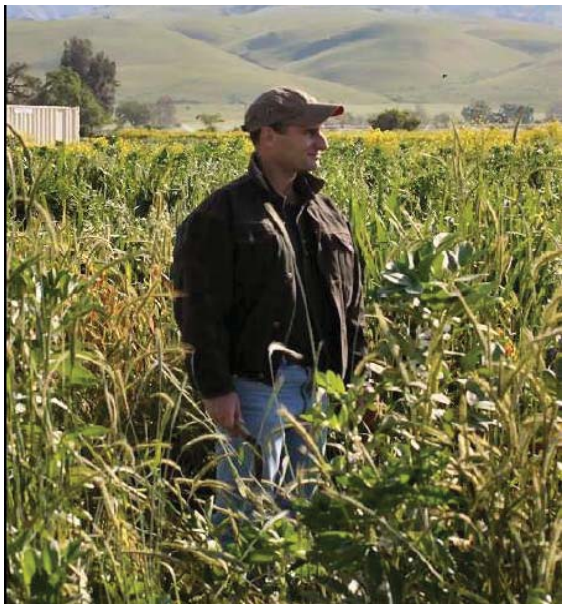
Cooperative Extension • Monterey County

Crop Notes

May/June, 2008

HUGH SMITH - NEW ENTOMOLOGY ADVISOR



Hugh Smith is the new Entomology Farm Advisor in Monterey, Santa Cruz and San Benito Counties. He will begin his position on July 1, 2008.
Hugh earned his BA in the Classics in 1986 at Brown University in Rhode Island and his MS and PhD in Entomology at the University of Florida in 1996 and 1999, respectively. He has worked in a number of capacities since obtaining his PhD. He was a visiting lecturer at the Universidad del Valle-Altiplano, Sololá in Guatemala, a consultant for Child Fund in Vietnam, a Fulbright visiting scholar in Guatemala and an agricultural entomologist in Hawaii and the Northern Mariana Islands. Most recently, Hugh worked for Bill Chaney for two years on an insect biological control project and served as Vegetable Crop and Strawberry Farm Advisor in Santa Barbara County since December, 2006.
Hugh comes with a solid background in entomology and excellent experience in researching entomological issues confronting vegetable and strawberry production. Hugh can be reached at 831-759-7359 or at hasmith@ucdavis.edu.

FOOD SAFETY AND SALINAS VALLEY CROPS: 3. RODENT CONTROL IN LEAFY GREEN VEGETABLE PRODUCTION

Terry Salmon, Richard Smith and Steve Koike
County Director and Extension Vertebrate Specialist, San Diego County and
Farm Advisors, Monterey County

This is the third of a series of articles dealing with the pathogenic bacterium *Escherichia coli* (abbreviated *E. coli*) within the context of leafy vegetable crops in California. The purpose of this article is to provide information on the identification, biology, and control of rodents. The presumed role of rodents in the spread of *E. coli* is also discussed.

Since the outbreak of *E. coli* 0157:H7 on spinach from California's central coast in September, 2006 there have been a number of measures proposed and implemented to help reduce the risk of microbial contamination in leafy green vegetables. Unfortunately, there is a lack of science based information supporting many of these practices. The presumed role of animals in the microbial contamination outbreaks has caused companies to require growers to exclude animals from fields. As a result, there have been efforts made to control rodents and other species by using traps, baits, and fences.

Terry Salmon, Extension Vertebrate Pest Specialist, gave a presentation on rodent control at the spring California Lettuce Research Board Meeting at Harris Ranch. He discussed the biology of rodents and issues that should be kept in mind when considering rodent control around leafy green vegetable fields. A brief summary of his talk is presented here.

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Common rodent species

Voles and Mice: Voles have stocky bodies with short legs and tails and ears that are partially hidden. They live underground and feed above ground. There are a number of mice species with the most common ones in our area being the deer mouse and house mouse. Voles like dense vegetation and can be discouraged by vegetation management; it is thought that a 15-30 foot wide area cleared of vegetation may deter them. However, deer mice are not readily discouraged by such open areas. Voles and mice can be controlled with rodenticide baits but you need to know the target animal to make the baiting program effective.

Ground Squirrels: California ground squirrels hibernate in the winter and breed once a year in the spring. They have 8-9 young per litter which live underground for six weeks before emerging. They eat green vegetation in the spring and seeds in the summer. Ground squirrels use vision in order to deal with threats from predators, and therefore need open areas in order to detect predators. Therefore, removing vegetation may create more favorable conditions for this species.

Rodent control

Rodents can be controlled by baits such as anticoagulants and zinc phosphide. Zinc phosphide bait is an acute toxicant and is registered for crop use only in alfalfa and artichokes. Anticoagulant baits must be fed upon for a few days, and death occurs in 5 -6 days. These baits are often placed in bait stations to keep them from being accessible to birds and other non-target animals. Broadcasting baits such as zinc phosphide and anticoagulants is acceptable if stated on the label. These baits are deposited on seeds and are not attractive to squirrels in the spring due to their preference for green feed at this time of year. The key to controlling ground squirrels is controlling the burrow system since new squirrels will invade the old systems. The USDA Food Safety Guidelines recommend that rodent pest "infestations" be controlled; however, it is unclear as to what constitutes an infestation. In general, using rodenticides indiscriminately and extensively is ill advised due to the risk for developing resistance in the rodent population. Other measures for controlling rodents include trapping. Exclusion fences may be effective for mice, but are not effective for ground squirrels.

In general, using rodenticides indiscriminately and extensively is ill advised due to the risk for developing resistance in the rodent population. Other measures for controlling rodents include trapping. Exclusion fences may be effective for mice, but are not effective for ground squirrels.

Rodents and foodborne pathogens

A brief review of pathogenic *E. coli* and animal involvement is helpful before discussing the presumed role of rodents in foodborne pathogen concerns. Extensive research has made it clear that cattle are by far the most common, prevalent, and important reservoir of *E. coli* pathogens such as the O157:H7 strain. Other ruminants such as sheep and goats can also carry these pathogens. Regarding non-ruminant animals as carriers of pathogenic *E. coli*, however, documented cases occur but are uncommon. The list includes domesticated animals such as cat, chicken, dog, horse, pig, and turkey. Wild animal carriers include deer, feral pig, Norwegian rat, rabbit, and wild birds (goose, gull, pigeon, sparrow, and starling). In many of these studies, the domesticated and wild animal carriers have been associated with dairy or beef cattle facilities; it is apparent that animals such as dogs, pigs, deer, rodents, and birds have been feeding on cattle feces or otherwise exposed to *E. coli* from cattle. When rats have tested positive for pathogenic *E. coli*, all the collected animals were living in and around cattle operations. In many of these studies, researchers question whether the non-cattle animals play a significant role in the persistence and spread of pathogenic *E. coli*.

The issue of rodent control for food safety purposes needs to be discussed in light of the research information available. To our knowledge, voles, mice, ground squirrels, and other rodents in coastal California agricultural fields have not been found to harbor pathogenic *E. coli*. Based on the studies mentioned above, it appears unlikely that these rodents will be found to be a common or important source of O157:H7 and other pathogenic strains. Therefore, unless future research findings indicate otherwise, it is hard to justify extensive trapping, baiting, fencing, and vegetation clearing for the specific purpose of reducing animal vectoring of *E. coli* O157:H7.

To our knowledge, voles, mice, ground squirrels, and other rodents in coastal California agricultural fields have not been found to harbor pathogenic *E. coli*. Based on the studies mentioned above, it appears unlikely that these rodents will be found to be a common or important source of O157:H7 and other pathogenic strains.

Summary

Controlling rodents around vegetable production fields must be carefully thought through due to the complex biology of the species involved. Creating open areas may discourage voles, but not mice and ground squirrels. The widespread use of baits could in the long run create resistance in the rodent species. Careful observation of rodent pest issues should be conducted and control efforts should be based on need. Additional research is necessary to determine if rodents in coastal agricultural areas are even involved in harboring or carrying pathogens such as *E. coli* O157:H7.

RESEARCH ON PRIMOCANE FRUITING BLACKBERRIES

Ellen Thompson, Consultant
Mark Bolda, UC Cooperative Extension, Santa Cruz County

A new type of blackberry is the primocane fruiting blackberry, meaning it fruits on the first year cane.

Historically, blackberries, like many other caneberries, have a perennial root system with biennial canes. The vegetative first year cane (known as the primocane) does not fruit and flower, while the second year cane (known as the floricane) is the cane which produces flowers and fruits.

A new type of blackberry is the primocane fruiting blackberry, meaning it fruits on the first year cane. The two varieties of primocane fruiting blackberry currently available from the University of Arkansas breeding program are called Prime-Jan and Prime-Jim. Both these varieties produce fruit in the late summer and fall of the first year from planting. Similar to primocane-fruiting raspberries, blackberries of this type can be cropped on the primocanes as well as the floricanes. Research, however, has focused on primocane management due to the ability to manipulate canes to adjust the target harvest time to achieve an advanced or delayed crop.

Investigation of Flowering and Fruiting Patterns of Primocane-fruiting Blackberry: Since the growth pattern of primocane-fruiting blackberry is different from both primocane-fruiting raspberry as well as floricane bearing blackberry, trials were done with the Prime-Jim and Prime-Jan varieties of primocane-fruiting blackberries. Two treatments were trialed in a standard design. One treatment was "soft-tipping" of the cane (removing the top 2.5 cm) once it had reached 1 meter in length, and an untipped standard. The goal of the tipped treatment was for the cane to begin producing lateral branches from below the point from which had been tipped.

The untipped primocane resulted in much longer and less branched canes, with an average number of one to two branches, and average branch length of 1.1 m. There were an average of 64 flowers per cane. The "soft tipped" cane had an average number of four to five branches, average branch length of 0.58 m and 89 flowers per cane. Branching tended to be more predictable on tipped canes, and flowers and fruit per lateral branch increased. The conclusion is that "soft-tipping" the cane of primocane-bearing blackberries results in a more productive, manageable cane.

Season Extension of Primocane-fruiting Blackberry Using Pruning, Tipping and High Tunnels:
The use of high tunnels is burgeoning in all major production regions of the world. High tunnels afford growers the ability to produce fruit in what was once the off season, and protects plants against UV rays and rain. Primocane-fruiting blackberries are well suited for this production practice, and this study was to test the effect of summer pruning and soft tipping in moving the harvest to mid-September through early October.
Two sets of treatments were conducted; one inside and one outside of a high tunnel. Treatments were as follows (m refers to height in meters): recut at 0.25 m, and then tipped at 0.5 m; re-cut at 0.5 m and tipped at 0.5 m; double tip (tip at 0.5 m, and tip branches when 0.5 m long); and tip at 0.5 m.

The results are as shown below in the tables below:

Primocane-fruiting blackberries are well suited for this production practice, and this study was to test the effect of summer pruning and soft tipping in moving the harvest to mid-September through early October.

The effect of primocane management on yield and berry weight of 'Prime-Jan' grown in the field and tunnel

2007	Tunnel		Field	
Treatment	Yield (lb/a)	Berry wt. (g)	Yield (lb/a)	Berry wt. (g)
Re-cut 0.25 m, Tip at 0.5 m	4,197 c	6.9 c	1,959 c	5.9 b
Re-cut 0.5 m Tip at 0.5 m	4,677 c	7.5 b	1,210 c	5.7 b
Double-tip	17,200 a	8.1 a	8,038 a	7.2 a
Tip 0.5 m (control)	6,607 b	6.5 c	3,861 b	5.9 b
Significance	***	***	***	*

Treatments followed by the same letter have no statistically significant differences.

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Yield in 7 lb boxes per acre

2007	Tunnel		Field	
Treatment	**Crates / acre**	**Units / acre**	**Crates / acre**	**Units / acre**
Re-cut 0.25 m	600	7,200	280	3,360
Re-cut 0.5 m	668	8,016	173	2,076
Double-tip	2,457	29,484	1,148	13,776
Tip 0.5 m (control)	944	11,328	552	6,624

The fruiting season in the tunnel, September 8 to November 15, was longer than that of the field, September 8 to October 26.

It is clear from the results that total fruit yield and average fruit size that double-tipping canes is the optmum management strategy for managing primocane fruiting blackberries.

NEW CANEBERRY VARIETIES AND BLACKBERRY TRELLISING SYSTEMS FOR CALIFORNIA

Chrislyn Particka, PhD
Research Director, Sakuma Bros., Inc.
Mark Bolda, UC Cooperative Extension, Santa Cruz County

Introduction: There are several new raspberry and blackberry varieties that can be obtained by local growers. Raspberry plants are mainly sold as registered canes and certified roots and canes, and tissue culture plugs are sold on request. Blackberry plants are mostly sold as tissue culture plugs, but nursery matured plants can be obtained on request.

The roots and crown of blackberries are perennial, but the canes are biennial. The first year canes, also known as primocanes are typically vegetative. The second year canes, also known as floricanes, flower and fruit. Most blackberry varieties currently available are floricane fruiting.

New Raspberry Varieties:

Nantahala:
Type: Primocane fruiting red raspberry.
Yield: Just below Heritage (2000-3000 7 lb boxes per acre).
Average Fruit Size: 3.5 grams, larger than Heritage and Caroline.
Flavor: Rated as good or better than Heritage and Caroline.
Ripening Season: Later than most varieties (August-September).
Other information: Lower yield may be attributable to lateness of ripening, exposing it to frost. Use of high tunnels might be recommended.

Joan J:
Type: Primocane fruiting red raspberry, thornless.
Yield: Like Heritage (2500-3500 7 lb boxes per acre).
Average Fruit Size: 5 grams, much larger than Heritage and Caroline.
Flavor: Good, texture is described as fleshy.
Ripening Season: Similar to Autumn Bliss, produces two to three weeks before Heritage (late June-early July).
Other information: Can be difficult in warm weather, and should be picked daily to avoid quality problems.

Jaclyn:
Type: Primocane fruiting red raspberry.
Yield: Just below Heritage (2000-3000 7 lb boxes per acre).
Average Fruit Size: 3.1 grams.
Flavor: Excellent in cool weather.
Ripening Season: Early, mid to late June.
Other information: Flavor may wash out in high heat, but fruit is dark and does not scald easily.

Polka:
Type: Primocane fruiting red raspberry.
Yield: Like Heritage (2500-3500 7 lb boxes per acre).
Average Fruit Size: 5 grams, much larger than Heritage and Caroline.
Flavor: Fruity, clean.
(Cont'd to page 5)

The roots and crown of blackberries are perennial, but the canes are biennial.

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Ripening Season: Very early.
Other information: Outstanding shelf life.

New Blackberry Varieties:

Natchez:
Type: Floricane-fruiting, thornless, erect to semi-erect
Yield: Similar to Ouachita and Apache (3000-5000 7 lb boxes per acre).
Average Fruit Size: 8-9 grams.
Flavor: Good, averages 9.5% soluble solids.
Ripening Season: Early June.
Chilling Requirement: Not known.
Other information: Natchez is an Arapaho "upgrade." Fruit storage and handling is better than Arapaho.

There are three main growth habits of blackberries; erect, semi-erect and trailing. Each growth habit has a most advatageous trellising method.

Prime-Jan
Type: Primocane-fruiting, thorny, erect
Yield: Floricane comparable to other varieties, primocane up to 2500 7 lb boxes per acre with double tipping and high tunnels in Oregon.
Average Fruit Size: Floricane average 5 g, primocane from 3-15 g in various trials.
Flavor: Similar to other thorny varieties, averages 9.6% soluble solids.
Ripening Season: Floricane mid June, primocane mid July (Sept 1 in Oregon).
Chilling Requirement: Floricanes around 200 hours; primocanes apparently none.
Other information: Has been primarily intended for home use, temperatures above 85o F can reduce fruit set, tipping treatment recommended.

Prime-Jim
Type: Primocane-fruiting, thorny, erect
Yield: Floricane comparable to other varieties, primocane up to 2500 7 lb boxes per acre with double tipping and high tunnels in Oregon.
Average Fruit Size: Floricane average 5 g, primocane from 3-10 g in various trials.
Flavor: Similar to other thorny varieties, averages 8 % soluble solids.
Ripening Season: Floricane mid June, primocane mid July (Sept 1 in Oregon).
Chilling Requirement: Floricanes around 200 hours; primocanes apparently none.
Other information: Temperatures above 85o F can reduce fruit set, tipping treatment recommended.

Ouachita:
Type: Floricane-fruiting, thornless, erect
Yield: Among the highest of erect thornless.
Average Fruit Size: 6-6.5 g.
Flavor: Very good, 10-11% soluble solids.
Ripening Season: Begins mid-June and goes on for 5 weeks.
Chilling Requirement: Likely 400-500 hours.
Other information: Exceptional storage and shipping qualities, no problem with white druplets.

Obsidian:
Type: Floricane-fruiting, thorny, trailing
Yield: High, up to 3600 7 lb boxes per acre. (information based on experimental plots)
Average Fruit Size: 6.8 g.
Flavor: Excellent, classic trailing blackberry flavor, averages 12% soluble solids.
Ripening Season: Likely end of May in Watsonville, fruits for 4 weeks.
Other information: Excellent fresh market characteristics for a trailing blackberry.

Metolius:
Type: Floricane-fruiting, thorny, trailing.
Yield: Good, 2400 7 lb boxes per acre. (information based on experimental plots)
Average Fruit Size: Very uniform 5.6 g.
Flavor: Excellent, classic trailing blackberry flavor, averages 12% soluble solids.

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Ripening Season: Likely end of May in Watsonville, fruits for 4 weeks.
Other information: Much firmer than Obsidian, thorns are dense.

Black Diamond:
Type: Floricane-fruiting, thornless, trailing.
Yield: Very good, 2700 7 lb boxes per acre. (information based on experimental plots)
Average Fruit Size: 5.8 g.
Flavor: Very good, averages 14% soluble solids.
Ripening Season: Likely end of May in Watsonville, fruits for 4-5 weeks.
Other information: Uneven bud-break has been seen in Southern California, closer plant spacing is recommended as is less vigorous than most trailing types.

Trellising According to Blackberry Growth Habit

There are three main growth habits of blackberries; erect, semi-erect and trailing. Each growth habit has a most advantageous trellising method.

Trellis design for erect blackberries, such as Ouachita, Natchez, Arapaho and Navaho, is made to tie up early primocanes and to later to support longer floricanes.Plants should be spaced 2-4 ft within the row and 10-12 ft between rows, although many California growers use narrower row spacing on the order of 7-8 feet wide. This planting should be managed as a hedgerow with root suckers growing into and filling the row. The trellis should be composed of T-posts supporting two lower wires about 1.5-2 ft high and 1.5-2 ft apart. These lower wires are optional, but if they are included, they are used to tie up the first year canes, which are trailing. Growers in the southeast US have found that tying up the first year canes allows for a much larger harvest from the "baby" crip. Two upper wires are also strung on the T-posts, at 3.5 ft high, and 3 ft apart. Primocanes should be topped at 3-4 ft during the growing season, and laterals should be pruned to 12-14 inches during the dormant season.

Trellis design for erect, floricane fruiting blackberry.

Planting design for erect primocane fruiting varieties, such as Prime-Jan and Prime-Jim, is similar to that for erect floricane fruiting varieties. Trellis design, however, is simpler than that for erect floricane fruiting types. The trellis can simply be constructed from a T-post with wires or baling twine at 1.5 to 2 ft high and 1.5 to 2 ft apart. If baling twine is used, it can easily be removed each year to facilitate mowing, if only a primocane crop is being grown. Primocanes should be tipped when they reach 1.5 ft in length, and laterals should also be trimmed when they are 1.5 ft in length. There is still work to be done pruning and training for these new varieties, so these recommendations may very change.

Trellis design for semi-erect blackberry varieties such as Chester and Triple Crown is similar to that for erect blackberry types. Plants should be spaced 5-6 ft within the row and 10-12 ft between rows and man-

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aged as individual plants rather than a hedgerow. The trellis system should be composed of large wooden posts placed 25 ft apart with one or two wires at 2 and 4 ft in height. An upper wire can also be placed at 5 ft in height. Primocanes should be topped at 6 ft, and the laterals then shortened to 1.5- 2 ft during the growing season. During the winter, canes should be tied to the upper wire, remaining canes topped at 6 ft, and laterals shortened.

Trellis design for semi-erect blackberry.

Trellis design for trailing varieties such as Metolius, Black Diamond, Ollalieberry and Obsidian accounts for the long winding canes. Plants are generally spaced 5-6 ft apart in the row (3 ft for Black Diamond), and 10-12 ft between the rows and are managed as individual plants. California growers with experience with Ollalieberry may space the plants closer together, but Metolius and Obsidian may be more vigorous and require a broader spacing. Trellis should be large wooden posts spaced 28 ft apart with two lower wires with sets of hooks at 2 and 3.5 ft, which hold emerging primocanes and lift them up as the season progresses to keep them from being run over by harvesters. One upper wire should be placed at 5 ft. For the winter, canes should be tied to the upper wire in two bundles, with the canes topped at 6 ft.

Trellis design and wire placement for trailing blackberry.

We evaluated raspberry and blackberry rooting patterns in commercial fileds near Watsonville CA in 2007.

ROOTING PATTERNS OF CANEBERRIES

Michael Cahn, Irrigation and Water Resources Advisor, UCCE Monterey County
Sharid Kamal, Research Assistant, UCCE Monterey County
Mark Bolda, Strawberry and Caneberry Advisor, UCCE Santa Cruz County

Crop rooting patterns should be considered in the management of irrigation water and fertilizer.
A shallowly rooted crop will generally require more frequent irrigations than a deep rooted crop. The distance and depth that fertilizers should be placed relative to the crown of the plant may depend on the distance and depth roots grow laterally from the plant row. Also a deep rooted crop may be efficient at recovering leached nutrients, such as nitrate compared to a shallowly rooted crop. For purposes of water and nutrient absorption, we consider the cross-sectional boundary that contains 90% of the roots to be the effective rooting pattern.

Little information has been published about the extent that caneberry roots grow laterally and downward in commercial fields. Growers often cultivate the alleys between the rows, which may limit lateral root development. Since most caneberries grown on the central coast are irrigated with drip systems, the root systems may be confined to the wetting pattern of the soil. We evaluated raspberry and blackberry rooting patterns in commercial fields near Watsonville CA in 2007. Blackberry and raspberry crops were planted on 1-foot high berms spaced 88 inches apart. Pits, centered on the berm, were dug to expose a cross section of the soil 5-feet wide and 5-feet deep. Rooting patterns of 1st and 2nd year primocane raspberries, and 2nd year blackberries were mapped by overlaying a grid and counting the root numbers in each quadrant. Roots exposed on the pit wall were sprayed with white paint to enhance contrast against the soil background so that a photograph of the cross-sectional rooting pattern could be recorded.

Results

At 10 months after planting, the rooting depth of a 1st year raspberry crop was about 24 inches, as measured from the top of the berm (Figure 1). The deepest roots were observed at 30 inches depth. Roots extended laterally 20 inches from the center of the plant row. In spring of the second year raspberry crop (approximately 18 months after planting), roots extended down to 30 inches and the deepest roots were found at 45 inches below the top of the berm (Figure 2). The roots of the 2nd year crop extended laterally 25 inches from the center of the plant row. The rooting depth of the 2nd year blackberry was also 30 inches (Figure 3) with some roots reaching the 40-inch depth. Roots were observed to grow laterally as far as 25 inches from the center of the plant row. A concentration of fine roots in the crown was observed in all raspberry and blackberry root profiles. The fine roots were concentrated in between the surface of the berm to 10 inches below and about 10 inches to each side of the plant row.

Roots were observed to grow laterally as far as 25 inches from the center of the plant row.

Discussion and Conclusions

The effective rooting depth of 2nd year raspberry and blackberry crops was 30 inches 18 months after crop establishment. The effective rooting depth of 1st year raspberry was 24 inches, 10 months after establishment. Roots extended laterally 25 inches from the center of the plant row for 2nd year plantings of both raspberry and blackberry, and 20 inches for 1st year raspberries.

Although these measurements of rooting pattern were from 3 individual profiles they appeared to show a consistent pattern of root development for caneberries. Few roots extended into the alleys beyond 25 inches from the plant row either due to cultivation or because of a lack of soil moisture. Because most of the roots were concentrated in the crown of the plant, where the drip tape was located, fertilizer applied through the drip system should be readily absorbed by the plant. The deep roots at 40 to 45 inches may help with water uptake and absorb some of the leached nutrients, such as nitrate.

The effective rooting of 2nd year raspberry and blackberry crops was 30 inches 18 months after crop establishment.

Because caneberry roots were not observed to extend fully into the alleys between the plant rows, moisture that could be extracted by the root system would be limited to a 50-inch x 30-inch cross-section of the soil profile. Hence if the soil normally had 1.5 inches of moisture available per foot of depth, 3.75 inches of moisture would be estimated to be available for a crop rooted to a 30 inch depth, but because the roots only extended laterally 50 inches of the 88-inch wide rows, the available moisture that could be extracted from the soil profile would be limited to 2.13 inches. Assuming that a depletion of 20% of the available moisture would be optimal for crop growth and the evapotranspiration demand of the crop was 0.15 inches per day, then the ideal irrigation interval would be every 3 days rather then every 5 days for a root system that was uniformly distributed across the rows.

Acknowledgements: The authors thank Kevin Healy of Reiter Berry for his assistance in establishing the pits for this study.

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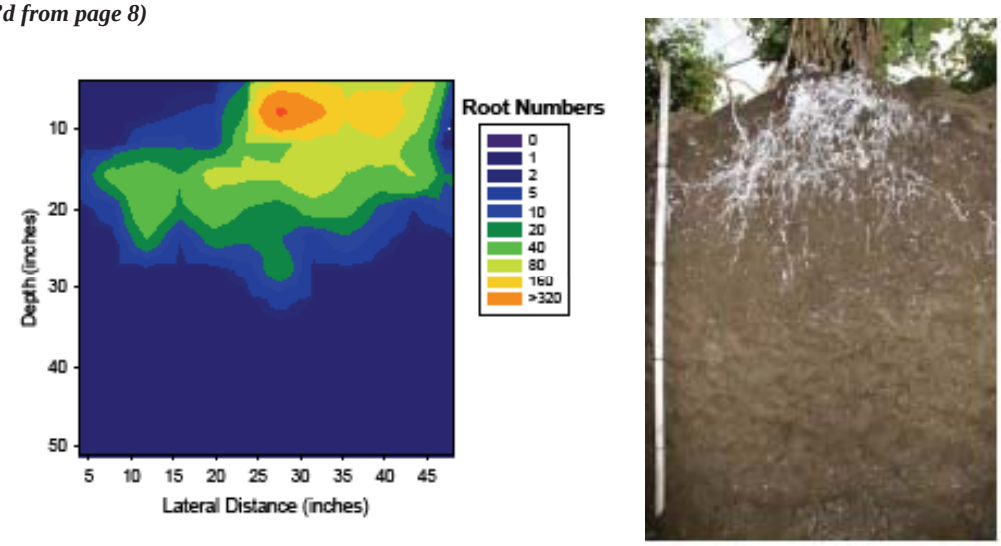

Figure 1. Cross-section of root distribution of 1st year raspberry on 88-inch spaced rows, drip irrigated. Watsonville CA. May 2007.

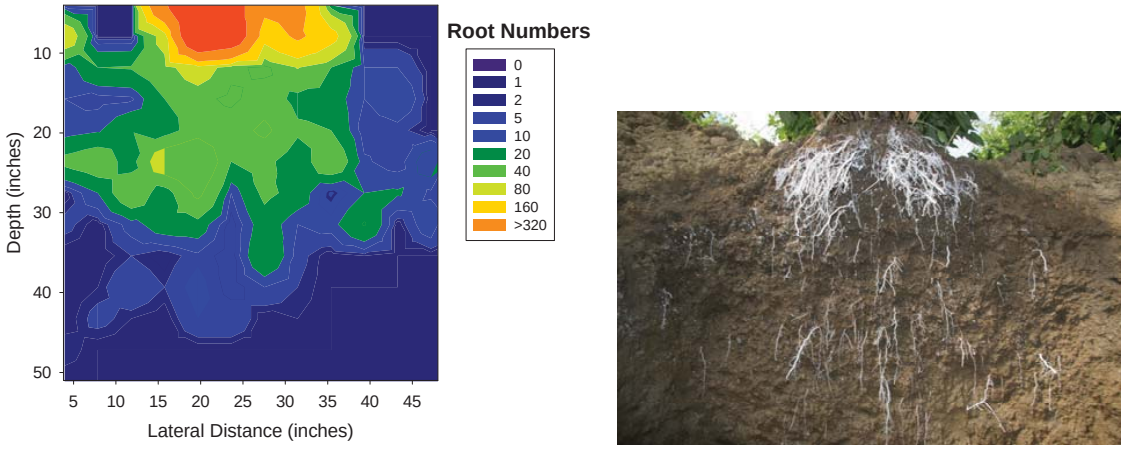

Figure 2. Cross-section of root distribution of 2nd year raspberry on 88-inch spaced rows, drip irrigated. Watsonville CA. May 2007.

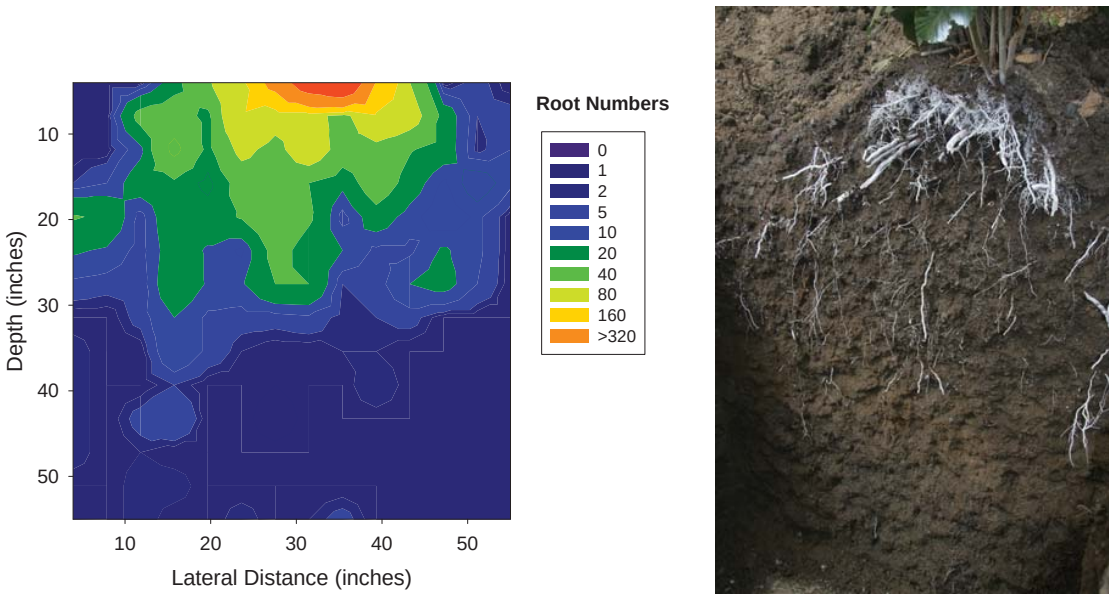

Figure 3. Cross-section of root distribution of 2nd year blackberry on 88-inch spaced rows, drip irrigated. Watsonville CA. May 2007.