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Crop Physiology

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Estimating Potential Biomass Production of Crops

While we are currently entering the cooler months of the year it is not too early to look ahead and consider the principles involved in producing biomass during the warmer months. It is not uncommon to hear unreasonable and overly-optimistic projections of the amounts of biomass that plants can be expected to produce. Often these unreasonable projections are speculative relative to "new crops" that are touted as being capable of producing much larger biomass than is produced by our commonly-grown crops.

While complex, the biomass accumulation over time of crops growing under ideal conditions is well understood and can be predicted reasonably well if one knows the amount of sunlight received and the length of time (in days) that the crop fully intercepts light. Biomass accumulation of an annual crop generally follows a sigmoidal shape as illustrated for corn in the following graph:

Once a crop reaches full leaf canopy coverage (that is, it intercepts most of the available sunlight each day), the biomass accumulation per day is fairly constant until senescence begins to occur toward the end of the crop's life cycle, or near the end of the season. This means that the slope of the linear portion of the line multiplied by the length of time (in days) that the crop fully intercepts sunlight can be used to estimate total biomass produced.

Let's use the above example of corn. The rate of biomass accumulation (slope of the linear portion of the total biomass accumulation curve) of a wellmanaged crop is about 223 lbs.



per acre per day in this example. If the duration of the linear growth phase is 100 days, then the total biomass accumulated will be approximately 22,300 lbs. per acre, which is a typical biomass for a productive crop like corn.

To my knowledge there are no "magic" new crops that would be expected to produce significantly higher biomass <u>per day</u> (that is, have a significantly higher slope) than those produced by our already productive crops. Thus, the key to high biomass production is <u>high solar radiation (sunlight)</u> and <u>full interception of radiation over long periods of time</u>. Indeed, many of the crops being evaluated for bioenergy production accumulate biomass over long periods of time, but in fact may be no more productive than other crops on a daily basis. It is important to recognize that high biomass production requires significant inputs of water, nutrients, sunlight and other resources. The old adage that we "don't get something for nothing" certainly applies to production of biomass by plants.

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Cool-Season Grass – Fertilization

A profitable and sound fertilizer program should be based on having available nutrients in the soil according to the plant needs.

The nutrients required by forage plants in large amounts include nitrogen, phosphorus and potassium. They are also known as primary nutrients. Plants need other nutrients in smaller amounts and they are referred to as 'secondary' nutrients; they include calcium, magnesium, and sulfur. There are others required in even very small or trace amounts called micronutrients. Regardless of their classification all of them have a role in plant growth and production.

<u>Nitrogen</u> – This nutrient is usually the most limiting. Early-season N nutrition is



critical for strong growth and tillering. Excessive fall-applied N can lead to increased susceptibility to lodging, disease pressure, and freeze damage of cool-season grasses. The plant absorbable forms are highly soluble making it subject to leaching if applied in excess of the crop requirements. Typical applications in Florida are 20 to 40 lbN/ acre at planting, and 50 to 60 lbN after each harvest or grazing cycle.

<u>Phosphorus</u> – This nutrient is usually the second most limiting nutrient in forage plant production. Southern US soils are normally deficient except in effluent irrigated fields where it is commonly in excess. Phosphorus is critical in stand establishment because it is used for seedling root growth. *Phosphorus fertilizer rates should be applied according to soil test recommendations* or estimated crop removal. In Florida soils, recommendations range from 80 lb P_2O_5 if soil phosphorus is low or very low to 40 lb P_2O_5 if soil P is medium; all of the P_2O_5 should be applied pre-plant or at planting.

Potassium – This nutrient is essential for winter hardiness, disease resistance as well as moisture stress resistance. *Potassium fertilizer rates should be based on your soil test recommendations*. In Florida, fertilizer recommendations range from 80 lb K_2O (if soil potassium is low or very low) to 40 lb K_2O if soil potassium is medium. Typical applications are made at planting but split potassium applications are recommended with 50% at planting, and the remaining after first harvest or grazing.

<u>Micronutrients</u> – These include iron, manganese, boron, copper, zinc, molybdenum, nickel – These are very important but required in very small amounts; in large amounts they become toxic. In most cases they are available in the soil solution but if suspecting a deficiency, fertilization rates for micro minerals should be based on a soil test recommendation.

Weed Science

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Wild Radish Control in Small Grains

Wild radish (aka wild mustard) is common throughout the northern part of the state. This weed is difficult to manage, particularly because we have such a small window when the herbicide is most effective. Therefore, if growing a small grain crop, timing is key. Below is a list of options for managing this weed.

Crop	Herbicide	Recommendations
Wheat	Harmony Extra	Will only control small wild radish (2-4 leaf stage). Apply after wheat reaches 2 leaf stage, but before flag leaf forms.
	2,4-D	Must keep rates between 0.5 and 0.6 pounds of ac- tive ingredient (1 to 1.25 pints of a 3.8 lb/gal for- mulation). Will only control small wild radish. If bolting or flowering, control will not occur.
Oats	Harmony Extra	Apply after 3-leaf stage, but prior to jointing. Will not control large wild radish.
	2,4-D	Max use rate is 1 pt/A. Ester formulations are not recommended due to increased injury potential on oats.
Rye	2,4-D	Max rate is 1 pt/A. Ester formulations can be used.

As you can see from this table, there are no herbicides that will effectively control large radish. The only option is to scout the crop closely and apply the herbicides to small weeds.

Calendar of Events

To follow the link, press "Ctrl" and put cursor over link, and "click."

Nov 20	Drip Irrigation School, Suwannee Valley Agricultural Extension Center, Live Oak, FL. http://smallfarms.ifas.ufl.edu/
Dec 09	5th National Conference on Grazing Lands, Orlando, FL http://www.glci.org/5NCGL.html
Jan 6-8	American Forage and Grassland Council Annual conference, Covington KY http://www.afgc.org
Feb 4-7	Weed Science Society of America Annual Meeting, Baltimore, MD http://www.wssa.net

Weed Science

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Limited herbicide alternatives for perennial peanut in residential areas

Perennial peanut (*Arachis glabrata* Benth) is a legume that has traditionally been used as forage due to its high nutritional value and palatability to livestock. Over the last few years, the use of perennial peanut in residential and commercial areas in urban settings has increased, especially to provide vegetation ground cover where turfgrass species do not grow well. Perennial peanut has the advantage that



is a low maintenance species that requires less irrigation, fertilization and mowing and tolerates moderate levels of shading better than turfgrass species. This new use of perennial peanut has confronted landscapers and homeowners with the challenge of controlling weeds in a species for which there are few herbicides registered that can be used in residential and commercial areas. *So, what are the options?*

Pendimethalin applied at 1.48-to 1.98-ai lbs/acre can provide good preemergence (PRE) control of grasses such as crabgrass, goosegrass and annual bluegrass and broad-leaved species including spurge, cudweed, chickweed and oxalis.

Metolachlor is another herbicide that can be used for PRE control at rates of 1.24 to 2.48 lbs ai/ acre. This herbicide is absorbed by emerging seedlings and roots, so it needs to be incorporated into the soil with irrigation to become active. This herbicide will provide control of many annual grass weed species and also of sedges such as kyllinga, yellow nutsedge and annual sedges.

Glyphosate is a non-selective postemergence (POST) herbicide that is registered for urban settings and at 1.12 to 2.25 lbs ae/acre will show broad-spectrum weed control, but it will also injure the perennial peanut. Therefore, glyphosate must be used only to target weed patches (spotted applications), and replanting of perennial peanut is recommended in those areas after weed control.

2,4-D amine is registered for perennial peanut and can be used in residential and commercial areas. This herbicide is a good alternative for POST control of multiple broad-leaved species without killing the perennial peanut. Rates of 0.48 to 0.95 lbs ae/acre can be used once the perennial peanut is well established and has formed a dense canopy. However, when using this herbicide in gardens and urban landscapes there is a risk of affecting ornamental plants commonly grown close to the perennial peanut. *...Continues next page*

Weed Science

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Clethodim is a selective POST herbicide for the control of grass species that will not injure broad-leaved plants including perennial peanut. A rate of 2 oz ai/acre will provide adequate control of established annual grass weeds although two sequential applications 2 to 4 weeks apart with 4 oz ai/acre might be necessary to control established perennial grass species. This herbicide will injure and possibly kill turfgrass growing close to the perennial peanut, so measures must be taken to prevent drift in this type of situation.

These five herbicides have restrictions in the frequency and amounts that can be used per year. Therefore, it is important to remember that proper application timing is critical to maximize weed control. These herbicides must be used primarily to deal with serious weed infestations in which cultural practices might not be enough to keep weed populations in check. Also, the use of these herbicides in residential and commercial areas is strictly for lawn maintenance purposes, so the clippings resulting from mowing the perennial peanut must not be used for hay.

Homeowners and landscapers should consider the limited herbicide alternatives before choosing perennial peanut as a ground cover in urban settings, because most of the weed control will likely rely on mowing and hand weeding. Avoiding mowing too low and too frequently will allow the perennial peanut to develop a dense competitive canopy that will decrease weed germination, emergence and growth, reducing the need for herbicide use.



Perennial peanut used for landscaping in sunny and shady areas, mixed with ornamental plants. *Photo source:* EDIS HS960 Dr. Fred Fishel, Pesticide Information Director

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USDA Releases 2010 Pesticide Data Summary

USDA's Pesticide Data Program (PDP) annually tests a wide range of commodities in the U.S. food supply. PDP tests fresh and processed fruit and vegetables, grains, beef products, catfish, groundwater, and treated and untreated drinking water for pesticide residues. These data are important to ensure the implementation of the 1996 Food Quality Protection Act (FQPA) is followed. The FQPA requirements include stricter safety standards, especially for infants and children, and a complete reassessment of all existing pesticide tolerances. Thirteen states participated in 2010, including Florida. Sound conclusions about the U.S. food supply can be drawn from the PDP results because these states represent all regions of the U.S. and more than half the population.

During 2010, PDP tested 12,845 samples for various insecticides, herbicides, and fungicides. Of the 12,845 total samples collected and analyzed, 10,974 were fresh and processed fruit and vegetables. Of these, 9,211 were fresh product and 1,763 processed product. Other samples collected included water, catfish, eggs, and oats. Excluding water and catfish, only 29 samples (0.25%) contained pesticides that exceeded established tolerances.

PDP laboratory operations are designed to detect the smallest possible levels of pesticide residues possible, even when those levels are well below the safety margins established by EPA. It is important to note that the mere presence of a pesticide on food does not indicate the food is unsafe. For samples containing residues, the vast majority of the detections were well below established tolerances and/or action levels. Before allowing the use of a pesticide on food crops, EPA sets a tolerance, or maximum residue limit, which is the amount of pesticide residue allowed to remain in or on each treated food commodity. EPA also factors in large margins of safety when determining any given tolerance. The reporting of residues present at levels below the established tolerance serves to ensure and verify the safety of the U.S. food supply.



Of all samples collected and analyzed, the majority were fresh fruits and vegetables, many of which are often eaten in a fresh, raw state. Health experts and the U.S. Food and Drug Administration agree washing fresh fruit and vegetables before eating is a healthful habit. Consumers can reduce pesticide residues, if they are present, by washing fruit and vegetables with cool or lukewarm tap water. Such reports of data are reassuring to know that the U.S. not only has the world's most abundant food supply, but also the safest.