

**STRAWBERRY  
SRSFC AGENT TRAINING  
November 5-6, 2008**

Slide Script  
“Strawberry Production Update”  
Barclay Poling, NCSU

**Introduction:**

(Slide 1 - Purpose) My primary goal in this approximate one hour presentation is to provide you with a production update to the *2005 Southeast Regional Strawberry Plasticulture Production Guide* (Poling, Krewer, Smith), and I also hope to reserve a few minutes to discuss the new strawberry plasticulture enterprise budget (Oct. 2008) developed by Dr. Charles Safley and myself.

(Slide 2 – Older Guide) Since the publication of the 2005 production guide for the SRSFC website, there have been some important developments with varieties, plant material options and improved strategies for row cover management.

**A. Varieties (Spring Season):** Since Dr. Ballington will be concentrating on varieties for extended season production (summer and fall) and protected culture, I will be confining my comments to the performance of several spring season strawberry varieties.

(Slide 3 – Summary Table of Recommended Varieties)

(Slide 4 - Camarosa) In the last two years, we have observed a rather remarkable situation with Camarosa, variety that is showing potential for up to 8-9 weeks of fruiting, which is a significantly longer harvest period than Chandler, which typically does not exceed 5-6 weeks of fruiting. In hotter years, the Chandler season may be as short as four weeks, but Camarosa has the potential to continue production in warm periods, provided that the grower maintains excellent soil moisture conditions during hotter weeks in spring. In a later section of this presentation I will address the factors that “we think” are involved with this extended spring cropping potential with Cama

(Slide 5 – Sweet Charlie) Sadly, we seem to be losing a favorite early season strawberry cultivar, Sweet Charlie to PHYTOPHTHORA CROWN ROT, caused by *Phytophthora cactorum*. I am not sure, but perhaps the heavy rains in Canada this past summer had something to do with the greater scarcity of this variety. Traditionally, we have recommended that a typical pick-your-own and local sales type operation should include a “mix” of three varieties with 10 percent Sweet Charlie, 60 percent Chandler, and 30 percent Camarosa.

(Slide 6 – Galletta - an answer to Sweet Charlie?) A new strawberry variety developed at North Carolina State University ripens early in the growing season and produces big,

attractive, good-quality berries as you can see in this slide. In the Raleigh, NC area, Galletta ripens in late April to early May, which is a week to 10 days before Chandler, which is the most widely grown strawberry in North Carolina. Along the coast, Galletta may ripen as early as mid-April. It has particularly attractive fruit with a glossy finish. According to Dr. Ballington, the new variety produces better quality fruit than Sweet Charlie.

(Slide 7 – Variety Table) This table is a summary from the 2007-2008 season at Clayton.

Variety	Total Yd	Market Yd	Cull
Albion	22,351	21,749	602
Camarosa	35,826	33,848	1,978
Chandler	39,727	36,161	3,566
Festival	35,210	33,813	1,397
Galletta	26,767	25,810	957
Sweet Ch	22,356	21,327	1,029

(Slide 8 - Albion – a new dayneutral for the spring season?). Albion is a relatively new release from UC Davis expected to replace Seascape in commercial growing in California. The fruit is long, conical, symmetrical; firm with excellent flavor. It is believed to have some phytophthora crown rot and some resistance to anthracnose crown rot. This variety is expected to do quite well in the upper mountain regions like Laurel Springs (elevation 3,000 ft) for summer and early fall. The thing that has surprised me the most about this dayneutral is that it is even showing adaptation to lower elevation areas, and the data in the previous table at Clayton Central Crops indicated a marketable yield of 21,749 lbs/A. for Albion.

**B. Plant type and quality.** Plug plants are generally more expensive to purchase than freshly dug strawberry plants, but they do have the advantage of being suitable for mechanical transplanting with a water-wheel or disposable pot mulch planter. In contrast,

freshly dug plants are most often transplanted by hand. The establishment procedure for highly perishable freshly dug transplants depends on intense overhead sprinkling for one to two weeks, depending on weather, and the condition of the freshly dug plants. Freshly dug plants exposed to cooler temperatures, chilling in the nursery, or both will require less time for establishment than freshly dug plants produced in warmer climates. Commercial grower experiences in North Carolina with plug plants indicate that these do require overhead sprinklings for the first, second, and possibly third day following transplanting for approximately 5 hours, 3 hours, and 2 hours per day, respectively.

<Slide 9 - Plugs versus freshly dug plants> Freshly dug plants are not usually available until the final week of September, and this is too late for transplanting in colder regions: the upper piedmont, foothills, and mountains of North and South Carolina; the low mountains of Georgia, as in northwest Georgia and the south slope of the Blue Ridge Mountains; and the high mountains within the north slope of the Blue Ridge Mountains. However, if good quality freshly dug plants can be obtained in the third week of September, growers in warmer sections of Zone 6 may wish to evaluate freshly dug plants from the standpoint of their relative cost savings and the possibility of enjoying a harvest season that is not quite so concentrated in picking.

<Slide 10 - Plugs are definitely recommended over freshly dug plants for part-time growers> For growers who do not have the time to oversee the continuous overhead watering of freshly dug plants during the first week following field transplanting. Also, less experienced growers are encouraged to consider planting plugs because they are more "mistake-proof" than highly perishable freshly dug plants. Transplanting dates for plugs can also be slightly later than for freshly dug plants without as great a yield reduction. This is because plugs establish more quickly than freshly dug plants after transplanting.

<Slide 11 - "Cutoff" and "frigo" plants> Another type of transplant, called a "cutoff" or "tops off" plant is available in late October from northern California nurseries. These have accumulated considerable chilling in the nursery and have been mowed prior to digging and harvest. Cutoffs are only recommended for the very mildest winter areas in southeastern North Carolina, but not for areas further north or west. They may have some utility in coastal South Carolina and Georgia as well. Based on past research studies, fully dormant or "frigo" plants are not recommended for strawberry plasticulture in any parts of the Mid-South and Deep South.

### **C. Milder Winter Seasons (Global Warming?)**

(Slide 12 - Warm fall conditions in recent years). Other factors besides the planting date have an important influence on the final number of branch crowns produced. Fall weather

conditions following planting in early to mid-September can play a very important role in determining ultimate plant size. Fall temperatures may be so warm as to produce excessive plant size by harvest (more than six branch crowns). In North Carolina, growers who are especially interested in optimizing fruit size and shape will purposely set out a portion of their crop several days to one week later than recommended for their area in case of an unseasonably warm fall. Chandler plugs set at the “normal planting date” may produce two to three runners per plant in a warm fall, and removing these runners can involve a significant labor expense. In colder plasticulture regions in the Mid-South, such as the higher elevations in western North Carolina, it may be better to delay the winter row-cover application until late November or early December if you are experiencing an unusually warm fall season.

(Slide 13 – What to do when plants are set very late?). Growers can only “go so far” with later and later planting dates, and though I am in favor of setting perhaps a week later than “normal,” I do not recommend setting any later than this. However, in some years growers encounter very late deliveries of plants from their nursery suppliers, and in some cases in fall 2008, this was a very serious problem for NC growers. One of the very exciting adjustments I have seen in recent time to the problem of late plant delivery has been to apply a very light weight row cover, and I would personally even consider using a cover as light as 0.5 – 0.6 oz/sq yard, as this cover will provide nearly ideal light levels beneath the cover for late fall plant growth. I recommend against the use of heavier covers like a 1.5 oz/sq yard, as this will actually cause excessive shading. There is always the question of “when” the cover should be applied to achieve additional fall and winter season growth enhancement, and in the question and answer period I wish to address this subject in more detail.

#### **D. Changes in Row Cover Usage – An Update**

(Slide 14 - Important Reason Why Row Covers Appeal To Smaller Growers). The use of sprinkler irrigation to protect strawberry flower buds and blossoms has been the accepted practice for frost protection for many decades, and if a grower did not have an adequate water supply for overhead sprinkler irrigation system, he or she was simply advised to not go into strawberry production. The water requirement for an overhead sprinkler irrigation system is usually estimated on the basis of three consecutive frost or freeze nights. For example, 5.4 acre-inches of water (27,152 gallons equal 1 acre-inch) would be needed for sprinkling at the rate of 0.18 inch per hour (for control down to 24° F), for 10 continuous hours each night over three nights. Or 1.8 inch per night (10 hours times 0.18 inch) for three nights equals 5.4 acre-inches. An irrigation pond would need to hold about 150,000 gallons of water for each acre of plasticulture production under these conditions (5.4 inches times 27,152 gallons per acre-inch equals 146,620 gallons). That’s a lot of water!

(Slide 15 – Experience of Agent). The fact that small growers like Joey Knight have demonstrated that row covers can be used for late season frost and frost/freeze protection without overhead irrigation, is a fairly exciting development from the standpoint that

farmers with relatively limited water supplies can now grow strawberries in the plasticulture system, and achieve full crops in most seasons using the covers.

(Slide 16 – Georgia and SC). Normally, row covers are not applied for the entire winter season in Georgia and SC. But, it is important to use row covers in late winter freeze and frost/freeze situations that may occur in these states.

(Slide 17 – Critical Temperature Table). Strawberry flower buds begin to emerge from the end of January and sometimes even earlier in coastal Georgia and South Carolina. During this time, flower buds may be killed at temperatures below 22 F. Row covers work very well for tight bud stage, but lighter weight covers may not be reliable for popcorn and open blossom stages which can be killed in the range of 26.5 – 30. If you are using row covers as your only source of cold protection, then you should be prepared to lose some amount of crop, especially the popcorn and open blossom stages in late winter freezes. If you can supplement with sprinkler irrigation under colder conditions, this may be beneficial. Nonetheless, even if you do not have access to overhead irrigation to supplement row cover protection in late winter cold conditions, it is still true that row covers alone will be very beneficial compared to no protection. Windborne freezes can cause devastating crop losses and delay the harvest by one or two weeks in crops that are completely unprotected. Be sure to apply the row cover at least a day or two prior to windborne freeze events.

**E. Changes in Fumigant Use:** . I am also pleased that Rob Welker will be joining us for a full discussion of methyl bromide alternatives. I will be making a few remarks about our research with Midas 50:50 and Midas 98:2 at Clayton Central Crops. At this juncture I also wish to acknowledge the very important contribution of NCSU Research Associate, Rocco Schivaone, to our research program in strawberry plasticulture.

(Slide 18 – Yields with Midas). In the 2005-2006 season at Central Crops in Clayton, the total, marketable and cull yield were significantly greater for fumigated soil with Midas 50:50 compared with the control (Table 1). No statistical differences were detected for Midas 50:50 fumigation rates, but it was notable that the rate of 150 lb/acre produced the highest total and marketable yield in this trial. This information was also presented in an Orlando meeting in May 2006 when the EPA was reviewing Arysta LifeScience's request for an EUP. The 150 lb/acre broadcast rate would indicate that only 75 lb/acre of this product would be required for shank treatment in-the-bed in North Carolina, where a 5' row center is standard and the plastic mulch covered beds occupy 50% of an acre. The 100 lb/acre Midas 50:50 rate was not as satisfactory as the 150 lb rate/acre for either total or marketable yield. The control produced less than 50% of the total yield of fumigated plots.

Table 1. Yield of Chandler strawberry plants grown with different Midas 50:50 fumigant rates, Clayton Central Crops, 2005-2006

Midas 50:50	Total yield	Marketable yield	Cull yield	Crown
-------------	-------------	------------------	------------	-------

(broadcast rate)	(lb/acre)	(lb/acre)	(lb/acre)	number/plant
300 lb/acre	27,268 a	25,157 a	2,110 a	4.4 a
250 lb/acre	27,847 a	25,921 a	1,925 a	4.0 a
200 lb/acre	29,145 a	27,021 a	2,124 a	4.6 a
150 lb/acre	29,361 a	27,113 a	2,248 a	4.3 a
100 lb/acre	28,061 a	25,761 a	2,300 a	4.7 a
0 lb/acre (control)	13,939 b	12,832 b	1,106 b	2.4 b

In this study there did not appear to be any benefit associated with the use of metalized film covers compared to conventional polyethylene mulch films used in the North Carolina strawberry industry. However, it should be mentioned that we did encounter some problems in application of the metalized films due to their “slickness” and getting adequate tension in all directions was a definite problem with our application equipment.

(Slide 19 - 2006-2007 Season). We expanded our evaluations of plastic films in 2006-2007 to include Pliant Blockade (VIF), and also added methyl bromide:chloropicrin (67:33) treatments at 350 lb/A and 175 lb/A for comparison to Midas 50:50 at 125, 150 and 175 lb/A. The barrier film Pliant Blockade did appear to improve efficacy of MeBr:pic with 31,510 lb/A marketable fruit production vs. 28,051 with standard black LDPE at the 175 lb/A rate. However, we did not observe similar results with Midas 50:50 as the 175 lb/A rate with black LDPE plastic produced yields of 32,030 per acre (highest in study). In contrast, marketable yields were 29,927 lb/A with Pliant black VIF and Midas 50:50 at 175 lb/A. Portions of the 2005-2006 and 2006-2007 studies will be repeated in 2007-2008 to try to understand why Midas 50:50 at rates of from 150 to 175 lb/A broadcast has performed so well in North Carolina conditions without the added expense for barrier film.

Additional questions from NC Agents on Telone: I wish to share a remark from Dr. Frank Louws to one of our new agents this fall about the use of Telone. The question related to a tobacco grower who wanted to use C-17 and not C-35. Here is Frank’s recommendation: “The more chloropicrin content the better. In fact, 96% chloropicrin gives the best strawberry yields (if there is low to no weed pressure). Telone C17 will help - but is not optimal. I do not have a recommended range of rates. If the grower rotates and has not had a history of soilborne diseases I would use the lower label rate. If the grower does not rotate and/or has a history of stunting and poor crop performance, I would migrate toward the higher rate on the label.

**F. Economics:** Dr. Charles Safley and I have just completed a new enterprise budget for plasticulture strawberries in mid-October and this budget is included in your notebook immediately following this presentation. In this final portion of this presentation I wish to share our most recent information on the costs and returns we are projecting for a “typical” 5 acre U-Pick/Ready Pick grower.

(Slide 20 – Assumptions)

Fuel Prices:

Regular Gas	\$3.50	per gallon
Diesel Fuel	\$4.00	per gallon

Fumigation and Plastic Mulch Bed Costs:\*

Midas 50:50 (88 lb in the bed)	\$9.00	per lb
VIF Plastic Film (1.25 ml, 4 rolls)	\$162.00	per roll (2400')
Drip tape (1.6 rolls)	\$192.00	per roll

\* the budget builds in a 10% higher use rate per acre for fumigant, plastic film and drip tape than generally recommended. This takes into account the field experiences of commercial applicators in NC who use about 10% more fumigant, plastic film and drip tape per acre when laying plastic. For example, the budget shows a usage rate of 88 lb/A in-the-bed for Midas 50:50, to reflect the fact that about 10% more product is used than the recommended rate of 80 lb/A (160 lb/A broadcast).

Row cover:

1 ounce per sq yd (Gro-Guard)	\$0.245	per sq yd
-------------------------------	---------	-----------

Labor Costs:

Employee:

Base Wage Rate	\$7.00	per hour
Employer Costs <sup>1</sup>	\$7.91	per hour

Owner/Supervisor

Base Wage Rate	\$15.00	per hour
Employer Costs <sup>1</sup>	\$16.84	per hour

<sup>1</sup> Employer costs includes estimated SSN, Unemployment Insurance and Workman's Compensation Insurance

Irrigation Systems:

Drip Irrigation System	\$6,031	per five acres
Frost Protection	\$14,712	per five acres

Strawberry Plants:

Plants Planted	15,000	per acre
Cost per Plant	\$0.22	each
Four Quart Baskets	\$0.68	each

(Slide 21 – Summary) I wish to conclude with my “top ten” costly mistakes from the 2007-2008 season, and this information on “Avoiding Costly Mistakes” is most appropriately shared with new growers you come into contact with as horticultural extension agents:

1. *Rule Number One* is to always carefully read the label for all pesticides you plan to apply. Follow all applicator safety requirements. Pesticide certification exams are administered by the NCDA&CS Pesticide Section (and comparable divisions and sections in other states), and your County Extension Agent can assist you in getting enrolled in a Training School. Also, be sure you have positively identified a pest before applying control measures! Do you know for sure what you are trying control? Sometimes a simple phone call to your agent can keep you from making an application of a product that will not control the problem you are having!
2. *Rule Number Two* is to make sure there is adequate moisture in strawberry plasticulture beds for fumigant application. Methyl bromide applied to a soil that is relatively dry will be completely wasted.
3. *Rule Number Three* is to allow adequate time for what is called the plantback period (period from fumigation to planting) – methyl bromide 50%: chloropicrin 50% requires 14 days. Cutting corners on this waiting period can lead to a very costly crop reduction. So, be sure to allow adequate time for the plantback period. Other registered fumigants usually require as many as 3 weeks for plantback. In fall 2008, one of the biggest surprises a number of new and veteran growers had was finding how much “gas” could still be detected when they tried to start planting a few days before the required plantback with MeBr:pic 50:50. The fumigant will not dissipate as quickly in moist clay soils and in areas of the field that had higher soil moisture at fumigation time
4. *Rule Number Four* is to be fully familiar with proper planting techniques for the type of transplant (plug, fresh dug or cutoff) you are using. It is critical to set plants at the right depth, and roots must be straight down (no J-rooted) and the growing point of the crown must never be covered in soil. Plugs that are set too shallow will have tremendous issues with “wicking out”. Fresh dug require continuous irrigation for at least 7-10 days from around 9 am to 5 pm. If you notice anything that doesn’t look quite right about your plugs/fresh dug plants, be sure to call your agent as soon as possible!
5. *Rule Number Five* is to be ready to put into place an electric fence soon after planting for deer control. Deer can become a problem in October soon after planting, and by early November they can destroy a new strawberry patch.
6. *Rule Number Six* is to have a 5x or greater magnifying glass for sampling new transplants for two-spotted spider mites soon after planting. In some years, mites can even be a problem in the plug trays. Gather 60 leaflets from throughout the new field and examine the underside carefully for presence of mites or their eggs. In warm production areas like NC, a 5% threshold of infested leaflets can warrant control measures. If you are using Acramite, be aware that this product can be used only one time each season (once in the fall and once in the spring).

7. *Rule Number Seven* is to be very cautious about fertilizer use in the post plant period – the pre-plant dry fertilizer application is almost always more than adequate. Further fertilizer application in the fall should only be made through the drip, and before this is done be sure you take a Plant Tissue Sample.
8. *Rule Number Eight* is to not lose any time in getting suspicious looking plants that may have a disease, such as Colletotrichum crown rot (petiole rot), diagnosed by the Plant Disease and Insect Clinic. New plantings that are heavily infected may not produce an economical crop, and if the problem is caught early enough in the fall, the producer may be able to locate a new source of plants and have the option to replant. But, past the 1<sup>st</sup> of November there is very little you can do, so act quickly to get any suspicious looking plants diagnosed. Be sure to not set the new plants in the same holes where anthracnose infected transplants grew. We remain “hopeful” that we will not see the kinds of issues with Colletotrichum crown rot (petiole rot) that we saw in 2007-2008
9. *Rule Number Nine* is to carefully evaluate the water requirements for frost protection in the spring and determine whether you might have enough water to handle as many as 10-12 nights of cold protection? If you do not have enough water for overhead sprinkling, then you must order a row cover! The best overall weight cover is 1.5 oz for general cold protection.
10. *Rule Number Ten* is to not overlook the value of having 2 healthy hives of honey bees per acre, especially with the Chandler variety.

(Slide 22) Thanks for your attention!