after planting, but before crop emerges to kill emerged annual grasses and weeds. Liberty will not provided adequate burndown control of small grains. **Very effective for burndown control of volunteer peanuts.** Can be tank-mixed with glyphosate or 2,4-D. MOA = 10.
carfentrazone (Aim) 2EC	 0.5 - 1.0 ozs.	0.008 - 0.016	Tank-mix with glyphosate or glufosinate for the improved control of large morningglories. Corn can be planted immediately. MOA = 14.
pyraflufen (ET) 0.208EC	 0.5 - 2.0 ozs.	0.0008 - 0.003	Tank-mix with glyphosate or glufosinate for the improved control of large morningglories. Corn can be planted immediately. MOA = 14.
2,4-D (various trade names) 3.8 lb/gal	 1.0 pt	0.475	Very effective for cutleaf evening primrose control. Can be tank-mixed with other burndown herbicides. Corn can be planted in 7- 14 days after application. MOA = 4.
flumioxazin (Valor SX 51WG)	 2 oz	0.064	Tank-mix with glyphosate to improve burndown control of certain weeds. Will also provide residual control of many broadleaf weeds including pigweed and Florida beggarweed. No-till or minimum tillage corn can be planted 14 days after application in fields where last year's crop residue has not been incorporated into the soil. Do not irrigate from emergence to 2-leaf stage. Corn planted in other tillage systems should not be planted for at least 30 days after application. MOA = 14.
thifensulfuron + tribenuron (FirstShot SG) 50SG	 0.5 -0.80 oz	0.008 - 0.013 + 0.5 - 0.8 oz	Tank-mix with glyphosate, paraquat, or Liberty for improved control of broadleaf weeds. Corn can be planted in **14-21** days depending upon soil type. MOA = 2 + 2.
dicamba (Banvel, Clarity, Diablo, Rifle, Sterling, etc.) 4SL	 8 oz	0.25	Apply in combination with either Liberty, glyphosate, or paraquat in fields where marestail or horseweed is a problem. Wait 7 days before planting corn. Corn must be planted at least 1.5" deep. MOA = 4.
BURNDOWN CONTROL OF RR FIELD CORN (REPLANTING)			
clethodim (SelectMax / TapOut) 0.97EC	 6 oz	0.045	For the control of an existing stand of RR field corn or volunteer RR field corn prior to replanting field corn. Use a NIS (0.25% v/v) + AMS (2.5 lbs/A). Corn can be replanted in 6 days. MOA = 1.

USE STAGE/ HERBICIDE	BROADCAST RATE/ACRE AMOUNT OF FORMULATION	BROADCAST RATE/ACRE LBS ACTIVE INGREDIENT/A	REMARKS AND PRECAUTIONS
HARVEST AID			
2,4-D (numerous trade names) 3.8 lb/gal	 1- 2 pt	0.48 - 0.96	Apply by air or high clearance equipment when corn reaches the hard dough stage to suppress, control or decrease seed production of cocklebur, jimsonweed, ragweed, or vines which interfere with harvesting. Observe drift control precautions noted for postemergence use of 2,4- D. No adjuvant is recommended. Wait 5-7 days after application before harvesting. MOA = 4.
sodium chlorate 3 lb/gal 5 lb/gal 6 lb/gal 7.5 lb/gal	 2 gals 1.2 gals 1 gal 0.8 gals	6.0	Apply 14 days prior to harvest by aerial or ground equipment. Apply on warm, sunny day with high temperatures (>70° F) and humidity. Do not apply if rainfall is expected within 24 hours. More effective on grass weeds than broadleaf weeds. Desiccation of morningglory and other vines may be erratic. MOA = NC.
glyphosate (numerous trade names) 3.00 lb ae/gal 3.73 lb ae/gal 4.00 lb ae/gal 4.17 lb ae/gal 4.50 lb ae/gal 5.00 lb ae/gal	 32 oz 26 oz 24 oz 23 oz 22 oz 19 oz	0.75 ae	Apply 7 days before harvest when kernel moisture is less than 35% and after black layer formation. Avoid drift onto sensitive crops. **Do not use on corn grown for seed if hybrid is not RR Corn 2**. Not all formulations of glyphosate may be labeled for use as a harvest aid. Please refer to the specific product label. MOA = 9.
carfentrazone (Aim 2EC)	 1.6-1 .9 ozs	0.025 - 0.030	Apply for the defoliation/desiccation of annual morningglories and pigweed. Use a COC @ 1% v/v. Can be applied aerially or by ground. Do not apply within 3 days of harvest. Do not graze corn stover until 14 days after application. MOA = 14.
paraquat (Firestorm/ Parazone) 3 lb/gal (Gramoxone Inteon / Gramoxone SL) 2 lb/gal	 0.8-1.3 pts 1.2-2.0 pts	0.30 - 0.50	Application must be made at least 7 days before harvest. Apply after the corn is mature and black layer has formed at the base of the kernels. Add a NIS at 0.25% v/v (1 qt/100 gals). Can be applied aerially or by ground. MOA = 22.

*When using atrazine formulations other than 4L, use equivalent rates: 1.0 qt. 4L equal 1.25 lbs. 8 0W or 1.1 lbs. 90 DF.

Suggested Herbicide Programs for the Post-Harvest Control of Tropical Spiderwort :

OPTION 1: 2,4-D amine 3.8SL @ 1.5 pt/A followed by 2,4-D amine 3.8SL @ 1.5 pt/A or Gramoxone Inteon / Gramoxone SL 2SL @ 32 oz/A or
Firestorm /Parazone 3S L @ 21 o z/A + COC @ 1% v/v or Aim 2E C @ 1.5 o z/A + COC @ 1% v/v 14 -21 days later

OPTION 2: Gramoxone Inteon / Gramoxone SL 2SL @ 32 o z/A o r Firestorm /Parazone 3S L @ 21 o z/A + COC @ 1% v/v followed by Gramoxone Inteon / Gramoxone SL 2SL @ 32 oz/A or Firestorm/Parazone 3SL @ 21 oz/A + COC @ 1% v/v 14- 21 days later

OPTION 3: Aim 2EC @ 1.5 oz/A + COC @ 1% v/v followed by Aim 2EC @ 1.5 oz/A + COC @ 1% v/v 14-21 days later

Metolachlor and S-Metolachlor Products

Trade Name	Active Ingredient	lbs/gal	Corn Safener	Company
Brawl	S-metolachlor	7.62	none	Tenkoz
Brawl II	S-metolachlor	7.64	benoxacor	Tenkoz
Charger Basic	S-metolachlor	7.62	none	Agriliance
Charger Max	S-metolachlor	7.64	benoxacor	Agriliance
Cinch	S-metolachlor	7.64	benoxacor	DuPont
Dual Magnum	S-metolachlor	7.62	none	Syngenta
Dual II Magnum	S-metolachlor	7.64	benoxacor	Syngenta
Me-Too-Lachlor	metolachlor	8.0	none	Drexel
Me-Too-Lachlor II	metolachlor	7.8	dichlormid	Drexel
Medal	S-metolachlor	7.62	none	Syngenta
Parallel	metolachlor	7.8	benoxacor	Makhteshim-Agan
Parallel PCS	metolachlor	8.0	none	Makhteshim-Agan
Parrlay	metolachlor	8.0	none	Monsanto
Stalwart	metolachlor	8.0	none	SipCam
Stalwart C	metolachlor	7.8	dichlormid	SipCam

PREPACKAGED TANK-MIXES FOR FIELD CORN
[See manufacturer's label for specific rates and application uses]

Product Name	Active Ingredients (lbs ai/gal or % ai)	Product Name	Active Ingredients (lbs ai/gal o r % ai)
Accent Gold	nicosulfuron (6.5%) + rimsulfuron (6.5%)+ flumetsulam (19.1%) + clopyralid (51.7%)	Axiom	flufenacet (54.4%) + metribuzin (13.6%)
Accent Gold WDG	nicosulfuron (5.4%) + rimsulfuron (5.4%) + flumetsulam (15.9%) + clopyralid (51.4%)	Axiom AT	flufenacet (19.6%) + metribuzin (4.9%) + atrazine (50.5%)
Balance Flexx	isoxaflutole (2.0) + cyprosulfamide[4]	Basis	rimsulfuron (50%) + thifensulfuron (25%)
Basis Gold	rimsulfuron (1.34%) + nicosulfuron (1. 34%) + atrazine (82.44 %)	Bicep	metolachlor (3.33) + atrazine (2.67)
Bicep II	metolachlor (3.23) + atrazine (2.67) + benoxacor[1]	Bicep Lite II	metolachlor (2.3) + atrazine (1. 67) + benoxacor
		Bicep Lite II Magnum	*S*-metolachlor (3.33) + atrazine (2.67) + benoxacor
Bicep II Magnum	*S*-metolachlor (2.4) + atrazine (3. 1) + benoxacor	Breakfree ATZ	acetoachlor (3.0) + atrazine (2.25) + dichlormid[2]

PREPACKAGED TANK-MIXES FOR FIELD CORN (continued)
[See manufacturer's label for specific rates and application uses]

Product Name	Active Ingredients (lbs ai/gal or % ai)	Product Name	Active Ingredients (lbs ai/gal o r % ai)
Breakfree ATZ Lite	acetoachlor (4.0) + atrazine (1.50) +dichlormid[2]	Bullet	alachlor (2.5) + atrazine (1.5)
Callisto Xtra	atrazine (3.2) + mesotrione (0.5)	Camix	mesotrione (0.33) + S-metolachlor (3.3 4)+ benoxacor
Capreno	thiencarbazone (0.57) + tembotrione (2.88) + isoxadifen[3]	Celebrity Plus	dicamba (4 6.6%) + diflufenzopyr (18. 1%) + nicosulfuron (10.6%)
Charger Max ATZ	*S*-metolachlor (2.4) + atrazine (3. 1) + benoxacor	Charger Max ATZ Lite	*S*-metolachlor (3.33) + atrazine (2.67) + benoxacor
Cinch ATZ Cinch ATZ Lite	*S*-metolachlor (2.4) + atrazine (3. 1) +benoxacor *S*-metolachlor (3.33) + atrazine (2.67) + benoxacor	Corvus	thiencarbazone (0.75)+ isoxaflutole (1.88) + cyprosulfamide[4]
Degree Xtra	acetochlor (2.7) + atrazine (1.34)	Distinct	diflufenzopyr (20%) + dicamba (50%)
Epic	flufenacet (48%) + isoxaflutole (10%)	Equip	foramsulfuron (30%) + idosulfuron (2%)
Exceed	primisulfuron (28.5%) + prosulfuron (28.5%)	Expert	*S*-metolachlor (1.74) + atrazine (2.14) + glyphosate (1.0)
FieldMaster	acetochlor (2.0) + atrazine (1.5) + glyphosate (0.75)	FulTime	acetochlor (2.4) + atrazine (1.6)
Guardsman	dimethenamid (2.33) + atrazine (2.67)	Guardsman Max	dimethenamid-p (1.7) + atrazine (3.3)
Halex GT	mesotrione (0.209) + *S*-metolachlor (2.09) + glyphosate (2.09)		
Harness Xtra	acetochlor (4.3) + atrazine (1.7)	Harness Extra 5.6L	acetochlor (3.1) + atrazine (2.5)
Hornet	flumetsulam (23%) + clopyralid (62.5%)	Keystone Keystone LA	acetochlor (3.0) + atrazine (2.5) acetochlor (4.0) + atrazine (1.5)
Imperium	EPTC (5.6) + acetochlor (1.4)		
Laddock	bentazon (1.66) + atrazine (1.66)	LandMaster	glyphosate (1.2) + 2,4-D (1.9)
Lariat	alachlor (2.5) + atrazine (1.5)	Lexar	*S*-metolachlor (1.74)+ atrazine (1.74) + mesotrione (0.224) + benoxacor
Lightning	imazethapyr (52.5%) + imazapyr (17.5%)	Liberty ATZ	atrazine (3.3) + glufosinate (1.0)
Lumax	*S*-metolachlor (2.68) + mesotrione (0.2 68) + atrazine (1.0) + benoxacor	Marksman	dicamba (1.1) + atrazine (2.1)
Parallel Plus	atrazine (2.8) + metolachlor (2.7) + benoxacor	Prequel	rimsulfuron (15%) + isoxaflutole (30%)
Priority	carfentrazone (12.5%) + halosulfuron (50.0%)	Propel ATZ Propel ATZ Lite	dimethenamid-p (1.7) + atrazine (3.3) dimethenamid-p (2.25) + atrazine (2.75)
Radius	flufenacet (3.57) + isoxaflutole (0.43)	Realm Q	rimsulfuron (7.5%) + mesotrione (31.25%) + isoxadifen[3]
Resolve Q	rimsulfuron (18.4%) + thifensulfuron (4.0%) + isoxadifen[3]	Stalwart Xtra	atrazine (3.1) + metolachlor (2.4) + dichlormid[2]
Shotgun	atrazine (2.25) + 2,4-D (1.0)		
Steadfast Steadfast ATZ	nicosulfuron (50%) + rimsulfuron (25%) nicosulfuron (2.7%) + rimsulfulorun (1.3%) + atrazine (85.3%)	Steadfast ATZ	nicosulfuron (2.7%) + rimsulfulorun (1.3%) + atrazine (85.3%)
Steadfast Q	nicosulfuron (25.2%) + rimsulfuron (12.5%) + isoxadifen	Sterling Plus	dicamba (1.1) + atrazine (2.1)
Stout	nicosulfuron (67.5%) + thifensulfuron (5.0%)	SureStart	clopyralid (0.29) + acetochlor (0.38) + flumetsulam (0.12)
TripleFLEX	acetochlor (3.75) + clopyralid (0.38) + flumetsulam (0.12)	Yukon	halosulfuron (12.5%) + dicamba (55%)

[1]Benoxacor - a safener that protects corn from metolachlor injury.
[2]Dichlormid - a safener that protects corn from metolachlor injury.
[3]Isoxadifen - a corn safener
[4]Cyprosulfamide - a corn safener

WEED RESPONSE TO HERBICIDES USED IN FIELD CORN

Eric P. Prostko, Extension Agronomist - Weed Science

	Sutan	Eradicane	Micro-Tech Lasso	Zidua	Outlook / Propel	AAtrex Atrazine	Pursuit[1]	Dual[1] Cinch	Harness Surpass TopNotch Degree Warrant	Simazine	Python
	PPI		**PRE**								
PERENNIAL WEEDS johnsongrass (rhizome)	F	F-G	P		P	P	P	P	P	P	P
nutsedge, purple	G-E	G-E	P	P	P	P	G	P	P	P	P
nutsedge, yellow	G-E	G-E	F	P	F-G	P	F-G	F-G	F	P	P
ANNUAL GRASSES broadleaf signalgrass	G	G	F-G	F-G	F-G	P	P	F-G	G	P	P
crabgrass	E	E	E	E	E	G	F	E	E	G	P
crowfootgrass	E	E	E	E	E	G	P	E	E	G	P
fall panicum	E	E	E	E	E	P	P-F	E	E	G	P
goosegrass	E	E	E	E	E	G	F	E	E	G	P
johnsongrass (seedling)	E	E	P	E	P	P	G	P	P	P	P
sandbur	E	E	F-G	F-G	F-G			F-G	F-G	G	P
Texas panicum	G-E	G-E	P-F	F	P- F	P	P-F	G	P	P	P
annual ryegrasses				G			G	G		E	P
BROADLEAF WEEDS bristly starbur			P		P	G	F	P	P	G	E
burcucumber			P		P	P-F		P	P	F	P
citronmelon			P		P	G	G	P	P	F	
cocklebur			P		P	G-E	E	P	P	G	E
cowpea			P		P	E	P	P	P	G	
crotalaria			P		P	G-E		P	P	G	
croton, tropic			P		P	G	P	P	P	G	
Florida beggarweed			F		P	E	P	F	F	G	F-G
Florida pusley	G-E	G-E	G-E	G	G-E	E	P	G-E	G-E	G	G
jimsonweed			P		P	E	G	P	P	E	P
lambsquarters, common	G	G	F-G		F	E	F	F	F	E	E
morningglories			P		P	G	G	P	P	G	F-G
pigweeds[3]	G	G	G	G	G	E	E	G	G	E	E
ALS-resistant	G	G	G	G	G	E	P	G	G	E	P
glyphosate-resistant	G	G	G	G	G	E	E	G	G	E	E
atrazine-resistant	G	G		G	G	P	E	G	G	P	E
prickly sida	G	G	F-G		F	E	G-E	F	F	E	E
purslane	G	G	G		G	E		G	G	E	
ragweed, common			P		P	E	P	P	P	E	G
sesbania, hemp		P	P		P	F-G		P	P		
sicklepod	F	F	P		P	G	P	P	P	G	F-G
smartweed	P	P	P		P	G-E	G-E	P	P	G	G
tropical spiderwort				G-E	F	F	F-G	G-E			
volunteer peanuts	P	P	P	P	P	G	P	P	P	F	
velvetleaf			P			G	G	P	P		E
wild poinsettia											G
wild radish	P	P	P		P	G	E	P	P	F	

PPI = Preplant soil incorporated **PRE** = Preemergence (surface applied)

[1]Weed response for Pursuit is similar for PPI and PRE applications. **Pursuit can only be used on Clearfield corn hybrids (IR/IT).**

[2]Includes all metolachlor products (Cinch, Dual, Dual II, Dual Magnum, Dual II Magnum). The generic formulations of metolachlor (**Parallel, Stalwart, Me-Too-Lachlor**) have not provided the same length of residual control of certain weeds as similar rates of Dual Magnum formulations in some UGA field trials.

[3]Palmer Amaranth control is poor.

Key to response symbols: E = Excellent control, weed kill 90 percent or above.; G = Good control, weed kill 80 percent or above; F = Fair control, weed kill less than 80%, usually unacceptable unless supplemental chemical or cultivation practices are used; P = Poor control. If no symbol is given, weed response is unknown.

WEED RESPONSE TO HERBICIDES USED IN FIELD CORN (continued)

	Evik	Attrex, Atrazine	Accent	Option	Beacon	Exceed	Basagran	Callisto	Laudis	Capreno	Steadfast Q
	Postemergence/Post-Directed)										
PERENNIAL WEEDS johnsongrass (rhizome)	P	P	G-E	G-E	F-G	P-F	P	P			
nutsedge, purple	G	P	P-F			P	P	P-F			
nutsedge, yellow	G	P				P	G	P-F			
ANNUAL GRASSES broadleaf signalgrass	G	P-F	G	G	P		P	F			
crabgrass	E	P-F	P	P-F	P	P	P	F-G	F-G	G	F
crowfootgrass	E	P	G-E			P	P	P			G-E
fall panicum	E	P	G-E	G-E	F	P	P	P			
goosegrass	E	P	G-E	G-E		P	P	P			
johnsongrass (seedling)	E	P	G-E	G-E	G-E	F-G	P	P			
sandbur	E	F	G-E	G-E		P	P	P			
Texas panicum	G-E	P	G-E	G	P	P	P	P	F-G	G	G-E
annual ryegrasses	F-G	P-F	G				P	P			
BROADLEAF WEEDS bristly starbur	E	E					E				
burcucumber	F	F-G	F-G	F-G	G	G	P	P-F			
citronmelon	G	G				F	P				
cocklebur	F	E	P-F	P-F		G	E	G-E			
cowpea	G	G					P				
crotalaria	E	G					P				
croton, tropic	G	G					P				
Florida beggarweed	E	G	G		G-E		P				
Florida pusley	E	G	P-F		G-E		P				
jimsonweed	E	E	F-G	F-G		G	E	G-E			
lambsquarters, common	E	E	F-G	G		G	P	G-E			
morningglories	G	E	G-E	F-G	F	F-G	F-G	F-G			
pigweeds	E	E	G-E	G	G-E	G	P	G	G	G-E	G-E
ALS-resistant	E	E	P	P	P	P	P	G	G	G	P
glyphosate-resistant	E	E	G-E	G	G-E	G	P	G	G	G-E	G-E
Atrazine-resistant	E	P	G-E	G	G-E	G	P	G	G	G-E	G-E
prickly sida	E	E	P			F-G	G	P			
purslane	E	E					P				
ragweed, common	E	E	P-F	G		G	F	F-G			
sesbania, hemp	P-F	F-G	P-F		P	F-G	P				
sicklepod	E	E	P-F		G	G	P	P	P	P	
smartweed		G-E	G	P	G		G-E	G-E			
tropical spiderwort	G-E	P					F-G				
velvetleaf		E	F	G	F-G		G-E	E			
volunteer peanuts	G-E	F-G	F		F	P	P	P			
wild poinsettia											
wild radish	G-E	F-G	G		G	G	F				

Key to response symbols: E = Excellent control, weed kill 90% or above; G = Good control, weed kill 80% or above; F = Fair control, weed kill less than 80%, usually unacceptable unless supplemental chemical or cultivation practices are used; P = Poor control. If no symbol is given, weed response is unknown.

WEED RESPONSE TO HERBICIDES USED IN FIELD CORN (continued)

	Resolve Q	Pursuit [1]	Lightning [1]	Liberty2	Glyphosate [3]	Banvel,Clarity	Lorox, Linex
	PO (Postemergence/Postemergence Directed)						
PERENNIAL WEEDS							
johnsongrass (rhizome)		P	F	P-F	E	P	P
nutsedge, purple		G		P	F-G	P	F
nutsedge, yellow		F	P	P	F	P	F
ANNUAL GRASSES							
broadleaf signalgrass		P		G	E	P	G
crabgrass		P-F	G	F-G	E	P	G
crowfootgrass		P-F	G	G	E	P	E
fall panicum		P		G	E	P	E
goosegrass		P		P	E	P	E
johnsongrass (seedling)		F		G	E	P	E
sandbur					E	P	E
Texas panicum	F-G	P-F	P-F	G-E	E	P	G-E
annual ryegrass				G	F-G	P	
BROADLEAF WEEDS							
bristly starbur		P-F		G-E	G	E	G
burcucumber		P	P	G	E	F	F
citronmelon		F		G	G	E	E
cocklebur		E	G	E	G	E	E
cowpea		P		G	G	E	G
crotalaria					G	G	E
croton, tropic		P		G	G	G	G
Florida beggarweed		P		G-E	G-E	G	E
Florida pusley		F-G	F-G	P-F	F	G	G
jimsonweed		F-G		G	G	E	E
lambsquarters, common		P	F	E	G	E	E
morningglories		F-G	G-E	G-E	F-G	E	G
pigweeds	G	G-E	G-E	F-G	G-E	G-E	G
ALS-resistant	P	P	P	F-G	G-E	G-E	G
glyphosate-resistant	G	G-E	G-E	F-G	P	G-E	G
Atrazine-resistant	G	G-E	G-E	F-G	G-E	G-E	G
prickly sida		P-F		P-F	G	E	G
purslane				G	G	E	G
ragweed, common		P	G	G	G	E	E
sesbania, hemp		P		G-E	F	E	G
sicklepod		P	F	G	G-E	E	E
smartweed		E	G-E	G-E	G-E	E	
tropical spiderwort		F	F-G	P-F	F	P	F
velvetleaf		G-E	E	E	G	F-G	
volunteer peanuts		P	P	G-E	F	F-G	G
wild poinsettia					G-E		
wild radish		G-E		F	G	G-E	G

[1]Pursuit and Lightning are **only** for use on Clearfield corn hybrids (IR/IT).
[2]Liberty is **only** for use on Liberty-Link corn hybrids.
[3]Glyphosate is **only** for use on Roundup Ready corn hybrids. Ratings also reflect weed control in minimum tillage applications prior to crop emergence/planting. Key to response symbols: E = Excellent control, weed kill 90 percent or above; G = Good control, weed kill 80 percent or above; F = Fair control, weed kill less than 80%, usually unacceptable unless supplemental chemical or cultivation practices are used; P = Poor control.
If no symbol is given, weed response is unknown.

WEED RESPONSE TO HERBICIDES USED IN FIELD CORN (continued)

	paraquat	Prowl⁺	Trifluralin+	Stinger	2,4-D	Sandea	Buctril	Aim
	PO (Postemergence/Postemergence Directed)							
PERENNIAL WEEDS								
johnsongrass (rhizomes)	P	P	P	P	P	P	P	P
nutsedge, purple	F	P	P	P	P	G	P	P
nutsedge, yellow	F	P	P	P	P-F	G	P	P
ANNUAL GRASSES								
broadleaf signalgrass	G	G	G	P	P	P	P	P
crabgrass	G	G-E	G-E	P	P	P	P	P
crowfootgrass	G	G-E	G-E	P	P	P	P	P
fall panicum	G	G-E	G-E	P	P	P	P	P
goosegrass	G	G-E	G-E	P	P	P	P	P
johnsongrass (seedling)	G	G	G	P	P	P	P	P
sandbur	G	G	G	P	P	P	P	P
Texas panicum	E	G	G	P	P	P	P	P
annual ryegrass		F	F	P		P		P
BROADLEAF WEEDS								
bristly starbur	G	*	*	F-G		G	G	P
burcucumber	G	P	P	P	P	P	F-G	P
citronmelon	F	*	*	F-G	E	P-F		
cocklebur	G	*	*	G-E	E	G	E	G
cowpea	G	*	*	G-E	E			
crotalaria	G	*	*	G-E	G	P		F
croton, tropic	G	*	*	G	G			G
Florida beggarweed	E	*	*	G-E	P	P	G	F
Florida pusley	F-G	G	G	F-G	G		E	F-G
jimsonweed	G	*	*	G	E			G
lambsquarters, common	F-G	G*	G*	P	E	P-F	G	G-E
morningglories	G	*	*	P	G	P-F	G	E**
pigweeds	G	G*	G*	P	G-E	F-G	G	G-E
ALS-resistant	G	G	G	P	G-E	P	G	G-E
glyphosate-resistant	G	G	G	P	G-E	F-G	G	G-E
Atrazine-resistant	G	G	G	P	G-E	F-G	G	G-E
prickly sida	F-G	*	*		G			F
purslane	G	G*	G*		G			G
ragweed, common	G	*	*	G	E	G	G	F
sesbania, hemp	P-F				G	F-G	G	
sicklepod	G	*	*	F-G	E	P	P	P
smartweed				F	P-F	F-G		G
tropical spiderwort	G-E	P	P		G-E	P		G-E
velvetleaf		P	P		G	E	G	E
volunteer peanuts	P	P	P	F-G	P	P	P	P
wild poinsettia	F-G	P	P					
wild radish	G	P	P		G	G-E	G	

Key to response symbols: E = Excellent control, weed kill 90 percent or above; G = Good control, weed kill 80 percent or above; F = Fair control, weed kill less than 80%, usually unacceptable unless supplemental chemical or cultivation practices are used; P = Poor control. If no symbol is given, weed response is unknown.
Ratings are based on average to good soil and weather conditions for herbicide performance.
*Must be tank mixed with atrazine or glyphosate for postemergence control of seedling grasses and broadleaf weeds. +For control of grasses and selected broadleaf weeds, these herbicides must be applied prior to weed emergence. **Aim will not effectively control smallflower morningglory.

*** Only for use in no-till or minimum tillage fields with previous crop residue. Rotation restriction for corn in other tillage systems is 30 days (1" rainfall/ irrigation is required between application and planting)

Weed and Cover Crop Response to Burndown Herbicides Used in Conservation Tillage Field Corn Production Systems in Georgia

Eric P. Prostko, Extension Agronomist - Weed Science

Weed	Glyphosate	Glyphosate + 2,4-D	Glyphosate + Atrazine	Glyphosate + Valor***	Paraquat	Paraquat + 2,4-D	Paraquat + Atrazine	glufosinate
Carolina geranium	P	F-G	G-E	G	G-E	G-E	G-E	G-E
chickweed	E	E	G-E	E	E	E	E	G-E
corn spurry	G-E	G-E	G-E		F-G			
crimson clover	P-F	F	F		G	G-E	G-E	
cutleaf evening primrose	P-F	E	G-E	F-G	F	E	G-E	G-E (mature plant)
henbit	F-G	E	G-E	E	G	E	G-E	G-E
horseweed	G	G-E	G-E	G-E	F	G	G-E	G-E
red sorrel	E	E	E	E	E	E	E	P-F
ryegrass**	G	G	G-E	G	P-F	P-F	F	P
small grains	E	E	G-E	E	F-G	F-G	G	P-F
swinecress	F-G	G	G	F-G	P-F	F-G	F-G	G-E
volunteer peanut	F	F	F	F-G	P	P-F	F	G-E
wild radish	F-G	G-E	G-E	E	F	G-E	G-E	G-E (mature plant)
corn plant-back restriction	**0 days**	**7-14 days**	**0 days**	**14 days*** **	**0 days**	**7-14 days**	**0 days**	**0 days**

Burndown rates are the following: Glyphosate at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3 lb ae/gal); paraquat at 0.75 lb ai/A (3 pt/A of Gramoxone Inteon / Gramoxone SL or 2 pt/A of Firestorm/Parazone); glufosinate at 0.40-0.53 lb ai/A (22-29 oz/A of Ignite 2.34SL); atrazine at 1.0 lb ai/A (1 qt/A of Atrazine 4L), Valor SX 51WG at 2 oz/A; and 2,4-D amine at 0.48 lb ai /A (1 pt/A of 2,4-D Amine 3.8SL).

** Ryegrass can be very difficult to control. The following programs are suggested: **OPTION 1** - Glyphosate at 1.125 lb ae/A (32 oz/A of 4.5 lb ae/gal or 48 oz/A of 3 lb ae/gal) + 32-48 oz/A of Atrazine 4L; **OPTION 2** - Gramoxone Inteon / Gramoxone SL @ 64 oz/A or Firestorm/Parazone @ 43 oz/A + Atrazine 4L @ 32-48 oz/A; **OPTION 3** - Glyphosate at 1.125 lb ae/A (32 oz/A of 4.5 lb ae/gal or 48 oz/A of 3 lb ae/gal) followed by Gramoxone Inteon /Gramoxone SL at 48 oz/A or Firestorm/Parazone at 32 oz/A + Atrazine 4L @ 32-48 oz/A (14-21 days after the glyphosate). **OPTION 4** - Select/Arrow 2EC @ 8 oz/A or SelectMax/TapOut @ 16 oz/A applied at least 30 days before planting followed by Gramoxone Inteon/Gramoxone SL @ 48 oz/A or Firestorm/Parazone @ 32 ož/A + Atrazine 4L @ 32 oz/A at planting.

Herbicide Programs for Managing Glyphosate and ALS-Resistant Palmer Amaranth in Field Corn[1]

Corn Hybrid	Preemergence	Postemergence	Layby as needed
Conventional	Atrazine**	Prowl[2] + Atrazine + Crop Oil	2,4-D[5] or Banvel/Clarity[4,5] or Status[10]
	Bicep II Magnum[3], or Bullet, or Guardsman, or Lariat, or Lexar	Atrazine or Banvel/Clarity[4,5] or 2,4-D[5] or Aim or Callisto or Laudis or Capreno or Impact or Armezon or Status[10]	2,4-D[5] or Banvel/Clarity[4,5] or Status[10]
Liberty Link	Atrazine**	Liberty + atrazine[7]	2,4-D[5] or Banvel/Clarity[4,5] or Status[10]
	Dual II Magnum[6] or Outlook or Micro-Tech or Zidua	Liberty + atrazine[7]	2,4-D[5] or Evik or Banvel/Clarity[4,5] or Status[10]
Roundup Ready	Atrazine**	glyphosate + atrazine or glyphosate + Warrant or Banvel/Clarity[4,5] or Status[10] or Expert[8] or Sequence[9] or Halex GT[11]	2,4-D[5] or Banvel/Clarity[4,5] or Status[10]
	Bicep II Magnum[3], or Bullet, or Guardsman, or Lariat, or Lexar	glyphosate + atrazine or glyphosate + Warrant or Banvel/Clarity[4,5] or Status[10] or Expert[8] or Sequence[9] or Halex GT[11]	2,4-D[5] or Banvel/Clarity[4,5] or Status[10]

[1]Glyphosate- and ALS-resistant Palmer amaranth are very serious concerns. An aggressive management program is necessary to slow spread of resistant biotypes and to reduce selection pressure in areas currently not infested with resistant biotypes.

[2]Generic brands of Prowl (pendimethalin) are available and perform similarly.

[3]Bicep II Magnum is a pre-mixture of S-metolachlor and atrazine. Less expensive, generic brands containing metolachlor and atrazine are available (Parallel Plus, Stalwart Xtra). These generic brands may not provide the same length of residual control as Bicep II Magnum (which contains S-metolachlor).

[4]Generic brands of Banvel (dicamba dimethylamine salt) are available and perform similarly.

[5]Use extreme caution to avoid drift to sensitive crops, such as cotton, tobacco, soybeans, and vegetables. Use only amine formulations of 2,4-D. Follow all label directions for drift management.

[6]Generic brands containing metolachlor are available (Me-Too-Lachlor-II, Parallel, Stalwart-C). However, these generic brands may not provide the same length of residual control as Dual II Magnum (S-metolachlor).

[7]Also available in a pre-mixture sold under the trade name of Liberty ATZ.

[8]Expert is a pre-mixture of glyphosate + S-metolachlor + atrazine.

[9]Sequence is a pre-mixture of glyphosate + S-metolachlor.

[10]Status is a pre-mixture of dicamba + diflufenzopyr + isoxadifen.

[11]Halex GT is a pre-mixture of glyphosate + S-metolachlor + mesotrione

**** When atrazine is applied PRE + POST, a total of 2.5 lb ai/A can be applied per year (2.5 qt/A of 4L or 44 oz/A of 90DF). When atrazine is applied only POST, then a total of 2.0 lb ai/A can be applied per year (2 qt/A of 4L or 36 oz/A of 90DF).**

Herbicides Programs for Managing Glyphosate, ALS, and Atrazine Resistant Palmer Amaranth in Field Corn

Hybrid	Preemergence	Postemergence[1]
Any	Dual II Magnum or MicroTech or Outlook or Zidua	Callisto[2], Capreno, Impact, Armezon, Laudis, Realm Q, or Status
Liberty-Link	Dual II Magnum or MicroTech or Outlook or Zidua	Liberty

[1]Atrazine can be tank-mixed with these herbicides if other weeds are a concern such as sicklepod and morningglory.
[2]Callisto Xtra is a premixed formulation of Callisto + Atrazine.

Post-harvest (CORN) Management of Palmer Amaranth

After corn harvest, Palmer amaranth plants that emerge up until 35 days before first frost will have the potential to produce viable seed. Consequently, these postharvest populations should be managed up until this time using 1 or more of the following strategies:

a) For plants larger than 6" in height:

• Mowing

2) Tillage

b) For plants less than 6" in height:

• Tillage or

• Gramoxone Inteon/Gramoxone SL @ 48 oz/A or Firestorm/Parazone 3SL @ 32 oz/A + 2,4-D **amine** 3.8SC @ 16-24 oz/A + COC (1.0% v/v). If cotton is nearby and drift is a concern, consider using Clarity 4SL @ 8 oz/A instead of 2,4-D. Delay planting of small grains for at least 7 days for each 16 oz/A of 2,4-D applied or 15 days for each 8 oz/A of Clarity applied.

3) If residual control is desired and a small grain will **not** be planted in the fall, Dual Magnum/ Stalwart, etc. @ 1 pt/A can be included with the burndown treatment.

It is important to remember that viable Palmer amaranth seed can be produced within 2 weeks after pollen shed. Thus, control strategies need to be implemented before this time to be effective in reducing weed-seed rain back into a field.

INSECT CONTROL IN FIELD CORN

David Buntin

Field corn in Georgia is subject to attack by many different kinds of insect pests. Some of these insects are capable of completely destroying a corn crop. However, there is no key insect pest of corn in Georgia causing serious damage in most fields every year.

Corn is sensitive to plant population. As little as a 10% loss in stand will reduce yield potential. Consequently, insect management in corn focuses more on seedling insect pests causing stand loss than in other crops. Once corn plants are established and past the seedling stage (6+ leaf stage), corn can tolerate considerable leaf defoliation and some ear and kernel damage before significant yield loss occurs. Therefore, insecticide use in field corn in Georgia historically has been limited and aimed mostly at soil and seedling pests.

Insect pest management in field corn consists of two approaches: **(1) prevention** of insect damage by crop management and preventive insecticide use in high-risk situations and **(2) regular monitoring** of the insect-pest infestations and treatment on a field by field basis as needed after plants have emerged. Historically low commodity prices for corn made routine preventive use of insecticides in Georgia a questionable practice. However, recent robust grain prices and availability of low cost seed treatments make active pest management with insecticides more beneficial. Certain crop management practices can help to minimize or prevent damage by some insects in field corn.

- **Good Soil Conditions:** Good fertility, optimum soil pH, good field drainage, irrigation and other agronomic practices that promote rapid stand establishment and vigorous plant growth are important in minimizing losses from insect injury.
- **Crop Rotation:** In general, rotation of corn with other summer crops helps prevent the buildup of corn pests from year to year. Most corn insect pests are highly mobile and therefore are not affected by rotation. However, billbug and western corn rootworm can be controlled by crop rotation.
- **Plant at the recommended time:** Plantings of field corn at the recommended time often escape serious damage by most insects.
- **Control Certain Weeds:** Nutsedge, bahiagrass, and johnsongrass may enhance infestations by certain insects.
- **Tillage:** Reduced-tillage production, previous-crop residue, sod, winter cover crop and/or heavy weed populations increases the risk of damage by soil insects. Soil insects attacking seedlings usually are worse in reduced, strip-till and no-tillage production, where residue from previous crops, cover crops or weeds remains on the soil surface. Conventionally-tilled fields following winter cover crops or winter weeds should be fallowed for at least 2 weeks before planting.

Hybrid Selection. A vigorous well-adapted hybrid will help corn tolerate injury by insects. Different types of Bt traits which contain toxins from *Bacillus thuringiensis* (Bt) are now available for control of either larvae of certain moth species or mid-season corn rootworms.

- **Agrisure® CB/LL** can contain the same gene (Cry1Ab) with either the MON810 event or the Bt11 event. YGCB targets caterpillar pests including European and southwestern corn borers, fall armyworm, and other lepidopterans. The toxin is expressed season-long throughout the plant although expression may be limited in seedlings.

- **Herculex® I** contains the gene Cry1F. It also targets caterpillar pests including European and southwestern corn borers, fall armyworm, and other lepidopterans. The toxin is expressed season-long throughout the plant. Activity in seedling and whorl-stage plants in greater than YGCB. Conversely Herculex I provide little protection in ears and kernels is against corn earworm damage.
- **Triple Stacked Traits:** Many hybrids now contain Bt caterpillar trait, a Bt rootworm trait plus herbicide tolerance or a three way stack. Products with stalk protection, root protection and herbicide tolerance include Agrisure 3000GT, Herculex XTRA and YieldGard VT Triple.
- **Genuity® VT Triple PRO™**, **Genuity® VT Double PRO™** contain two traits for caterpillar control, the same one in YieldGard VT Triple plus a new trait (Cry2A). The combined traits provide good control of stalk borers and fall armyworm in the whorl, but also provides good levels of control of corn earworm in the ear. Triple PRO also contains a gene for rootworm control but Double PRO does not have rootworm control.
- **Genuity® SmartStax® and SmartStax® by Dow** is an 8 gene combination and contain all the traits in Genuity VT Triple PRO plus all the traits in Herculex EXTRA. SmartStax provides good to excellent control of all target pests listed in Table 1.
- **Agrisure® Viptera™** is a new product series that contains a second new trait (Vip3A) for caterpillar especially corn earworm control. Specific Viptera products have a number designation which for southern hybrids will be 3110, 3111 and 3220. Depending on the product it also may be stacked with one or two traits for corn borer and corn rootworm control as well as tolerance to glyphosate and glufosinate herbicides.
- **Optimum® Intrasect™** by Pioneer is a new product for the southern U. S. It contains the two original corn borer proteins, in YieldGard-CB and Herculex 1, but does not contain a rootworm trait. This product provides very good to excellent control of corn borers and fall armyworm in the whorl. It also provides partial reduction in kernel damage by corn earworm similar to that of YieldGard-CB. Optimum® Intrasect™ XTRA also has the rootworm trait in Herculex® XTRA.
- **Integrated or blend refuge-in-the-bag products.** For 2013 there will be several Bt products marketed for the Midwest corn belt that have a reduced 5% or 10% non-Bt refuge that is mixed or blended in the bag of a Bt product. They include Genuity® SmartStax® RIB Complete, REFUGE ADVANCED Powered by SmartStax®, and Optimum® AcreMax® (several products). These products will not be marketed in cotton areas of the southern U.S., but if grown in cotton areas they will still require a 20% non-Bt structured refuge.

When to Use Bt Hybrids for Caterpillar Control: Hybrids with caterpillar Bt traits should be considered for planting when the planting time is after the recommended planting time when risk of caterpillar damage is greatest. Use of Bt corn permits planting of corn as a double-crop and at times later than previously recommended for susceptible corn. Planting corn during the recommended planting time in your area may not provide a consistent yield benefit, because early plantings usually avoid most damage by fall armyworm, corn earworm and corn borers. Compare the agronomic performance of adapted susceptible hybrids and hybrids with Bt traits and plant the best high-yield adapted hybrid.

Bt Hybrids for Rootworm Control: Bt rootworm traits target midseason rootworms. The only midseason rootworm species in Georgia is the western corn rootworm, and it currently is present in the northern two thirds of the state. Western corn rootworm is only a pest when corn is grown continuously in the same field for several years. Bt for rootworm control is NOT needed where corn is rotated annually with other crops. Therefore hybrids with a rootworm Bt trait should be considered for where corn is grown continuously, such as in dairy operations, and western corn rootworms were present in the corn the previous year. Several types of Bt rootworm products are available. Each product contains a different Bt gene that is active against rootworm larvae. Rootworm Bt traits are not effective against wireworms, white grubs or southern corn rootworm in the seedling stage.

Bt products with their associated traits and relative efficacy against major caterpillar/moth pests and rootworms.

Brand/ Product Name	Traits	Corn borers (stalks)	Cutworm (seedlings)	Lesser Cornstalk borer§ (seedlings)	Corn earworm (ear)	Fall armyworm (whorl)	Western corn rootworm (midseason roots)
Agrisure CB/LL	Cry1Ab	Excellent	Poor	Good	Fair	Fair-Good	None
Herculex I	Cry1F	Excellent	Good	Very Good	Poor	Good	None
Agrisure 3000GT	Cry1Ab Cry3A	Excellent	Poor	Good	Fair	Fair-Good	Good
YieldGard VT Triple	Cry1Ab Cry3Bb	Excellent	Poor	Good	Fair	Fair-Good	Excellent
Herculex XTRA	Cry1F Cry34/35Ab1	Excellent	Good	Good	Poor	Good	Excellent
Genuity VT Triple Pro	Cry1A.105, Cry2A, Cry3Bb	Excellent	Poor	Very Good	Very Good	Excellent	Excellent
Genuity VT Double Pro	Cry1A.105, Cry2A	Excellent	Poor	Very Good	Very Good	Excellent	None
Genuity SmartStax Dow SmartStax	Cry1A.105, Cry2A, Cry1F Cry3Bb, Cry34/35Ab1	Excellent	Good	Very Good	Very Good	Excellent	Excellent
Agrisure Viptera* 3110	Cry1Ab, Vip3A	Excellent	Good	Good	Excellent	Excellent	None
Agrisure Viptera* 3111	Cry1Ab, Vip3A, mCry3A	Excellent	Good	Good	Excellent	Excellent	Good
Agrisure Viptera* 3220	Cry1Ab, Cry1F, Vip3A	Excellent	Very Good	Very Good	Excellent	Excellent	None

§Lesser cornstalk borer is not specifically listed as a target pest for most Bt product labels.
*When this document was prepared, Viptera products were approved for use in North America but not for export. Full export approval is expected spring 2013.

Bt Hybrid Refuge Requirements: In 2013, all corn seed with Bt traits will have details of the refuge requirements and options for planting the refuge for that hybrid on the seed bag tag. General refuge requirements for Bt corn for caterpillar control in cotton growing areas such as Georgia are as follows:

- Bt products with a single gene for above-ground (corn borer) control must have a 50% non-Bt structured refuge. New stacked products with two or more above-ground (caterpillar) genes have a 20% structured non-Bt refuge requirement.
- For Bt corn products with above-ground traits only (no rootworm traits), the non-Bt corn refuge must be planted within ½ mile of the Bt corn.
- For Bt products for below ground containing a rootworm trait(s), the refuge must be planted in the same field or adjacent to the Bt corn.
- Bt and non-Bt corn can be planted as in-field strips of 4 or more consecutive rows. Strips of 1 to 3 rows are not allowed.
- Check with seed dealers, seed company, or the www.irmcalculator.com for complete Bt corn refuge requirements.

Before and At Planting

Insects that live in the soil, including wireworms, white grubs, rootworms, seedcorn maggots, whitefringed beetle larvae, lesser cornstalk borer and other, can damage corn seeds and seedlings. These insects cannot be controlled once corn seed has been planted. **Rotated, conventionally tilled corn with good weed control generally has the least risk of serious early-season insect damage,** although insect damage can still occur under these conditions. Several factors increase the risk of damage by soil insects and the need for an at-planting insecticide to prevent damage.

1. Planting continuous corn in the same field.
2. Planting in no-till or minimum-till situations (such as strip till) where residue of the previous crop remains on the soil surface.
3. Planting behind small grains, winter cover crops or sod of any type especially in reduced tillage situations.
4. Late-planting (more than 1 month after the recommended planting time).
5. Planting on light soils following periods of drought (lesser cornstalk borer).
6. When planting on heavier soils following extended wet periods.
7. Planting in fields with certain weeds. Southern corn billbug damage often is associated with nutsedge infestations and sugarcane beetle builds can up on bahiagrass. Leafhoppers and aphids serve as vectors of corn viruses from johnsongrass to field corn.

Insecticides for Use At-Planting:

Seed Treatments: Systemic seed treatments are only available as commercial seed dealer application. Seed corn from nearly all seed companies will be automatically treated with a systemic insecticide seed treatment Poncho 250 or Cruiser 250. Untreated seed or seed treated with a higher rate must be ordered with the seed early, usually in December of the previous year. Cost for seed treatments varies per acre between irrigated and dryland corn based on differences in seed planting rate.
Poncho (clothianidin) 250: Provides good control of most soil insects, but has variable control or not effective against corn billbug, cutworms, and stink bugs. Also provides systemic control for

2-3 weeks after planting of aphids, leafhoppers, and moderate infestations of chinch bug. In 2013, the insecticide component of Acceleron™ is clothianidin.

Cruiser (thiomethoxam) 250: Provides fair to good control of most soil insects, but is not effective against corn billbug, cutworms, sugarcane beetle and stink bugs. Also provides systemic control for 2-3 weeks after planting of aphids, leafhoppers, and moderate infestations of chinch bug.

Poncho 500 / Cruiser 500: Both products may be available on a special order basis at an intermediate '500' which is double the 250 rate. The 500 rate should provide more consistent control under moderate to severe infestations and also improve control of insects like stink bugs, chinch bugs and sugarcane beetle where the 250 rate only provides suppression. Acceleron™ seed treatment with Poncho 500 may only be available combined with VOTiVO™ for nematode control. Likewise, Cruiser 500 also may be available as Avicta Complete Corn™ which also contains a nematicide and fungicides.

Poncho 1250 / Cruiser 1250: Consider use for control of billbug and cutworms and in fields with a history of serve infestations of soil insects. Also may provide suppression of light to moderate infestations of western corn rootworm.

Imidacloprid (various brands): Available at rates of 0.16, 0.60 and 1.34 mg a.i./kernel. The low rate is too low for most pests in Georgia. The 0.60 mg rate is effective against wireworms, sou. corn rootworm, seedcorn maggots, and usually white grubs. In most cases, Poncho or Cruiser at the equivalent rate provides control of a broader range of soil insect pests.

Granular Insecticides: Granular insecticides require the use of specialized application equipment. The best method where **only** wireworms, seedcorn maggots, grubs and southern corn rootworms are a problem is an in-furrow application where the label allows. For insects that feed at or near the soil surface (lesser cornstalk borer, cutworms, billbugs, sugarcane beetle), the best placement (where the label allows) is in a T-band or a narrow band (6 to 8 inches) behind the planter shoe and in front of the press wheel. Since most labels specify a covered-band application, in-furrow applications are the only option in no-till plantings.

Counter (terbufos) 20G: Only available in a Lock'nLoad or Smartbox closed handling system. Apply as in-furrow, T-band or band. Most effective against beetle type insects; not a good choice for cutworms and lesser cornstalk borer. Counter also provides fair to good nematode suppression. **Interactions with ALS herbicides such as Accent and Option may cause severe injury.** Check herbicide product label for restrictions.

Lorsban (chlorpyrifos) 15G: Apply as a T-band or band for control of cutworms and lesser cornstalk borer. Less effective against beetle type insects, wireworms and grubs. The label states that Lorsban is compatible with ALS herbicides; see herbicide labels for restrictions.

Phorate / Thimet (phorate) 20G: Apply as T-band or band application, and do not apply in-furrow due to risk of seed injury. Because of the risk of seed injury, Counter 20G is a better choice for soil insect control. **Interactions with ALS herbicides may cause severe injury**; see herbicide labels for restrictions.

Liquid injected insecticides: Several liquid insecticides are labeled for at-planting use in corn. They should be applied in-furrow using specialized application equipment or applied in the open seed furrow using flat-fan nozzles oriented with the row. See product dealer to obtain equipment. Injection spray equipment may be difficult to use if not properly installed or under certain soil conditions.

Capture (bifenthrin) 2EC, LFR(1.5): Fair to good control of soil insects. No systemic activity or activity against nematodes. Capture LFR may be tank mixed with liquid fertilizers according to label directions. Premixing to determine compatibility is recommended. Tank mixes should be continuously agitated.

Force (tefluthrin) CS**:** Apply in-furrow or band. Force is a pyrethroid insecticide and is effective against most soil insects. No systemic activity, no nematode activity and no herbicide interactions. Force tends to breakdown quickly in warm, sandy soils.

Relative efficacy[1] of seed treatments and soil insecticides for at-planting use in corn.

Product[2, 3]	**Seed-corn mag-got**	**S. Corn root-worm**	**Wire-worm**	**White Grubs**	**Lesser corn-stalk borer**	**Cut-worm**	**Chinch bug**	**Corn Bill-bug**	**Sugar-cane beetle**
Counter 20G	++	++	++	++	-nl	-nl	-/+	+	-nl
Lorsban 15G	++	++	-/+	-/+	++	++	-	-	-
Force 3G	++	++	++	+	+	+	-nl	-	-nl
Capture 1.15G	++	++	++	+	+nl	+	-nl	-nl	-nl
Capture 2EC LQ	++	++	++	+	+nl	++	-/+nl	-nl	-nl
Lorsban 4E LQ	++	++	-/+	-/+	++	++	+	-	-nl
Poncho 250 ST	++	+nl	+	-/+	+nl	-	-/+	-nl	+
Poncho 500 ST	++	++	++	+	+nl	-	+	-/+nl	++
Poncho 1250 ST	++	++	++	++	++nl	-/+	++	++	++
Cruiser 250 ST	++	+nl	+	-/+	+nl	-	-/+	-nl	-
Cruiser 500 ST	++	++	++	-/+	+nl	-	-/+	-/+nl	-/+
Cruiser 1250 ST	++	++	++	++	++nl	-/+	++	++	+
Imidacloprid 0.60 mg rate	++	++	+	+	-nl	-	-/+	-	-

[1]Rating: - indicates poor or no activity; + indicates fair activity; ++ indicates good activity.

[2]G = granule insecticide; LQ = Products require specialized equipment for liquid injection in-furrow; ST = seed treatments, applied by seed dealers.

3 nl = indicates the insect pest is not listed on the product label. Ratings in boxes with nl are listed if data from trials is available.

Seedling Stage Corn

Corn fields should be checked about 2 weeks after planting to verify that plants are emerging and to determine the kinds and numbers of insects may be present and initiate controls if necessary. Yield loss occurs when as few as 10% of plants are destroyed or damage so severely as to prevent normal stalk and ear development. Look for insects around the plants, on the plants, and in the soil around the stem and roots; look for dead, dying and lodged plants. If insects are present heavy damage to the young seedlings can occur in 2 to 3 days if not controlled. Check late-planted corn very carefully for the lesser cornstalk borer by looking for larvae (usually in a silken tube) boring into the plant just at the soil line.

Billbugs are reddish-brown or black weevil type beetles with long curved snouts. Billbug feed at the base of the stalk just below the soil surface where they chew holes through the stem killing the growing point. Billbugs move by crawling and mostly cause damage in non-rotated corn following corn, in fields next to last year's corn or in fields with heavy infestations of nutsedge. At-planting banded insecticide treatments such as Counter 20G may aid in control. Systemic seed treatments, Poncho or Cruiser, are only effective at the 1250 rate. Foliar application of an insecticide directed at the stalk and base of the plant are available.

Sugarcane beetles are black and about ½ inch long. They gouge large holes in the stalk just below the soil surface. Damage usually occurs over a short period of time when beetles are active. This insect can build up on bahiagrass and other grassy weeds in or near corn fields. Notes on insecticide use for billbugs also apply to sugarcane beetle, except Poncho 250 and 500 rates will provide fair and good control, respectively. Rescue treatments are almost never effective.

Cutworms are larvae of various moth species. They cut leaves and entire corn seedling off near the soil line. They typically spend the day under soil or plant residue in the field. Infestations often are associated with reduced tillage with plant residue on the soil surface and/or fields with serious weed infestations the previous year or before planting. Environmental conditions causing slow seedling growth also enhance damage by cutworms. Treat when 10% of plants are cut and worms are present. Chlorpyrifos or various pyrethroid insecticides applied as a broadcast application before planting OR applied as a band over the row at planting can control cutworms. Low rate of systemic seed treatments, Poncho and Cruiser, are not effective. Herculex 1 Bt technology and some stacked Bt products also will suppress cutworm damage.

Lesser cornstalk borer is a larva of a moth. It prefers hot, dry conditions and conventional tillage. Late planted corn is at more risk from attack. Moths are highly attracted to burnt stubble. Larvae bore into the side of seedling plants. They live in a silken tube that is covered with soil particles. Poncho and Cruiser seed treatments and several Bt traits provide good control. For non-Bt hybrids, chlorpyrifos (Lorsban and similar products) 15G applied as a band or T-band at planting also is an option. Dry conditions and lack of moisture may limit activity. Lesser cornstalk borer is very difficult to control after plant emergence.

Chinch bugs are small true bugs with black and white X-patterned wings as adults. Nymphs are reddish gray with a white band across their back. Chinch bugs suck sap from roots, leaves and stems causing stunting wilting and deformation of seedling plants. Chinch bugs are favored by hot dry conditions and by reduced tillage following grassy winter crops or weeds. Vigorous corn may outgrow severe seedling injury. Treat chinch bugs when 3 to 5 bugs per plant occur on 20% of plants. Systemic seed treatments Poncho and Cruiser at the 250 rate will control low to moderate infestations although the 500 rate provides more consistent control. Large infestations may require spraying seedlings. Directed spray at the base of plants using plenty of water is recommended for chinch bug control after planting.

Stink bugs feed by piercing and sucking sap from corn seedlings. Common species in Georgia are the Southern green, brown, and rice stink bugs. Feeding in the seedling stage stunts and deforms developing whorls. New leaves do not expand properly and are trapped in the previous leaf causing "buggy-whip" type damage. Stink bugs are very difficult to scout in the seedling stage. About 10% seedling damage is economically important. Most at-planting insecticides are not effective in preventing stink bug damage. Systemic seed treatments, Poncho and Cruiser will suppress damage at the 250 rate; the 500 rate is needed for good control.

Thrips are tiny black or yellow insects. They feed on leaves where they can cause discoloration of leaves of seedling plants. Unless damage is severe, plants usually grow out of this damage by the 6 leaf stage with no measurable yield loss. Systemic seed treatments, Poncho and Cruiser, at low rates provide only fair to poor control. Some foliar insecticides will aid in control thrips on seedling corn.

Whorl Stage Corn

Once corn plants reach the 5 - 7 leaf stage they are large enough to escape damage by most seedling pests. Most insects of importance during the whorl stage defoliate the whorl and leaves. These include grasshoppers, armyworms, corn earworm, cereal leaf beetles and others. Whorl stage corn is very tolerant to defoliation. The following table may be helpful in assessing the yield loss potential from defoliation at different stages whorl development.

Yield loss Potential in Bushels Per Acre from Defoliation.

	Percent leaf Area Destroyed				
Leaf stage	20	40	60	80	100
5	0	0	1	4	6
7	0	1	4	6	9
9	0	2	6	9	13
11	1	5	9	14	22
13	1	6	13	22	34
15	2	9	20	34	51
17	4	12	27	45	70

Source: J. van Duyn, North Carolina State University.

Whorlworms (Fall armyworm, corn earworm, true armyworm, and other armyworms) infest whorls where they chew large holes in expanded and unfurling leaves. These caterpillars as a group are sometimes called ‘budworms’. Armyworms lay masses of eggs on the leaves whereas corn earworm lays single eggs. Small larvae cause window-pane or shot-hole type injury before moving to infest the whorl. Larvae tunnel in the whorl causing large holes to develop as the leaves unfold and expand. Control should be initiated when 25% of the plants in a field are infested and larvae are present. Use ground equipment and apply as much finished spray per acre as possible directed down into the whorls. Cone type nozzles producing large sized droplets will aid in control. Herculex I, Genuity VT3 PRO and Double PRO, SmartStax and Agrisure Viptera Bt traits will prevent serious damage by whorlworms. Agrisure CB/LL also will suppress whorl damage but is less effective under heavy infestations.

Cereal leaf beetle is a pest of winter small grains in the spring. Newly emerged adults leave small grain crops as they mature and move to adjacent grass crops such as corn. Adults chew long, thin, irregular lines in leaves of seedling and whorl-stage corn. Corn fields immediately next to small grain fields are most heavily infested. Beetles typically occur along the field edge initially and often can be controlled by treating the first 50 - 100 ft of the corn field edge.

Grasshoppers feed on many different plants and usually are a problem in dry years. Adults are very mobile and hard to control. Nymphs should be controlled if they are numerous and causing excessive defoliation. Reduced tillage situations tend to have greater grasshopper infestations than clean tillage fields. Grasshoppers typically occur along the field edge initially and often can be controlled by treating the first 50 - 100 ft of the corn field edge.

Mid-Season Stalk-Boring and Root-Feeding Insects

European corn borer, Southwestern corn borer and Southern cornstalk borer are caterpillars of moths that tunnel inside corn stalks during the whorl and ear fill stages. Eggs are laid in masses on leaves. Small larvae feed in foliage before tunneling into the stalk. Once in the stalk, they cannot be controlled using insecticides. Stalk borers usually are not serious insect pests of corn in most of Georgia. The southwestern corn borer only occurs in the northwestern part of the state and can cause significant stalk damage. All caterpillar Bt trait products are very effective in controlling these insects.

Western corn rootworm is present in the northern two thirds of Georgia, but the insect continues to spread southward. (Note: the other major rootworm species in the Midwest, the northern corn rootworm, does not occur in Georgia). Larvae feed on root tips causing root pruning reducing root activity and yield potential. In severe cases most of the roots are destroyed causing the plants to lodge or fall over in a 'gooseneck' appearance. Western corn rootworm only feeds on corn. Adults are attracted to silks where they feed. Females lay eggs in the soil in corn fields. Eggs over winter and hatch the next year to damage the following corn crop. Therefore, western corn rootworm is ONLY a pest of continuous corn. Crop rotation is a very effective method for controlling this insect. Hybrids with Bt rootworm traits effectively control western corn rootworm. At-planting insecticides also are available for use in continuous corn fields with a history of rootworm damage.

Ear Formation, Tasseling/Silking, and Kernel-fill Stages

Stink bugs can cause feeding damage to small developing ears before silking. This type of feeding injury usually deforms ears into a C or boomerang shape. These ears fail to develop properly and are more susceptible to infection by corn smut fungus. Treat during the ear elongation / vegetative tassel stage (stage VT) if 1 stink bug per 2 plants is present. During pollination to blister stages (R1 - R3), stink bugs feed through the husk and damage individual kernels. Control is warranted if populations reach 1 bug per plant. Use pyrethroid insecticides if green stink bugs are prevalent. If brown stink bugs are prevalent and the field situation allows it, use methyl parathion before pollen shed (methyl parathion cannot be used during pollen shed and will be cancelled after 2013). During pollen shed, high rates of bifenthrin will provide about 75-90% control of brown stink bugs.

Corn rootworm adults, Japanese beetles, and grasshoppers can clip corn silks thereby interfering with pollination. Silk damage or removal by insect feeding can cause poor seed set and partially filled ears. Damage must be severe to justify control with insecticides. Insecticidal control may be needed if: (1) most ears are infested AND (2) silks are being clipped to within ½ inch of the ear tip AND (3) 1 to 2 or more rootworm or Japanese beetles per ear are present.

Aphids seldom require control on field corn in Georgia. Corn leaf aphid is the most common aphid occurring on field corn in Georgia. Natural enemies such as ladybugs and parasites are usually effective in regulating them at non-damaging levels. Consider control if heavy aphid infestations occur and leaves appear to be drying and dying over large areas of the field, or aphids on the tassels and silks appear likely to interfere with pollination. Poncho and Cruiser seed treatments also provide control on seedlings for a few weeks after emergence.

Corn earworm and Fall armyworm larvae feed on developing kernels in corn ears. **Corn earworm** feeding damage usually is confined to the tips of the ears. Several small larvae may infest an ear, but because larvae are cannibalistic, so usually only one larva completes development per ear. Corn earworm feeding activity tends to open up the husks to provide points of entry for kernel diseases and secondary insects such as sap beetles. Later plantings have greater infestations than earlier planting. Infestations of 60 to 100% of ears can occur in some years, but yield loss from one larva per ear generally is about 4%. In later planting infestations yield loss may exceed 4%, because almost every ear is infested and more than one larva per ear is common. **Fall armyworm** damage is similar to corn earworm but several fall armyworms may complete development in a single ear. Therefore damage during armyworm outbreaks can be much more severe than by corn earworm. Early-planted corn often escapes ear infestation by fall armyworm. Because larvae are protected within the husk, **using insecticides to control corn earworm and fall armyworm in the ear is not feasible in field corn.** Of the caterpillar Bt traits, only Genuity VT Triple PRO, Genuity VT Double PRO, SmartStax, and Agrisure Viptera provide a good level of control of corn earworm in the ear. Agrisure CB/LL and Optimum Intrasect™ only provide partial suppression (<50%), and Herculex I in not effective in preventing kernel damage.

Maize weevils naturally infest corn in Georgia as corn matures in the field. Maize weevils are very small brown beetles with a distinct snout. Larvae feed inside individual kernels and destroy the kernel contents. Maize weevil can also cause serious losses in store corn if not properly managed. Timely harvest is the most effective tool for minimizing maize weevil infestations in the field. Insecticide control before harvest is not recommended in the field. Instead corn should be treated as it is placed in storage and managed to reduce the temperature of the corn in storage.

Relative Efficacy of Foliar-applied Insecticides

The following table lists the relative efficacy (1 = very good, 5 = not effective) of register insecticides for control of insect pests after plant emergence. White boxes indicate a product the insect pest is listed on the product label, while black boxes indicate that the insect pest is not listed on the product label. Specific insecticide recommendations, rates and precautions are updated annually and are available in the Georgia Pest Management Handbook, commercial edition at: http://www.ent.uga.edu/pmh/Com_Corn.pdf. But read the label before application in case changes are made to the label since the time of this publication was prepared.

Note that methyl parathion and Penncap-M will be canceled at the end of 2013, and cannot be purchased after August 31, 2013 and cannot be used after December 31, 2013.

Relative efficacy of post-emergence insecticides for control of above-ground (seedling, whorl, stalk, ear) corn insect pests.

Insecticide	Fall army-worm larvae*	True army-worm larvae	Corn Billbug adults	Chinch bug	Corn earworm larvae*	Cut-worm larvae	European corn borer larvae**	South-western corn borer larvae**
Baythroid XL	3	2	nl	3	2	1	3	2-3
Tombstone	3	2	nl	2	2	1	3	2-3
Belt (4.0)	1	2	nl	nl	2	?	1	1
Capture 2EC	2	2	nl	1	2	1	3	2-3
Delta Gold 1.5EC	2	2	nl	3	2	1	3	2-3
Asana XL	nl	2	nl	4	2	1	3	2-3
Proaxis	2	2	nl	3	2	1	3	2-3
Karate Zeon	3	2	nl	3	2	1	3	2-3
Pounce 25 WP	4	2	nl	nl	3	2	4	4
Mustang MAX	3	2	nl	3	2	1	3	3
Sevin 80S	4	1	nl	5	3	3-4	-	-
Lorsban 4E	2	1	4	2	3	1-3	-	-
Lannate LV	2	1	nl	nl	2	nl	-	-
Intrepid 2F	nl	2	nl	nl	nl	nl	1-2	1-2
Penncap M	nl	2	nl	nl	nl	5	5	5
Prevathon 0.43	1	nl	nl	nl	1	nl	1	nl
Radiant 1SC	2	1	nl	nl	2	nl	2-3	2-3
Tracer 4SC	3	1	nl	nl	2	nl	3	3
Oberon	nl	nl	nl	nl	nl	nl	nl	nl
Onager	nl	nl	nl	nl	nl	nl	nl	nl
Mixtures								
Besiege	1	1	nl	3	2	1	1	1
Consero	2	1	nl	3	2	1-2	3	3
Cobalt	2	1	4	2	2	1-3	3	2-3
Hero	3	1-2	4	2	1-2	1	2	2

Ratings range from 1-5: 1 = Very Effective and 5 = Not Effective; 1 = Standard; 3 = Fair; 5 = Poor; (2 = very good - fair, and 4 = fair to not effective). 'nl' indicates an insect pest is not listed on the product label. A dash indicates either not labeled or efficacy not determined.

*Insecticide must be able to reach the target pests. Ratings relate to applications made to the target pest before it enters the stalk or ear.
**Targeted for second generation larvae before they bore into the stalk or ear.

Relative efficacy of post-emergence insecticides for control of above-ground (seedling, whorl, stalk, ear) corn insect pests (cont.).

Insecticide	**Flea beetle (adult)**	**Grass-hopper**	**Japanese beetle, Rootworm adults**	**Lesser cornstalk borer larvae***	**Green or Southern Green stink bug**	**Brown stink bug**	**Spider mites**
Baythroid XL	2	1-2	1-2	nl	1-2	3 (high rate)	nl
Tombstone	2	1-2	1-2	nl	1-2	3 (high rate)	nl
Belt (4.0)	nl	nl	nl	nl	nl	nl	nl
Capture 2EC	2	1-2	1-2	nl	1-2	3 (high rate)	3
Delta Gold 1.5EC	2	1-2		nl	1-2	4 (high rate)	nl
Asana XL	2	1-2	2	nl	nl	nl	nl
Proaxis	2	1-2	1	nl	1-2	3-4 (high rate)	nl
Karate Zeon	2	1-2	1	4	1-2	3-4 (high rate)	nl
Pounce 25 WP	?	nl	?	nl	nl	nl	nl
Mustang MAX	2	1-2	1	nl	1-2	4 (high rate)	nl
Sevin 80S	1-2	3	1	nl	nl	nl	nl
Lorsban 4E	-	1-2	1-2	3	nl	nl	nl
Lannate LV	-	nl	1-2	nl	nl	nl	nl
Intrepid 2F	nl	nl	nl	nl	nl	nl	nl
Penncap M	-	5	-	nl	1	1	nl
Prevathon 0.43	nl	nl	nl	nl	nl	nl	nl
Radiant 1SC	nl	nl	nl	nl	nl	nl	nl
Tracer 4SC	nl	nl	nl	nl	nl	nl	nl
Oberon	nl	nl	nl	nl	nl	nl	1-3
Onager	nl	nl	nl	nl	nl	nl	2-3
Mixtures							
Besiege	2	2	1	nl	1-2	3-4 (high rate)	nl
Consero	2	1-2	2	?	2	3-4 (high rate)	3-4
Cobalt	2	3	1-2	3	1-2	3 (high rate)	nl
Hero	1-2	1-2	1	?	1-2	4 (high rate)	2-3

Ratings range from 1-5: 1 = Very Effective and 5 = Not Effective; 1 = Standard; 3 = Fair; 5 = Poor; (2 = very good - fair, and 4 = fair to not effective). 'nl' indicates an insect pest is not listed on the product label. A dash indicates either not labeled or efficacy not determined.
*Insecticide must be able to reach the target pests. Ratings relate to applications made to the target pest before it enters the stalk or ear.
**Targeted for second generation larvae before they bore into the stalk or ear.

CORN
INSECT CONTROL

David Buntin, Research/Extension Entomologist and John All, Research Entomologist

PEST	MATERIAL AND FORMULATION	AMOUNT PER ACRE or PER 1000 FT OF ROW	LB. ACTIVE INGREDIENT PER ACRE	REMARKS AND PRECAUTIONS
Preplant treatment for soil insects	chlorpyrifos Lorsban, Chlorpyrifos, Chlorfos, others 4E	4 pt.	2.0	Use chlorpyrifos for grubs, wireworms, seed corn maggot, and S. corn rootworm. Broadcast using 20 gpa before planting and immediately incorporate into top 2 - 4 inches of soil. Plant crop as soon as possible after treatment.
	bifenthrin Brigade, Capture, Discipline, Fanfare, others (2EC)	3 - 4 fl. oz.	0.047 - 0.062	Use bifenthrin for grubs, wireworms, seedcorn maggot, and cutworms. Broadcast using 20 gpa before planting and immediately incorporate into top 3 inches of soil. Plant crop as soon as possible after treatment. May be tank mixed with preplant herbicides.
Soil Insects; At-planting: wireworm, grubs, S. corn rootworm, seed corn maggot, fire ants	**At-Planting** bifenthrin Brigade, Capture, Fanfare, Discipline, others 2EC, Capture LFR	0.15 - 0.3 fl. oz./ 1000 ft of row	0.0023-0.0046 / 1000 ft	All these materials at the listed rates provide helpful control, but may not provide complete protection if population pressure is great. Risk of severe infestation is greater in reduced/no tillage, fallow land, following sob, poor soil conditions for seedling growth, and late-planted corn.
	Capture 1.15G, similar products	6.4 - 8.0 oz /1000 ft	Varies with row spacing	**NOTE**: Rates are for 1000 ft of row in 30-40 inch rows. Per acre rates vary with row spacing; See labels for per acre rates for specific row spacing and for row spacings less than 30 inches apart.
(Also see sections for billbugs, cutworms, lesser cornstalk borer, and mid-season root-worms for these pests)	chlorpyrifos Lorsban, Chlorpyrifos, Chlorfos, others 4E	2.4 fl. oz./1000 ft or 2 pt / acre	Varies 1.0	
	Lorsban 15G, similar products	8 oz / 1000 ft	Varies	**NOTE**: Apply Counter 15G or Counter 20G as a T-band or in-furrow. Counter will interact with ALS inhibiting herbicides like Accent, Beacon, Option to cause severe plant injury. See corn weed section of this handbook and product labels for specific herbicide interactions and precautions.
	Counter 15G Counter 20G	6 - 8 oz./1000 ft 4.5 - 6.0 oz / 1000 ft	Varies	**NOTE**: Phorate / Thimet (phorate) 20G also are labeled but not listed. Apply as a band application only; in-furrow applications may cause plant injury and stand loss. Due to the risk of plant injury, Counter 15G is a better choice. Phorate / Thimet will interact with ALS inhibiting herbicides as noted for Counter.
	Force 3G	4 - 5 oz / 1000 ft of row	Varies	**NOTE**: Apply Lorsban 15G at planting as a T-band or in- furrow. For wireworms apply in-furrow or use an insecticide seed treatment with T-band applications. Lorsban 15G is compatible with ALS inhibitor herbicides. See corn weed section of this handbook and product labels for specific herbicide interactions and precautions.
	Regent 4SC	0.17 fl. oz.	Varies	**NOTE**: Apply Force 3G and bifenthrin products as a T-band or in-furrow. Force and bifenthrin do not interact with ALS herbicides.
	Seed Treatments Cruiser 250 (5FS) Cruiser 1250 (5FS) Cruiser 500 (5FS)	0.25 mg (ai)/seed 1.25 mg (ai)/seed 0.5 mg (ai)/seed	 - -	**NOTE**: Regent 4SC must be applied in-furrow using a liquid-injection system or sprayed in-furrow with flat-fan nozzles oriented with the row furrow. Supplemental label for control of wireworms and seed corn maggot only.
	Poncho 250 Poncho 500 Poncho 1250	0.25 mg (ai)/seed 0.5 mg (ai)/seed 1.25 mg (ai)/seed	- - -	**NOTE**: Poncho and Cruiser are commercially applied seed treatments. The low rate may not provide good protection under severe infestations. These products also suppress aphids and chinch bugs on seedlings. Both insecticides available in combination with various fungicides under several brand names. Avicta Complete Corn contains Cruiser 500. Acceleron for corn contains Poncho 250 and Acceleron with VITiVO contains Poncho 500. **NOTE**: EPA has revoked all crop tolerances of all formulations of Furadan. Any crop receiving an application of Furadan after January 1, 2010 cannot be legally sold.

PEST	MATERIAL AND FORMULATION	AMOUNT PER ACRE or PER 1000 FT OF ROW	LB. ACTIVE INGREDIENT PER ACRE	REMARKS AND PRECAUTIONS
<u>Soil Insect Mid-season</u>: Western corn rootworm	**At-Planting Treatment** Counter 15G Counter 20G Force 3G Lorsban 15G Poncho 1250 Bt-corn traits (YieldGard-RW) (Herculex - RW) **Cultivation Time Treatments** Counter 15G Counter 20G Force 3G Lorsban 4E	 6 - 8 oz./1000 ft 4.5 - 6.0 oz / 1000 ft 5 oz / 1000 ft of row 8 oz./1000 ft 1.25 mg (ai)/kernel Insecticide produced in plant 8 oz./1000 ft 4.5 - 6.0 oz / 1000 ft 4 - 5 oz./1000 ft. 3 pt.	 varies varies varies varies varies varies 1.5	Western corn rootworm can be a problem in non-rotated corn in northern and central Georgia. <u>At-Planting Treatments:</u> Apply at-planting in a 6 to 7 inch band or T-band (if label permits) over the open seed furrow in front of the planter press wheel. **Counter** and **Force** can be applied in furrow. For no-till where <u>no</u> incorporation is obtained with the press wheel, use **Lorsban**, or **Counter** <u>in-furrow</u> at indicated rates. **NOTE: Counter** may interact with ALS herbicides like Accent and Beacon to cause plant injury. See corn weed control section of this handbook and product labels for herbicide interactions and precautions. **NOTE:** Rates are for 30 to 40 inch row. See label for rates for specific row spacing. Most products cannot be used at the listed rate in less than 30 inch rows without exceeding the maximum labeled amount per acre. See label for narrow rows. **NOTE: Poncho 1250** available as a commercially applied seed treatment. Provides suppression only of western corn rootworms. <u>Cultivation Time treatments:</u> Apply **Counter** in a 7-inch band over the row of seedling plants and lightly incorporate into soil. Counter can not be used if already applied at planting. See label for detailed instructions. Apply **Force 3G** by placing granules at the base of plants on both sides of the row and cover with 2 to 3 inches of soil. For liquid formulations of **Lorsban**, apply as a directed spray on both sides of base of the plants in front of the cultivator shovels. Proper application is critical for good control. Rates indicated are 40 inch rows. **NOTE:** Hybrids with Bt-rootworm traits are available and are effective against mid-season rootworms but are NOT effective against other soil insects. Bt-rootworm traits have a 20% refuge requirement.
<u>Soil Insects:</u> Billbug, Sugarcane beetle	**At-Planting Treatment** Counter 15G Counter 20G Poncho 500 (sugarcane beetle only) Poncho 1250 Cruiser 1250 **Post-emergence treatments** <u>lambda cyhalothrin</u> Karate Z (2.08) Warrior, Lambda T, Silencer, others (1CS) <u>gamma cyhalothrin</u> Declare (1.25) Proaxis (0.5)	 8 oz./1000 ft 4.5 - 6.0 oz / 1000 ft 0.50 mg (ai)/seed 1.25 mg (ai)/seed 1.25 mg (ai)/seed 1.92 fl. oz 3.84 fl. oz. 1.54 fl. oz. 3.84 fl. oz.	 varies with row spacing - - - 0.03 0.03 0.015 0.015	Beetles feed on seedling plants at or below soil line causing dead or dead-hearted plants. Generally problems worse in reduced tillage, when a winter cover crop is use. Billbugs are often associated with nutgrass infestation and sugarcane beetle is often associated with bahiagrass infestation. <u>At-Planting treatments</u>: Apply **Counter** as a T-band application. **Poncho 1250 and Cruiser 1250** are available only as a commercial seed treatment. Poncho 500 may also provide suppression of billbug. Poncho 250 also provides fair-good control of sugarcane beetle. **NOTE: Counter** may interact with ALS herbicides like Accent and Beacon to ca use plant injury. See corn weed control section of this handbook and product labels for herbicide interactions and precautions. <u>Post-emergence control</u>: Stand loss of 5 to 10% justifies control. Direct liquid sprays at base of plant using at least 25 gal/acre of spray. Generally rescue treatments for sugarcane beetle are not effective.

PEST	MATERIAL AND FORMULATION	AMOUNT PER ACRE or PER 1000 FT OF ROW	LB. ACTIVE INGREDIENT PER ACRE	REMARKS AND PRECAUTIONS
Soil Insects Lesser cornstalk borer	**Preplant** chlorpyrifos Lorsban 4E, Chlorpyrifos, Chlorfos, others 4E	6 pt.	3.0	Lesser cornstalk borer larvae tunnel into the seedling plant below the soil line causing dead or dead-hearted plants Larvae spin silken tube at plant base. Hot, dry conditions, clean tillage, and late planting favor infestations. **Difficult to control after planting**; at-planting treatments are most effective.
	At-planting Poncho 250 Poncho 500	0.25 mg (a.i.)/seed 0.5 mg (a.i.)/seed	- -	Pre-plant: broadcast before planting and immediately incorporate into top 4-6 inches of soil. Plant crop as soon as possible after treatment. Do not graze for forage within 14 days of application.
	chlorpyrifos Lorsban 15G, similar products Lorsban 4E, Chlorpyrifos, Chlorfos, others 4E	8 oz / 1000 ft 2.4 fl. oz. / 1000 ft or 2 pt / acre	Varies with row spacing 1.0	At-Planting: Apply as a T-band and incorporate around seed.
	Post-emergence chlorpyrifos Lorsban 4E, similar products	2 pt	1.0	Post-emergence: Direct spray at full rate in a band around base of plants and lightly incorporate. Apply before larvae enter plants. A rescue treatment once larvae tunnel into plants is rarely effective.
	lambda cyhalothrin Karate Zeon (2.08) Warrior, Silencer, Lambda, others (1.0)	1.92 fl. oz. 3.84 fl. oz.	0.03 0.03	**NOTE**: Systemic seed treatments and Bt traits also may provide useful control.
	gamma cyhalothrin Declare (1.25) Proaxis (0.5)	1.54 fl. oz. 3.84 fl. oz.	0.015 0.015	
Aphids (foliar treatments)	esfenvalerate Asana XL, Adjourn (0.66EC)	5.8 - 9.6 fl. oz.	0.03 - 0.05	Aphids seldom require control on field corn in Georgia. Natural enemies, mainly lady beetles, usually move in and rapidly control aphid infestations. During silking and tasseling, treat if aphids are so abundant they appear likely to interfere with pollination.
	bifenthrin Brigade, Capture, Fanfare, Discipline, others 2EC	2.1 - 6 .4 fl. oz.	0.033 - 0.01	**NOTE: Poncho and Cruiser** seed treatments as applied at planting for soil insect control will control aphids on seedling corn for up to 30 days after planting.
	Dimethoate 2.67EC Dimethoate 4E, 400	1 to 1.5 pt. 0.67 to 1 pt.	0.33 - 0.5 0.33 - 0.5	
	methyl parathion Methyl 4EC Penncap-M 2FM	0.5 pt 2 to 3 pt.	0.25 0.5 - 0.75	

Armyworm - True (See fall armyworm in whorl)	Baythroid XL (1.0EC)	1.6 - 2 .8 fl. oz	0.013 - 0.022	Reduced tillage and grassy weeds favor infestations.
	Belt (4.0)	2 - 3 fl. oz.	0.063 - 0.094	Seedling plants, treat if 25% of plants show defoliation including window-panning type defoliation and larvae are present. Treat within 48 hours.
	bifenthrin Brigade, Capture, Fanfare, Discipline, others 2EC	2.1 - 6 .4 fl. oz.	0.033 - 0.01	Whorl stage plants, treat when 30% of the plants are infested. Use ground equipment and apply at least 20 gallons of finished spray per acre directed down into the whorls. Nozzles with large droplet size will aid in control.
	Bt-trait corn (Herculex-I)	Insecticide produced in plant		
	Delta Gold 1.5EC	1.5 - 1 .9 fl. oz.	0.012 - 0.018	**NOTE**: Bt- corn, especially YieldGard-CB, generally not effective against true armyworm. See seed dealer for refuge requirements of Bt corn hybrids.
	Intrepid 2F	4 - 16 fl. oz.	0.06 - 0.25	
	Lannate 2.4 LV Lannate 90SP	0.75 - 1.5 pt. 0.25 - 0.5 lb.	0.445 0.445	
	chlorpyrifos Lorsban, Chlorpyrifos, other brands 4E	2 pt.	1.0	
	methyl parathion Methyl 4EC Penncap-M 2FM	 0.5 pt. 2 - 3 pt.	 0.25 0.5 - 0.75	
	Tracer 4SC	2 - 3 pt.	0.062 - 0.093	
	Tombstone (2.0)	2.8 fl. oz.	0.044	
	lambda cyhalothrin Karate Z (2.08) Warrior, Lambda T, Silencer, others (1CS)	 1.28 - 1.92 fl. oz. 2.56 - 3.84 fl. oz.	 0.02 - 0.03 0.02 - 0.03	
	gamma cyhalothrin Declare (1.25) Proaxis (0.5)	 1.02 - 1.54 fl. oz. 2.56 - 3.84 fl. oz	 0.01 - 0.015 0.01 - 0.015	

PEST	MATERIAL AND FORMULATION	AMOUNT PER ACRE or PER 1000 FT OF ROW	LB. ACTIVE INGREDIENT PER ACRE	REMARKS AND PRECAUTIONS
Chinch bug	**At-planting**			**At-planting treatments:** Low (250) rates of **Poncho and Cruiser** seed treatments as applied at planting for soil insect control may suppress chinch bugs for up to 25 days after planting. **Poncho 500, 1250 and Cruiser 1250** may control chinch bugs for several weeks after planting.
	Poncho 250	0.25 mg (a.i.)/seed	-	
	Poncho 500	0.5 mg (a.i.)/seed	-	
	Poncho 1250	1.25 mg (a.i.)/seed	-	
	Cruiser 250	0.25 mg (a.i.)/seed	-	
	Cruiser 1250	1.25 mg (a.i.)/seed	-	Counter 15G for suppression of light to moderate infestations.
	Counter 15G	6 - 8 oz/1000 ft	varies within row width	**Post-emergence treatments:** Treat if bugs become numerous and wilting leaves are noticed. Usually not important after seedling stage. Chinch bug infestations are difficult to control. Treatment after boot stage is rarely effective.
	Post-emergence			
	deltamethrin			
	Delta Gold 1.5EC	1.9 fl. oz.	0.022	
	chlorpyrifos			
	Lorsban, Chlorpyrifos, other brands 4E	2 pt.	1.0	
	lambda cyhalothrin			
	Karate Z (2.08)	1.92 fl. oz.	0.03	
	Warrior, Lambda T, Silencer, others (1CS)	3.84 fl. oz.	0.03	
	gamma cyhalothrin			
	Declare (1.25)	1.54 fl. oz.	0.015	
	Proaxis (0.5)	3.84 fl. oz.	0.015	
Cutworms	esfenvalerate			Several species including black, dingy and variegated cutworms. Reduced tillage conditions, plant residue, winter cover crops and winter grassy weeds favor infestation.
	Asana XL, Adjourn (0.66EC)	5.8 - 9.6 fl. oz.	0.03 - 0.05	
	Baythroid XL (1.0EC)	0.8 - 1 .6 fl. oz.	0.0065- 0.0125	**Pre-plant** broadcast application within 2 weeks of planting may provide helpful control of large cutworms. Use intermediate to highest rate listed. Most products can be tank mixed with a pre-plant herbicide.
	bifenthrin			
	Bifenthrin, Capture, Discipline, Fanfare 2EC	3.2 - 6 .4 fl. oz.	0.05 - 0.10	**At planting** apply insecticide as a band or T-band over the row. Check label for specific banding directions. Poncho 1250 as applied at planting for soil insect control also will reduce cutworm damage.
	Delta Gold 1.5EC	1.0 - 1.5 fl. oz.	0.012 - 0.018	
	chlorpyrifos			
	Lorsban, Chlorpyrifos, other brands 4E	2 pt.	1.0	**After emergence** treat if 5% of seedling show feeding or cutting damage. Apply as band over the row. For broadcast sprays, use ground equipment with at least 20 gal per ac re finished spray for thorough coverage.
	Mustang MAX, Respect (0.8EC)	2.8 - 4.0 fl. oz. per acre or 0. 16 fl. oz. per 1000 ft	0.014 - 0.025 -	**Bt-corn**: Herculex Bt corn may provide suppression of cutworm damage in seedling corn. YieldGard - CB corn is generally not effective against cutworms.
	Permethrin, others 3.2EC	4 to 8 fl. oz.	0.1 - 0.2	
	lambda cyhalothrin			
	Karate Z (2.08)	1.28 - 1.92 fl. oz.	0.02 - 0.03	
	Warrior, Lambda T, Silencer, others (1CS)	2.56 - 3.84 fl. oz.	0.02 - 0.03	
	gamma cyhalothrin			
	Declare (1.25)	1.02 - 1.54 fl. oz.	0.01 - 0.015	
	Proaxis (0.5)	2.56 - 3.84 fl. oz.	0.01 - 0.015	
	Tombstone (2.0)	1.6 - 2.8 fl. oz.	0.025 - 0.044	

PEST	MATERIAL AND FORMULATION	AMOUNT PER ACRE or PER 1000 FT OF ROW	LB. ACTIVE INGREDIENT PER ACRE	REMARKS AND PRECAUTIONS
Fall armyworm, Corn earworm, other armyworms **(In whorls)**	esfenvalerate Asana XL, Adjourn (0.66EC) Baythroid XL (1.0EC) Belt (4.0) Bt-trait corn (YieldGard-Corn borer) (Herculex-CB) Coragen (1.67SC) Prevathon (0.43) chlorpyrifos Lorsban, Chlorpyrifos, other brands (4E) Lannate 2.4 LV Lannate 90SP Tracer 4SC lambda cyhalothrin Karate Z (2.08) Warrior, Lambda T, Silencer, others (1CS) gamma cyhalothrin Declare (1.25) Proaxis (0.5)	9.6 fl. oz. 2.8 fl. oz. 3.0 fl. oz. Insecticide produced in plant 3.5 - 5.0 14 - 20 fl. oz. 2 pt. 1.5 pt. 0.5 lb. 2 - 3 pt. 1.6 - 1 .92 fl. oz. 3.2 - 3 .84 fl. oz. 1.54 3.84 fl. oz.	0.05 0.022 0.094 0.045 - 0.065 0.047 - 0.067 1.0 0.445 0.445 0.062 - 0.093 0.02 - 0.03 0.02 - 0.03 0.015 0.015	"BUDWORMS" IN WHORL: Most infestations are fall armyworms. Small larvae feed on leaves before moving to the whorl. Most difficult to control in the whorl. Do not base treatment solely on defoliation, verify that larvae are present. **NOTE**: For large infestations in whorl, tank mix an OP (Lannate, chlorpyrifos) and a pyrethroid (esfenvalerate, Baythroid, lambda or gamma cyhalothrin) insecticides for best results. **Seedling plants**, treat if 25% of plants show defoliation including window-panning type defoliation and larvae are present. Treat within 48 hours. **Whorl-stage plants**, treat when 30% of the plants in the field are infested. Use ground equipment and apply at least 20 gallons of finished spray per acre directed down into the whorls. Nozzles with large droplet size will aid in control. **NOTE**: Bt corn borer traits, especially YieldGard-CB, may not prevent whorl damage by fall armyworms, armyworms and corn earworms under high pressure. **NOTE**: **Tracer** is most effective against small larvae.
Corn earworms, Fall armyworms **(In ears)**	Do not treat Bt-trait corn Genuity VT Triple PRO Agrisure Viptera	Insecticide produced in plant		Corn earworm and fall armyworm in ears are difficult to control. Usually not economical to keep these insects out of the ears using insecticides. Bt-trait in Genuity, VT Triple PRO, Agrisure Viptera, and SmartStax will reduce infestation and ear/kernel damage by corn earworm and fall armyworm. Other single Bt traits usually are not effective in preventing ear damage.
European corn borer, Southwestern corn borer	esfenvalerate Asana XL, Adjourn (0.66EC) Belt (4.0) bifenthrin Bifenthrin, Capture, Disipline, Fanfare, others 2EC Bt-trait corn (YieldGard-CB) (Herculex-I) Coragen (1.67SC) Prevathon (0.43) Intrepid 2F chlorpyrifos Lorsban, Chlorpyrifos, other brands 4E lambda cyhalothrin Karate Z (2.08) Warrior, Lambda T, Silencer, others (1CS)	7.8 - 9.6 fl. oz. 2 - 3 fl. oz. 3.2 - 6 .4 fl. oz. Insecticide produced in plant 3.5 - 5.0 14 - 20 fl. oz. 4 - 16 fl. oz. 2 pt. 1.6 - 1 .92 fl. oz. 3.2 - 3 .84 fl. oz.	0.04 -0.05 0.063 - 0.094 0.033 - 0.01 - 0.045 - 0.065 0.047 - 0.067 0.06 - 0.25 1.0 0.025 - 0.03 0.025 - 0.03	EUROPEAN CORN BORER: Insecticides must be applied before larvae bore into stalks. Whorl stage (1st generation), treat if numerous egg masses are found in the field (treat just as eggs hatch) or when 50% of the plants have leaf feeding and live, small larvae are found. Tasseling stage (2nd generation), treat with when the corn is in the early-tasseling stage and moths are active in the field. SOUTHWESTERN CORN BORER: Currently restricted to northwestern Georgia. Infestations usually worse in late-planted fields. Comments on European corn borer also apply to southwestern corn borer. **NOTE**: Bt-corn borer traits are very effective against 1st and 2nd generations of both borer species. See seed dealer for refuge requirements of Bt corn hybrids.

PEST	MATERIAL AND FORMULATION	AMOUNT PER ACRE or PER 1000 FT OF ROW	LB. ACTIVE INGREDIENT PER ACRE	REMARKS AND PRECAUTIONS
European corn borer, Southwestern corn borer (cont)	gamma cyhalothrin Declare (1.25) Proaxis (0.5)	 1.02 - 1.54 fl. oz. 3.2 - 3.84 fl. oz.	 0.0125 - 0.015 0.0125 - 0.015	
Grasshoppers	esfenvalerate Asana XL, Adjourn (0.66EC)	5.8 - 9 .6 fl. oz.	0.03 - 0.05	Generally a problem in reduced tillage and along field margin. Products listed are most effective against small to medium sized nymphs. Adults are difficult to control.
	Baythroid XL (1.0EC)	2.1 - 2 .8 fl. oz.	0.0165 - 0.022	
	Delta Gold 1.5EC	1.5 fl. oz.	0.018	
	chlorpyrifos Lorsban, Chlorpyrifos, other brands 4EC	0.5 - 1 pt.	0.25 - 0.5	
	zeta-cypermethrin Mustang MAX, Respect (0.8EC)	2.72 - 4.0 fl. oz.	0.017 - 0.025	
	lambda cyhalothrin Karate Z (2.08) Warrior, Lambda T, Silencer, others (1CS)	 1.28 - 1.92 fl. oz. 2.56 - 3.84 fl. oz.	 0.02 - 0.03 0.02 - 0.03	
	gamma cyhalothrin Declare (1.25) Proaxis (0.5)	 1.02 - 1.54 fl. oz. 2.56 - 3.84 fl. oz.	 0.01 - 0.015 0.01 - 0.015	
Beetle Adults: Cereal Leaf beetles, Flea beetles, Japanese beetle, Corn rootworm adults	Baythroid XL (1.0EC)	1.6 - 2 .8 fl. oz.	0.0125 - 0.022	LEAF FEEDING by CEREAL LEAF BEETLES, FLEA BEETLES, JAPANESE BEETLES: Leaf feeding on whorl stage plants usually in late spring. Cereal leaf beetles move out of maturing small grain fields and infest nearby corn fields. Usually only border rows are damaged and may need control. Treat if beetles become numerous and their feeding damage exceeds 25% leaf area loss. SILK FEEDING by JAPANESE BEETLE, CORN ROOTWORM ADULTS: Feeding on silks by beetles during pollination. Treat if 2 or more Japanese beetles or 5 or more rootworm beet les are present AND most silks are being clipped to within ½ inch of the ear tip.
	bifenthrin Bifenthrin, Capture, Fanfare, others 2.0	3.2 - 3.8 fl. oz.	0.05 - 0.06	
	Delta Gold 1.5EC	1.5 - 1 .9 fl. oz.	0.018 - 0.022	
	Mustang MAX, Respect (0.8EC)	2.72 - 4.0 fl. oz.	0.017 - 0.025	
	Permethrin, others 3.2EC	0.4 - 0 .8 fl. oz.	0.1 - 0.2	
	Sevin 80S Sevin XLR Plus, 4F	1.25 - 2.5 lb. 1 - 2 qt.	1.0 - 2.0 1.0 - 2.0	
	lambda cyhalothrin Karate Z (2.08) Warrior, Lambda T, Silencer, others (1CS)	 1.28 - 1.92 fl. oz. 2.56 - 3.84 fl. oz.	 0.02 - 0.03 0.02 -0.03	
	gamma cyhalothrin Declare (1.25) Proaxis (0.5)	 1.02 - 1.54 fl. oz. 2.56 - 3.84 fl. oz.	 0.01 - 0.015 0.01 - 0.015	
	Tombstone (2.0)	1.6 - 2.8 fl. oz.	0.025-0.044	
Mites	bifenthrin Bifenthrin, Capture, Fanfare, others 2EC	5.12 - 6.4 fl. oz.	0.08 - 0.10	MITES: Treat if infestations become widespread, leaf discoloration is evident, and 1 to 2 lower leaves are dying. Bifenthrin products: use 6.4 fl. oz. rate alone OR use 5.1 fl. oz. rate tank mixed with dimethoate at 0 .5 lb (AI) per ac re.
	Comite II	2.5 - 3 3/8 pt.	1.875 - 2.53	Comite II: Only apply to dry foliage. Do not tank mix; do not use an oil-based surfactant. See table for additional restrictions.
	Dimethoate 2.67EC Dimethoate 4E, 400	Tank mix with bifenthrin at 0.5 lb (AI) per acre		Oberon: Use 8. 5 fl. oz. rate for large infestations. A NIS adjuvant is beneficial.
	Oberon 2SC	5.7 - 8 .5 fl. oz.	0.087 - 0.13	

PEST	MATERIAL AND FORMULATION	AMOUNT PER ACRE or PER 1000 FT OF ROW	LB. ACTIVE INGREDIENT PER ACRE	REMARKS AND PRECAUTIONS
Stink bugs	**Brown Stink Bugs** methyl parathion Methyl 4EC Penncap-M 2FM bifenthrin Bifenthrin, Capture, Discipline, Fanfare, others 2EC **Green / S. Green Stink Bugs** Baythroid XL (1.0EC) bifenthrin Bifenthrin, Capture, Discipline, Fanfare 2EC Delta Gold 1.5EC methyl parathion Methyl 4EC Penncap-M 2FM Mustang MAX, Respect (0.8EC) lambda cyhalothrin Karate Z (2.08) Warrior, Lambda T, Silencer, others (1CS) gamma cyhalothrin Declare (1.25) Proaxis (0.5) Tombstone (2.0)	 1 pt. 2 - 3 pt. 6.4 fl. oz. 2.0 - 2 .8 fl. oz. 3.2 - 3 .8 fl. oz. 1.5 - 1 .9 fl. oz. 1 pt. 2 - 3 pt. 3.2 - 4 .0 fl oz. 1.6 - 1 .92 fl. oz. 3.2 - 3 .84 fl. oz. 1.28 - 1.54 fl. oz. 3.2 - 3.84 fl. oz. 2.0 - 2.8 fl. oz.	 0.5 0.5 - 0.75 0.1 0.015-0.022 0.05 - 0.06 0.018 - 0.022 0.5 0.5 - 0.75 0.02 - 0.025 0.025 - 0.03 0.025 - 0.03 0.0125 - 0.015 0.0125 - 0.015 0.031 - 0.044	SEEDLING STAGE: Treat if 5% of seedling plants have damage and stink bugs are present. Poncho 250, 500 and 1250 will suppress stink bug damage to seedlings for a few weeks after planting. EAR STAGE: Corn is most sensitive to stink bug injury during ear formation before silking. Treat if 25% (1/4) of plants in the ear zone are infested with stink bugs. KERNEL FILL: During kernel filling bugs feed through the husk damaging individual kernels. Treat if 50% (1/2) of ears are infested. **NOTE**: Use pyrethroids (Baythroid, Capture, Delta Gold, Mustang, Karate, Warrior, Declare, Proaxis, Tombstone) if southern green stink bug is present. These products are less effective against brown stink bug. **NOTE**: Do not apply **methyl parathion** during pollen shed. **NOTE**: Bidrin as used on cotton is not registered for use on corn.
Thrips	**Seedling Control** Cruiser Extreme 1250 Poncho 500 Poncho 1250 **Foliar Treatment** Lorsban, Chlorpyrifos, other brands (4E)	 1.25 mg (a.i.)/seed 0.50 mg (a.i.)/seed 1.25 mg (a.i.)/seed 1 - 2 pt.	 - - - 0.5 - 1.0	Treat if field is heavily infested and new leaves show excessive damage. Rarely causes yield loss on field corn. **Seed treatments provide suppression only; low (250) rate usually not effective.** **NOTE:** Tracer 4SC as applied for fall armyworm may provide helpful control.

Premixed or Co-Packed Insecticides: Products listed are available as premixes or co-packages of two insecticide active ingredients. User should check mixture labels for active ingredient, specific use rates, target pests, and precautions.

Brand name (active ingredients)	Range of formulation rates
Cobalt (chlorpyrifos, gamma-cyhalothrin)	13 - 42 fl. oz per acre
Consero (spinosad, gamma-cyhalothrin)	2.0 - 3.0 fl. oz per acre
Hero (zeta-cypermithrin, bifenthrin)	2.6 - 10.3 fl. oz per acre
Steed (zeta-cypermithrin, bifenthrin)	2.5 - 4.7 fl. oz. per acre
Besiege; Voliam Xpress (lambda-cyhalothrin, clorantraniliprole)	5.0 - 9.0 fl. oz per acre

Bt-TRAITS FOR CORN: Most corn hybrids now contain one or more Bt traits. Some traits target caterpillar pests including of corn borers, cutworms, fall armyworm and corn earworm in the whorl, and corn earworm and fall armyworm in the ears. Hybrids with two or three stacked traits for caterpillar control will be available for the 2011 season. Hybrids also may contain one or more Bt traits for control of western corn rootworms that attack roots during mid-season. Bt-rootworm traits are effective against mid-season rootworms but are **NOT effective** on seedlings against southern corn rootworm or other soil insects such as wireworms and white grubs. Depending on specific traits, refuge requirements for hybrids with Bt traits are either 20 or 50% of the corn acreage on a farm. Check with seed supplier for a complete list of resistant management restrictions. A table listing various combinations of Bt traits and relative efficacy against pests in Georgia is in the Insect Control section of the 2011 Georgia Corn Production Handbook and on the Georgia Grain web page.

INSECTICIDE USE RESTRICT IONS FOR FIELD CORN

Insecticide	Brand Name	Days to Grain Harvest	Days to Grazing or Silage Harvest	Restricted Entry Interval (REI, hours)	Maximum Amount Allowed Per Acre Per Crop	Remarks
bifenthrin	Brigade, Capture, Bifenthrin, Discipline, Fanfare (2E)	30	30	24	19.2 fl. oz.	
(beta) cyfluthrin	Baythroid XL (1.0EC)	21	0	12	11.2 fl. oz (4 applications)	Only 1 application from early dent to 21 days before harvest
carbaryl	Sevin	48	14	12	8 qt.	
chlorantraniliprole	Coragen (1.67SC) Prevathon (0.43)	14	14	4	15.4 fl. oz.	Do not apply less than 7 days apart.
chlorpyrifos	Lorsban 15G	35	14	12	13.5 lbs.	
chlorpyrifos	Lorsban 4E, generics	35	14	24	15 pt.	
clothianidin	Poncho 600 sold as Poncho 250 and Poncho 1250	-[1]	-[1]	0	seed treatment	Commercially applied; See label for plant back restrictions
cyfluthrin	Tombstone 1.0	21	21	12	11.2 fl. oz.	Only 1 application from early dent to 21 days before harvest.
deltamethrin	Delta Gold 1.5EC	21	12 21 for fodder	12	8.1 fl. oz. (5 applications)	Do not apply less than 21 days apart
dimethoate	Dimethoate	42	14	48	3 applications	Do not apply during pollen shed
esfenvalerate	Asana XL, Adjourn	21	-[1]	12	48 fl. oz.	Do not apply more than 0.25 lb (ai) per acre per season
fipronil	Regent 4SC	90	90	0	1 application at-planting	In-furrow application only; Do not apply through any type of irrigation system.
flubendiamide	Belt (4.0)	28	1	12	12 fl. oz./acre (4 applications)	
gamma cyhalothrin	Declare 1.25, Proaxis 0.5	21	21	24	0.48 pt 0.96 pt.	See label for additional restrictions
lambda cyhalothrin	Warrior, Silencer 1.0 Karate Z (2.08)	21	21	24	0.96 pt. 0.48 pt.	See label for restrictions
methozyfenozide	Intrepid 2F	21	21	4	64 fl. oz.	
methyl parathion	Methyl 4EC	12	12	96	-[1]	Do not apply during pollen shed
methyl parathion microencapsulated	Penncap-M	12	12	31 days	3 applications or 12 pt.	Do not apply during pollen shed if bees are foraging in the area to be treated.
permethrin (foliar)	Permethrin	30	0	12	24 fl. oz.	
methomyl	Lannate 2.4LV, 90SP	21	3	48	2.25 lb ai	
phorate	Phorate, Thimet 20G	30[2]	30	48	1 application; 6.5 lbs/acre	Do not apply in-furrow or after cultivation
propargite	Comite II	30	30	7 days	1 application	Only apply to dry foliage, Do not tank mix, do not use an oil-based surfactant, Use minimum of 20 GPA by ground and 5 GPA for aerial applications.

Insecticide Use Restrictions for Field Corn chart continued on next page.

INSECTICIDE USE RESTRICT IONS FOR FIELD CORN (continued)

Insecticide	Brand Name	Days to Grain Harvest	Days to Grazing or Silage Harvest	Restricted Entry Interval (REI, hours)	Maximum Amount Allowed Per Acre Per Crop	Remarks
spinosad	Tracer 4SC	28	3	4	6 fl oz	
spiromesifen	Oberon 2SC	30	5	12	17.0 fl. oz. and 2 applications	Use at least 10 GPA by ground and 5 GPA by air.
terbufos	Counter 15G	30[2]	30[2]	48	6.5 lbs.	Make only one application
tefluthrin	Force 3G	-[1]	-[1]	0	1 application	Granules must be incorporated into soil
thiamethoxam	Cruiser 5FS	-[1]	--	12	Seed treatment	Commercially applied; see label for plant back restrictions. Some formulations may contain fungicides.
zeta-cypermethrin	Mustang MAX, Respect	30	60	12	16 fl oz	

[1]Not listed.
[2]Not listed for at-planting application.

CORN NEMATODE CONTROL

Bob Kemerait, Extension Plant Pathologist

CHEM ICAL	Rate/A	REMARKS AND PRECAUTIONS
AVICTA Duo Corn (seed treatment)		AVICTA Duo Corn is a combination of abamectin and thiamethoxam
Counter 15G	7	*Apply in furrow as row treatment. DO NOT exceed 8.7 pounds per acre regardless of row spacing. ALS-inhibiting herbicides should not be used if Counter 15G has been applied to the corn at planting.
Counter 20G	5.25	Apply in-furrow as row treatment. DO NOT exceed 6.5 pounds per acre regardless of row spacing. ALS-inhibiting herbicides should not be used if Counter 20G has been applied to the corn at planting.
PONCHO VOTiVO (seed treatment)		PONCHO VOTiVO is a systemic insecticide and biological seed treatment for use on corn to control insect pests and plant pathogenic nematodes listed on the label to include lance, root-knot, stubby-root, stunt, and sting nematodes.
Telone II	3 gal	Apply Telone II at least 7 days prior to planting by injecting 12 inches below the soil surface.

*NOTE: Granules should be incorporated for best results.

CORN DISEASE AND NEMATODE MANAGEMENT UPDATE FOR 2013

Bob Kemerait, Department of Plant Pathology

Report from the 2012 Field Season: Southern corn rust and northern corn leaf blight were severe across the Coastal Plain throughout much of the season; southern corn leaf blight became a problem for later-planted corn. Use of fungicides to protect against these diseases was generally recommended by UGA Cooperative Extension for corn growers with reasonable yield expectations across the state. It is believed that the severity of disease in corn in 2012 was directly related to the warm spring that was observed and the increased rainfall from the 2011 season. Additionally, early-season tropical storms helped to bring rust spores into Georgia; the wind and rain also helped to spread spores of the northern corn leaf spot pathogen as well. (Note: The results of the sentinel plot survey for southern corn rust sponsored by the Georgia Commodity Commission for Corn can be viewed at http://scr.ipmpipe.org). As in previous years, the importance of plant-parasitic nematodes, especially the root-knot and stubby-root nematodes, has become apparent to our corn producers.

Quick Note: Recommendations for the 2013 season: The amount of disease that growers will experience in their corn crop in 2013 will largely be the combined result of a) the weather, b) crop rotation, c) use of fungicides, and d) variety selection. As corn acreage increases in the state, the length of time between corn crops will likely decrease. Shorter corn rotations will increase the threat from northern corn leaf blight, southern corn leaf blight, and plant-parasitic nematodes. All corn growers who produce their crop under irrigation should recognize the potential benefits from protecting their crop with a fungicide program. Such producers should anticipate the value in a fungicide application at the crop approaches the tassel/VT growth stage. Though UGA Cooperative recommendations do not call for such an application for every field of corn in the state, it is recognized that this is typically a key time to protect the crop. Where the threat of disease is severe, a second application 2-3 weeks following the VT application can also be important and profitable. For a crop planted later in the year, an earlier fungicide application, around the V5-V6 growth stage, can help to reduce the severity of southern rust and leaf blights and protect yield. Growers should follow the results of our UGA Southern Rust Sentinel Plot Program at http://scr.ipmpipe.org throughout the season to determine where rust has been found.

All corn growers in Georgia must respect the possible impact from plant-parasitic nematodes to their crop. Increasing years between corn crops in a field can help to reduce the impact of the stubby-root nematode and, depending upon the crop used for rotation, the impact of the southern root-knot and peanut root-knot nematodes. In addition to crop rotation, corn growers can protect their crop with the use of products like Telone II, Counter 20G, AVICTA Complete Corn and Poncho VOTiVO. Sampling for nematodes is an important tool for growers so that they understand not only the types of nematodes, but also the population size in the field. Both the type and the number will affect the best selection of best management practices.

Corn and Nematode Disease Management for Georgia: "Interest in management of diseases and nematodes affecting field corn in Georgia has never been greater." This statement was true when I wrote it in 2012 and it is even truer in 2013. Grower appreciation for the value of disease and nematode management is the fruit of research results from the University of Georgia, improved corn commodity prices, availability of new fungicides and nematicides and an increased respect for the damage that diseases and nematodes can cause in a corn field.

Based upon research conducted at the University of Georgia, I estimate that the use of fungicides to protect a corn crop against southern corn rust typically increases yield by 5-25 bu/A depending upon how early disease affects the crop and the number of times fungicides are applied during the season. Although the effect of northern and southern corn leaf blights are not as well documented in Georgia, results from 2012 demonstrate that use of fungicides can result in similar increases in yield as for southern rust.

It is my estimation that use of nematicides to protect a corn crop from damaging populations of root-knot, stubby-root, and sting nematodes can easily increase yields by 10 to 40 (or more) bu/A. The magnitude of the yield increase is related to the size of the nematode population, the yield potential of the crop, and the type of nematicide that is used, e.g., Poncho-VOTiVO vs. Avicta Complete Corn vs. Counter 20G vs. Telone II. The top yield increases are expected when Telone II is used to protect the corn crop where high populations of parasitic nematodes exist.

Growers who invest significant resources into seed costs, irrigation, weed and insect control and soil fertility cannot afford to ignore the impact of diseases and nematodes on their crop. Although every corn grower in Georgia may not need to use a fungicide or nematicide in 2013, it is important that every corn grower who has the potential for good-to-excellent yields at least CONSIDER the value of disease and nematode management in his or her fields.

There is no doubt that corn grown in Georgia is susceptible to a number of diseases that are caused by fungi, bacteria, and viruses. Also, it has become clear from research conducted in recent years that plant parasitic nematodes can also cause significant yield losses on corn. Although rarely resulting in total crop loss, diseases such as seed rots, seedling blights, leaf spots, rust diseases, leaf blights, root rots, stalk rots, nematode damage and ear rots are important because they can lead to significant losses of yield and losses in quality. Mycotoxins such as aflatoxin and fumonisins are produced by fungi (often belonging to the genera *Aspergillus* and *Fusarium*) that infect the kernels. Presence of mycotoxins may result in feed that is unsafe for consumption by humans or livestock.

Foliar Diseases of Corn. Growers in Georgia typically did not use fungicides for management of foliar diseases on field corn in the past. However, solid research conducted over the past seven years clearly demonstrates that losses can be minimized by implementing sound disease management practices. Sizeable yield increases (e.g. 25 bu/A) are attainable when growers deploy approved fungicides at the proper time when warranted by the presence of disease, especially southern corn rust, northern corn leaf blight and also southern corn leaf blight. **The arsenal of fungicides available to corn growers in Georgia continues to grow and now includes Tilt and other propiconazole products, tebuconazole products, Stratego, Stratego YLD, Headline, Headline AMP, Quadris, Quilt, Quilt Xcel, EVITO, EVITO T and Domark (tetraconazole).** These fungicides will be discussed in greater detail later. Efficient disease management practices integrate the use of resistant varieties, cultural practices, crop rotation, and judicious use of fungicides or nematicides.

NOTE: The introduction of **southern rust** in Georgia, as observed via scouting and our sentinel plot network, will result in recommendations for use of fungicides in affected areas. This is because of the explosive nature of southern rust. For example, if southern rust is detected in one field, it is advised that growers apply fungicides to neighboring fields whether the disease is found in them or not. Although fungicides are important tools for the management of **northern corn leaf blight**, growers should understand that simply finding this disease in small amounts does not necessarily mean a fungicide application is needed. Nearly every field in the state will have some level of northern corn leaf blight; timely fungicide applications are advised in situations where this disease is likely to develop further.

Southern Corn Rust Sentinel Plots. Since 2009, the Georgia Corn Commission has sponsored a sentinel plot monitoring program for the early detection of southern rust. Because the southern rust disease is unable to survive for any length of time in the absence of a living host (mainly corn), the disease does not successfully overwinter in our state after the last corn has been killed by cold weather. Therefore, southern rust must become re-established in our state each year, typically by airborne spores from southern Florida, the Caribbean, and Mexico. Each year, the University of Georgia establishes "sentinel" plots across the state that include two corn hybrids, one which is susceptible to both races of ***Puccinia polysora*** (southern rust pathogen) and one which is only susceptible to the new race of ***P. polysora***. Leaf samples are collected weekly from each of these plots and are analyzed for rust diseases and also for leaf blights in our diagnostic clinic in Tifton. The results are distributed to our county agents and also posted on the Internet at http://scr.ipmpipe.org. Early detection of southern corn rust in sentinel plots is critical and allows growers to make timely, protective fungicide applications. In years where rust does not appear in sentinel plots, growers can delay and even omit fungicide applications from a disease management program. Please see images below. Note that in Figure 1 (2010) and Figure 3 (2012) southern corn rust was much more severe than in 2011 (Figure 2). Many growers were advised to protect their crop with fungicides in 2010 and 2012; few growers received such a recommendation in 2011 from the University of Georgia Cooperative Extension.

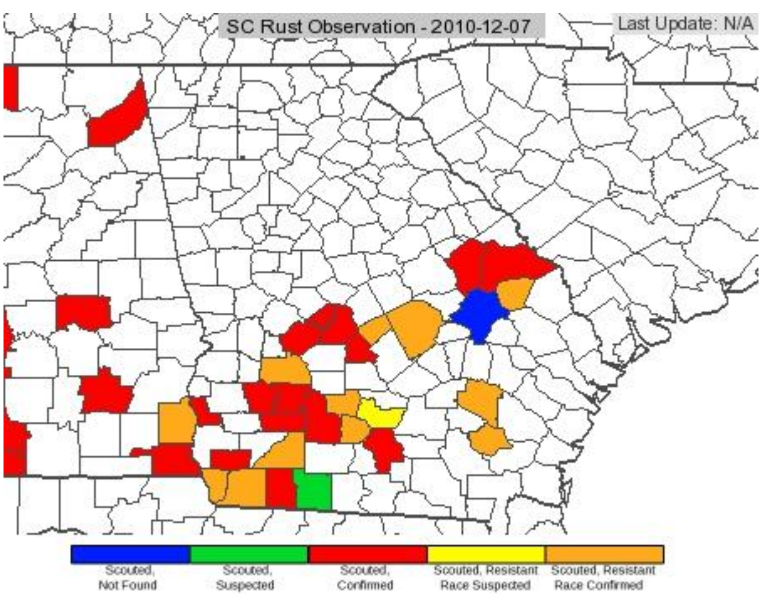

Figure 1. Results from the 2010 Southern Rust Sentinel Monitoring Program in Georgia.

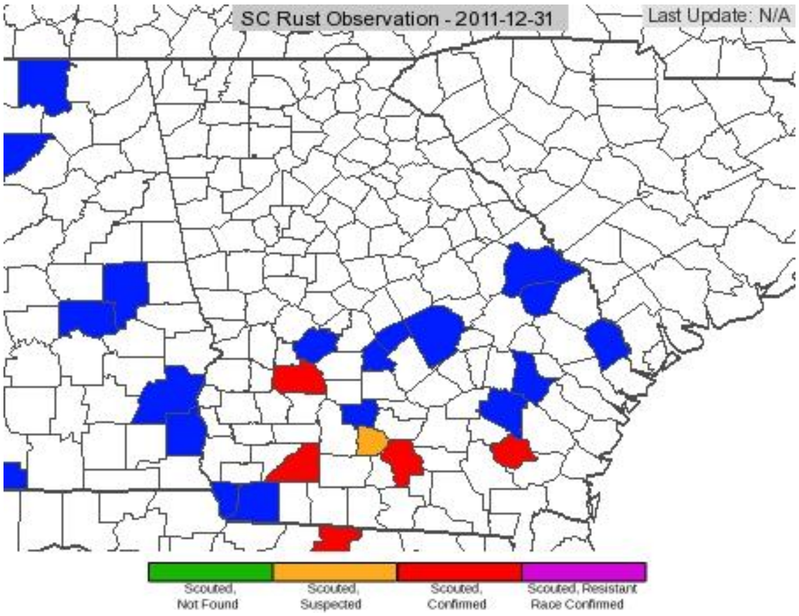

Figure 2. Results from the 2011 Southern Rust Sentinel Plot Monitoring Program in Georgia.

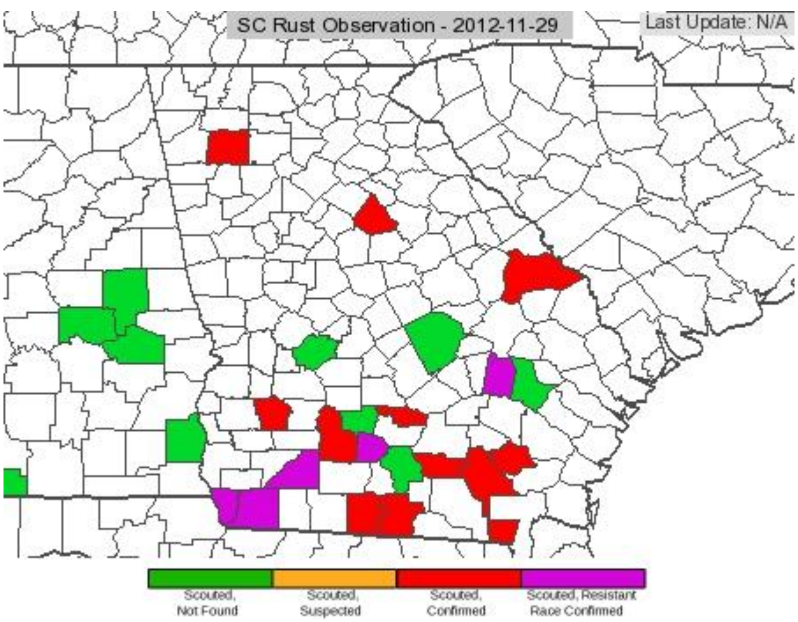

Figure 3. Results from the 2021 Southern Rust Sentinel Plot Monitoring Program in Georgia.

Using Fungicides to Manage Corn Diseases: Lessons Learned

1. Sentinel plots sponsored by the Georgia Corn Commission effectively allow us effectively detect early development and spread of southern rust.

2. Based upon early detection of southern corn rust in sentinel plots, much of the corn acreage in Georgia was treated with fungicide in 2010 and 2012 to protect against southern corn rust and, possibly, northern corn leaf blight; in one fungicide trial yields were increased by nearly 25 bu/A where a single, well-timed fungicide was applied. It was determined based upon sentinel plots in 2011 that southern rust did not develop until late in the season. Use of fungicides was not recommended on most of the corn crop in Georgia and was typically only recommended on very late-planted corn.

3. Northern corn leaf blight was not as severe in 2010 or in 2011 as had been expected. Development of this disease was likely suppressed by extend periods of hot and dry weather. However northern corn leaf blight was much more severe 2012, likely due to increased rainfall.

4. Based upon results from our sentinel plot program, both the "old race" and the "new race" (capable of overcoming resistance in some hybrids) were widespread across Georgia in 2010 and 2012.

A New race of *Puccinia polysora*, the fungus that causes southern corn rust

To manage southern rust in Georgia, many corn growers have planted "rust resistant varieties" such as P33M52. In 2008, southern rust was able to overcome resistance in some commercial fields in Georgia. Southern rust samples collected in Burke County appear to have been of a race that was sensitive to, and thus controlled by, the *Rpp9* gene for rust resistance that is found in varieties such as P33M52. Southern rust samples collected in Macon County were of a different race-type than those found in Burke County. Rust isolates from Macon County were able to overcome the resistance conferred on a variety like P33M52. In 2009, 2010, and 2012, the more virulent race of the southern rust pathogen was found again in Georgia.

It is not known conclusively how or when a second race of southern rust was introduced into Georgia, a race that can overcome resistance in some important corn hybrids. There is speculation that the second race was introduced from somewhere in the Caribbean via tropical storm Fay; however this remains conjecture. Spores of the southern rust pathogen are unlikely to survive in Georgia during the winter because of freezing temperatures and because there are no corn plants upon which to grow. Therefore, the southern rust spores from both race types will have to be reintroduced into Georgia each season.

Lessons from 2010 and 2012: Southern corn rust and resistant varieties

1. In 2010 and 2012 southern corn rust was found on both a "rust-resistant" hybrid and on a "rust-susceptible" hybrid in sentinel plots.

2. In 2010 and 2012, the final severity of rust on the "rust-resistant" hybrid was typically about half of the severity (or less) as on the "rust-susceptible" hybrid.

3. Although our rust-resistance hybrids (i.e., the ones with the *rpp*9 gene) will get some rust, fungicides are generally not needed on them for the control of southern rust. However, because these same hybrids are affected by northern corn leaf blight and southern corn leaf blight, the use of fungicides may still be wattanted.

FOLIAR DISEASE MANAGEMENT

Foliar diseases are common in Georgia and include southern and northern corn leaf blights, brown spot, common rust, southern rust and bacterial leaf blight. Grey leaf spot occurs occasionally in northern Georgia. Bacterial leaf blight is observed frequently in southern Georgia during rainy periods in mid-season. The other foliar diseases are caused by fungi and typically develop in late-season.

Of the foliar diseases that affect corn in Georgia, southern rust caused by the fungus *Puccinia polysora* and Northern corn leaf blight caused by *Exserohilum turcicum* have the greatest potential to cause severe losses for producers. Northern corn leaf blight has been a significant problem for corn growers in Georgia since 2008. Fortunately, southern rust does not affect our corn producers every year; however when it does occur it can be very damaging in a field with yield losses of more than 25 bu/A not uncommon. Southern rust causes yellow-orange pustules to develop rapidly on the leaves and sheathes of the corn plants. Southern rust can be differentiated from common rust in the field because pustules are likely to occur on the upper side of the leaves. In contrast, pustules caused by common rust occur both on the upper and lower sides of the leaves. (Note: when in doubt, disease samples should be submitted to the UGA Plant Disease Diagnostic Lab in Tifton for identification.) Southern rust can cause yield losses due to reduced grain fill and also by weakening the stalks leading to lodging and losses at harvest. The use of fungicides to control southern rust is warranted when a grower has planted a susceptible variety and the disease is likely to occur in a field. A grower should apply an appropriate fungicide when the disease first appears in the field or when it has been reported to be spreading in the area. If a grower waits too long to apply a fungicide and the disease has become too severe, fungicides will no longer be able to protect the crop or offer any benefit to the grower in that field.

There are currently a number of fungicides that are labeled to manage diseases of corn.

Tilt (propiconazole) (2.0-4.0 fl oz/A for leaf blights; 4.0 fl oz/A for rust diseases)

Tebuconazole 3.6F (various products, 4.0-6.0 fl oz/A for leaf blights and rust diseases)

Quadris (azoxystrobin) (9.2-15.4 fl oz/A for leaf blights and 6.2-9.2 fl oz/A for rust diseases)

Quilt (azoxystrobin + propiconazole) (7.0-14.0 fl oz/A for leaf blights and 10.5-14.0 fl oz/A for rust diseases)

Quadris Xcel (azoxystrobin + propiconazole) (10.5-14.0 fl oz/A for leaf blights and rust diseases)

Stratego (trifloxystrobin + propiconazole) (10.0-12.0 fl oz/A for leaf blights and 7.0-10.0 for rust diseases)

Stratego YLD (trifloxystrobin + prothioconazole) (4-5 fl oz/A for leaf blight and rust diseases)

Headline (pyraclostrobin) (9.0-12.0 fl oz/A for leaf blights and 6.0-9.0 fl oz/A for rust diseases)

Headline AMP (pyraclostrobin + metconazole) (10 fl oz/A for leaf blight and rust diseases)

EVITO 480SC (fluoxostroibin) (4.0-5.7 fl oz/A for leaf blights and 2.0-5.7 fl oz/A for rust diseases)

EVITO T (fluoxastrobin + tebuconazole) (4.0-9.0 fl oz/A for leaf blight and rust diseases)

Domark 230ME (tetraconazole) (4.-0-6.0 fl oz/A for leaf blight and rust diseases)

Based upon research trials conducted by the UGA Cooperative Extension, growers are most likely to see a yield benefit (and an increase in profit) from using a fungicide on field corn when:

1. Southern rust infects the crop (or in cases of severe outbreaks of northern or southern corn leaf blight) early in the season.
2. The grower has planted a variety that is susceptible to southern rust or when race of southern rust is present that is able to overcome the resistance found in a "resistant" variety.
3. The grower is able to apply the fungicide before it has spread significantly within the field.
4. The corn crop in the field has otherwise good-to-excellent yield potential.
5. **Note: Severe outbreaks of northern corn leaf blight in some fields have also warranted treatment with fungicide. It is recommended that a grower consider use of a fungicide to protect a corn crop if northern corn leaf blight is affecting the crop as it reaches tasseling. Although there is little data to support this stance, it is likely that a strobilurin or strobilurin-triazole combination will offer the best management of this disease when applied early enough.**

Based upon research trials conducted by the UGA Cooperative Extension, growers are unlikely to see an increase in yield or profit from using a fungicide on corn if:

1. Southern rust and or northern corn leaf blight are not present or threatening.
2. In the absence of northern corn leaf blight, the grower has planted a variety that is resistant to southern rust AND only the resistance is believed to protect against the strains of rust present in the state.
3. Environmental conditions, such has drought, have already greatly reduced the yield potential in a field.

Note: Despite the physiological effects that use of a strobilurin fungicide may have on a corn crop, our research has been unable to determine any consistent benefit to applying a strobilurin fungicide to a field if southern rust is not an issue. Our recommendation is that fungicides should be applied to a corn crop primarily IF southern rust is a factor or if a disease like southern or northern corn leaf blight affects the crop at an early growth stage.

Fungicide recommendations for managing southern rust and northern corn leaf blight include:

1. Apply an appropriate fungicide at labeled rate either prior to appearance of rust in a field or when it first appears in the field. Apply a fungicide to control northern corn leaf blight if this disease appears to be spreading early in reproductive growth. If Northern Corn Leaf Blight is observed on the 3rd leaf below the ear leaf, it is indication that it could be beneficial to use a fungicide to protect the crop.
2. We continue to investigate the value to the grower in terms of disease control that are obtained by treating a corn crop during vegetative growth stages, for example around the V5 growth stage. To date, a fungicide application at the V5-V6 growth stage on corn planted in the spring had little impact on yield or disease control. However, the V5-V6 application has had some benefit for reducing disease and improving yields on late-planted corn. This is because the later-planted corn will be affected much earlier in its growth and development than is spring-planted corn.
3. A second fungicide application may be warranted 2-3 weeks after the initial application IF weather conditions still favor the spread of the disease and the corn crop is still some time away from harvest maturity.
4. Southern corn rust can result in significant yield losses in corn and a susceptible variety should be protected with a fungicide before disease is established in a field. Many growers ask, "At what growth stage is my corn crop safe from rust?" Currently we have little specific data to answer this question; however the general recommendations from Dr. Kemerait and Dr. Dewey Lee are that a corn crop is likely to benefit from protection from southern rust until the ears reach the R4 "dough" growth stage. Southern rust is less likely to adversely affect the corn crop if it occurs after the corn has reached the dough stage.

COMMON SMUT

Common smut, caused by the fungus *Ustilago maydis*, is perhaps the most visually dramatic disease to affect field corn in Georgia. As its name implies, this disease is abundant around the state, though it rarely causes severe losses. The disease is recognized by the large, dark, tumorlike galls that form on the ears, leaves, stalks, and tassels that fill with fungal spores. Common smut has been found to be most severe when corn is planted next to wheat fields and when stink bugs have moved from wheat fields into corn. The primary management tactic is too plant varieties which have resistance to this disease.

NEMATODES

Historically, the impact of plant parasitic nematodes, such as root-knot ("southern" and "peanut"), stubby-root, stunt, sting, and Columbia lance, has been overlooked by many field corn producers in Georgia. Many hoped that the damage caused to the corn crop by nematodes was not extensive enough to warrant use of nematicides. However, recent studies indicate that nematodes are causing greater damage to the state's corn crop than previously believed and the use of nematicides is warranted in some fields. In some of the trials conducted in 2008, 2009, 2010, 2011and 2012, yield increases associated with the use of the fumigant Telone II have led not only to better growth, higher plant vigor and better use of available nutrients, but also yields that add economic value to the grower's crop. In 2013 growers will have Telone II, Counter

20G, AVICTA Complete Corn, and PONCHO VOTiVO for consideration to use for management of nematodes in their corn fields.

Nematodes damage the corn crop in Georgia by causing significant damage to the root system. The damaged root systems are less efficient at water and nutrient uptake by the corn plant and this in turn multiplies stresses, for example drought that may affect the crop. Nematode damage to corn can be reduced by (1) rotating with crops not susceptible to nematodes that damage corn, (2) using cultural practices which reduce plant stress, (3) sub-soiling under-the-row to promote root growth, and (4) using nematicides in fields diagnosed by field observation and/or soil sample assay to have nematode populations that cannot be controlled well enough by other recommended practices. Problem nematodes in corn include sting, stubby root, southern and peanut root-knot, and the Columbia lance. Field corn is not a host for the reniform nematode that causes damage on cotton.

Research will continue in 2013 to determine benefits of using a nematicide to minimize the impact of nematodes in a corn field. Possible benefits include increased yield, more vigorous growth early in the season, early transition to reproductive growth, stress reduction and thus less need for irrigation, healthier stalks, and earlier harvest. Counter 20G insecticide/nematicide and the fumigant Telone II have been used on field corn in Georgia. Use of nematicide seed treatments like AVICTA Complete Corn and PONCHO VOTiVO will become more common in the future. The largest and most consistent yield benefits observed thus far have been when Telone II is used to protect the corn crop from nematodes.

Products currently labeled for management of nematodes affecting corn now include:

Telone II (3 gal/A) excellent control

Counter 20G (5.25 lb/A) fair-to-good control

AVICTA Complete Corn (seed treatment) still being evaluated; has provided fair-to-good control in some trials

PONCHO VOTiVO (seed treatment) still under evaluation

Management of Nematodes

1. Data continues to accumulate documenting the yield benefits that can result from the use of nematicides in appropriate fields infested with nematodes.

2. Root-knot nematodes are the most common plant plant-parasitic nematodes affecting corn in our state; it is likely that we have also underestimated the losses associated with stubby-root nematodes.

3. Use of Telone II has provided the most consistent increases in plant vigor, early crop development, and yields compared to other nematicides. Use of Telone may also result in improved utilization of available nutrients.

4. Use of other nematicides, such as Counter 20G and AVICTA Complete Corn, can be effective in fields where nematode populations are at an appropriate level.

Plant parasitic nematodes that affect field corn are widespread across the production areas of Georgia and can reach damaging levels in specific fields. In a recent field survey conducted by county agents and supported by Dow Agrosciences, root-knot and stubby-root nematodes were found in over half of all fields that were sampled.

In a field study conducted in 2007 in Seminole County, high populations of the southern root-knot nematodes severely affected the growth of the corn in the field. Use of Telone II, 3 gal/A, or Counter insecticide-nematicide (7 lb/A in-furrow at planting time) reduced early season levels of nematodes both in the soil and in the roots of the corn. Fumigation with Telone II led to dramatic increases in growth and also resulted in treated plants reaching tasseling approximately nine days ahead of corn not planted in fumigated soil. However at harvest, yields were similar in plots treated only with Poncho seed treatments, Counter, or Telone II + Poncho seed treatment.

Multiple nematode management studies have been conducted in corn fields in Georgia in 2008, 2009, and 2010. In the most important studies, results from 2007 were verified. Management of plant parasitic nematodes with a product like Telone II can result in better root growth, better overall plant growth, better nutrient uptake, less time to reach reproductive growth stages and maturity, and significant increases in yield.

Field trials conducted in 2010 confirmed much of the same information from 2007, 2008, and 2009. Use of appropriate nematicides in fields where these pests are damaging can increase yields, increase growth rates, and other important factors. Further research in 2010 demonstrated that yield in plots fumigated with Telone II were not adversely affected when rates of fertilizer applied at lay-by were significantly reduced. Such results are further evidence that use of a highly effective nematicide like Telone II may enhance nutrient utilization in fields affected by nematodes. In 2009 and 2010, use of a new nematicide seed treatment from Syngenta, AVICTA Complete Corn, also helped to improve growth and yield in some trials.

Growers who will plant field corn where nematodes affecting the crop are believed to have reached damaging levels are encouraged to consider the use of a nematicide such as Telone II (3 gal/A) for pre-plant fumigation, Counter 20G or AVICTA Complete Corn seed treatment at planting. Growers are cautioned that we still have much to learn about AVICTA Complete Corn and Poncho VOTiVO. In the past, growers who used Counter would not need to use an insecticidal seed treatment like Poncho because Counter is effective against the same early-season insect pests. However, now most commercial corn seed will be pre-treated with an insecticide seed treatment, thus increasing the expense to the grower. Still, use of Counter can provide benefits to the grower in fields where nematodes damage the corn. Growers who use Counter at planting should not use an ALS herbicide in order to avoid phytotoxicity to the crop.

Fumigation with Telone II, 3 gal, per acre PRIOR to planting can help the growth of the corn crop; however the full benefits to yield at harvest and the economic analysis continue to be investigated. Where nematode populations caused significant damage to the corn crops in 2009 and 2010 field studies, use of Telone II led to important yield increases that brought economic benefits to the grower.

EAR AND KERNEL ROTS and MYCOTOXIN PRODUCTION

Many different types of fungi attack corn kernels and may cause losses in yield and grain quality; however species of *Aspergillus, Fusarium,* and *Penicillium* produce toxins (mycotoxins) that make corn unsafe for animal or human consumption. Mycotoxins are a normal byproduct of the growth and development of these fungi. Toxins may be produced by the fungi while the crop is in the field or after harvest and during storage. The presence of mycotoxins in the field is related to environmental conditions and other factors, such as damage caused by birds and insects. Insects that invade and damage the ear of corn carry the spores of fungi such as *Aspergillus* and *Fusarium* from the environment into the ear of corn, or create wounds that are readily colonized by these fungi. Also, spores from these fungi may be deposited on the silks and grow down the silk tissue to infect the kernels. Infected kernels are often easily identified because of the fungal growth that is associated with them. For example, kernels infected with *Aspergillus* may show masses of yellow and green spores while those infected with *Fusarium* have whitish-pink-red growth on the kernels. Mycotoxin contamination in storage results from improper drying or storage conditions that support the growth of the fungi. To help prevent the formation of mycotoxins, corn must be dry and free of insects and air movement regulated to avoid the accumulation of moisture.

Aflatoxin and Afla-Guard. Aflatoxin, produced by two closely related fungi, Aspergillus flavus and Aspergillus parasiticus, is a major problem for corn and peanut production in Georgia. Extreme heat and drought during the growing season, insect damage, and improper storage all can increase the risk to contamination with aflatoxin. High temperatures in 2010 certainly increased the risk for corn and peanut production. The high temperatures and dry conditions made aflatoxin an even greater problem in 2011. However, cooler and wetter conditions in 2012 made aflatoxin less important in Georgia's field corn production.

Syngenta Crop Protection has now acquired Afla-Guard which is a no-toxigenic strain of Aspergillus flavus that can compete for colonization of the corn or peanuts with the native, toxigenic strains found in the field. Afla-Guard is applied at some point between the V10-V12 and R1 growth stages, or approximately 14 days prior to tasseling up to the onset of silking. The rate for application is 10-20 lb/A of product. The efficacy of Afla-Guard to minimize the levels of aflatoxin in corn in Georgia continues to be evaluated. The University of Georgia will develop detailed recommendations once a larger data set is available.

SEED ROTS AND SEEDLING BLIGHTS

As the seed germinates and seedlings develop, corn is susceptible to rot and disease that may kill the young plant or leave it stunted and nonproductive. Symptoms of seed rot and seedling disease in a field include poor, "skippy" stands and the presence of plants with poor growth that are never able to reach the genetic potential of the variety planted, despite otherwise acceptable management practices.

Seed rot and seedling blight are caused by fungal pathogens, some of which may be present on the seed even before it is planted. Once these fungal pathogens infect the seed or seedling, decay, lesions, stunting, and chlorosis are likely to occur. Common seedling pathogens include species of *Pythium*, *Fusarium*, *Penicillium*, and *Rhizoctonia*.

An important tactic to control seed rot and seedling blight is to plant only high quality seed that has been treated with a labeled fungicide. Fungicide seed treatments are an important tool in the battle to fight seedling diseases. Poor quality seed, such as that produced under drought conditions or which has mechanical damage, is more likely to be susceptible to these problems. Poor seed is likely to produce seedlings with less vigor and greater fungal infection than healthy, undamaged seed. Additional steps to protect against seedling blight include rotation with nongrass crops, planting in warm soils that promote rapid germination and seedling growth, and the avoidance of deep planting. Also, it is important to bury crop residues that act as a nutrition source and that allow pathogens to survive between crops.

ROOT ROTS

Although typically not a major problems for corn producers in Georgia, root-rot diseases can cause significant loss in some fields. Species of the soilborne fungi *Pythium*, *Rhizoctonia*, and *Fusarium*, that are factors in seedling blights can also cause root rot in corn. Root rot results from the interaction of a complex of soilborne fungi, bacteria, nematodes, and root feeding insects and thus may require use of integrated pest management. Symptoms of root rot include visible lesions, discoloration and degradation of the root system, cankers on the adventitious crown and brace roots of large plants, and yellowing and stunting of the whole plant. The severity of root rot can be reduced by improving drainage in a field, rotation with non-host crops, good weed control, and control of parasitic nematodes.

STALK ROT

The stalk rot-lodging complex is the most costly corn disease in Georgia. This disease is caused by several different fungal pathogens as well as a bacterial pathogen. AStalk rot@ describes such maladies as stalk breakage, stalk lodging, and premature death of the plant. In the most general sense, this rot is an internal decay of the pith tissue of the stalk, though plants with rotted stalks often have root rot as well. Losses result from poor grain fill associated with premature plant death, difficulty in the mechanical harvest of lodged plants, and rot that occurs when ears come in contact with the soil. The incidence and severity of stalk rot is related to fertility and growing conditions during the season. If conditions are favorable for growth early in the season, corn plants will produce a large number of kernels. These kernels later become a sink for the carbohydrates produced through photosynthesis. If a plant is unable to produce all of the carbohydrates needed for optimal health and development because of environmental stresses or poor fertility, the grain sink (ear) has priority over other tissues. Without adequate carbohydrates, cells in the root and lower stem senesce and are more easily colonized by opportunistic stalk-rotting organisms.

Stalk rots are differentiated based upon the pathogen and symptoms that are associated with the disease. Fungal pathogens cause Gibberella, Diplodia, Anthracnose, Fusarium, and Pythium stalk rots and Charcoal rot. General symptoms of fungal stalk rot include wilt and disintegration of internal pith tissue. Bacterial stalk rot is caused by *Erwinia chrysanthemi* pv. *zeae*. Bacterial stalk rot is easily identified by plants that suddenly lodge in midseason with one to several internodes above the soil line dark brown, water soaked, soft or slimy, with a foul odor.

Although no direct controls are available, losses to stalk rot can be reduced by (1) planting early and harvesting before lodging occurs, (2) planting good-standing hybrids, (3) maintaining a balanced fertility level, (4) avoiding extremely high plant populations, and (5) preventing moisture stress. A balanced and continuous supply of nitrogen is needed throughout the season to maintain the health of the pith tissue. Adequate potassium is needed to maintain normal photosynthesis and the cell walls of pith tissue. High plant populations have been associated with an increase in the severity of stalk rot.
favored by (1) drought and temperature stress of the plants in the field, (2) nitrogen deficiency, (3) insect damage to ears, (4) physical damage during harvest, (5) inadequate drying before storage, (6) holding wet corn on trailers too long without adequate cooling and ventilation before drying, (7) moisture build-up in bins during storage, (8) insect damage in storage and (9) poor sanitation. Avoiding these situations will help reduce the risk of mycotoxin contaminated corn. Corn varieties with adequate husk cover over the kernels will be less damaged by insects such as weevils, worms, and thrips, and thus less likely to be contaminated by aflatoxin. Corn is most susceptible to contamination by aflatoxins during periods of sustained drought, water stress, and high temperature. Contamination can be reduced using irrigation and minimizing fertilizer stress.

GENERAL DISEASE MANAGEMENT for CORN

1. Plant seed treated with a fungicide to reduce seed rots.
2. Rotate to non-cereal crops to prevent a build-up of certain disease organisms, including fungi, bacteria and nematodes.
3. Plant hybrids that are resistant to problem diseases.
4. Plant early to help reduce stalk and ear rot problems. (Field molding and aflatoxin contamination also appear to be worse on later plantings where insect damage is usually greater).
5. Destroy old crop residues to help reduce problems from disease organisms that overwinter in crop residue.
6. Follow good fertilization practices, include starter fertilizers, and a good liming program to promote vigorous seedling growth (Healthy plants are less susceptible to many diseases.)
7. Subsoil under-the-row to reduce compaction and promote root growth.
8. Use approved fungicides on susceptible hybrids when the disease is present as the crop reaches the tassel stage.

HARVESTING AND DRYING CORN

Paul Sumner

When to Harvest

One general principle applies to all of the available options: the grain should be dried or delivered quickly, preferably within 24 to 48 hours of harvest. Equipment and operations that have worked well when corn was harvested at 22% moisture content may not work so well when the corn is wetter. Combines often have much greater capacity than driers when the corn is very wet. The options available for handling high moisture grain fall into three general categories:

1. ***Dry on the farm***. - Where adequate drying equipment is available, this option may be chosen. Drying capacity, economics, and convenience and are major factors in this decision. Higher moisture contents can substantially reduce drying capacities so that factor should be carefully considered when evaluating the choices.

2. ***Deliver to Elevator or other Buyer***. - Buyers may or may not be able to handle wet grain. If they accept wet grain their capacity will be limited. The major factor in choosing this option is usually one of economics although delivery may also be important. Various combinations of price discounts, weight shrinkage and drying charges are used to compensate the buyers for their drying cost and for the weight lost during drying. These discounts and charges will vary from one buyer to another and may change with time. Good decisions cannot be made if current and accurate information about wet grain discounts is not available.

3. ***Custom Drying***. - In some places there may be limited access to a custom drying arrangement. This would most likely involve a neighbor who may not have started or has already finished his harvest or a peanut buying point. Costs for such a service would be a drying charge and handling fee. Custom services could be used to boost drying capacity or as a supplement for systems that were not designed to handle high moisture corn.

The length of the harvest period is highly dependent on the size of the operation, combine speed and capacity, efficiency of the harvesting-hauling-handling-drying-storage system, and weather.

Drying

Drying is one of the oldest methods of preserving food and feedstock. It is simply the removal of moisture from a product, usually by forcing dry air through the material.

Air serves two basic functions in grain drying. First, the air supplies the necessary heat for moisture evaporation; second, the air serves as a carrier of the evaporated moisture. The amount of moisture which can be removed from corn depends on the moisture content of the corn, and the drying air relative humidity and temperature.

Air temperature determines to a large extent the total water-carrying capacity of the drying air. Hot air can hold more moisture than cold air. For example, a pound of air at 40°F can hold only 40 grains of moisture (7000 grains = 1 pound) while a pound of 80°F air can hold 155 grains - almost a four fold increase.

Relative humidity also plays an important part in the drying process. Air at 100°F and 50 percent relative humidity can absorb 60 more grains of moisture per pound of air than it can at 75 percent humidity.

When grain is placed in a drier and air is forced through the grain, a drying zone is established at the point where the air enters the facility (Figure 1). The drying zone moves uniformly through the grain in the direction of air flow at a rate depending on the volume, temperature and relative humidity of the air and the moisture content of the grain.

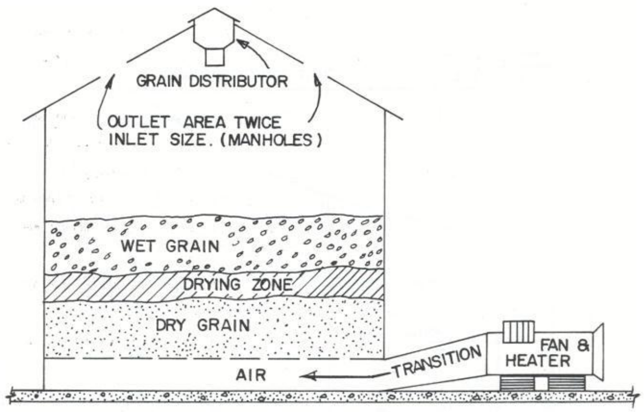

Figure 1. Grain is dried from the point of air entry with the drying front moving in the direction of air flow. The wetter grain occurs where the air leaves the grain layer.

Batch-in-Bin Drying

In this method a two to four foot layer of grain is placed in a drying bin. The layer (batch) is rapidly dried then cooled and removed. A new batch is then placed in the bin and the process repeated. Fan requirements: medium to high (40 CFM/sq. ft. @ 3 inches static pressure). Heat requirements: medium (120 - 140°F.).

Batch Drying

Batch drying involves special drying equipment which holds a relatively thin layer of grain (1-2 feet).

Some models recirculate the grain during drying for uniform moisture removal. Grain is normally dried, cooled and then removed. Fan requirements: very high (50 - 100 CFM/sq. ft.). Heat requirements: medium high (160 - 180°F).

Continuous Flow Drying

A thin layer of grain ($^2/_3$ - 1½ ft.) moves continuously through the drier; first through a drying section then through a cooling section. Continuous loading and unloading is required. Fan requirements: very high (75 - 125 CFM/sq. ft.). Heat requirements: very high (180 - 200°F).

Peanut Wagons (Batch Drying)

Peanut wagons/trailers have been used extensively in Georgia for many years to dry high moisture peanuts. Peanuts have a different density and drying characteristics than grain products. Grain (corn) can be dried in the units. The main difference between drying peanuts and corn is the drying temperatures and resistance to air flow. The drying air temperatures for peanuts should not exceed 95ºF. Most peanut dryer thermostats have a set point range between 70 and 140ºF. The LP burners used have the capability of increasing air temperature by 50 to 70ºF. Therefore maximum drying temperature that could be obtained with an 85ºF ambient air temperature is 135 to 155ºF. The resistance to air flow is approximately 2.5 to 3 inches static pressure for 2 feet of corn depth compared to peanuts of 0.5 inches static pressure for 4 feet depth of peanuts. Peanut wagons can be 14, 21, 28 or 45 feet in length. The CFM/Bushel of corn ranges from 25-60 CFM/bushel (50-100 CFM/ft^2) at a depth of 2 feet.

Suggestions for Drying Corn in Peanut Wagons

- Only fill peanut wagons to a maximum of 2 feet or grain fill line.
- Set thermostat to highest setting - 140ºF. (If the burner is capable of a higher temperature rise replace thermostat for a higher range setting - 160-180ºF)
- Drying time will depend on air conditions and drying temperature. Figure 2 and 3.

The amount of LP required to dry corn can be estimated by the graph in figures 4 and 5.

Graphs 2 and 4 are based on 85ºF and 85 percent relative humidity ambient air being forced through the grain at a rate of 50 CFM/ft^2 of floor area. Graphs 3 and 5 are based on 85ºF and 85 percent relative humidity air being forced through the grain at a rate of 100 CFM/ft^2. When the air flow rate is increased drying time is reduced but fuel usage per bushel will increase because of removing the moisture faster.

Corn dryers range in capacity from a few hundred to several thousand bushels per day. Producers should size their dryer(s) to match daily combine capacity and harvest moisture target levels.

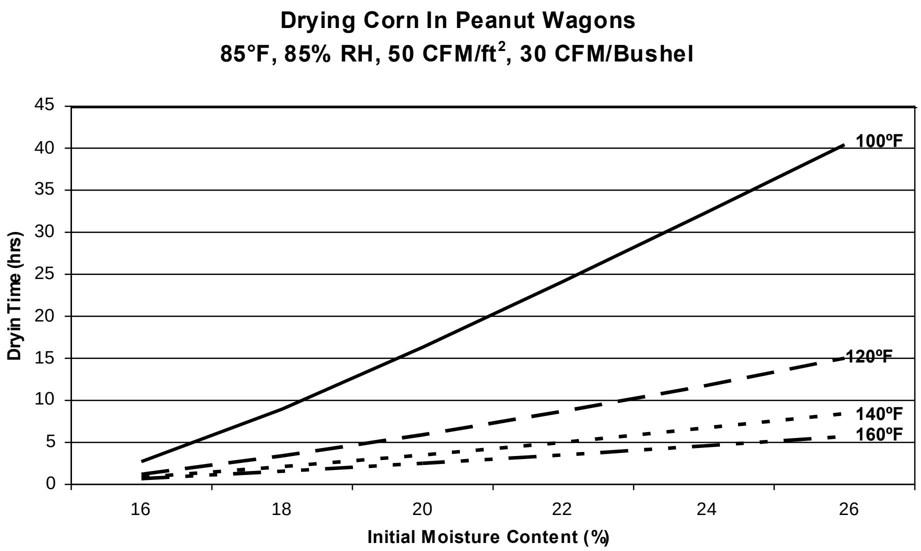

Figure 2. Estimated total drying time for corn with air at 85ºF and 85 percent relative humidity, 30 CFM/Bushel, 50 CFM/ft^2 of floor area.

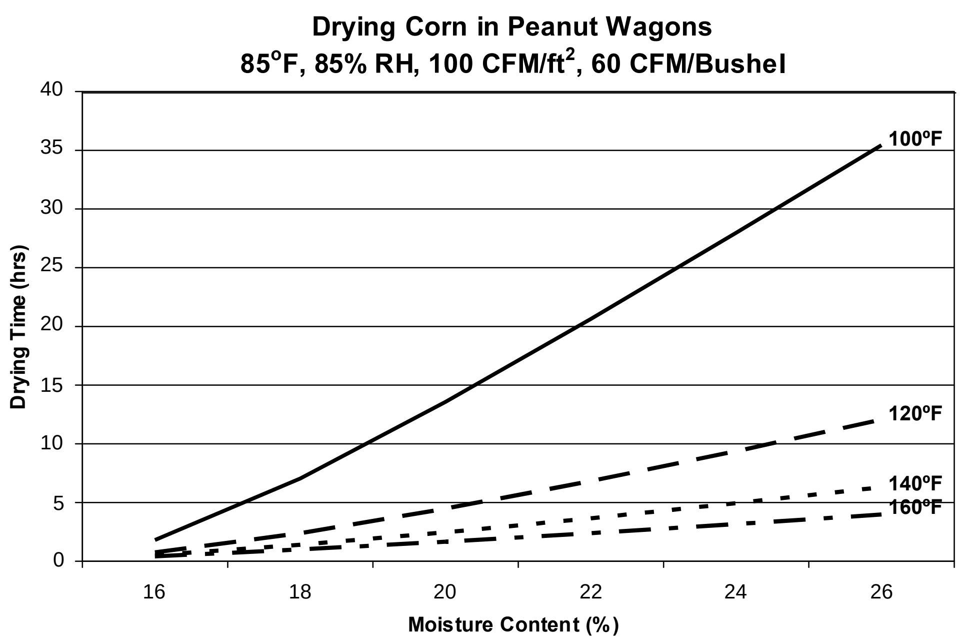

Figure 3 Estimated total drying time for corn with air at 85ºF and 85 percent relative humidity, 60 CFM/Bushel, 100 CFM/ft^2 of floor area.

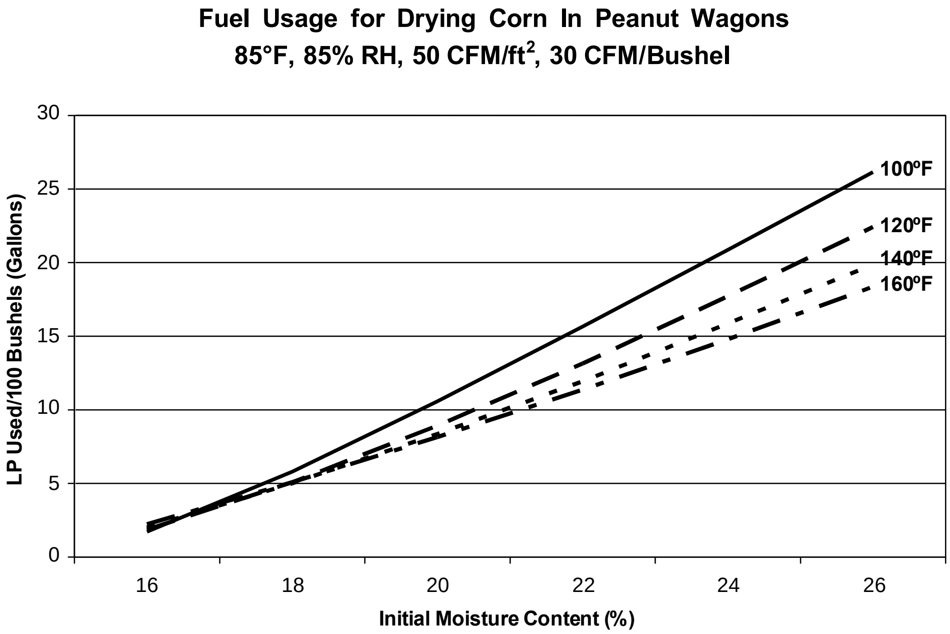

Figure 4. Estimated LP fuel use for corn with air at 85ºF and 85 percent relative humidity, 30 CFM/Bushel, 50 CFM/ft^2 of floor area.

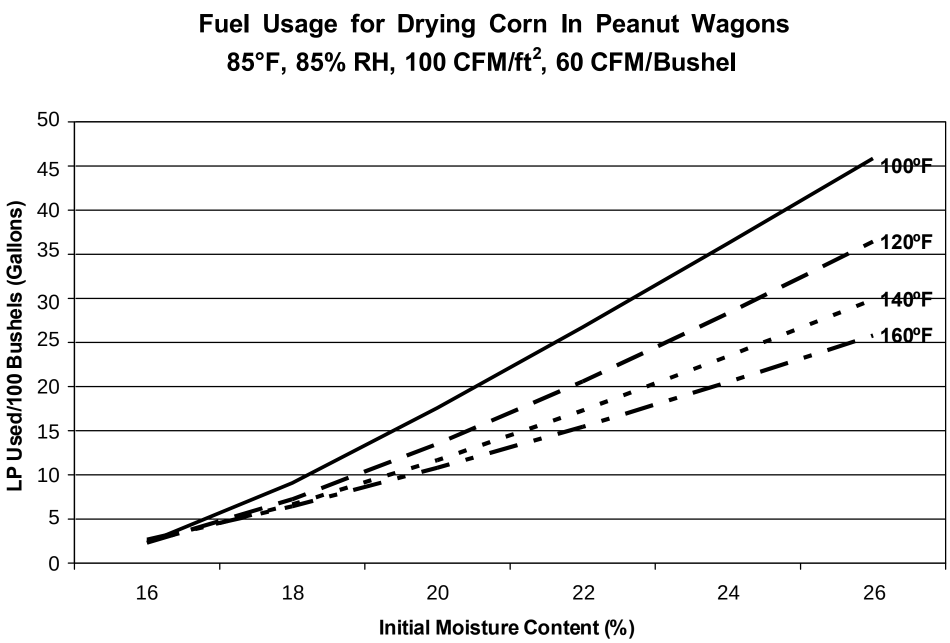

Figure 5. Estimated LP fuel use for corn with air at 85ºF and 85 percent relative humidity, 60 CFM/Bushel, 100 CFM/ft^2 of floor area.

Natural Air Drying

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Many small farmers prefer to dry crops using unheated or natural air drying in bins in layers 3 to 6 feet deep. It is desirable to have heat available on standby which will allow safe drying in any weather. Significant aflatoxin buildup can occur in 48 hours in grain if the air leaving the grain is between 55 and 105^{o}F and relative humidity is over 85 percent.

Equilibrium Moisture Content

Grain can be dried in many areas (except along the coast) of our state using natural air if the drying layer is limited to three to four feet and a sufficient volume of air with the proper relative humidity and temperature is circulated through the grain. If, for example, corn is to be dried to 12 percent moisture, air must be circulated which will remove moisture from the corn rather than adding moisture. When the air circulating through the corn neither absorbs moisture nor adds moisture, the air and corn are said to be at the equilibrium moisture content. Table 16 shows 12 percent moisture corn to be in equilibrium with air at 50^{o}F and 50 percent humidity. If the humidity increases to 60 percent and the air temperature remains at 50^{o}F, it is not possible to dry the corn below 13.3 percent. If the relative humidity dropped below 50 percent and remained at 50^{o}F, drying to 12 percent or below would be possible.

Table 16 . Equilibrium moisture content of shelled corn at various relative humidity and air temperature.

Air Temperature (^{o}F)	Relative Humidity (%)									
	30	35	40	45	50	55	60	65	70	80
30	10.3	10.8	11.3	12.2	13.1	13.8	14.6	15.5	16.4	18.7
50	8.8	9.7	10.5	11.3	12.0	13.0	13.9	14.8	15.7	17.9
60	8.5	9.3	10.1	10.9	11.7	12.5	13.3	14.2	15.1	17.2
70	8.1	8.9	9.7	10.5	11.2	12.0	12.8	13.6	14.5	16.6
80	7.8	8.6	9.3	10.1	10.8	11.6	12.4	13.2	14.0	16.0
90	7.6	8.3	9.0	9.7	10.5	11.2	12.0	12.7	13.6	15.5
100	7.3	8.0	8.7	9.4	10.1	10.9	11.6	12.4	12.2	15.1

A small amount of heat raises the drying air temperature and reduces the humidity which increases the drying capability of the air. A 20°F temperature rise reduces the relative humidity by 50 percent. For example, air at 60^{o}F and 70 percent relative humidity heated to 80°F. (20^{o}F temperature rise) reduces the relative humidity to 35 percent (50 percent of the 70 percent). With shelled corn, the original air (60^{o}F and 70 percent humidity) would reach equilibrium at 15.1 percent while the 80^{o}F and 35 percent relative humidity would reach equilibrium at 8.6 percent. This would result in more drying capability (Table 16). If the air were heated 10^{o}F (one half the 20^{o}F above), the relative humidity would drop only 25 percent or one half the above value to about 50 percent.

Airflow - the Key to Natural Air Drying

Table 17 gives the maximum quantities of grain that can be dried per batch per fan horsepower for minimum air flow rates and maximum depths using natural air under favorable conditions.

The air flow rate in Table 17 is the minimum flow rate with grain depth being the maximum for clean grain with little or no fines using unheated air. (Heat should be available on standby). The static pressure on the fan is given in inches of water.

Table 17. Estimated maximum quantities of grain that can be dried per batch per fan horsepower for minimum air flow rates and grain depths using natural air.

Grain	Air Flow Rate per Bushel (CFM)	Initial Moisture Content (Percent)	Grain Depths (Feet)	Static Pressure (Inches Water Gage)	Maximum Quantity That Can Be Dried Per Fan Horsepower (Bushels)
Corn (Shelled)	6	25	3	0.60	885
			5	1.50	360
			7	3.20	170
	5	22	5	1.00	635
			7	2.40	265
			8	3.40	190
	3	18	7	1.27	835
			9	2.14	495
			10	2.65	400
	2	15	7	0.81	1965
			9	1.33	1200
			11	1.95	815

The approximate drying time for shelled corn at different initial moisture contents (in Georgia) is shown in Tables 18-22 for unheated air. Unheated air is defined as air being pulled across an electric fan motor giving a 2.5ºF temperature rise. Notice drying is quite slow. For this reason, many farmers will not find natural air drying acceptable since faster methods will usually be needed. Drying rate can be increased by adding heat or increasing air flow rate, or both. Slow drying is not desirable to maintain grain quality and reduce risk from aflatoxin. Increasing airflow will decrease drying time as shown in Tables 18-22.

Table 18. Approximate drying time (days) for shelled corn at different initial moisture contents for 2.5ºF temperature rise and 2 CFM/bushel.

Final Moisture (%)	Drying Time (hours)							
	Initial Moisture (%)							
	20	19	18	17	16	15	14	13
20	0							
19	6	0						
18	13	7	0					
17	19	13	6	0				
16	25	19	12	6	0			
15	31	25	18	12	6	0		
14	37	31	24	18	12	6	0	
13	43	37	30	24	18	12	6	0
12	48	42	35	29	23	17	11	5
11	53	47	40	34	28	22	16	10
10	58	52	45	39	33	27	21	15

Table 19. Approximate drying time (days) for shelled corn at different initial moisture contents for 2.5ºF temperature rise and 3 CFM/bushel.

Final Moisture (%)	Drying Time (hours)							
	Initial Moisture (%)							
	20	19	18	17	16	15	14	13
20	0							
19	4	0						
18	9	5	0					
17	13	9	4	0				
16	17	13	8	4	0			
15	21	17	12	8	4	0		
14	25	21	16	12	8	4	0	
13	29	25	20	16	12	8	4	0
12	32	28	23	19	15	11	7	3
11	35	31	27	23	19	15	11	7
10	39	35	30	26	22	18	14	10

Table20. Approximate drying time (days) for shelled corn at different initial moisture contents for 2.5ºF temperature rise and 5 CFM/bushel.

Final Moisture (%)	Drying Time (hours)							
	Initial Moisture (%)							
	20	19	18	17	16	15	14	13
20	0							
19	2	0						
18	5	3	0					
17	8	5	2	0				
16	10	8	5	2	0			
15	12	10	7	5	2	0		
14	15	12	10	7	5	2	0	
13	17	15	12	10	7	5	2	0
12	19	17	14	12	9	7	4	2
11	21	19	16	14	11	9	7	4
10	23	21	18	16	13	11	9	6

Table 21. Approximate drying time (days) for shelled corn at different initial moisture contents for 2.5ºF temperature rise and 6 CFM/bushel.

Final Moisture (%)	Drying Time (hours)							
	Initial Moisture (%)							
	20	19	18	17	16	15	14	13
20	0							
19	2	0						
18	4	2	0					
17	6	4	2	0				
16	8	6	4	2	0			
15	10	8	6	4	2	0		
14	12	10	8	6	4	2	0	
13	14	12	10	8	6	4	2	0
12	16	14	12	10	8	6	4	2
11	18	16	13	11	9	7	5	3
10	19	17	15	13	11	9	7	5

Table 22. Approximate drying time (days) for shelled corn at different initial moisture contents for 2.5ºF temperature rise and 9 CFM/bushel.

Final Moisture (%)	Initial Moisture (%)							
	20	19	18	17	16	15	14	13
20	0							
19	1	0						
18	3	2	0					
17	4	3	1	0				
16	6	4	3	1	0			
15	7	6	4	3	1	0		
14	8	7	5	4	3	1	0	
13	10	8	7	5	4	3	1	0
12	11	9	8	6	5	4	2	1
11	12	10	9	8	6	5	4	2
10	13	12	10	9	7	6	5	3

Adding low levels of heat (10 - 15^{o}F) allow faster drying and the drying process becomes less sensitive to the weather. A good method for controlling the supplemental heat is to install a humidistat in the blower discharge air stream or near the top of the storage bin. The humidistat, set at the desired humidity level, provides almost perfect control if three conditions are met. First, the heating unit should have a modulating valve so heat output changes will be gradual. Second, the humidistat must be able to operate in a dusty environment. Third, reaction time of the humidistat and heater should be such that there is little if any overrun of the heater.

Bin Capacity and Airflow Rates

Table 23 gives estimated capacities for various depths and bin diameters. One bushels equals 1.245 ft^3. The CFM/bushel can be calculated by knowing the amount of bushels and dividing by the fan CFM.
Depth of grain should not exceed 4 feet. Figures 1 and 2 illustrate the amount of air available per bushel at different depths for a 15 foot diameter bin when drying grain.

Example: Corn is harvested at 17 percent moisture. A 30 feet diameter grain bin filled to a height of 18 feet holds 10,220 bushels (Table 21). The fan has a capacity of 20,000 CFM at 3.0 inches static pressure. Dividing the 20,500 CFM by 10,220 bushels gives us 2.0 CFM/bushel based on full bin. Natural air drying should only be for 4 feet or less. The number of bushels for 4 feet depth is 2,271 bushel. Now calculating the CFM/bushel equals 20,500 divided by 2,271 equals 9 CFM/bushel. Table 21 shows drying time for 17 percent moisture shelled corn at 4 days to achieve 14 moisture content. Higher moisture corn could then be added on top. Remember adding 4 feet will half the amount of CFM/bushel to 4.5. Drying the second layer to 14 percent will take over 7 days (Table 19).

Table 23. Capacities of level full round bins.

Based on 1.245 ft^3= 1 bushel does not involve test weight, moisture content or shrinkage.

Grain depth	Bin diameter (ft)												
ft	15	18	21	24	27	30	33	36	39	42	45	48	60
1	142	204	278	363	460	568	687	818	960	1,113	1,277	1,453	2,271
1.5	213	307	417	545	690	852	1,030	1,226	1,439	1,669	1,916	2,180	3,407
2	284	409	556	727	920	1,136	1,374	1,635	1,919	2,226	2,555	2,907	4,542
3	426	613	835	1,090	1,380	1,703	2,061	2,453	2,879	3,338	3,832	4,360	6,813
4	568	818	1,113	1,453	1,840	2,271	2,748	3,270	3,838	4,451	5,110	5,814	9,084
6	852	1,226	1,669	2,180	2,759	3,407	4,122	4,905	5,757	6,677	7,665	8,721	13,626
8	1,136	1,635	2,226	2,907	3,679	4,542	5,496	6,541	7,676	8,902	10,220	11,628	18,168
10	1,419	2,044	2,782	3,634	4,599	5,678	6,870	8,176	9,595	11,128	12,774	14,534	22,710
12	1,703	2,453	3,338	4,360	5,519	6,813	8,244	9,811	11,514	13,354	15,329	17,441	27,252
14	1,987	2,861	3,895	5,087	6,438	7,949	9,618	11,446	13,433	15,579	17,884	20,348	31,794
16	2,271	3,270	4,451	5,814	7,358	9,084	10,992	13,081	15,352	17,805	20,439	23,255	36,336
18	2,555	3,679	5,008	6,541	8,278	10,220	12,366	14,716	17,271	20,030	22,994	26,162	40,878
20	2,839	4,088	5,564	7,267	9,198	11,355	13,740	16,351	19,190	22,256	25,549	29,069	45,420
22	3,123	4,497	6,120	7,994	10,117	12,491	15,114	17,986	21,109	24,481	28,104	31,976	49,962
24	3,407	4,905	6,677	8,721	11,037	13,626	16,488	19,622	23,028	26,707	30,659	34,883	54,504
26	3,690	5,314	7,233	9,447	11,957	14,762	17,861	21,257	24,947	28,933	33,213	37,790	59,046
28	3,974	5,723	7,790	10,174	12,877	15,897	19,235	22,892	26,866	31,158	35,768	40,696	63,588
30	4,258	6,132	8,346	10,901	13,796	17,033	20,609	24,527	28,785	33,384	38,323	43,603	68,130
32	4,542	6,541	8,902	11,628	14,716	18,168	21,983	26,162	30,704	35,609	40,878	46,510	72,672
34	4,826	6,949	9,459	12,354	15,636	19,304	23,357	27,797	32,623	37,835	43,433	49,417	77,214
36	5,110	7,358	10,015	13,081	16,556	20,439	24,731	29,432	34,542	40,061	45,988	52,324	81,756
38	5,394	7,767	10,572	13,808	17,475	21,575	26,105	31,067	36,461	42,286	48,543	55,231	86,298
40	5,678	8,176	11,128	14,534	18,395	22,710	27,479	32,703	38,380	44,512	51,098	58,138	90,840
42	5,961	8,584	11,684	15,261	19,315	23,846	28,853	34,338	40,299	46,737	53,653	61,045	95,382
44	6,245	8,993	12,241	15,988	20,235	24,981	30,227	35,973	42,218	48,963	56,207	63,952	99,924
46	6,529	9,402	12,797	16,715	21,154	26,117	31,601	37,608	44,137	51,189	58,762	66,858	104,466
48	6,813	9,811	13,354	17,441	22,074	27,252	32,975	39,243	46,056	53,414	61,317	69,765	109,008
50	7,097	10,220	13,910	18,168	22,994	28,388	34,349	40,878	47,975	55,640	63,872	72,672	113,550
52	7,381	10,628	14,466	18,895	23,914	29,523	35,723	42,513	49,894	57,865	66,427	75,579	118,092
54	7,665	11,037	15,023	19,622	24,833	30,659	37,097	44,148	51,813	60,091	68,982	78,486	122,634
56	7,949	11,446	15,579	20,348	25,753	31,794	38,471	45,784	53,732	62,316	71,537	81,393	127,176
58	8,232	11,855	16,136	21,075	26,673	32,930	39,845	47,419	55,651	64,542	74,092	84,300	131,718
60	8,516	12,263	16,692	21,802	27,593	34,065	41,219	49,054	57,570	66,768	76,646	87,207	136,260

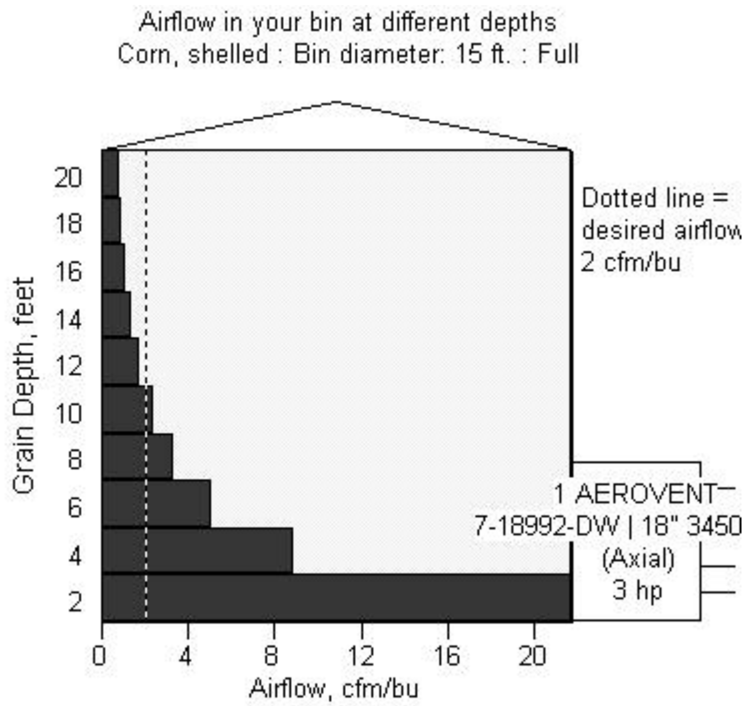


Figure 1. Airflow per bushel for a 15 ft diameter corn bin at different depths, total desired airflow is 2 cfm per bushel.

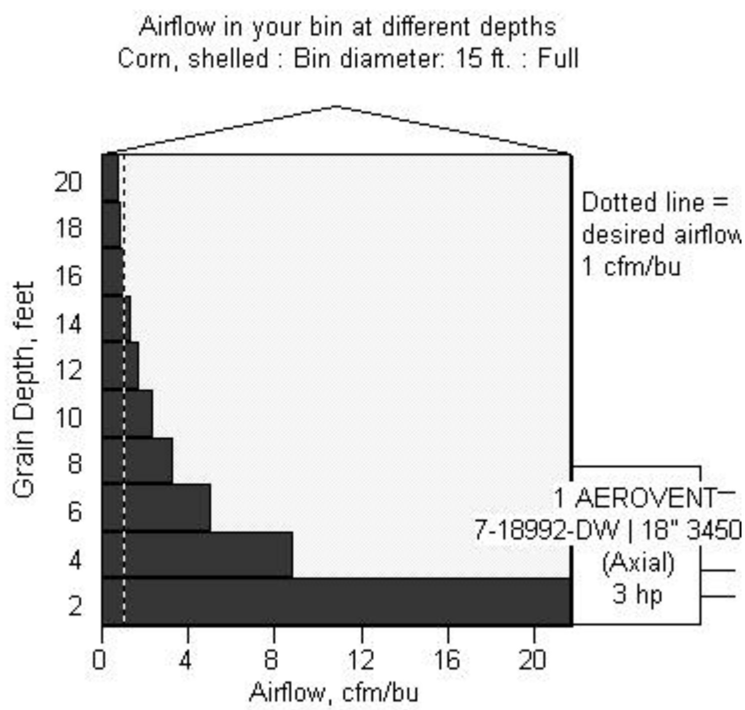


Figure 2. Airflow per bushel for a 15 ft diameter corn bin at different depths, total desired airflow is 1 cfm per bushel.

2013 Corn Outlook and Cost Analysis

Nathan B. Smith and Amanda Smith

Corn Supply and Demand Highlights

- **Acreage** - U.S. corn plantings rose by 5.4% to 96.9 million acres in 2012. Harvested acres are projected to be 87.7 million (90.5% of planted acres), 3.3 million more than last year. Georgia corn growers planted the same acres as 2011, 345,000 acres.

- **Drought Hammers the Midwest**- Despite a second year of increased acres, U.S. corn production again, falling below 11 B bushels. The 2012 estimated corn production is pegged at 10.725 billion bushels, a 13.2% drop from last year. The U.S. average yield fell 122.3 bushels per acre. Georgia production, however, increased 31% to 56 million bushels based on another record yield of 190 bushels per acre and 2950,000 acres harvested.

- **Corn Use Responds to High Prices** - Total corn use finished the 2011/12 marketing year at 12.527 billion bushels, down 4% from the previous year. Total use for 2012/13 marketing year is projected to fall nearly 11% to 10.2 billion bushels.

- **Ethanol Use Weakens** - Corn used for ethanol production was flat in 2011 at 5 billion bushels. However, ethanol production was ramped up at the end of 2011 to take advantage of the blender's tax credit. Use in 2013 is now projected fall back to 4.5 billion bushels.

- **Feed Use Continues to Fall** - Domestic feed use fell to 4.54 billion bushels in 2011 and continues to retract to 4.15 billion bushels. Livestock numbers are down but may beginning to show a bottom.

- **Global Supplies Still Relatively Tight** - Global corn stocks fell to historically low level, in terms of stocks-to-use ratio, due to drought in South America and then the U.S. Global feed, domestic use and exports are projected to increase, thus lowering ending stocks to 127 million metric tons. China realized record production offsetting U.S. decline in global production.

- **Tight Carryover Stocks Heading into 2013** - Once again the shortfall in U.S. production is greater than the decline in use leading to a projected carryover of 647 million bushels, 35% lower than 2012.

- **Prices Fall from Summer Highs, In a Sideways Pattern Due to Uncertainty of 2013.** - 2013 futures are roughly $1 below 2012 prices indicating a replenishing of supplies. A return to normal yields on current acreage would drop prices back to pre-May 2012 level when $6 per bushel would have been a good price.

Georgia Situation

Georgia growers planted 345,000 acres of corn in 2012, same as last year. Harvested acres increased from 270,000 to 295,000. Average yields set records again, passing the 2011 record of 158 bushels by leaps and bounds to 190 bushels per acre. Total corn production for Georgia jumped to 56 million bushels which is 31% more than last year. The 2012 production represents about 25 percent of the total corn needed for livestock and poultry production in Georgia.

Corn prices ranged between $6.00 and $7.25 prior to planting in 2012 and were headed to below $5.50 at the end of May until the drought in the Cornbelt became a bigger concern. Some producers marketed aggressively early around $7.00 per bushel and then nearby futures peaked in August at $8.30 per bushel. Georgia growers were fortunate to have record yields along with high prices. 2012 was one of those rare years when the lower correlation between price and yield for the Southeast turned out to be a positive for Georgia growers. The Georgia average price received in 2010/11 was $5.95 per bushel and 2011/12 was $7.30 per bushel. 2012/13 should be close to another record. USDA is projecting the 2012/13 U.S. season average price for corn to range between $6.80 and $8.00 per bushel. The current trend in demand has caused prices to fall a dollar in September and then begin a sideways pattern. Prices could rise again with signs of problems in South America where wet conditions in Argentina has made it too wet to plant all the corn intended. Rain is also needed in the Midwest to break the drought as well as Georgia.

2013 Outlook

The forecast for 2013 is for corn demand to slid as a result of high prices dropping below 11 billion bushels. Industrial use of corn has grown since 2007 driven by ethanol but 2013 will reverse this trend. The impact of the loss of the blenders credit and import tariff, high corn prices, lower oil prices, and recovery of South America ethanol production has been lower margins for ethanol plants. Imports from Brazil will come into the U.S. as exports of U.S. ethanol slows. Ethanol use is pegged at 4.5 billion bushels in 2013. This is down from 5 billion bushels last year but some of 2012 use was produced in 2011 as production was ramped up before the loss of the blender's tax credit. The value of the dollar has a major impact on exports and the U.S. dollar has begun to weaken in strength relative to the Euro, a major destination for corn exports. Use experienced some rationing due to high prices and a return of growth will have to be jumped started by either an improving export situation and global outlook, a drop in the value of the dollar or a large 2013 crop.

U.S. corn acres are expected to remain high in 2013 but may lose some ground to soybeans. The trend yield of 160 bushels is needed to build stocks and would result in a large production but trend yield talk has subsided in last year because weather has proven it difficult to reach since 2009. Prices relative to soybeans have lost some ground. Georgia, however, looks favorable for more corn acres. Low peanut prices and a weak cotton outlook make corn more competitive. The biggest concern is for water availability and the capacity to handle a bigger corn crop than 2012 in a timely manner.

The still short situation in the corn market should be supportive of prices in the first month of the year until the South American situation is better known. Once the crop is planted and acres are increased, the market will be driven by weather and yield estimates. Prices are expected to follow the pattern last year up until June. The question is will prices hold up into February for revenue insurance price projections. Favorable growing conditions should put downward pressure on prices and begin a recovery in demand. However, a crop lower than 13 billion bushels will create conditions similar to 2011. The most probable outlook right now is for corn prices to return to sub $6 per bushel once the crop is planted and moderate during the summer and fall of 2013.

Cost of Production

Variable costs again were higher than projected in some cases in 2012 because of increased irrigation. Expenses for 2013 are projected higher due to fuel and fertilizer. Dryland corn is projected up 7% and irrigated corn up 10%.

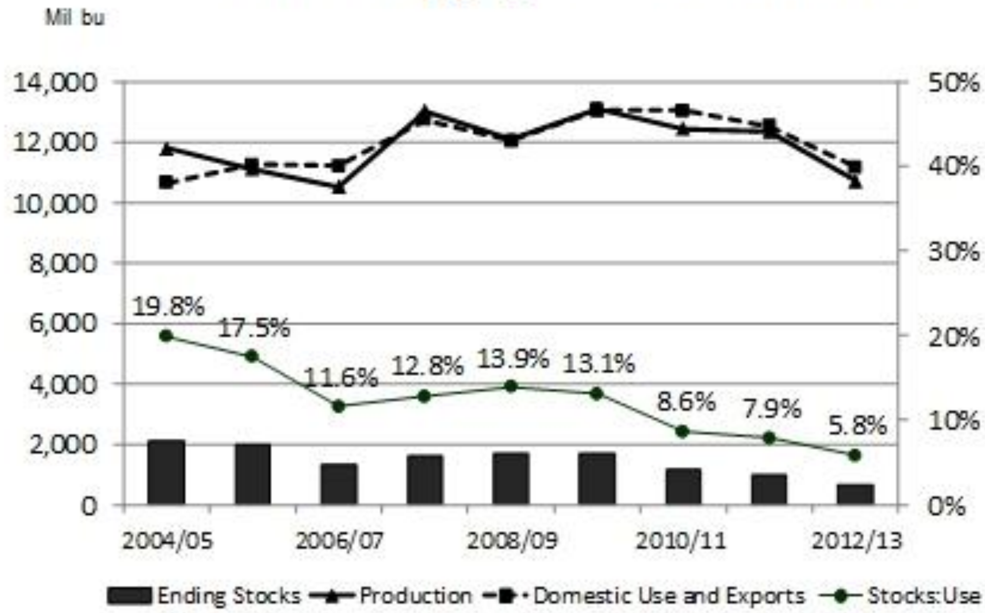
Seed, Fertilizer and Chemicals - Seed cost is projected to be about the same with some increases for new hybrid, stacked-gene varieties and some decreases for older varieties. Cost per bag will likely range again between $190 to $325 per bag depending on the variety and technology. Fertilizer prices are beginning to move up again with demand. A major factor that will determine fertilizer prices in the spring will be how much corn acres can hold. increase. A large increase in corn will push fertilizer prices up also. Nitrogen is priced in mid 60s to 75 cent range per pound of nutrient at the end of 2012. Phosphorus is estimated at 50 cent per pound of nutrient. Potash is estimated up at about 56 cents per pound. Chemical costs in general have been on the rise and but is offset by lower price of atrazine and glyphosate in the corn budget.

Cost of Borrowed Funds - The interest rate charged in the corn budgets is dependent upon what lending institutions pay for funds they lend. The prime lending rate hasn't moved from a year ago at 3.25%. Farmers in good financial standing should be able to qualify for a lower rate. The rate used for 2013 is 6.5% which is higher than using the usual rule of thumb.

Fuel and Energy Costs - Energy prices had been rising until the European crisis and a warm beginning to winter helped drop fuel prices. The 2013 budgeted price is $3.70 per gallon verses $3.55 in 2012 budgets. The irrigated corn budget charges an average of $11.50 per acre inch of water reflecting a 50/50 ratio of diesel and electric power sources.

Labor and Repairs - Operator labor rates remain at $12.00 per hour in the 2013 budget while machinery repairs are increased reflecting higher cost of equipment and parts.

U.S. Corn Supply and Demand



Source: USDA WASDE Report, 12/11/2012

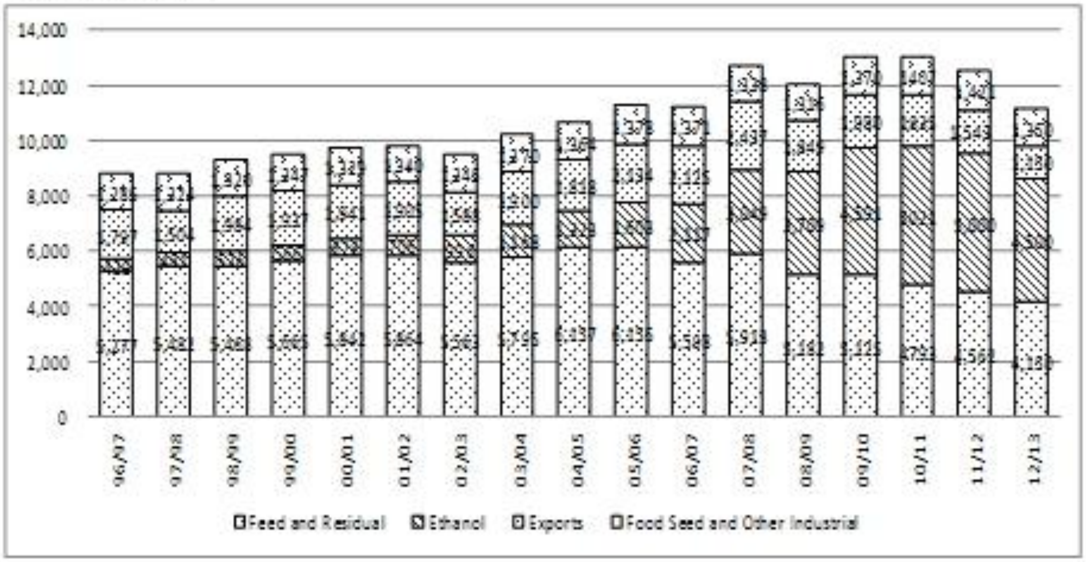
GA & US **Corn** Crops, 2010 -2012

	Planted Acres			Harvested Acres			Yield (bu/acre)		
	2010	2011	2011	2010	2011	2011	2010	2011	2011
GA (1,000)	295	345	345	245	270	295	145	158	190
US (million)	88.2	91.9	96.95	81.45	83.98	87.72	152.8	147.2	122

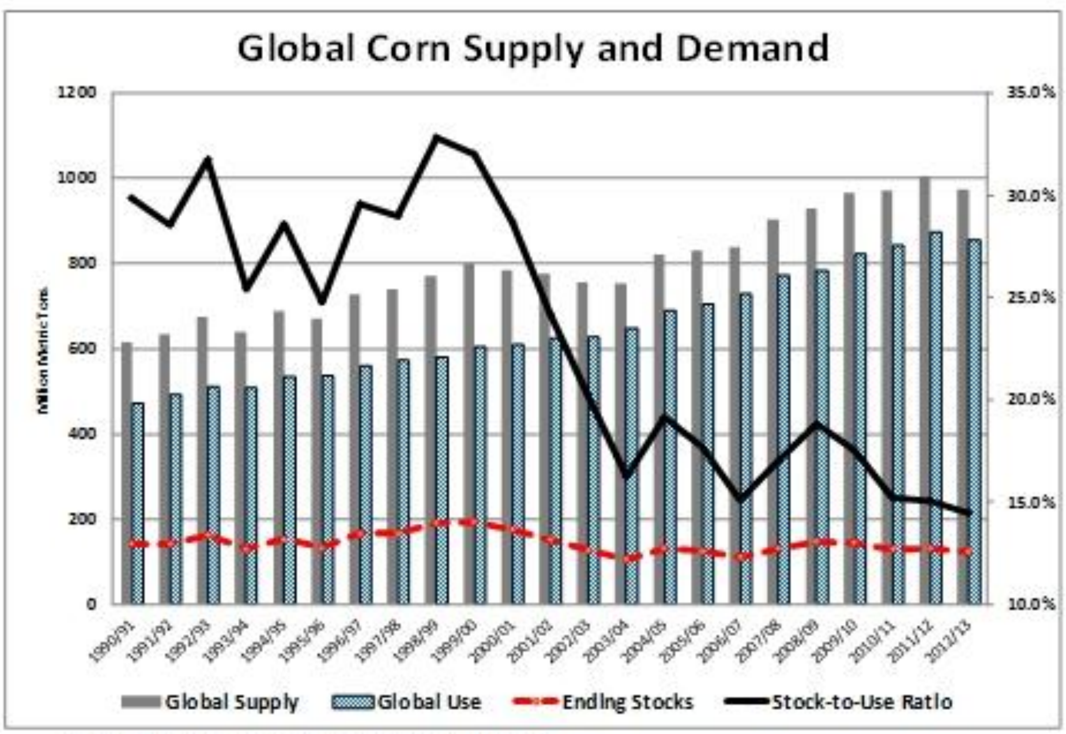
- U.S. planted acreage up 5.5% in 2012, GA even
- Harvested up 4.4% for U.S., GA up 9.2%
- U.S. production down 13.4%, GA up 31%

All Corn Uses Down

Million bushels

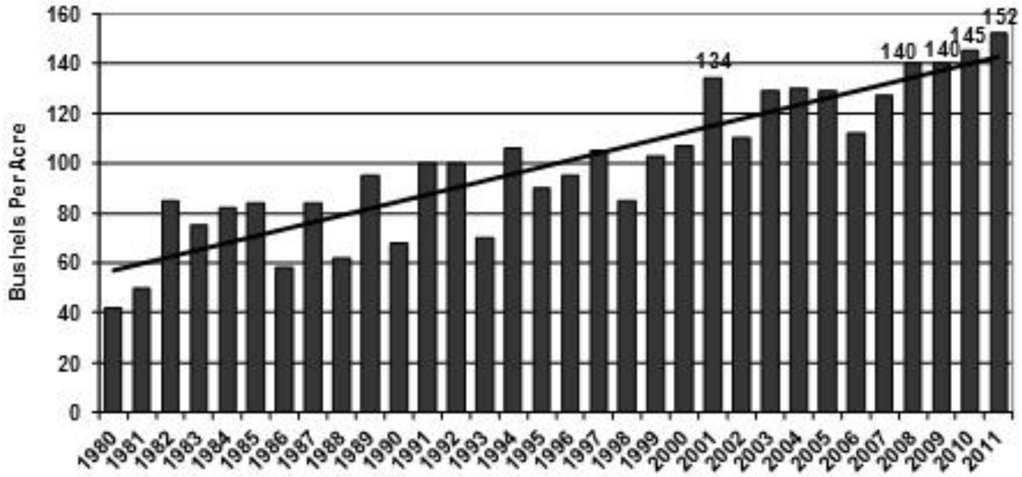


Source: USDA WASDE Report, 12/11/2012



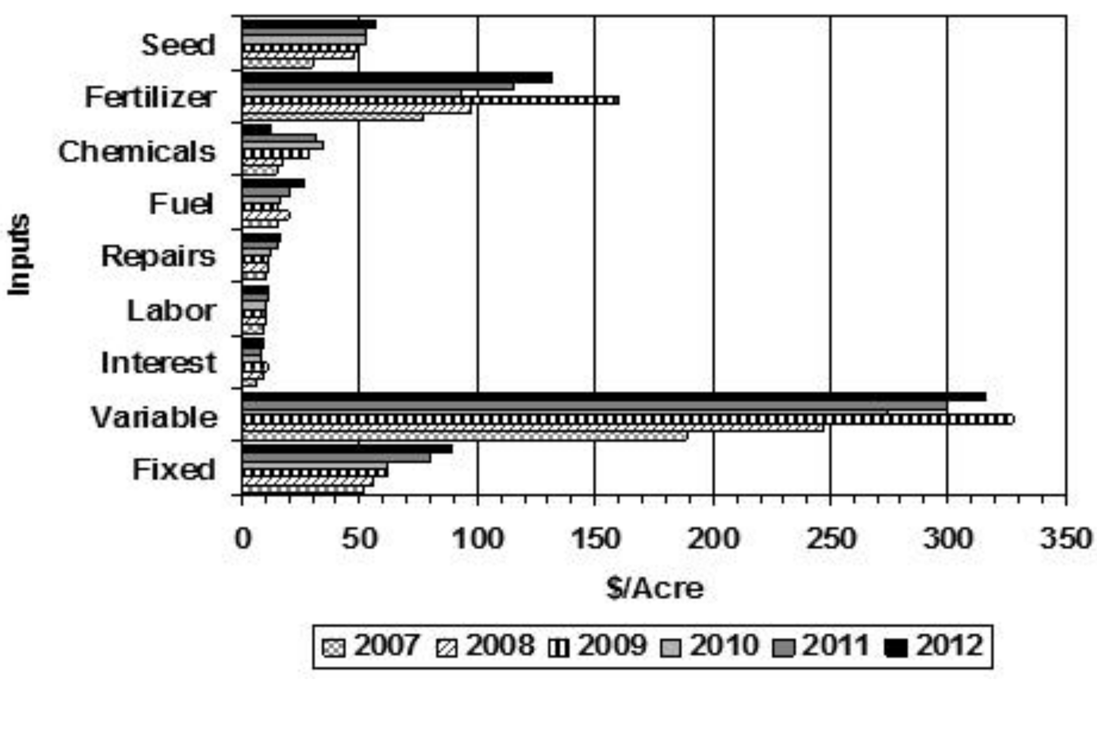
Source: USDA WASDE Report, 12/11/2012

Georgia Corn Yields



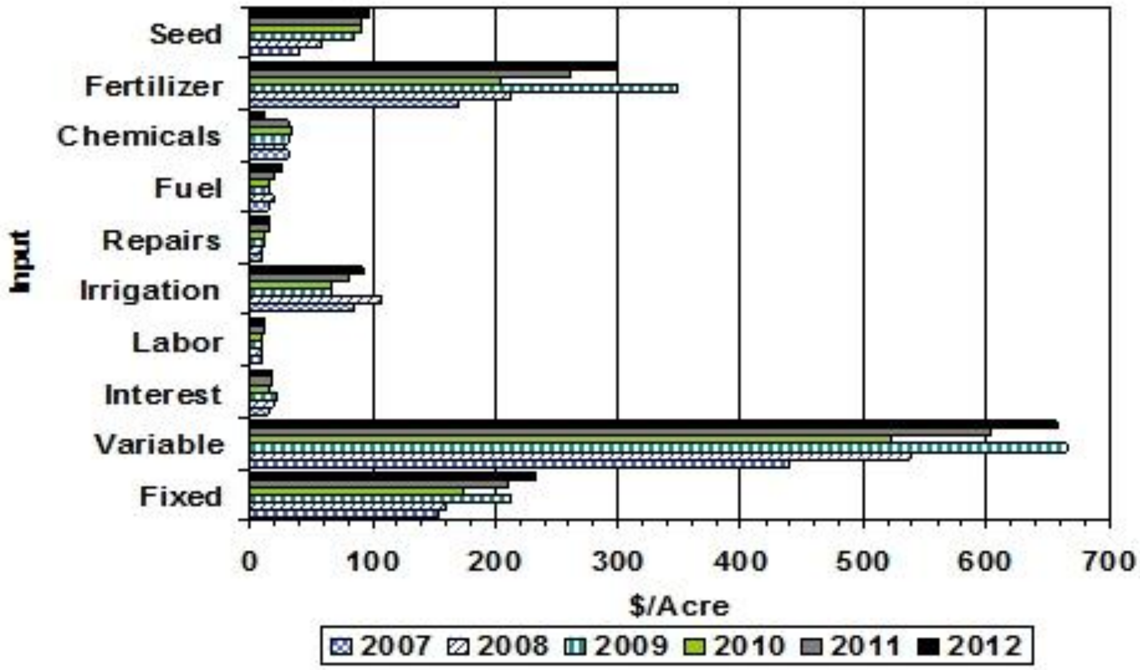
Corn Cost Estimates

Dryland Corn, Conventional



Corn Cost Estimates

Irrigated Corn, Conventional



2012 Corn Cost Analysis

Practice	Dryland		Irrigated	
Yield	85 bu		200 bu	
	Per Acre	Per Bu	Per Acre	Per Bu
Variable Costs	$328	$3.86	$664	$3.32
Fixed Costs	$71	$0.84	$197	$0.99
Management	$16	$0.19	$33	$0.17
Total Costs	$415	$4.89	$894	$4.47

Breakeven Yield bu/ac	$5	$5.5	$6	$5	$5.5	$6
for Variable Costs	66	60	55	133	121	111
for Total Costs	83	76	69	179	163	149

Non-Irrigated Corn

South Georgia, 2012

Estimated Costs and Returns

Expected Yield: **85** bushel

Variable Costs	**Unit**	**Amount**	**$/Unit**	**Cost/Acre**	**$/bushel**
Seed	thousand	20	$ 2.85	$ 57.00	$ 0.67
Lime	ton	0.25	$ 35.00	$ 8.75	$ 0.10
Fertilizer					
Nitrogen	pounds	100	$ 0.68	$ 68.00	$ 0.80
Phosphate	pounds	40	$ 0.50	$ 20.00	$ 0.24
Potash	pounds	60	$ 0.58	$ 34.80	$ 0.41
Weed Control	acre	1	$ 12.40	$ 12.40	$ 0.15
Insect Control	acre	1	$ -	$ -	$ -
Disease Control	acre	1	$ -	$ -	$ -
Preharvest Machinery					
Fuel	gallon	4.7	$ 3.55	$ 16.75	$ 0.20
Repairs and Maintenance	acre	1	$ 9.83	$ 9.83	$ 0.12
Harvest Machinery					
Fuel	gallon	2.5	$ 3.55	$ 8.99	$ 0.11
Repairs and Maintenance	acre	1	$ 6.45	$ 6.45	$ 0.08
Labor	hours	1.0	$ 11.25	$ 11.35	$ 0.13
Crop Insurance	acre	1	$ 26.00	$ 26.00	$ 0.31
Land Rent	acre	1	$ -	$ -	$ -
Interest on Operating Capital	percent	$ 140.16	6.5%	$ 9.11	$ 0.11
Drying - 8 Points	bushel	93	$ 0.28	$ 26.12	$ 0.31
Total Variable Costs:				**$ 315.55**	**$ 3.71**
Fixed Costs					
Machinery Depreciation, Taxes, Insurance and Housing					
Preharvest Machinery	acre	1	$ 27.01	$ 27.01	$ 0.32
Harvest Machinery	acre	1	$ 30.69	$ 30.69	$ 0.36
General Overhead	% of VC	$ 315.55	5%	$ 15.78	$ 0.19
Management	% of VC	$ 315.55	5%	$ 15.78	$ 0.19
Owned Land Cost, Taxes, Cash Payment, etc.	acre	1	$ -	$ -	$ -
Other ________________	acre	1	$ -	$ -	$ -
Total Fixed Costs				**$ 89.26**	**$ 1.05**
Total Costs Excluding Land				**$ 404.80**	**$ 4.76**
Your Profit Goal			**$**	________	**/bushel**
Price Needed for Profit			**$**		**/bushel**

Excel template developed by Nathan Smith and Amanda Smith. Data may be modified by the user to more closely reflect their operation. UGA estimates are available online at http://www.ces.uga.edu/Agriculture/agecon/agecon.html.

Sensitivity Analysis of Non-Irrigated Corn

Net Returns Above Variable Costs Per Acre

Varying Prices and Yields (bushel)

	-25%	-10%	Expected	+10%	+25%
Price \ bushel/Acre	64	77	85	94	106
$5.00	**$3.20**	**$66.95**	**$109.45**	**$151.95**	**$215.70**
$5.50	**$35.08**	**$105.20**	**$151.95**	**$198.70**	**$268.83**
$6.00	**$66.95**	**$143.45**	**$194.45**	**$245.45**	**$321.95**
$6.50	**$98.83**	**$181.70**	**$236.95**	**$292.20**	**$375.08**
$7.00	**$130.70**	**$219.95**	**$279.45**	**$338.95**	**$428.20**

Estimated Labor and Machinery Costs per Acre

Preharvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use* (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Heavy Disk 27' with Tractor (180-199 hp) MFWD 190	13.2	2	0.19	1.48	$ 3.19	$ 9.27
Disk Harrow 32' with Tractor (180-199 hp) MFWD 190	16.3	1	0.08	0.60	$ 1.41	$ 4.08
Bed-Disk (Hipper) 6R-36 with Tractor (180-199 hp) MFWD 190	9.6	1	0.13	1.02	$ 1.39	$ 4.30
Plant - Rigid 6R-36 with Tractor (120-139 hp) 2WD 130	9.5	1	0.13	0.70	$ 1.67	$ 4.66
Fert Appl (Liquid) 6R-36 with Tractor (120-139 hp) 2WD 130	9.2	1	0.14	0.73	$ 1.83	$ 3.88
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	1	0.04	0.19	$ 0.34	$ 0.82
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
Total Preharvest Values			0.70	4.72	$ 9.83	$ 27.01

Harvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use* (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
					$ -	$ -
Header - Corn 6R-36 with Combine (200-249 hp) 240 hp	6.5	1	0.19	1.90	$ 5.23	$ 27.40
Grain Cart Corn 500 bu with Tractor (120-139 hp) 2WD 130	10.6	1	0.12	0.63	$ 1.22	$ 3.29
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
Total Harvest Values			0.31	2.53	$ 6.45	$ 30.69

* Includes unallocated labor factor of 0.25. Unallocated labor factor is percentage allowance for additional labor required to move equipment and hook/unhook implements, etc.

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Irrigated Corn
South Georgia, 2012

Estimated Costs and Returns

Expected Yield:		**200**	bushel		

Variable Costs	Unit	Amount	$/Unit	Cost/Acre	$/bushel
Seed	thousand	30	$ 3.25	$ 97.50	$ 0.49
Lime	ton	0.5	$ 35.00	$ 17.50	$ 0.09
Fertilizer					
Nitrogen	pounds	240	$ 0.68	$ 163.20	$ 0.82
Phosphate	pounds	90	$ 0.50	$ 45.00	$ 0.23
Potash	pounds	125	$ 0.58	$ 72.50	$ 0.36
Weed Control	acre	1	$ 12.40	$ 12.40	$ 0.06
Insect Control	acre	1	$ -	$ -	$ -
Disease Control	acre	1	$ -	$ -	$ -
Preharvest Machinery					
Fuel	gallon	4.7	$ 3.55	$ 16.75	$ 0.08
Repairs and Maintenance	acre	1	$ 9.83	$ 9.83	$ 0.05
Harvest Machinery					
Fuel	gallon	2.5	$ 3.55	$ 8.99	$ 0.04
Repairs and Maintenance	acre	1	$ 6.45	$ 6.45	$ 0.03
Labor	hours	1.0	$ 11.25	$ 11.35	$ 0.06
Irrigation*	applications	8	$ 11.60	$ 92.80	$ 0.46
Crop Insurance	acre	1	$ 23.00	$ 23.00	$ 0.12
Land Rent	acre	1	$ -	$ -	$ -
Interest on Operating Capital	percent	$ 288.63	6.5%	$ 18.76	$ 0.09
Drying - 8 Points	bushel	220	$ 0.28	$ 61.46	$ 0.31
Total Variable Costs:				**$ 657.49**	**$ 3.29**
Fixed Costs					
Machinery Depreciation, Taxes, Insurance and Housing					
Preharvest Machinery	acre	1	$ 27.01	$ 27.01	$ 0.14
Harvest Machinery	acre	1	$ 30.69	$ 30.69	$ 0.15
Irrigation	acre	1	$110.00	$ 110.00	$ 0.55
General Overhead	% of VC	$ 657.49	5%	$ 32.87	$ 0.16
Management	% of VC	$ 657.49	5%	$ 32.87	$ 0.16
Owned Land Cost, Taxes, Cash Payment, etc.	acre	1	$ -	$ -	$ -
Other ________________	acre	1	$ -	$ -	$ -
Total Fixed Costs				**$ 233.45**	**$ 1.17**
Total Costs Excluding Land				**$ 890.94**	**$ 4.45**
Your Profit Goal			**$**	________	**/bushel**
Price Needed for Profit			**$**		**/bushel**

*Average of diesel and electric irrigation application costs. Electric is estimated at $7/appl and diesel is estimated at $16.20/appl when diesel costs $3.55/gal.

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Sensitivity Analysis of Irrigated Corn

Net Returns Above Variable Costs Per Acre

Varying Prices and Yields (bushel)

	-25%	-10%	Expected	+10%	+25%
Price \ bushel/Acre	150	180	200	220	250
$5.00	**$92.51**	**$242.51**	**$342.51**	**$442.51**	**$592.51**
$5.50	**$167.51**	**$332.51**	**$442.51**	**$552.51**	**$717.51**
$6.00	**$242.51**	**$422.51**	**$542.51**	**$662.51**	**$842.51**
$6.50	**$317.51**	**$512.51**	**$642.51**	**$772.51**	**$967.51**
$7.00	**$392.51**	**$602.51**	**$742.51**	**$882.51**	**$1,092.51**

Estimated Labor and Machinery Costs per Acre

Preharvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Heavy Disk 27' with Tractor (180-199 hp) MFWD 190	13.2	2	0.19	1.48	$ 3.19	$ 9.27
Disk Harrow 32' with Tractor (180-199 hp) MFWD 190	16.3	1	0.08	0.60	$ 1.41	$ 4.08
Bed-Disk (Hipper) 6R-36 with Tractor (180-199 hp) MFWD 190	9.6	1	0.13	1.02	$ 1.39	$ 4.30
Plant - Rigid 6R-36 with Tractor (120-139 hp) 2WD 130	9.5	1	0.13	0.70	$ 1.67	$ 4.66
Fert Appl (Liquid) 6R-36 with Tractor (120-139 hp) 2WD 130	9.2	1	0.14	0.73	$ 1.83	$ 3.88
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	1	0.04	0.19	$ 0.34	$ 0.82
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
Total Preharvest Values			0.70	4.72	$ 9.83	$ 27.01

Harvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
					$ -	$ -
Header - Corn 6R-36 with Combine (200-249 hp) 240 hp	6.5	1	0.19	1.90	$ 5.23	$ 27.40
Grain Cart Corn 500 bu with Tractor (120-139 hp) 2WD 130	10.6	1	0.12	0.63	$ 1.22	$ 3.29
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
Total Harvest Values			0.31	2.53	$ 6.45	$ 30.69

** Includes unallocated labor factor of 0.25. Unallocated labor factor is percentage allowance for additional labor required to move equipment and hook/unhook implements, etc.

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Non-Irrigated Corn, Strip Tillage

South Georgia, 2012

Estimated Costs and Returns

Expected Yield: **85** bushel

Variable Costs	**Unit**	**Amount**	**$/Unit**	**Cost/Acre**	**$/bushel**
Seed	thousand	20	$ 2.85	$ 57.00	$ 0.67
Cover Crop Seed	bushel	1.5	$ 20.00	$ 30.00	$ 0.35
Lime	ton	0.25	$ 35.00	$ 8.75	$ 0.10
Fertilizer					
Nitrogen	pounds	100	$ 0.68	$ 68.00	$ 0.80
Phosphate	pounds	40	$ 0.50	$ 20.00	$ 0.24
Potash	pounds	60	$ 0.58	$ 34.80	$ 0.41
Weed Control	acre	1	$ 15.50	$ 15.50	$ 0.18
Insect Control	acre	1	$ -	$ -	$ -
Disease Control	acre	1	$ -	$ -	$ -
Preharvest Machinery *					
Fuel	gallon	3.4	$ 3.55	$ 12.11	$ 0.14
Repairs and Maintenance	acre	1	$ 7.37	$ 7.37	$ 0.09
Harvest Machinery					
Fuel	gallon	2.5	$ 3.55	$ 8.99	$ 0.11
Repairs and Maintenance	acre	1	$ 6.45	$ 6.45	$ 0.08
Labor	hours	0.8	$ 11.25	$ 9.32	$ 0.11
Crop Insurance	acre	1	$ 26.00	$ 26.00	$ 0.31
Land Rent	acre	1	$ -	$ -	$ -
Interest on Operating Capital	percent	$ 152.14	6.5%	$ 9.89	$ 0.12
Drying - 8 Points	bushel	93	$ 0.28	$ 26.12	$ 0.31
Total Variable Costs:				**$ 340.30**	**$ 4.00**
Fixed Costs					
Machinery Depreciation, Taxes, Insurance and Housing					
Preharvest Machinery *	acre	1	$ 19.83	$ 19.83	$ 0.23
Harvest Machinery	acre	1	$ 30.69	$ 30.69	$ 0.36
General Overhead	% of VC	$ 340.30	5%	$ 17.01	$ 0.20
Management	% of VC	$ 340.30	5%	$ 17.01	$ 0.20
Owned Land Cost, Taxes, Cash Payment, etc.	acre	1	$ -	$ -	$ -
Other ________________	acre	1	$ -	$ -	$ -
Total Fixed Costs				**$ 84.55**	**$ 0.99**
Total Costs Excluding Land				**$ 424.85**	**$ 5.00**
Your Profit Goal			**$**	________	**/bushel**
Price Needed for Profit			**$**		**/bushel**

* Rip, strip and plant in one pass. Performing rip, strip and plant as separate operations increases preharvest fuel use by 0.6 gal ($2.13/ac), labor costs by $0.77/ac, and repairs by $0.80/ac. Fixed costs would increase by $2.30/ac.

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Sensitivity Analysis of Non-Irrigated Corn, Strip Tillage

Net Returns Above Variable Costs Per Acre

Varying Prices and Yields (bushel)

	-25%	-10%	Expected	+10%	+25%
Price \ bushel/Acre	64	77	85	94	106
$5.00	-$21.55	$42.20	$84.70	$127.20	$190.95
$5.50	$10.33	$80.45	$127.20	$173.95	$244.08
$6.00	$42.20	$118.70	$169.70	$220.70	$297.20
$6.50	$74.08	$156.95	$212.20	$267.45	$350.33
$7.00	$105.95	$195.20	$254.70	$314.20	$403.45

Estimated Labor and Machinery Costs per Acre

Preharvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Spin Spreader 5 ton with Tractor (120-139 hp) 2WD 130	23.8	1	0.05	0.28	$ 0.56	$ 1.59
Disk Harrow 32' with Tractor (180-199 hp) MFWD 190	16.3	1	0.08	0.60	$ 1.41	$ 4.08
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	1	0.04	0.19	$ 0.34	$ 0.82
ST Plant Rigid 6R-36 with Tractor (180-199 hp) MFWD 190	6.9	1	0.18	1.42	$ 2.89	$ 8.64
Fert Appl (Liquid) 6R-36 with Tractor (120-139 hp) 2WD 130	9.2	1	0.14	0.73	$ 1.83	$ 3.88
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	1	0.04	0.19	$ 0.34	$ 0.82
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
Total Preharvest Values			0.52	3.41	$ 7.37	$ 19.83

Harvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
					$ -	$ -
Header - Corn 6R-36 with Combine (200-249 hp) 240 hp	6.5	1	0.19	1.90	$ 5.23	$ 27.40
Grain Cart Corn 500 bu with Tractor (120-139 hp) 2WD 130	10.6	1	0.12	0.63	$ 1.22	$ 3.29
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
Total Harvest Values			0.31	2.53	$ 6.45	$ 30.69

** Includes unallocated labor factor of 0.25. Unallocated labor factor is percentage allowance for additional labor required to move equipment and hook/unhook implements, etc.

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Irrigated Corn, Strip Tillage
South Georgia, 2012

Estimated Costs and Returns

Expected Yield: **200** bushel

Variable Costs	Unit	Amount	$/Unit	Cost/Acre	$/bushel
Seed	thousand	30	$ 3.25	$ 97.50	$ 0.49
Cover Crop Seed	bushel	1.5	$ 20.00	$ 30.00	$ 0.15
Lime	ton	0.5	$ 35.00	$ 17.50	$ 0.09
Fertilizer					
Nitrogen	pounds	240	$ 0.68	$ 163.20	$ 0.82
Phosphate	pounds	90	$ 0.50	$ 45.00	$ 0.23
Potash	pounds	125	$ 0.58	$ 72.50	$ 0.36
Weed Control	acre	1	$ 15.50	$ 15.50	$ 0.08
Insect Control	acre	1	$ -	$ -	$ -
Disease Control	acre	1	$ -	$ -	$ -
Preharvest Machinery *					
Fuel	gallon	3.4	$ 3.55	$ 12.11	$ 0.06
Repairs and Maintenance	acre	1	$ 7.37	$ 7.37	$ 0.04
Harvest Machinery					
Fuel	gallon	2.5	$ 3.55	$ 8.99	$ 0.04
Repairs and Maintenance	acre	1	$ 6.45	$ 6.45	$ 0.03
Labor	hours	0.8	$ 11.25	$ 9.32	$ 0.05
Irrigation**	applications	7	$ 11.60	$ 81.20	$ 0.41
Crop Insurance	acre	1	$ 23.00	$ 23.00	$ 0.12
Land Rent	acre	1	$ -	$ -	$ -
Interest on Operating Capital	percent	$ 294.82	6.5%	$ 19.16	$ 0.10
Drying - 8 Points	bushel	220	$ 0.28	$ 61.46	$ 0.31
Total Variable Costs:				**$ 670.26**	**$ 3.35**
Fixed Costs					
Machinery Depreciation, Taxes, Insurance and Housing					
Preharvest Machinery *	acre	1	$ 19.83	$ 19.83	$ 0.10
Harvest Machinery	acre	1	$ 30.69	$ 30.69	$ 0.15
Irrigation	acre	1	$ 110.00	$ 110.00	$ 0.55
General Overhead	% of VC	$ 670.26	5%	$ 33.51	$ 0.17
Management	% of VC	$ 670.26	5%	$ 33.51	$ 0.17
Owned Land Cost, Taxes, Cash Payment, etc.	acre	1	$ -	$ -	$ -
Other ________________	acre	1	$ -	$ -	$ -
Total Fixed Costs				**$ 227.55**	**$ 1.14**
Total Costs Excluding Land				**$ 897.81**	**$ 4.49**
Your Profit Goal			**$**		**/bushel**
Price Needed for Profit			**$**		**/bushel**

* Rip, strip and plant in one pass. Performing rip, strip and plant as separate operations increases preharvest fuel use by 0.6 gal ($2.13/ac), labor costs by $0.77/ac, and repairs by $0.80/ac. Fixed costs would increase by $2.30/ac.

** Average of diesel and electric irrigation application costs. Electric is estimated at $7/appl and diesel is estimated at $16.20/appl when diesel costs $3.55/gal.

Excel template developed by Amanda Smith and Nathan Smith. Data may be modified by the user to more closely reflect their operation. UGA estimates are available online at http://www.ces.uga.edu/Agriculture/agecon/agecon.html.

Sensitivity Analysis of Irrigated Corn, Strip Tillage

Net Returns Above Variable Costs Per Acre

Varying Prices and Yields (bushel)

	-25%	-10%	Expected	+10%	+25%
Price \ bushel/Acre	150	180	200	220	250
$5.00	**$79.74**	**$229.74**	**$329.74**	**$429.74**	**$579.74**
$5.50	**$154.74**	**$319.74**	**$429.74**	**$539.74**	**$704.74**
$6.00	**$229.74**	**$409.74**	**$529.74**	**$649.74**	**$829.74**
$6.50	**$304.74**	**$499.74**	**$629.74**	**$759.74**	**$954.74**
$7.00	**$379.74**	**$589.74**	**$729.74**	**$869.74**	**$1,079.74**

Estimated Labor and Machinery Costs per Acre

Preharvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use*** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Spin Spreader 5 ton with Tractor (120-139 hp) 2WD 130	23.8	1	0.05	0.28	$ 0.56	$ 1.59
Disk Harrow 32' with Tractor (180-199 hp) MFWD 190	16.3	1	0.08	0.60	$ 1.41	$ 4.08
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	1	0.04	0.19	$ 0.34	$ 0.82
ST Plant Rigid 6R-36 with Tractor (180-199 hp) MFWD 190	6.9	1	0.18	1.42	$ 2.89	$ 8.64
Fert Appl (Liquid) 6R-36 with Tractor (120-139 hp) 2WD 130	9.2	1	0.14	0.73	$ 1.83	$ 3.88
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	1	0.04	0.19	$ 0.34	$ 0.82
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
Total Preharvest Values			0.52	3.41	$ 7.37	$ 19.83

Harvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use*** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
					$ -	$ -
Header - Corn 6R-36 with Combine (200-249 hp) 240 hp	6.5	1	0.19	1.90	$ 5.23	$ 27.40
Grain Cart Corn 500 bu with Tractor (120-139 hp) 2WD 130	10.6	1	0.12	0.63	$ 1.22	$ 3.29
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
Total Harvest Values			0.31	2.53	$ 6.45	$ 30.69

*** Includes unallocated labor factor of 0.25. Unallocated labor factor is percentage allowance for additional labor required to move equipment and hook/unhook implements, etc.

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GEORGIA COUNTY ESTIMATES

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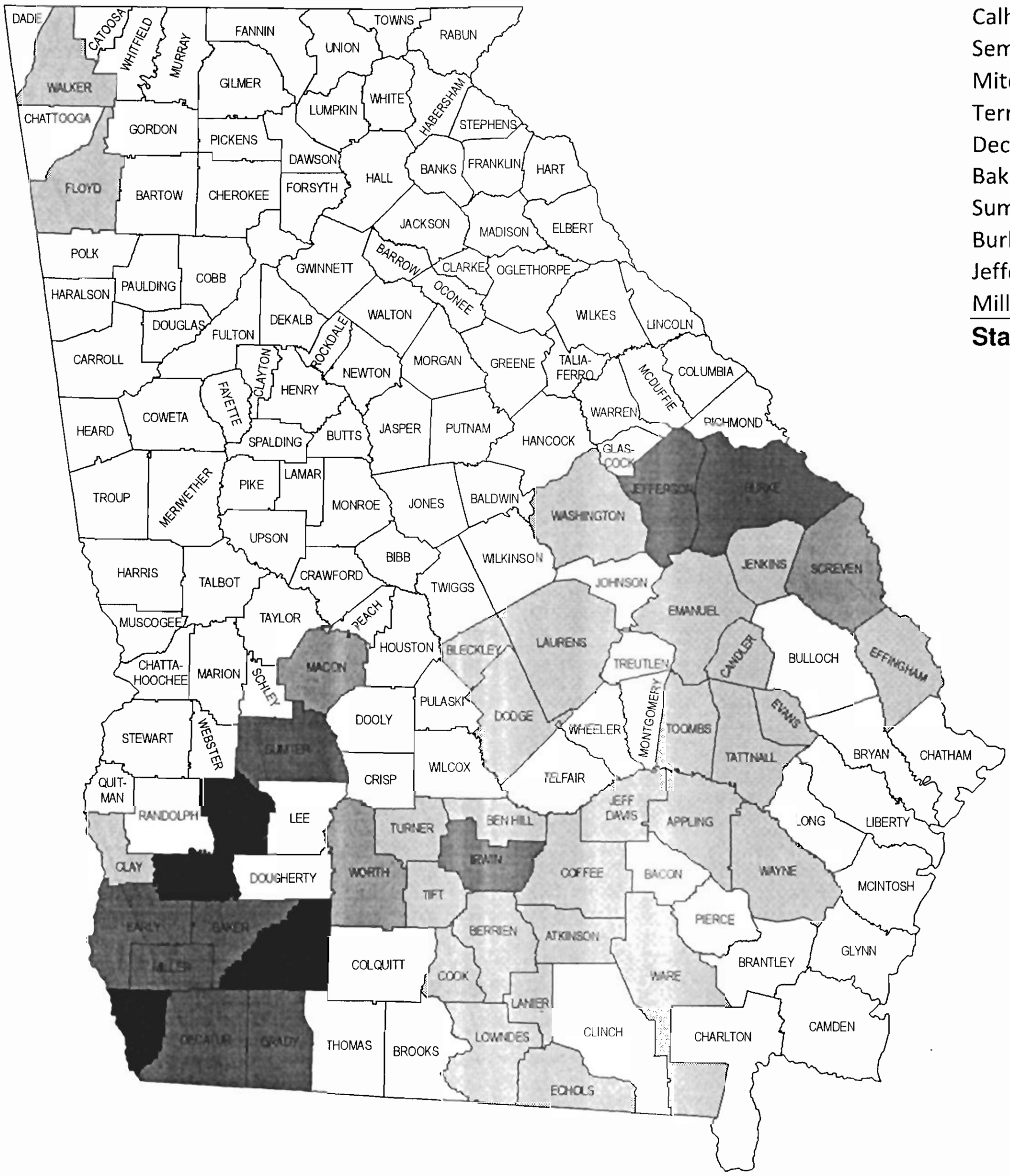
Corn
2009-2010

Released: July 2011

**Corn
Top Producing Counties
2010**

Calhoun	1,653,000 bu
Seminole	1,601,000 bu
Mitchell	1,575,000 bu
Terrell	1,533,000 bu
Decatur	1,442,000 bu
Baker	1,342,000 bu
Sumter	1,218,000 bu
Burke	1,141,000 bu
Jefferson	1,113,000 bu
Miller	1,109,000 bu
State Total	**35,525,000 bu**



Corn Production 2010

- Less than 100,000 bu*
- 100,000 - 499,999 bu
- 500,000 - 999,999 bu
- 1,000,000 - 1,499,999 bu
- 1,500,000 or more bu

*Includes County data not published to avoid disclosing individual operations.

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USDA/NASS COOPERATING WITH THE GEORGIA DEPARTMENT OF AGRICULTURE

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Scott Angle, Dean and Director