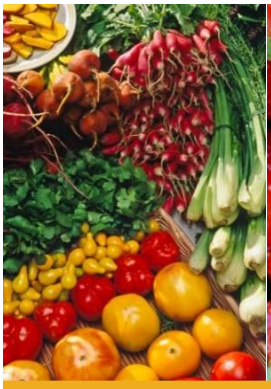

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SANTA BARBARA COUNTY
UC COOPERATIVE EXTENSION
2156 Sierra Way Suite C
San Luis Obispo, CA 93401
Phone: 805.781.5940
Fax: 805.781.4316

Email:cesantabarbara@ucdavis.edu
cesanluisobispo@ucdavis.edu

EDITOR
Surendra Dara, PhD, DAIT
Strawberry and Vegetable Crops Advisor

ASSISTANT EDITOR
Ingrid Schumann AA III

AUTHORS
Mark Gaskell
Tim Hartz
Tom Bottoms
Surendra Dara

CONTENTS

Considerations for Raspberry and Blackberry Production Using Soil-less and Containerized Production

Mark Gaskell, Small Farms and Specialty Crops Advisor, UCCE San Luis Obispo and Santa Barbara Counties

A number of different soil-less production systems for strawberries have been available for many years and research and field development projects continue to expand soil-less field production options for strawberries. Historically, these systems have been designed for specialized situations, often involving hydroponics and/or a desire to more thoroughly control the production environment, and where field conditions are limited. Blueberries are also grown, from time to time, on a limited scale in containers, often with a desire to more carefully control soil conditions than actual soil-less production. More recently, soil-less strawberry production systems are also being evaluated as alternatives for methyl-bromide application, serious soil and water restrictions, soil pests and weeds, or other regulatory issues.

Initial efforts with floricane raspberries

Over the past decade, similar efforts have evolved to also produce caneberries – raspberries and blackberries - in soil-less production systems. Initially, those systems were developed to allow production of raspberries in the winter or early spring in greenhouses and tunnels. These early production systems for out-of-season raspberry production often involve planting in pots or other containers to aid with winter chilling of floricane fruiting varieties that can then be moved into the warmer conditions to force early flowering and fruiting. Some of this containerized, soil-less production systems for raspberries have shown promise for winter production and can be a real alternative for those situations where out-of- season production is limited to floricane fruiting types. In each soil-less culture case however, onsiderable increase in costs related to the management, additional materials, and labor cannot always be justified; particularly when these costs are added to already high controlled environment costs.

The evolution of primocane fruiting raspberries over the past 20 years has enabled successful expansion of out-of-season production of raspberries under tunnels. These systems based on primocane fruiting raspberries in field tunnels are increasing and are becoming the backbone for raspberry production worldwide. These newer primocane fruiting raspberry varieties combine high fruit quality and productivity. The primocane types also can be readily produced in the field soil without the need for moving or chilling the plants. They can be managed to produce during nearly any time of the year in mild climates and with management adjustments can be fit into a wide range of environmental conditions. And more recently, PrimeArk-45, Reuben, and other primocane fruiting blackberries have been developed that offer more options for extended season production.

There are instances however, where selected floricane fruiting varieties maintain important advantages over the newer primocane types. In many European Union markets such as Germany, Italy, France, and United Kingdom, there is a consistent market preference for the Tulameen floricane raspberry fruit. Tulameen has for many years been considered the "gold standard" for raspberries in many markets worldwide. This preference can often lead to market price premiums of 100% or more for Tulameen over any other variety currently available. Unlike the primocane types, Tulameen must receive adequate winter chill for flowering and fruiting. This means for out-of- season production of Tulameen, using different systems of moving container plants in and out of cold storage or digging, and cold-storing one-year-old canes often coupled with different soil-less culture forcing operations. Costs rise dramatically in these systems but since market prices are often considerably higher, the additional investment may be justified. In all cases where soil-less production is being considered, growers must carefully evaluate the cost/benefit trade-offs for soil-less culture vs. field planting given anticipated prices.

Critical factors limiting soil-less caneberry production

Soil-less raspberry and blackberry culture systems with floricane and primocane types have a number of different potential limitations for profitable production beyond the higher investment and higher management requirements. Most importantly, raspberry and blackberry plants are very different from strawberries, with much more vigorous vegetative growth and pruning options and more delicate fruit that must be matched with fruiting and market cycles.

Figure1. Soil-less raspberry production in pots.

Soil-less systems have been successfully used for crops such as tomatoes for many years, but tomatoes are typically grown at a much lower plant population than caneberries, are more tolerant of heat, fruit over a longer season, and the fruit is not as delicate or sensitive to stress as caneberries. The different media options typically used for soil-less production - from pine bark to peat to coir to perlite - each have special water and nutrient considerations that interact continually with plant growth stage, irrigation frequency, water quality, and environmental conditions. And these considerations are even more critical in a restricted root zone.

Container size can be a serious factor limiting caneberry development particularly when the plant population must be optimized for a limited costly space. In most cases, optimum plant densities for different caneberry varieties and growing conditions have not been clearly established for field planting and reliable information is very limited for soil-less culture. Similarly, optimum container size also is not well established for caneberries and there is an evolution toward less limiting container sizes (Figs 1-3.). Often these problems with media type and container size are further exacerbated by limitations with water quality, nutrient management, or warmer than optimum temperatures during fruit production.

Water management problems multiply

Water availability in a restricted container, coupled with salt accumulation, or marginal water, and periods of high water electrical conductivity (EC) related to the nutrition program can readily cause marginal or more serious plant stress. And with crops like raspberries, these problems very rapidly lead to deterioration in production and fruit quality. Additionally, the frequent leaching irrigation required to manage salts in a restricted rooting area also leaches soluble nutrients such as nitrogen and this sets the stage for off-site movement of nitrogen and accompany problems with ground and surface water contamination.

Figure 2. Soil-less raspberry production in grow bags.

Beyond the limitations for basic information on soil-less culture for caneberries there are additional challenges for managing the interplay of these factors in a production environment. Even with marginally adequate container size and knowledge of media, simple yet important factors such as irrigation distribution uniformity or leaching fraction, for example can be serious challenges for day-to-day management in soil-less media in a protected environment.

Figure 3. Soil-less raspberry production in suspended troughs.

Many environments with soil and water restrictions may have high pH and high amounts of bicarbonates. In these cases, even routine maintenance of drip irrigation systems to prevent salt or algae accumulation in the system can be challenging on many farms. And these problems multiply quickly with soil-less culture systems and the container is not as forgiving as the soil bed.

Caneberries are known to be sensitive to subtle shifts in the growing environment and the response can be very critical for production and fruit quality. There are alternatives for amending the chemical and physical environment of the field soil that may still be more cost effective and profitable than soil-less culture of caneberries. The many challenges for soil-less caneberry production should be carefully compared with costs and cyclical market price fluctuations to determine if an amended soil environment may in many instances, still be a more cost-effective option.

Strawberry Fertility Research Update

Tim Hartz, CE Vegetable Crops Specialist, and Tom Bottoms, Plant Sciences Department UC Davis

We are nearing completion of the second year of data collection on a California Strawberry Commission-funded research project examining fertility management in strawberries. One of the goals of this project is to evaluate ways to improve the efficiency of nitrogen fertilizer usage. More restrictive environmental water quality regulations

considered by the Regional Water Quality Control Board will require Central Coast growers to tighten up their operations to reduce the amount of nitrogen lost from their fields through leaching and surface runoff. While the final results from this project will not be available until later in the fall, we can make some general observations about nutrient dynamics in strawberry production, and suggest modifications of current fertilization practices.

When and how much nitrogen do strawberries take up?

We have done periodic sampling of whole plants in a number of commercial 'Albion' fields, in both the Watsonville and the Santa Maria areas, and determined the seasonal pattern of crop nitrogen uptake. Between the planting of crowns in the fall and the beginning of rapid growth in the spring (early March in Santa Maria, late March in Watsonville) the total plant nitrogen uptake is typically less than 20 lb/acre. From that point through the end of summer the crop nitrogen uptake is quite consistent, averaging approximately one lb/acre per day; vigorous, high yield fields, and fields with high plant populations, can run somewhat higher. Nitrogen uptake is about evenly split between the vegetative tissue and the fruit. By the end of August total crop nitrogen uptake appears to fall between 200-250 lb/acre for the average field. Nitrogen uptake undoubtedly slows as the weather cools in the fall.

How does the N uptake pattern match the pattern of N fertilization?

Based on a survey of growers in both production areas, the average seasonal nitrogen fertilization total averages approximately 200 lb/acre. For most growers this is split about evenly between a preplant application of controlled release fertilizer (CRF) and soluble nitrogen applied through irrigation during the fruiting season. On the surface, it would seem as though seasonal nitrogen fertilization and seasonal crop nitrogen uptake are in approximate balance;. However, the extensive field monitoring we have done has suggested some ways that nitrogen fertilization efficiency could be improved. Regarding CRF application, it is important to consider when the application is made, the nitrogen release rate characteristic of the material, and the amount applied. Most CRFs have a polymer coating that allows the fertilizer to escape through diffusion, which starts as soon as the material is placed into moist soil. The earlier the CRF application, the greater the amount of nitrogen that will be released before significant crop uptake occurs. If fields in which drip-applied fumigation is used, the period between CRF application and crown planting can be considerable and one might consider switching to a CRF with a slower nitrogen release rate. Even in fields in which the CRF application is made close to the date of planting, there will still be at least 4 months between application and when rapid crop nitrogen uptake begins in the spring. During this time, it is likely that the CRF will release more nitrogen than can be taken up by the crop. In wet years, the nitrogen released from the CRF during the winter is at risk of leaching before crop uptake occurs. The use of high rates of preplant CRF, or use of a product that releases most of its nitrogen before spring growth, would appear to be an inefficient practices.

Regarding nitrogen fertigation, our experience is that many growers regularly apply nitrogen in approximate balance with crop uptake over the fruiting season. Coupled with good irrigation management, this management approach limits nitrate leaching losses while maintaining good crop productivity. However, it has been our observation that some growers do not initiate nitrogen fertigation as early in the spring as needed. In March and April, 2011, we sampled a number of fields in which soil nitrate level was very low, just at the time that rapid spring growth was occurring. In a drier winter more residual soil nitrate, or nitrogen released from the CRF, may have remained in the root zone to support early spring growth. However, in a wet year, early spring soil sampling for nitrate analysis could be useful in identifying fields in which nitrogen fertigation should be started early.

Acknowledgement: UC Farm Advisors Mark Bolda, Mike Cahn, and Mark Gaskell have been integrally involved in this project, and many strawberry growers in both the Santa Maria and Watsonville areas have participated. We appreciate their contributions.

Japanese Dodder: An Exotic and Noxious Weed Found in Santa Barbara County

Surendra Dara, Strawberry and Vegetable Crops Advisor, UCCE San Luis Obispo and Santa Barbara Counties

Japanese dodder is an exotic parasitic weed which is a high priority noxious weed in California. It was recently detected in a natural wooded area in Lompoc. It is the first time it is reported in Santa Barbara County.

Biology: Japanese dodder, *Cuscuta japonica* is a parasitic plant that belongs to Convolvulaceae family (note that older literature refers to it as a member of Cuscutaceae family). It is a parasitic annual plant that has a slender, yellow stem with red spots and striations, and scale-like leaves. It produces haustoria (singular hostorium), which are root-like structures that penetrate the vascular tissue of the host and absorb nutrients and water. It can reproduce by seed and by vegetative means through fragments of the plant. Seed can germinate in soil, but the plant has to come in contact with a host to for the young shoot to survive beyond a few days. It appears that Japanese dodder seed produced in California is not viable and vegetative reproduction is the main source of propagation.

Host range: Japanese dodder has a wide host range that includes herbaceous annuals to woody shrubs and trees. Crop plants like corn, cucumber, egg plant, pea, pumpkins, soybean, and tomato, and ornamental shrubs, fruit and other trees are among the hosts that are parasitized by this weed.

Japanese dodder in Lompoc, CA. Photo by Matt Victoria, Santa Barbara Ag Commissioner's Office

Damage: Depending on the extent of infestation, damage can range from stunted growth to death. Japanese dodder growers faster and spreads to larger areas than the other dodders.

Dissemination: It is spread by equipment, birds, animals and people as seed and fragments of plant material. Gardening activities and improper composting and infested plant material can spread the weed. Intentional planting for medicinal purposes is thought to be a significant factor for the dissemination of this weed.

Management: Prevention of the infestation is the best way to manage Japanese dodder. Due to its current status a high priority regulated pest, one should not attempt to control or remove Japanese dodder if detected. It should be immediately reported to the local Ag Commissioner's office (805-681-5600 for Santa Barbara Co and 805-781-5910 for San Luis Obispo Co). Detailed information on Japanese dodder biology, identification, and reporting the infestation can be found at the following sources.

References: Santa Barbara Co Ag Commissioner's Office:
http://www.countyofsb.org/agcomm/wma.aspx?id=29344
UC IPM:
http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7496.html
CDFA Noxious Weed Information Project:
http://www.cdfa.ca.gov/plant/ipc/noxweedinfo/noxweedinfo_jdodder.htm
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Blogs

http://ucanr.org/blogs/BlackberryGrowerNotes/
Information of interest to blackberry growers or others

http://ucanr.org/blogs/BlueberryGrowerNotes/
Production and marketing information of interest to blueberry growers

http://ucanr.org/blogs/NotasdelProductordeArándano/
Información de producción y mercadeo en español para productores de arándano

http://ucanr.org/blogs/strawberries-vegetables/
Information on production and pest management practices for strawberries and vegetables

http://ucanr.org/blogs/pestnews
Information on various pests for growers and public

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