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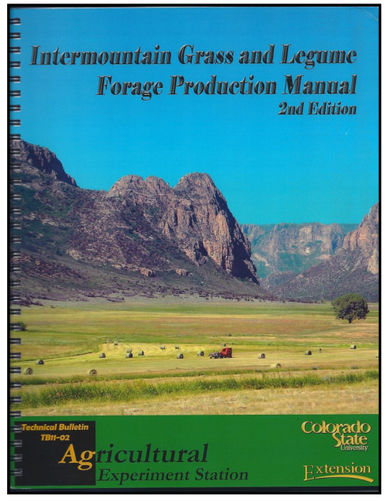
Both Calvin Pearson and Bob Hammon have extensive experience and expertise with western Colorado agriculture and the surrounding region. Both Pearson and Hammon have been employed with Colorado State University for more than 25 years each. Although Joe Brummer is located in Fort Collins he has considerable western Colorado expertise. He was at the Mountain Meadow Research Center at Gunnison from 1994 until 2003 when it officially closed. He was then transferred to the Rogers Mesa Research Center at Hotchkiss from 2003 until 2006 when he moved to the Ft. Collins campus.



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Editor: Stephen D. Menke, PhD

Melissa Franklin who works for Bob Hammon was responsible for formatting the articles, the layout of the publication, and editing of the photos. Her work was invaluable in creating an attractive publication and in achieving a timely publishing of the Production Manual.

The Intermountain Grass and Legume Forage Production Manual is 195 pages and is divided into three sections. Section 1 targets irrigated pasture/mountain meadows, Section 2 is devoted to alfalfa, and Section 3 focuses on the organic production of alfalfa and grass. Sixteen authors contributed their individual expertise on a wide range of relevant topics addressed in the 19 chapters contained in the Production Manual.

To purchase a copy of the Intermountain Grass and Legume Forage Production Manual contact Bob Hammon at the Tri-River County Extension office at 970 -244-1834, or email bob.hammon@mesacounty.us. Also you can stop by the Extension office at the Mesa County Fairgrounds, 2775 Hwy 50, Grand Junction, to obtain a copy. The purchase price is very reasonable at $10 each.

For more information about this article contact Dr. Calvin Pearson at calvin.pearson@colostate.edu.

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Intermountain Grass and Legume Forage Production Manual Recently Published

Alfalfa and grass hay together are one of the three most valuable crops in Colorado. In 2009, 4.8 million tons of alfalfa hay were produced in Colorado on 1.6 million acres with an estimated value of nearly $625 million. In 2010, 4.0 million tons of alfalfa hay were produced in Colorado on 1.6 million acres with an estimated value of more than $491 million. In some years, the value of alfalfa and grass hay in Colorado exceeds that of wheat and corn. Furthermore, alfalfa and grass hay crops are also widely grown and are valuable crops in western Colorado and the surrounding region. As with other crops, the technology for growing grass and alfalfa hay crops continues to advance and change and new technology and information continues to be developed for production agriculture.

The Intermountain Grass and Legume Forage Production Manual was published by Colorado State University, Agricultural Experiment Station and Extension in June 2011. This is the second edition of the Production Manual. The first edition was published in 1999. The second edition is a major revision with a completely new look and contains considerable new information.

The target audiences for the Production Manual are farmers, ranchers, extension agents and specialists, crop consultants, industry reps, agricultural technicians, federal and state agricultural professionals, and others.

The Production Manual was compiled and edited by Calvin Pearson, Professor and Research Agronomist at the Western Colorado Research Center at Fruita; Joe Brummer, Associate Professor and Extension Forage Specialist in the Dept of Soil and Crop Sciences on campus in Fort Collins; and Bob Hammon, Tri-River Extension, Entomology and Agronomy, Grand Junction.

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Fruit Orchard Specialist Joins CSU's Western Colorado Research Center

A specialist in fruit orchard management will join Colorado State University's Western Colorado Research Center in Grand Junction in June to conduct research and to work closely with fruit growers in the Western Slope region well-known for peaches, apples and other tree fruit.

Amaya Atucha, who recently earned a doctorate in horticulture at Cornell University, has assisted in management of her family's avocado grove in Chile. Her doctoral minor is in soil sciences and biological and environmental engineering.

Atucha has studied the effects of orchard groundcover management, and soil and nutrition management. She also has conducted research projects and has worked with growers to establish best management practices with fertilization and irrigation programs, pruning, water and soil management, and disease and pest control.

Atucha will join CSU as an assistant professor in the Department of Horticulture and Landscape Architecture. Based at the Western Colorado Research Center, she will develop a research program in orchard systems and will work with local growers to improve production and sustainability by addressing issues such as variety evaluation, cultural practices, irrigation, pest control, and mitigation of environmental stresses.

Amaya Atucha

Sub-surface drip project to explore irrigation efficiency benefits on alfalfa in the Lower Grand Valley.

This spring the Colorado Water Conservation Board (CWCB) funded a CSU request to test the potential benefits of sub-surface drip irrigating (SDI) alfalfa versus traditional gated pipe irrigation. The project includes an experiment station component of about 1 acre at the Western Colorado Research Center-Fruita, under the supervision of Dr. Calvin Pearson; and an off-farm component at a commercial alfalfa field of about 3 acres, within a mile of the research center. The project will commence this year, during the 2012 growing season, and be completed at the end of the 2015 growing season.

Dr. Ron Godin performed a similar study at the Rogers Mesa Research Center from 2006 to 2008 and established that SDI should give alfalfa yields a boost while reducing the amount of water applied that is diverted from the ditch. In addition to evaluating the yield benefits of SDI over gated pipe, a key component of the new study will be to establish if there are any evaporative water savings with SDI versus gated pipe. It is likely there will be a small savings in total crop water use but it will probably be offset somewhat by the projected increase in yields. Additionally the study will explore the economic benefits that any yield increases will provide local growers and how well they will account for the cost of investment in an SDI system.

CSU would like to thank CWCB and the HB-1177 Colorado Basin Roundtable for funding this project: Alternative Agricultural Water Transfer Methods $8,841; Water Supply Reserve Account: $46,894. The project will also gratefully receive assistance from local Natural Resources Conservation Service staff, Mesa Conservation District, Shavano Conservation District, and Grand Junction Pipe and Supply.

For questions on this project please contact Denis Reich: 970-2501-8467; Denis.Reich@Colostate.edu

For more information about this article contact Dr. Calvin Pearson at calvin.pearson@colostate.edu.

A WCRC site being scouted for the SDI study

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Wine Aroma Profiling of Five Colorado-grown Cultivars

Comparisons of Cultivar Profiles for Wine Volatile Aromas by GC/MS Direct Injection

The CSU Enology Program is analyzing the wine aroma chemical profiles for several cultivars grown at the Western Colorado Research Station high altitude plots. This is a first step in the overall eventual aim of understanding how the aroma chemicals in Colorado wines relate to the aromas identified by the noses of wine consumers.

Usually, there are dozens of aroma chemicals that can be individually identified by these methods. Each aroma chemical may elicit different smell responses in a human nose, depending on chemical concentration at the smell receptor level or context with other aroma chemicals smelled concurrently, or with the individual smeller's sum of learned smell experiences. Each identifiable smell response is called a descriptor, and has been validated by human sensory research panels and published.

An aroma chemical profile is a summation of the various individual volatile aroma chemicals as they are separated by chromatographic methods and the descriptors that have been recorded as associated with them. Thus, the profile is a summation of all of the potential smells associated with the chemicals identified. As a simple example, a Wine X might contain just three aroma chemicals, ethanol, butanedioic acid-diethyl ester and phenylethyl alcohol. The chemical ethanol is a very simple aroma, which has a descriptor of "ethanol" or "sweetly alcoholic". It is what we identify in wine and spirits as smelling alcoholic. The chemical butanedioic acid-diethyl ester elicits a complex set of fruit-like descriptors, ranging from "apple" to "chocolate" to "wine-like" to "peach". The chemical phenylethyl alcohol is associated with the smell of roses, and has subtly different descriptors, ranging from "rose" to "floral rose" to "dried rose flower" to

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"rose water". Therefore, the potential aroma profile of this wine would be as follows. "Wine X may have aromas of: ethanol, apple, apricot, chocolate, cranberry, grape, musty floral, fruity, peach, pear, waxy, wine-like, earthy mild fruity, cooked apple, rose, floral rose, dried rose flower, and rose water."

The particular method used in these studies is separation of aroma chemicals by gas chromatography followed immediately by physico-chemical identification with mass spectrometry, a coupled process commonly known as GC/MS analysis. In this particular case, wine was directly injected into the separatory column fiber of the gas chromatograph. This injection method was chosen for its ease of sample preparation and as a comparison to sample pre-extraction methods commonly used prior to GC/MS analysis.

All cultivar wines tested were 100% made from each cultivar, made with the same yeast strain, same fermentation temperature, same post fermentation treatment, except the normal pressing differences between the whites and reds. No ingredients were added, except potassium metabisulfite to inhibit microorganism growth before and after fermentation.

The potential aroma profiles below, for five cultivars tested, show the results of triplicate GC/MS analyses of two year old wines that had been bottled for a year prior to sampling. All chemical identifications were made against the NIST Mass Spectral Database. Sensory descriptions of chemicals are from various published references (not delineated herein).
It is important to note that the sensory descriptions of aroma chemicals belonging to each cultivar are for each chemical in isolation. It is well known that aromas in combinations may give overall impressions that are additive, subtractive, or even synesthetic with respect to the original descriptions.

As the wine aroma chemical database grows, we can see what differences in aroma chemicals are associated with broad influences on the grapes, like terroir and vintage. We can also test the differences between the grape must used for the wine and the fermented wine, enabling us to predict which aromas in the wine are derived directly from the aroma chemicals in the grapes and which come from the yeast fermentation process. We can also test specific combinations of these chemicals in specific amounts and ratios, with human sensory panelists, to see what role each chemical plays in the overall aroma impression for each cultivar's wine. Eventually, we can use this information to help predict what a wine will smell like when specific combinations of chemicals are present in the grapes from a particular location and vintage and we use certain fermentation and cellaring practices.

Potential Aroma Profile for Chambourcin
-alcohol, acetic acid, fruity, earthy fruity, rose, floral rose, dried rose flower, rose water, musty floral, wine-like, waxy, creamy, buttery, caramel, whiskey, burnt, fusel, smoky, phenolic, benzene-like, chocolate, apple, apricot, cranberry, grape, peach, pear, strawberry, banana, cooked apple

Potential Aroma Profile for Rkatsiteli
-ethanol, acetic acid, fruity, earthy fruity, rose, floral rose, dried rose flower, rose water, musty floral, wine-like, waxy, creamy, buttery, caramel, almond, whiskey, cognac, brandy, burnt, fusel, ether, fishy, ammonia, disagreeable, chocolate, apple, apricot, cranberry, grape, peach, pear, banana, cooked apple, pineapple

Potential Aroma Profile for Traminette
-ethanol, acetic acid, fruity, earthy fruity, rose, floral rose, dried rose flower, rose water, musty floral, wine-like, waxy, creamy, buttery, oily, fatty, whiskey, cognac, brandy, burnt, fusel, smoky, phenolic, benzene-like, musty, goaty, cheesy, almond, clove, spicy, chocolate, apple, apricot, cranberry, grape, peach, pear, strawberry, banana, cooked apple, pineapple

Potential Aroma Profile or Noiret
-ethanol, acetic acid, fruity, earthy fruity, rose, floral rose, dried rose flower, rose water, musty floral, chrysanthemum, wine-like, waxy, burnt, fusel, benzene-like, caramel, nutty, meaty, chocolate, apple, apricot, cranberry, grape, peach, pear, cooked apple

Potential Aroma Profile for Corot noir
-ethanol, acetic acid, fruity, earthy fruity, rose, floral rose, dried rose flower, rose water, musty floral, wine-like, waxy, creamy, buttery, fusel, smoky, phenolic, ether, amine -like, nutty, meaty, chocolate, apple, apricot, cranberry, grape, peach, pear, cooked apple

As these studies continue, the wines tested by GC/MS will also be tested by human sensory panelists, and the aroma chemical profiles and the aroma descriptions of the panelists will be compared for similarities and differences.

In future experiments, known aroma profiles will be compared under different conditions, such as vineyard location, vintage, manipulation of vine canopy or water, etc., in order to see more precisely how wine aromas can be affected by grape cultural practices.
For more information, contact Stephen Menke, CSU Enology Program, at Stephen.menke@colostate.edu .